

Prospects for development of Russian agricultural industry in the context of export-oriented strategy implementation in the agro-industrial complex

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Abstract. The research concept consists in the development of theoretical and empirical approaches for analysis and assessment of Russian agricultural production development trends in the context of export-oriented strategy implementation in the agro-industrial complex. The research is conducted using complex of methods of mathematical modeling in economics, including extrapolation methods (linear and non-linear trend models for analyzing the time dynamics of production and economic variables), scenario forecasting, Delphi approach. The projected parameters of the export potential of Russian agricultural production are developed and represented in the paper. Based on the data of 2009–2018, the development state is analyzed and trends become visible of the farm stock structure by farming categories in the Russian Federation and staple food production, including meat, milk, vegetables, potatoes, grain and sunflower. Three forecasting scenarios of staple food production per capita in the Russian Federation for the period up to 2025 are developed and proved (base case, best-case and worst-case scenarios).

1 Introduction

In conditions of sanctions between Russia and Western countries, the search for direction of the state social and economic policy is focused on the development of non-resource-based model of national economic growth. In this regard, the priority guideline consists in the agricultural industry development and increasing its export potential.

Over the past five years the government of Russia has been paying special attention to the issues concerning legal and regulatory framework improvement of agricultural production in order to support agricultural sectors, agricultural equipment enhancement and export development.

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In 2018 in accordance with the May Decrees of the RF President “On national goals and strategic missions of the Russian Federation development for the period up to 2024”, 12 national projects were developed, including “International cooperation and export”, designed for implementation of the federal project “Export of agricultural products”, along with the federal project “The system of farmers support and development of rural cooperation” as part of the national project “Small and medium-sized entrepreneurship and support for individual business initiatives”. Implementation of these projects will give the opportunity not only to increase food export by 1.6 times (from 24.9 billion US dollars to 40 billion US dollars by 2024), increase the agricultural production efficiency, significantly expand the participation of small agribusiness entities in providing the population with own-produced food products, but also to promote new job formation in the rural settlement [1, 2].

However, the existing mechanism and volumes of the industry state funding are not sufficient for its dynamic performance and development in current conditions. The shift in emphasis of the state agricultural policy from protectionism measures to the forward strategy of domestic agricultural products expansion on the world markets determined the need to evaluate production possibility of staple agricultural products in the country in conformity with the tasks set, and to validate the forecast parameters of the production of vitally important types of food in the country up to 2025 using the indicators achieved with the application of mathematical modeling in economics.

2 Research methodology

The forecast indicators include the following:

- the percentage of gross production of the certain farming category in the overall volume of all farming categories, %, defined according to the formula:

$$Y = V_k : V_v * 100 \% \quad (1)$$

where: Y is the percentage of gross production of the certain farming category in the overall volume of all farming categories;

V_k – gross production of the certain farming category (in current prices);

V_v – gross agricultural output (in current prices) of all farming categories: private farms, peasant farms, private plots;

- the share of farms of different categories in the crop and livestock production, %;

- livestock inventory structure by farming categories, %.

Let us investigate the export potential of the industry using the method of forecast extrapolation. For trend parameters assessment the analysis of various curvilinear and lineal relationships was conducted, which describe the studied economic functions in agriculture and show the best results: equation of a straight line, logarithmical, power and exponential curves.

The functions take the following forms:

- straight-line:

$$Y = a + bx, \quad (2)$$

- exponential:

$$Y_t = a * b^t, \quad (3)$$

- power:

$$Y = a_0 * x_t^n, \quad (4)$$

- logarithmical:

$$Y = b = a * \ln x, \tag{5}$$

The research information basis includes the assessment of country’s agricultural producer development trends for the past 10 years and the results of industry operation for the period 2009-2018.

3 Results

The research results show that in the period of the state agricultural policy implementation in terms of adopted strategies and programs, the change of the institutional structure of production of staple livestock products is observed. The forecast analysis of agricultural structure for the whole of the Russian Federation defined the expectable values of the share of different farming categories in agricultural production (Figure 1) [3].

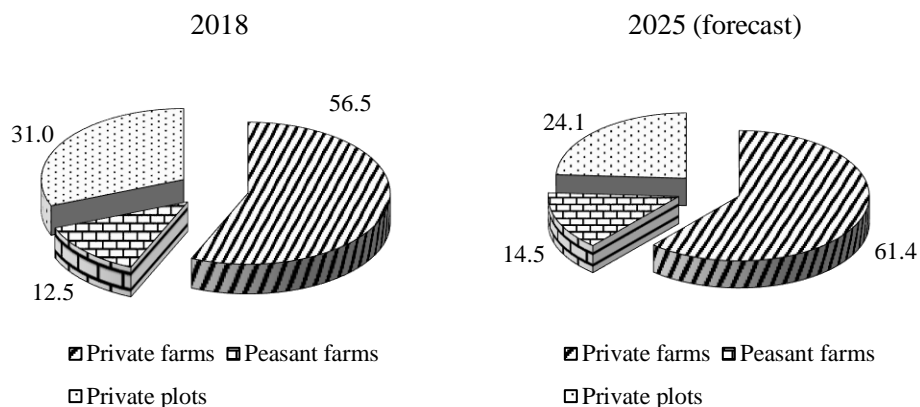


Fig. 1. The forecast of different farming categories share in Russian agricultural production for 2025, % (The source: developed by the authors).

In accordance with the forecast calculations, by 2025 the structure of the agricultural sector of Russian economy will experience significant changes. Countrywide the share of private farms in agricultural production will increase. Supposedly it will amount to 61.4 % (against 56.5 % in 2018). The large and medium-sized farm businesses which have primary processing and use the branding system of their products will efficiently carry out export activities. Thus, in one of the largest agricultural regions of the country, Rostov Region, which accounts for about 30.0 % of the total national food export, foreign sales of seed oil is performed under the trademark “Sdelano na Donu” [4].

By 2025 the share of small companies will account for less than half of total agricultural production – 38.6 % (against 43.5 % in 2018). Concurrently, the expansion of peasant farms operations will be observed, their share in the agricultural structure will increase from 12.5 % in 2018 to 14.5 % by 2025. The share of private plots is expected to decrease from 31.0 % in 2018 to 24.1 % in 2025. These structural changes are caused by, inter alia, the implementation of the federal project “The system of farmers support and development of rural cooperation”, which contributes to the transformation of peasant farms into a growth sector of agricultural economy.

In the structure of staple crop production the leading position is expected to remain with large and medium-sized agricultural enterprises, their share may increase up to 56.4 % by 2025 (against 52.2 % in 2018) (Figure 2).

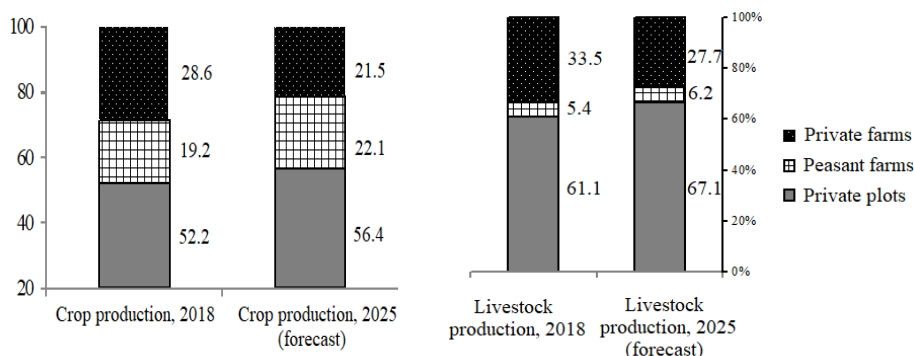


Fig. 2. The forecast of the sectoral agricultural production structure in the Russian Federation for 2025, % (The source: developed by the authors).

In accordance with the forecast estimates, the share of peasant farms in the prime crop production will increase from 19.2 % in 2018 to 22.1 % in 2025. The deficiency of distribution area and lack of logistics infrastructure development will cause the reduction of household range of activity. By 2025 the share of private farms in the structure of crop production industry presumably may amount to 21.5 % (against 28.6 % in 2018).

The dominant position in the sectoral structure of the livestock farming will be kept, as before, by private farms and private plots, which will indicatively account for 67.1 % and 27.7 %, respectively. According to the forecast analysis, the share of peasant farms in the livestock production is expected to reach 6.2 % by 2025 [5].

Considering the development of non-resource-based model of national economic growth based on food export, the estimated figures of different types of farm products in the context of farming categories throughout the country confirm the above-mentioned positive trend of agricultural industry development.

It is worth pointing out that in 2018 Russia landed first spot in grain export in the world, ahead of the United States and China. The sunflower oil, cotton, soya bean oil and rape oil also prevailed in the structure of raw materials and food export of the Russian Federation. Revenues from food exports turn into a stable and important source of currency proceeding.

It is known that agricultural production is highly correlated to a large number of factors, some of which cannot be predicted. For instance, it seems quite difficult to foresee the development pathway of the export-oriented national crop production industry in the conditions of a high degree of uncertainty by bulk yield volume of staple agricultural crops, their structure and quality. For this reason, the given problem is solved by using the methods of mathematical modeling in economics.

The forecast estimates show that between 2018 and 2025 grain production in the country is expected to increase by 14.4 % (up to 163063.5 thousand tons) (Figure 3), and sunflower production – by 12.8 %, amounting to 14380.2 thousand tons. The growth of bulk yield of crop and oilseed production will be ensured by favorable weather conditions, rational farming system, use of certified seeds, application of modern high-tech farm machines, well-timed mineral fertilization, crop protection agents and others [6].

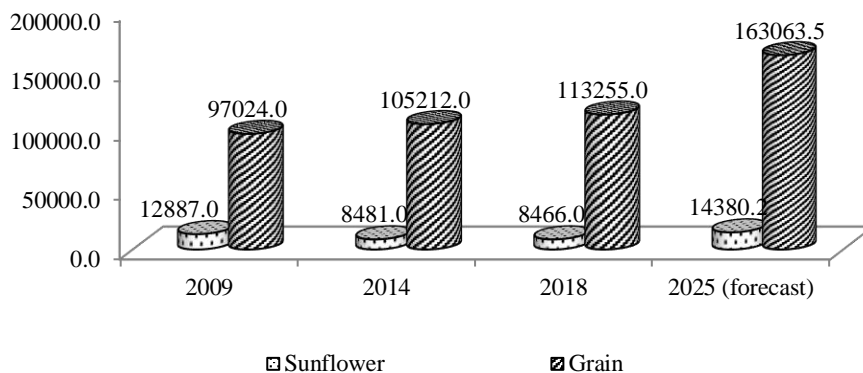


Fig. 3. The forecast of the production of prime export-oriented crops in the farms of all categories in the Russian Federation for 2025, thousand tons (The source: developed by the authors).

The key participants of the implementation of agricultural export-oriented strategy in the medium term period will include agricultural companies and peasant farms (Table 1).

Table 1. The forecast of the production of staple export-oriented crops by farming categories in the Russian Federation for 2025 (The source: developed by the authors).

Indicator	Private farms			Small agricultural entities					
	real value 2018	projected value 2025	2025 to 2018, %	Peasant farms			Private plots		
				real value 2018	projected value 2025	2025 to 2018, %	real value 2018	projected value 2025	2025 to 2018, %
grain, thousand tons	79540	109014.1	137.1	32824	53045.1	161.6	891	1004.3	112.7
the same, %	70.2	66.9	95.3	29.0	32.5	112.1	0.8	0.6	75.0
sunflower, thousand tons	8466	8808.7	104.0	4242	5518.4	130.1	45	53.1	118.0
the same, %	66.4	61.3	92.3	33.3	38.4	115.3	0.3	0.3	100.0

Thus, agricultural companies will account for 66.9 % of grain produced in the country and 61.3 % of produced sunflower.

At the same time, the role of small agricultural business in increasing the export potential of the country will grow. By 2025 the share of farms in grain production is expected to reach 32.5% (increasing by 12.1 % in comparison with 2018), in sunflower production – 38.4 % (increasing by 15.3 % in comparison with 2018) [7].

Upon the whole, the grain export volume calculated using nonlinear trend connections may amount to 69.4 million tons by 2025 (increasing by 26.6 % in comparison with 2018) [8].

The high capital cost of the vegetable farm-out is within the power of the large agricultural enterprises, operating on the innovation basis (Figure 4), but in the medium term period will not give an option of taking over the leadership from small businesses producing the given type of crops.

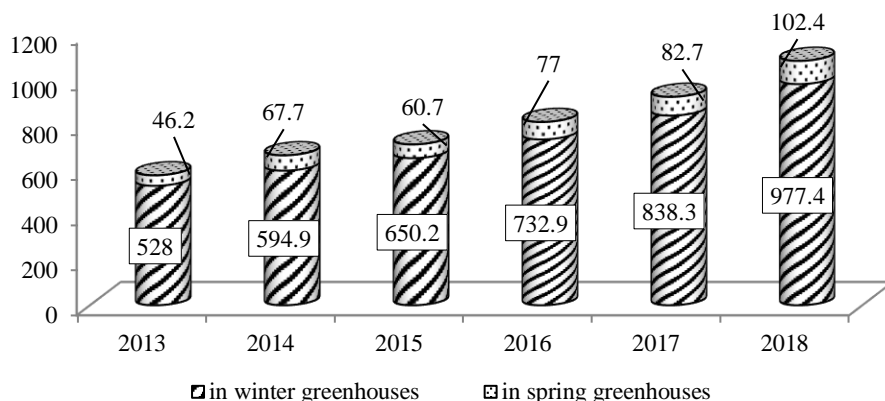


Fig. 4. The gross output of the vegetables grown in the greenhouses of the innovative agricultural enterprises in Russia, thousands of tons [2].

The forecast made for determination of the share of each farming category in the production of vegetables and potatoes for 2025, shows that the share of small businesses is expected to reach 67.9 % and 73.8 %, respectively (Table 2). The lion’s share of the output will be produced in private plots. Furthermore, the vegetable production by volume will increase by 8.4 % countrywide in 2025 [9, 10].

The focused attention of the state to the industry problems in the context of countersanctions will contribute to the increase in vegetable production by 32.5 % in large agricultural businesses with greenhouses, and by 16.8 % in peasant farms (Table 2).

The reason for this is the existence of real challenges related to well-managed food distribution channels. The experience shows that large private farms do not work directly with retail networks and cooperatives, and, in the majority of cases, sell their products in small consignments.

For another thing, changes in taxation of private plots, which sell their products on the market, will contribute to the decrease in vegetable and potato production in this segment in the long run.

Table 2. The forecast of vegetable and potato production by farming categories in the Russian Federation for 2025 (The source: developed by the authors).

Indicator	Private farms			Small agricultural entities					
	real value 2018	projected value 2025	2025 to 2018, %	Peasant farms			Private plots		
				real value 2018	projected value 2025	2025 to 2018, %	real value 2018	projected value 2025	2025 to 2018, %
vegetables, thousand tons	3581	4746.5	132.5	2559	2988.5	116.8	7545	7105.8	94.2
the same, %	26.2	31.9	121.8	18.7	20.1	107.5	55.1	47.8	88.4
potatoes, thousand tons	4317	5323.5	123.3	2841	3819.0	134.4	15237	10986.6	72.1
the same, %	19.3	26.0	134.7	12.7	19.0	149.6	68.0	54.8	80.6

One of the most vulnerable sectors of agricultural production under the conditions of export-oriented strategy is national livestock farming. Implemented programs for agricultural production development at the federal and regional levels promoted the arrangement of certain business conditions for industry development and motivated sustained trends of moderate economic growth of livestock production. Thus, in the last few years, the growth rate of livestock production in 2014 was 2.0 %, in 2015 – 3.1 %, in 2016 – 1.5 %, in 2017 – 2.8 %, 2018 – 1.3 %. However, it was not possible to reverse the situation related to the livestock sector development [11, 12].

The research results show that sanctions regime and implementation of export-oriented strategy in the agro-industrial complex will contribute to the change of institutional structure of staple livestock production. Thus, in the new economic reality the significant share of cattle, sheep and goat stock will be accounted for small business entities (Figure 5). By 2025 their share is expected to reach 55.8 % of cattle and 86.1 % of sheep and goats. The small agricultural business specialization that consists in the development of sheep and cattle breeding is associated with insignificant investments due to the lack of the need for sophisticated technical equipment application and use of inexpensive and available forage. Countrywide the number of cattle will be reduced from 18151.7 thousand heads in 2018 to 16719 thousand heads in 2025 (7.9 %) [13, 14, 15].

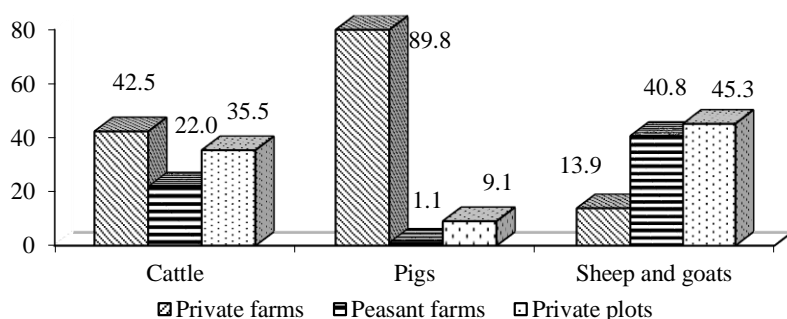


Fig. 5. The forecast of the farm stock structure by farming categories in the Russian Federation for 2025, % (The source: developed by the authors).

Large agricultural businesses will continue to develop pig production. The share of such companies will probably account for 89.8 % of the pig population, which is 2.0 % higher than in 2018 (Table 3).

Table 3. The comparison study of livestock inventory by all farming categories in Russia in 2018 and 2025 (forecast) (The source: developed by the authors).

Indicator	Private farms		Peasant farms		Private plots	
	real value 2018	projected value 2025	real value 2018	projected value 2025	real value 2018	projected value 2025
cattle stock, thousands of heads	8140	7118.4	2611	3677.4	7400	5923.7
the same, %	44.8	42.5	14.4	22.0	40.8	35.5
pig population, thousands of heads	20828	22886.1	377.7	283.5	2520.9	2314.8
the same, %	87.8	89.8	1.5	1.1	10.7	9.1

sheep and goats, thousands of heads	3704.5	3394.0	8689.4	9992.6	10735.4	11091.1
the same, %	16.0	13.9	37.6	40.8	46.4	45.3

According to the forecast, the key meat producers in the country in 2025 will still be agricultural companies with production volume of 9658.5 thousand tons (increasing by 15.0 % in comparison with 2018) (Table 3), their share is expected to be 83.9 % of the total volume of meat production. This positive trend is driven by the use of resource-saving, innovative, automatically controlled digital technologies in pig and poultry farming [16].

By 2025 the volume of meat production of private plots will decrease to 1442.6 thousand tons, amounting to 75.5 % of the level of 2018 (Table 4). By 2025 the volume of meat production of peasant farms will remain almost at the same level. High prices of animal feedstuff, inequality of exchange and low actual demand adversely affect the development of beef farming of small business entities.

Table 4. The forecast of meat and milk production by farming categories in the Russian Federation for 2025 (The source: developed by the authors).

Indicator	Private farms			Small agricultural entities					
	real value 2018	project ed value 2025	2025 to 2018, %	Peasant farms			Private plots		
				real value 2018	project ed value 2025	2025 to 2018, %	real value 2018	project ed value 2025	2025 to 2018, %
meat, thousand tons	8395.7	9658.5	115.0	321.9	415.1	129.0	1911.8	1442.6	75.5
the same, %	79.0	83.9	106.2	3.0	3.6	120.0	18.0	12.5	69.4
milk, thousand tons	16245.3	16891.3	104.0	251.1	3314.5	132.0	11854.9	9085.1	76.6
the same, %	53.1	57.7	108.7	8.2	11.3	137.8	38.6	31.1	80.6

Active state support for dairy breeding will not solve the key problems of the industry in the medium term period. Thus, in spite of the dynamic process of recent years, associated with the improvement and reconstruction of dairy livestock farms, the intensity of their use remains quite low. In 2018 the share of additional milk production at these facilities amounted to only 2.7 % of the total output [17].

An additional point is that the equipment of existing national dairy farms does not always satisfy the requirements of high-producing cows keeping, and this is the reason why the biological potential of animals is not used in full in some federal districts of the country, which adversely affects the gross milk production. So, according to the forecast, milk production of the farms of all categories in the country will decrease by 4.3 %.

The employment of manual labor and use of low technologies will lead to the slump of production of this food type in private plots from 11854.9 thousand tons in 2018 to 9085.1 tons in 2025 (23.4 %).

In 2025 the top positions in milk production will be taken up by agricultural businesses using present-day innovation technologies of hand-feed, livestock keeping and updating the genetic turnover of the pedigree base. Their share presumably will increase from 53.1 % to 57.7 %, amounting to 16891.3 thousand tons [18, 19].

State support measures focused on the development of small businesses in the livestock sector, in particular family dairy farms, encouraged the increase of peasant farms share in the structure of this food type production. Following the forecast calculations, the share of peasant farms in the structure of milk production will increase from 8.2 % in 2018 to 11.3 % in 2025. Milk production in this category of farms can increase by 32.0 %.

The validity of the milk production forecast developed with the use of trend modeling methods can be proved by the actual data of the State Program targets achievement for this type of food, which confirm the current trend of increase of the domestic deficiency of dairy foods [20].

The three authorial scenarios for the development of food self-sufficiency in the Russian Federation can be identified according to the forecast estimates for determination of the country's food self-sufficiency in the medium term period considering reasonable consumption rates (Table 5).

Table 5. The forecast of food staples production per capita in Russia for 2025 with the consideration of export-oriented strategy implementation (The source: developed by the authors).

Indicator	The forecast of production per capita for 2025			Average consumption rate, kg/cap/year	Food self-sufficiency level, as a percentage of the rate		
	I base case scenario	II best-case scenario	III worst-case scenario		I base case scenario	II best-case scenario	III worst-case scenario
Meat, kg	78.5	76.5	79.8	73.0	107.5	104.8	109.3
Milk, kg	199.8	194.8	203.1	325.0	61.5	59.9	65.2
Vegetables, kg	101.2	98.7	102.9	140.0	72.3	70.4	73.5
Potatoes, kg	136.6	133.2	138.9	90.0	151.8	148.0	154.3

The first base case scenario rests on the Russian Federation population size of 146.6 million people and suggests that in 2025 the capability of agriculture to provide the country's population with meat will amount to 107.5 % of the rate, potatoes – 151.8 % of the rate, vegetables – 72.3 % of the rate, milk – 61.5 % of the rate.

The second best-case scenario is calculated considering the positive trend of the country's population increase in the medium term period to 150.4 million people. According to this scenario, in 2025 achievement of food self-sufficiency of meat in the medium term will amount to 104.8 % of the rate, of potatoes – 148.0% of the rate, of vegetables – 70.4% of the rate, of milk – 59, 9% of the rate.

The third worse-base scenario is developed from the perspective of Russian population decrease to 144.2 million people by 2025. The forecast shows that the volume of vegetable production per capita in 2025 will amount to 73.5 % of the rate, potatoes production – 154.3 % of the rate, meat production – 109.3 % of the rate, milk production – 65,2 % of the rate (Table 4).

In the medium term period the surplus of meat and potatoes can be sold on the markets of countries near and far abroad. Thus, since 2010 67 enterprises of the Belgorod Region have been delivering pig and poultry meat for export to such countries, as China, Iran, Egypt, Singapore, United Arab Emirates, Saudi Arabia and others.

Successful sale of poultry meat under the brand name “Halal” is carried out by the leading poultry farms of Tatarstan, which deliver products to Saudi Arabia, Iraq and Qatar [3].

Taking into account contemporary trends, by 2025 the forecasted export volume of meat may reach 470.1 thousand tons, of potato – 399.0 thousand tons, which is 32.6 % and 48.8 % higher than the level of 2018.

4 Conclusion

Thus, the state agricultural policy in the scope of implementation of priority strategies and programs of federal and regional relevance in the agro-industrial complex enabled to plot the vector of non-resource-based model of national economic growth, providing the solution of country's food independence problem, increasing export potential and competitive ability, ensuring country's doubtless grain export leadership on the world stage.

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