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Forecasting the Main Indicators of Food Security of Russia

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***Abstract:** In the context of current geopolitical events, accurate and correct forecasting of food security and provision becomes highly relevant for solving managerial tasks and making management decisions under modern conditions. This article reviews the main trends in the field of food security, forecasts its key indicators, and identifies the main problems and directions for the development of food security in the Russian Federation. Indicators in the field of food independence, production, and consumption are analyzed. Forecasts of gross collection of vegetables and melons, cultivated areas, imports of food and agricultural raw materials, and consumer price index for food products are presented. The theoretical and methodological basis of the research includes both general and specific scientific methods for assessing the level of food security, as well as methods of economic and statistical analysis, extrapolation methods, modeling and forecasting of time series, adaptive forecasting methods, and factorial analysis. The main problems and threats to food security are identified, including the low level of real income of the population, low share of highly processed products in exports, continuing effect of Western sanctions, low level of innovation and technological development of the agro-industrial sector, etc.. The following measures to improve state regulation of food security have been determined: to increase the economic and physical access to food, to develop the capacity of the agro-industrial complex in the production and scientific and technical fields, to introduce modifications to the Food Security Doctrine, to implement innovative technologies in crop production and to increase its efficiency, to increase the share of companies engaged in organic farming, etc.*

***Index Terms:** food security, economic access to food, forecasting, export potential.*

I. INTRODUCTION

The study and analysis of the problem of food security can rightly be placed in line with the most popular tasks of modern economics in Russia. Provision of food to the population is the basic component of the social and economic security of the state [1]-[3].

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Food security in all its manifestations characterizes the ability of the agro-industrial complex (AIC) to ensure the balance and sustainability of economic development. The optimal balance of domestic production and import of food products is significant for food security. The stability in the domestic food market is an obligatory condition for an independent domestic and foreign policy of the state. This necessitates the economic study of food independence and security, as well as the analysis of their nature and impact on the welfare of the state and the quality of life of the population. This raises the necessity of forecasting and predicting the indicators of food security to ensure access to food and prevent emergencies.

In recent years, the impact of both internal and external factors on food security has increased considerably, including the state and dynamics of the AIC that have a significant influence on food security.

Forecasting of targets and indicators of food security allows determining the population's need for food and assessing the need for imported products and the export capacity of the country [4]-[7]. Further development and improvement of the forecasting and planning procedures for food security owe not only to the national strategic priorities but also to the high degree of responsibility of state authorities to the population for ensuring security, high level, and quality of life.

The Food Security Doctrine of 2010 establishes the concept of food security and the defining feature of its condition, that is, the share of Russian products in the total volume of commodities and specific threshold values of this criterion. The Doctrine also provides an important concept of food access. However, the Doctrine does not contain provisions on the structural development of the Russian AIC, industry priorities, as well as medium and long term threats and risks. The Doctrine's targets do not have time frames. Many of them are not brought up to the quantifiable indicators. Thus, it is impossible to assess the effectiveness of the document [8].

Today, the AIC and the country's economy in general work under difficult socio-economic conditions. The introduction of sanctions by the European Union against the Russian Federation made the Russian Government impose a food embargo in response. Among other areas, the sanctions affected agricultural lending, which resulted in a significant decrease in the ability of banks to attract external financial resources. Thus, the availability of internal credits for the AIC has decreased due to an increase in interest rates.

However, the countries that support the sanctions against Russia have not extended them on the delivery of pedigree and seed material, as well as technologies and equipment for the AIC [9].

One should note that the events that occurred in the country and in the world over the last decade have identified the need for developing a draft of a new Food Security Doctrine of Russia. In addition to the complicated international situation, the need for modification of the Doctrine is due to the fact that it was adopted before Russia joined the World Trade Organization and before the formation of the Eurasian Economic Community. It is also necessary to clarify the concept of food security, which is understood as self-sufficiency, while economic security cannot always be confirmed by the possibility of purchasing one or another product [10].

II. GENERAL DESCRIPTION

The theoretical and methodological basis of the research includes the use of both general and specific scientific methods for assessing the level of food security, as well as retrospective, economic, and statistical analysis. When forecasting indicators, extrapolation methods and adaptive forecasting methods, including Holt's exponential smoothing method and factorial approach, were used. The analysis was carried out on the basis of studying regulatory legal acts, materials of various analytical companies (Analytical Center under the Government of the Russian Federation, Deloitte Research Center), data from the Ministry of Agriculture of the Russian Federation, official statistics, and our own works concerned with food market research and the AIC development.

III. BLOCK DIAGRAM

The list of the key indicators of food security is presented in the Food Security Doctrine, and the Decree of the Government of the Russian Federation No. 2138-P dated November 18, 2013 "On approval of the list of indicators in the field of food security".

Cultivated areas of main crops, gross production of vegetables and melons, imports of agricultural products, raw materials, and food have been selected as indicators for forecasting the production of agricultural and fish products.

In the production field, gross collection of most agricultural crops has been at record levels for the third year in succession, mainly due to favorable weather conditions, which influenced the planting season, as well as the implementation of goals of the federal project "Export of tAIC products". The import substitution policy in the country is being successfully implemented and the next stage is the transition to export-oriented agriculture. This will help to overcome the negative balance of foreign trade in food products.

According to Rosstat statistics, in 2018, for the third year in succession, the production of vegetables and melons increased in farms of all categories in Russia and amounted to 15.7 million tons, which is 1.5% higher than in 2016 and 13.9% higher than in 2008 [11]. Taking into account the fact that in the draft of the Food Security Doctrine, the production norm of Russian vegetables and melons will be no lower than 90%, a forecast of the gross production of vegetables and melons has been generated using the Holt method (Fig. 1).

Fig. 1: Forecast of gross collection of vegetables and melons, thousand tons.
Source: Prepared by the authors based on Rosstat data.

According to the forecast, in 2019-2024, there will be a steady increase in the indicator by 1% per year on average due to favorable weather conditions for field work and the focus on the implementation of the targets of the project "Export of AIC products". According to the Ministry of Agriculture, the share of Russian production in resources will be 85-86% in the forecast period. The production of greenhouse vegetables has shown stable positive dynamics in recent years. Gross collection of greenhouse vegetables in Russia in 2018 increased by 11.7% compared to 2017 and by 75.9% compared to 2013. Moreover, in 2018, more than 350 ha of winter greenhouses were modernized and put into operation, including the fifth-generation greenhouses with modern technologies, in which the yield reaches a record level of 70 kg/m^2.

According to Rosstat, in 2018 in Russia, the total area under agricultural crops was 79.6 million ha, which is 0.3% less than in 2017, but 3.7% more than in the reference year 2008.

Cereals and leguminous crops occupied 46.3 million ha, which is 2.9% less than in 2017 and 0.9% less than in 2008. The area under corn decreased by 18.8%, oat – by 1.2%, buckwheat – by 38.2%, and sugar beet – by 6% [11].

This indicator was forecast using the Holt method (Fig. 2). According to the forecast, the cultivated area in 2019 will be 80.1 million ha. According to the preliminary data of the Ministry of Agriculture, the current year is characterized by favorable weather conditions and, as a result, it was possible to start spring field work earlier than the annual average time. The areas under cereals and leguminous crops, feed crops, as well as vegetables and potatoes, will increase. According to the agricultural census of 2016, about 97.2 million ha (44% of agricultural land) are not used. According to the statements of the Ministry of Agriculture of Russia, an increase in cultivated areas with these lands can be considered one of the priority directions of the agricultural sector.

Fig. 2: Forecast of cultivated areas under agricultural crops, thousand ha.
Source: Prepared by the authors based on Rosstat data.

Moreover, there will be a relatively high level of provision with spring grain and leguminous seeds (about 98.9%), due to the improvement of state support measures for farmers related to the quality enhancement of seed material. Moreover, on average, 90% of agricultural producers of the country and 97% of agricultural producers of the North Caucasus and the Southern Federal Districts are provided with the equipment [12].

One should also consider the dynamics and structure of the indicator of imports of agricultural products. This indicator shows that in 2013-2016 food imports decreased by 42%. This certainly indicates the strengthening of the country's food independence. However, it should also be noted that among other restrictions, the import in Russia currently faces artificial restrictions. The foreign trade of Russia has a negative balance in agricultural products and food [8].

In 2018, the amount of imported food and agricultural raw materials was USD 29.6 billion, thus, there was an increase of 2.4% compared to 2017. In the commodity composition of imports of the Russian Federation, the share of food and agricultural raw materials was 12.4% in 2017. The major share in the composition of food imports was attributable to the products of the processing industry: edible fruits and nuts (17.1%), alcoholic and nonalcoholic beverages (9.1%), meat and meat products and milk and dairy products (7% each), vegetables (6.2%), and oilseeds (6.1%) [13].

The value of imports of food products and agricultural raw materials was selected in order to build a forecast using the factorial forecasting method. Factors that have the greatest impact on the resulting indicator include the US dollar exchange rate, depreciation of fixed assets in agriculture, and investments in fixed capital of the industry.

According to the forecast (Fig. 3), in 2019-2024, food imports will grow by about USD 1 billion per year. This value is given in current prices, so the increase in imports is largely owing to the weakening of the national currency, not an increase in the volume of food delivery (Table 1).

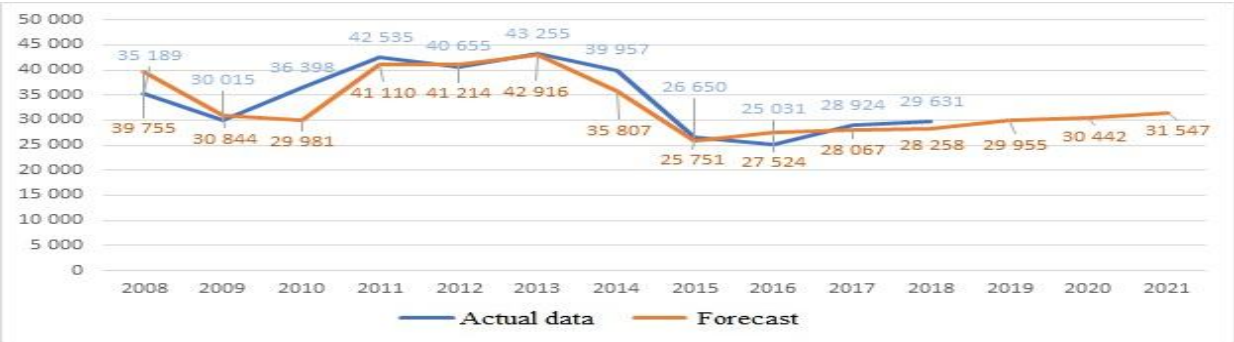

Fig. 3: Forecast of imports of food and agricultural raw materials (except for textile), million dollars.
Source: Prepared by the authors based on Rosstat data.

Table 1. Correlation matrix of factors and the resulting indicator

	Y	*X1*	*X2*	*X3*	*X4*	*X5*
Y	1					
X1	-0.81	1				
X2	0.45	-0.04	1			
X3	-0.24	-0.12	-0.79	1		
X4	-0.32	0.38	0.42	-0.76	1	
X5	0.39	-0.63	-0.55	0.72	-0.84	1

X1 –Share of agriculture, forestry, hunting, fishery, and aquaculture sectors in GDP, %
X2 – Degree of depreciation of fixed assets in agriculture, %
X3 – Average annual US dollar rate, rubles per US dollar
X4 – Dynamics of real disposable income of the population, %
X5 – Fixed capital investment in agriculture, forestry, hunting, fishery, and aquaculture sectors, billion rubles

Source: Prepared by the authors.

In general, the policy of import substitution continues. The targets of the Food Security Doctrine are achieved even before its expiration in 2020 and this creates all necessary prerequisites for the transition from the import-substituting model of the development of the AIC to the export-oriented strategy [11].

In the field of consumption, it is possible to note a gradual decline in the real disposable income of households over the past five years. Combined with an annual increase in food prices, it leads to a decrease in the purchasing power of the population and an increase in the share of food expenditures in total household spending. As a result, in the diet composition of the population, there is an excess of rational norms of consumption of bread products and potatoes and under-consumption of dairy products, fruits, berries, and vegetables. At the same time, the nutritional value of food is growing, but it does not comply with rational norms in all indicators [14], [15].

As for the index of consumer prices for food products, it was 14-15% in 2014-2015 (Fig. 4) [14].

The decrease in the purchasing power of the population can be explained by two reasons: a decrease in income and an increase in food prices. The income of the population has declined over the past five years, while over the same period food prices have increased by almost 40%.

This process has the most severe impact on the poorest groups of the population, who experience an increase in their food expenditures. In general, the dynamics of prices for food products for the period under review correspond to the dynamics of inflation for all products. In the last few years, the food price increase has slowed down significantly: in 2017, it was only 1.1% per year, in 2018 – 4.7% per year [11].

For the purpose of the research, a forecast of the consumer price index (CPI) for food products has been built using the factorial method of forecasting.

Fig. 4: Forecast of the CPI, %.
Source: Prepared by the authors based on Rosstat data.

Table 2. Correlation matrix of factors and the resulting indicator, %

	Y	*X1*	*X2*	*X3*	*X4*
Y	1				
X 1	0.69	1			
X 2	0.37	0.45	1		
X 3	0.27	0.45	0.47	1	
X 4	0.48	0.61	0.76	0.81	1

X1 – Cost of living index, on average per capita, %
X2 –US dollar Index, %
X3 – Share of agriculture, forestry, hunting, fishery, and aquaculture sectors in GDP, %
X4 – Average weighted key rate of the Central Bank, %

Source: Prepared by the authors.

According to the forecast, in 2019, the price increase in the food sector will remain at the level of 2018, due to the increasing income of the population and recovery of consumer demand. The question is whether the increase in VAT by 2% from January 1, 2019 and an increase in production costs will impact the CPI. As practice shows, retailers have also actively held back the readjustment and change in prices, which will also affect the indicator in the coming years (Table 2). By the end of 2020, a return to the target of 4% is expected, when the effect of the increase in VAT and the weakening of the ruble exchange rate will stop.

One of the main shortcomings of the Doctrine is that food security is actually equated with the achievement of food independence, the main indicator of which is the percentage of agricultural products in total resources.

Experts criticize this methodology because, in case of using this indicator, full food provision cannot be achieved even if there is surplus production because of the characteristics of calculation.

One should note that the Doctrine does not regulate such an important indicator as to the real affordability of products and achieving high quality at an affordable price is viewed as a minor task. However, according to the analysis, the majority of Russian citizens spend from 30% to 50 % of income on food, while in the EU countries, people spend only 6-8% of their income on food. There is also a risk of a gradual decline in real income of the population and the inconsistency between the diet and nutritional value of food rational norms [16].

At the moment, the AIC of Russia is moving from an import-substituting to an export-oriented model of development. In 2018, import substitution ceased to be the task of the industry development, because a new goal appeared, that is, implementing the export potential of agricultural products, raw materials, and food produced in Russia. In accordance with the May Decree the President of the Russian Federation, it is planned to increase the export of products of the AIC from 20 billion US dollars in 2018 to 45 billion US dollars in 2024. An increase in export volumes should occur due to highly processed products.

As for climatic and agroecological threats, increased land degradation and a decrease in fertility caused by the irrational use of land can be noted.

The state of the agricultural sector also affects the country's food security. The agro-industrial sector still has an inadequate level of technological and innovative development. In the industry, the share of innovatively active enterprises is about 10-12%, while in agriculture it does not exceed 4-7%.

IV. ALGORITHM

Therefore, food safety threats include the following:

• low real income and a high level of stratification in the society;

• impact of the Western sanctions and the weakening of economic bonds;

• instability of the economic situation and fluctuations in the ruble exchange rate;

• low competitiveness of products of Russian AIC.

V.RESULT ANALYSIS

The main directions of state policy in the field of food security are as follows:

1) increase in economic access to food, which will allow all groups of the population to maintain a healthy diet;

2) in the field of agricultural production, raw materials, and food, it seems reasonable to increase crop yields, prevent soil degradation, and restore soil fertility, as well as ensure sustainable rates of development of livestock breeding;

3) in the field of the development of the scientific and technical potential of the AIC, it is necessary to stimulate the creation of new technologies in the production, processing, and storage of agricultural products, to prevent the migration of highly qualified scientific personnel, as well as to create territorial production clusters and increase the level of energy input in the agriculture and fishery industry.

Based on the analysis of indicators of food security, it seems appropriate to make some modifications to the Food Security Doctrine. Although the draft of the new document contains a different methodology for the determination of achievement of food security, that is, the use of self-sufficiency indicator instead of the share of Russian production in resources, its goal is still the achievement of food independence. As a member of the United Nations, Russia supports the recommendations of the Food and Agriculture Organization of the United Nations to modify the definition of food security, putting economic and physical access to food at the core of the Doctrine.

It is also proposed to consider a list of indicators of food accessibility, primarily its economic accessibility, as the key indicators of food security, instead of the share of Russian production in resources and self-sufficiency. One such indicator was included in the draft of the Doctrine, that is, the ratio of expenditures on food per capita to the cost of a fixed consumer basket. However, the use of this indicator raises a number of questions about its calculation and interpretation. We propose to use a list of indicators, including the widely used indicator of the share of food expenditure in the volume of household consumption expenditure, which clearly shows trends in food availability, food consumption indicators, and food nutritional value, including macro and microelements and vitamins. It is also proposed to include in the Doctrine the indicator of the share of Russian production in resources and self-sufficiency in seeds of the main agricultural crops of the Russian selection in order to achieve self-sufficiency in seed material.

Organic farming has been identified as one of the possible directions for the development of agricultural production. Today, sales of organic products in the world are insignificant, about 3-5% of total sales. The global turnover of organic products is about 45-50 billion US dollars [6].

Today, Russia primarily imports products of organic farming, which are consumed mainly by the wealthiest groups of the population. At the same time, Russia has the objective potential to become one of the biggest producers of organic agricultural products, taking into account the significant amount of unoccupied agricultural land, which can be used without additional chemicals, and traditional agricultural land, which is underused due to the limited labor resources. However, the major problem in the production of organic products is the absence of relevant technologies, unqualified producers, lack of necessary seed material and livestock breeds, etc. [6].

Russian enterprises have already started to actively introduce the latest developments in the creation and breeding of hybrid varieties and innovative means of tillage and planting seeds. They take advantage of mechanization and automation, use plant protection products against diseases and insects, etc. Modern equipment of precise planting helps to maintain a certain distance between the seeds when planting. Such equipment already exists,

but its cost is too high, especially for small and medium-sized farms. “Smart” greenhouses allow to create the most favorable temperature conditions, light, watering, and a constant supply of nutrients for plants, as well as to monitor processes and carry out forecasting of yield. Navigation systems for agricultural equipment make it possible to process the fields as accurately as possible and to minimize the double-processing of the field, as well as to navigate at night time and under poor visibility conditions. Owing to the lack of public laboratories, laboratories for analyzing soil and products are being created in large organizations and they provide the most rapid analysis [3].

Despite the fact that over the past four years, imports of agricultural products to Russia have decreased by 26%, the country remains a big importer of food products and agricultural raw materials. When shaping the strategy for the development of import substitution policies in the AIC, the main issue that requires a solution is achieving the optimal balance of economic sovereignty and food security, on the one hand, and taking advantage of the international division of labor and economic efficiency, on the other hand [3].

Thus, long-term strategic management and development of the Russian AIC require the achievement of a rational balance between imports and exports, the development of the competitive advantages of the Russian agro-industrial sector and its seamless integration into the global food market, as well as modernization of all branches of the Russian AIC, development of institutes of growth, etc. The export strategy aimed at diversifying agricultural and food exports, as well as finding new markets for products, will be the most effective under current economic conditions.

VI. CONCLUSION

Modern food market in Russia is developing, accompanied by changes in the internal and external environment on a global scale. However, this situation is considered to be an additional encouragement for the AIC to large-scale restructurization and modernization, as well as the strengthening of competitiveness in the domestic and global markets. One of the most important factors of food security in the era of globalization should be the active implementation of export policy and an increase in export potential aimed at diversifying agricultural and food exports with high added value. This should be the next stage after import substitution. As a result, there will be a more equal distribution of income and stabilization of profitability in the AIC, as well as an increase in foreign exchange earnings and the development of promising food product markets.

As for measures to improve state regulation of food security, it is proposed to use the tools to develop economic and physical access to food, to modify the Food Security Doctrine of the Russian Federation, to develop production and scientific and technical potential of the AIC, to increase the efficiency of crop production and to use innovative agriculture, to develop organic farming, etc.

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