

Assessment of agricultural production in Russia in the context of global food security

Natalia Alekseeva^{1,}, Zinaida Mironova¹, Elena Aleksandrova¹, Larisa Istomina¹, and Marina Mironova²*

¹Udmurt State Agrarian University, Department of Production Organization and Economic Analysis, Izhevsk, Russia

²Udmurt State Agrarian University, Department of Economic Cybernetics and Information Technology, Izhevsk, Russia

Abstract. The world's economies are focused on sustainable development and food security. One of the main components of the food security system of the country - agricultural production - is highlighted. The study aims to identify the problems and prospects for the development of food security. The objectives of the study are related to the justification of the system of indicators (criteria) to assess the level of food security of countries, the choice of the list of countries for comparative analysis, conducting economic and statistical analysis, formulating directions to improve food security management. The system of indicators to assess the level of food security in the countries based on the assessment of average annual indices of production and consumption of products per capita and per arable land or livestock, poultry. An assessment of food security in terms of agricultural development indicators was conducted for the years 2010-2018. The scientific novelty of the research consists in the development of a methodology for assessing food security indicators, assessment of progressive and negative changes in the level of food security, formulation of conclusions to improve food security in Russia. The practical significance of the study lies in the possibility of developing a more efficient state agricultural policy.

1 Introduction

According to the Decree of the President of the Russian Federation [1] and the current Doctrine of Food Security of the Russian Federation, the food security of the country determines the ability of the national economy to produce “food products in volumes not less than rational norms of their consumption” and “threshold values of their specific weights in commodity resources of the domestic market”.

According to A. I. Altukhov [2], O. A. Medyanskaya, D. A. Romanov [3], the criteria of food security in the country must reflect the norms of consumption, the existing structure of the diet of the population, food traditions, physical access to food (considering the development of transport and trade infrastructure), economic affordability of food

* Corresponding author: 497477@mail.ru

(considering the population income) in terms of basic types of food, population groups. According to A. I. Altukhov [2], E. A. Shutaeva [4] erroneously included indicators of the level and quality of life in the system of evaluation indicators of food security. A. I. Altukhov [2] also pointed out that the assessment of the level of food security should include the possibility of international comparisons. G. N. Stroeva [5] pointed out the applicability of both individual indicators and integral assessments of food security.

According to K. Zemliak, A. Zhebo, and A. Aleshkov [6], food security is an integral part of national security and sovereignty. The causes of food shortages in the world are examined.

The important problem of the low level of digitalization of management in agriculture was considered by P. B. Akmarov, O. P. Knyazeva, E. S. Tretyakova [7], S. V. Ivanova, G. V. Kuznetsova [8].

In our opinion, not enough research in the field of food security is devoted to the main elements of the food security system (agriculture, fisheries, and food industry). If a country does not have developed and sustainable agriculture, it is difficult to claim food independence.

For example, a group of authors led by J. Guo [9] noted that there are 120 net food (grain) importing countries in the world without sustainable and developed agriculture. The increased influence of the world food trade harms global food security. Also, L. S. Arkhipova, I. V. Gorokhova [10] identified only 12 most developed regions in Russia out of 89 subjects of the Russian Federation, suitable for agricultural production by agroclimatic conditions. V. A. Ivanov [11] posed the problem of state regulation of food security in the Arctic zone of Russia.

2 Materials and methods

The scientific novelty of the study lies in the development of methodology for rationing the indicators that characterize the production of food, their consumption, reduced either to the population of the country or to the size of the arable land, and herd livestock. Normalization is to assign a given indicator of 1 point for satisfying the evaluation criterion, 0 points for not satisfying the evaluation criterion. The system of developed evaluation criteria, the grouping of countries for international comparison, and recommendations for the development of economic policies to regulate the level of food security are also novel.

The purpose of the study is to identify the problems and prospects of the development of food security in countries, including Russia. The objectives of the study are to substantiate a system of indicators to assess the status and trends of agricultural development in the context of global food security.

The main method of research was a structural-dynamic and comparative analysis of macroeconomic indicators. Since current world statistics do not cover post-pandemic macroeconomic changes and the global restructuring of material and monetary flows in Russia with an eastward orientation [12], the accuracy of predictions about the directions of food security improvement in Russia may be reduced.

3 Results

Let us present a system of indicators to assess the “production” component of food security:

1) the average annual index of production of cereals and leguminous crops per capita is higher than the average annual index of consumption of bakery products per capita;

2) the average annual index of livestock and poultry production in carcass weight per capita is higher than the average annual index of consumption of meat and meat products per capita;

3) the average annual index of cow’s milk production per capita is higher than the average annual index of consumption of milk and dairy products per capita;

4) the average annual index of production of vegetables and gourds per capita is higher than the average annual index of consumption of vegetables and gourds per capita;

5) the average annual index of sugar beet production per capita is higher than the average annual index of sugar consumption per capita;

6) the average annual index of sunflower production per capita is higher than the average annual index of vegetable oil consumption per capita;

7) the average annual index of cereal and leguminous crops production per capita is higher than the average annual index of growth of arable land;

8) the average annual index of cow milk production per capita is higher than the average annual index of cattle per capita growth;

9) the average annual index of livestock and poultry production in slaughter weight per capita is higher than the average annual index of growth in the number of cattle per capita;

10) the average annual index of production of chicken eggs per capita is higher than the average annual index of growth in the number of poultry per capita.

Let us apply the developed criteria for assessing the “production” component of food security to the economies of different countries (Table 1).

Table 1. Assessment of food security in the countries of the world for 2010-2018, points.

Country	Food safety criteria										Total
	1	2	3	4	5	6	7	8	9	10	
Slavic World											
Russia	1	1	1	1	1	1	1	1	1	0	9
Ukraine	1	1	1	1	1	1	1	0	0	0	7
Belarus	0	1	1	0	1	x	0	1	1	0	5
The Western World											
Hungary	1	0	1	1	1	1	1	0	0	0	6
Germany	0	1	1	1	1	0	0	1	1	0	6
Romania	1	0	0	0	1	1	1	1	1	1	7
Slovakia	1	0	0	0	1	1	1	0	0	1	5
Czech Republic	0	0	1	0	1	0	1	0	0	1	4
Austria	x	1	1	0	0	x	0	1	1	1	5
Bulgaria	x	0	0	1	x	1	1	0	0	1	4
Spain	x	1	1	x	0	1	1	1	1	1	7
Italy	x	0	1	1	0	1	0	1	0	0	4
Lithuania	1	1	0	0	0	x	1	1	1	1	6
Netherlands	x	1	0	x	1	x	0	0	1	1	4
Poland	1	1	1	1	1	x	0	1	1	0	7
Portugal	x	1	x	0	1	x	1	0	0	1	4
UK	x	1	1	0	0	x	0	1	1	1	5
Finland	x	0	0	0	0	x	0	1	1	0	2
France	x	1	0	1	0	1	0	0	0	1	4
Bulgaria	x	0	0	1	x	1	1	0	0	1	4
Spain	x	1	1	x	0	1	1	1	1	1	7
Italy	x	0	1	1	0	1	0	1	0	0	4
Lithuania	1	1	0	0	0	x	1	1	1	1	6

Netherlands	x	1	0	x	1	x	0	0	1	1	4
Poland	1	1	1	1	1	x	0	1	1	0	7
Portugal	x	1	x	0	1	x	1	0	0	1	4
UK	x	1	1	0	0	x	0	1	1	1	5
Finland	x	0	0	0	0	x	0	1	1	0	2
France	x	1	0	1	0	1	0	0	0	1	4
Japan	1	1	1	1	1	x	1	1	1	0	8
USA	x	1	0	0	1	1	1	1	1	1	7
Australia	1	0	0	0	0	x	0	1	1	1	4
The Eastern World											
Azerbaijan	1	1	1	1	1	1	1	1	1	1	10
Kazakhstan	1	0	0	1	1	1	1	0	1	1	7
Kyrgyzstan	1	0	0	0	1	0	1	0	0	0	3
Tajikistan	0	0	1	1	x	x	0	1	1	1	5
Total	12	15	14	12	16	12	15	16	17	16	x

Source: compiled by the authors.

Note: x – there is no possibility of calculating indices.

One of the highest levels of food security was observed in Russia (9 points). The highest score of 10 could not be obtained due to the insufficiently high efficiency of chicken egg production. The same insufficient level of efficiency of chicken egg production is noted in Hungary, Germany, Ukraine, Belarus, Kyrgyzstan, Italy, Finland, Japan, and Poland. Food security was higher than the Russian level only in Azerbaijan (10 points). Third place in terms of food security was given to Japan (8 points). There are 14 countries with an average level of food security (5-7 points), among which Romania, Kazakhstan, Spain, Poland, and the United States are the most influential.

The low level of food security (2-4 points) is noted in Finland, Kyrgyzstan, and several other countries, which is due to underdeveloped material and technical base of production, unfavorable natural and climatic conditions, and established specialization of agriculture.

In terms of the production of cereals and legumes concerning the consumption of bakery products and in relation to the size of arable land, Germany, Belarus, and Tajikistan lagged behind (comparison of indicators 1 and 7). Conversely, most countries recorded an increase in grain production concerning both the population and the size of the arable land (Russia, Hungary, Romania, Slovakia, Ukraine, and others - a total of 10 countries).

Unfavorable trends in the production of livestock and poultry in carcass weight in relation to the growth of consumption of meat and meat products and in relation to livestock were recorded in Hungary, Slovakia, Czech Republic, Kyrgyzstan, Bulgaria, Italy (comparison of indicators 2 and 9). On the contrary, 12 countries were leaders in the efficiency of livestock and poultry production in carcass weight.

Cow milk production decreased in relation to the consumption of milk and dairy products and in relation to the size of cattle in Slovakia, Kazakhstan, Kyrgyzstan, Bulgaria, the Netherlands, and France (comparison of indicators 3 and 8).

Australia, Romania, and Finland have highly intensified meat and dairy cattle production, and Australia also has poultry production. However, in Australia, Romania, and Finland the level of consumption of meat and dairy products is much higher than the level of their production, which increases the threats to food security in these countries. The United States had highly intensive agricultural production of all major products, but the country lagged in the production of milk and vegetables. In Poland, Japan, Spain, Austria, and Great Britain, highly intensive agriculture was combined with higher growth in domestic production relative to consumption. In Ukraine, the level of domestic food

production is higher than consumption, but there was a decrease in the intensification of the production of meat and dairy products.

In our view, the highest potential threat to food security was in Finland (indicators 1-6) and Kyrgyzstan. Here there were signs of intensification of production only for cereals and legumes. For milk, carcass weight of livestock and poultry, and eggs, the available resources were underutilized.

In general, among the indicators of intensification of grain, milk, increase in carcass weight and egg production (indicators 7-10, for which there is complete statistical information) in the countries studied, the greatest value was achieved in the increase in slaughter weight of livestock and poultry. Studies have shown that Russia has good opportunities for the development of agriculture and the improvement of food security through mutually beneficial cooperation with almost all countries of the world.

4 Discussion

The results obtained for 2018 and their comparison with previously obtained results for 2010 [13] showed marked progressive shifts in the growth of global production of all types of agricultural products (from 113% for milk, 120% for cattle and poultry in carcass weight, to 165% for sunflowers).

The role of the Ukrainian economy in ensuring global food security in the coming years is debatable. According to our estimates, Ukraine has significantly lost its existing production potential.

We agree with the estimates of A. V. Lukomets [14] that Russia needs to increase the production of legume crops (peas, lentils, beans, and others) as having high nutritional value for humans and animals, high yields and contributing to an increase in the gross harvest.

It is also worth agreeing with the position of I. V. Kovaleva, D. G. Galkin [15], as well as I. V. Kovaleva, M. Kudinova, N. Shevchuk, E. Uvarova [16], V. A. Kundius, I. V. Kovaleva, V. V. Gorshkov [17], who predict the growth of production in Russia of organic products with high added value, increased requirements for quality and certification, satisfying narrow segments of consumers as a response to increasing demand in developed countries for organic products.

5 Conclusion

Russia could share its agricultural technology for the production of grain and leguminous crops, livestock and poultry, and milk with France, Hungary, Portugal, Kyrgyzstan, Bulgaria, and other countries. Russia could significantly strengthen its position in exporting the main types of agricultural products studied, especially to the following countries: Romania, Slovakia, the Czech Republic, Kyrgyzstan, Lithuania, Finland, and Australia.

The most efficiently produced type of product in the countries studied is livestock and poultry in carcass weight (17 points on the final line). The most exported type of product could be sugar beet (16 points on the final line).

Given the exemption in Russia of some food markets from foreign suppliers of imported products, the transition to digital technology, and computer modeling methods, the food security of the country will only increase.

Due to the growth of Russian territories, fertile arable land is expected to increase, which will be reflected in an increase in the gross harvest of crop production, the growth of production of high-quality forage for farm animals, the growth of livestock production.

Since per capita production of the main types of agricultural products is higher than per capita consumption, Russia will continue to increase the export of agricultural raw materials and food on mutually beneficial terms, the mission of providing humanitarian food aid to countries in particular need.

References

1. On Approval of the Doctrine of Food Security of the Russian Federation. Decree of the President of the Russian Federation of 21.01.2020 No. 20. Accessed on: February 15, 2023. [Online]. Available: <http://www.kremlin.ru/acts/bank/45106>
2. A. I. Altukhov, *Econ. Agric. Proc. Enterp.* **3**, 2-7 (2016)
3. O. A. Medyanskaya, D. A. Romanov, *Soc.: Polit., Econ., Law* **1**, 36-38 (2016)
4. E. A. Shutaeva, *Act. Probl. Human. Nat. Sci.* **7-1**, 226-228 (2016)
5. G. N. Stroeva, *Reg. Econ.: Theory Pract.* **16(6(453))**, 1141-1159 (2018)
6. K. Zemliak, A. Zhebo, A. Aleshkov, *Food Security and Self-Sufficiency as a Basis for National Security and Sovereignty*, in M. Khosrow-Pour (ch. ed.) *Evidence from Russia Research Anthology on Strategies for Achieving Agricultural Sustainability* (IGI Global Publisher, 2022)
7. P. B. Akmarov, O. P. Knyazeva, E. S. Tretyakova, *IOP Conf. Ser. Earth Envir. Sci.* **666(4)**, 042036 (2021)
8. S.V. Ivanova, G.V. Kuznetsova, *LNNS* **205**, 209-217 (2021)
9. J. Guo, K. Mao, Z. Yuan, Z. Qin, T. Xu, S.M. Bateni, Y. Zhao, C. Ye, *Sustainability* **13**, 14005 (2021)
10. L.S. Arkhipova, I.V. Gorokhova, *LNNS* **205**, 55-63 (2021)
11. V. A. Ivanov, *North Market: Shap. Econ. Order* **1**, 58-71 (2022)
12. N.A. Alekseeva, O.G. Dolgovykh, E.V. Aleksandrova, L.A. Istomina, Z.A. Mironova, *LNNS* **380**, 256-260 (2022)
13. N. A. Alekseeva, *Bul. Inst. World Civil.* **12(1(30))**, 44-48 (2021)
14. A.V. Lukomets, *LNNS* **245**, 719-729 (2022)
15. I. V. Kovaleva, D. G. Galkin, *IOP Conf. Ser.: Earth Environ. Sci.* **988**, 022015 (2022)
16. I. Kovaleva, et al., *IOP Conf. Ser.: Earth Environ. Sci.* **981**, 022061 (2022)
17. V. A. Kundius, et al., *IOP Conf. Ser.: Earth Environ. Sci.* **677**, 022050 (2021)