Assessment of food security of the regions of the Arctic zone of the Russian Federation

A.N. Pestryakov, *N.V.* Sbrodova, *M.A.* Albycheva, and *E.A.* Reutova*

Ural State University of Economics, Yekaterinburg, Russia

Abstract. Ensuring food security and promoting the development of agriculture are included in the priority goals of sustainable development of the Arctic zone of the Russian Federation until 2035. The structural complexity and multidimensionality of food security in the region requires a clear methodology for its assessment. The article presents the results of a study of food security in the regions of the Arctic zone of the Russian Federation. This study is based on an analysis of the advantages and disadvantages of existing methods for assessing food security in the regions of the Arctic zone of the Russian Federation. The authors proposed a methodology for assessing the food security of the regions of the Arctic zone of the Russian Federation, which makes it possible to translate a phased multivariate analysis (the methodology was tested on the example of the Chukotka Autonomous Region).

1 Introduction

In 2010, according to the Decree of the President of the Russian Federation, the vector of the country's development in the field of agriculture was designated [1]. For Russia, the priority policy area has become food security, enshrined in the Food Security Doctrine. However, this document consolidated the provisions only for the territory of the entire country and did not have regional features. In this regard, on the territory of many constituent entities of the Russian Federation, their own normative legal acts were created to regulate relations to ensure food security. In these legal documents, systems of indicators for assessing food security are enshrined.

2 Materials and Methods

Currently, on the territory of Russia there is no unified system for assessing the food security of the region [6]. In the early studies of the authors, the current assessment methods enshrined in regulatory legal acts (including the Food Security Doctrine, the Law of the Murmansk Region "On ensuring the food security of the region", as well as the Resolution of the Government of the Yamal-Nenets Autonomous Region "On Yamalo-Nenets Autonomous Region"), analysis of security measurement tools was carried out.

The main disadvantages in the developed methods are the following provisions:

* Corresponding author: kata565722@yandex.ru

Lack of clear thresholds

The assessment tools do not cover all areas that form the food security of the region. The development of agricultural infrastructure, which provides storage, processing and transportation of manufactured products, remains not included in the methodology.

The methodologies are based on individual indicators that do not allow for an aggregate assessment.

The authors propose a methodology consisting of several sequential stages (table 1). At stage 1, an overall assessment of the level of self-sufficiency is given, a high indicator of which is the main task according to the Doctrine of the country's food security. Stage 2, including 3 indicators, establishes the main factors for the formation of a low level of food security in the region (low production, low consumption, low food quality). Stage 3 reveals the infrastructural features of the development of food security in the region, as the most important in ensuring food security in the regions of the Arctic zone of the Russian Federation.

Table 1. Methodology for assessing food security in the regions of the Arctic zone of the Russian Federation.

Stage	Rating parameter name	Calculation method	Parameter threshold
Stage 1. Food security	Self-sufficiency level	$\frac{\text{volume of food products produced in the region}}{\text{the volume of all food products in the region}}$	20%*
Stage 2. Food security indicators	Assessment of the physical availability of food	$\frac{\text{volume of food products produced}}{\text{rational consumption rates} * \text{population size}}$	100%
	Assessment of the economic availability of food	$\frac{\text{actual consumption food per capita}}{\text{rational consumption of food}}$	100%
	Assessment of food quality and safety	$\frac{\text{volume of low} - \text{quality and dangerous food products produced in the region}}{\text{the volume of all food products produced in the region}}$	0%
Stage 3. Scorecard.	Indicator 1. Consumer price index for the main socially significant food products	Index	30%**
	Indicator 2. Share of losses in the sale of food products	$1 - \frac{\text{the volume of all food products produced in the region}}{\text{production volume}}$	meat - 0.5%, bread - 0.5%, potatoes 0.6%, milk - 0.05%, vegetables 1.5% ***
	Indicator 3. Share of food stocks in total consumption by the population	$\frac{\text{food stocks}}{\text{actual food consumption per capita} * \text{population}}$	20%*

Table 1. Continued.

Stage 3. Scorecard.	Indicator 4. Availability of capacities for storage and processing of crop products.	If statistics are available, this is either a separate indicator or the amount of possible storage in warehouses / volume of products produced	100%
	Indicator 5. Volume of state social assistance to low-income families and low-income citizens living alone	$\frac{\text{amount of state aid}}{\text{the amount of funds required to provide for those in need}}$	100%
	Indicator 6. Volume of state support for legal entities and individuals engaged in the production of agricultural products per ruble of products sold	$\frac{\text{volume of state aid to agricultural producers}}{\text{agricultural products sold}}$	twenty%
	Indicator 7. Volume of state support for legal entities and individuals engaged in storage and processing of agricultural products per ruble of products sold	$\frac{\text{volume of state assistance to persons engaged in storage and processing of agricultural products}}{\text{agricultural products sold}}$	twenty%
	Indicator 8. Availability of areas for trade and catering per 1000 people	Separate indicator	208 m² ****

*The indicator is borrowed from [2].
**The indicator is borrowed from [3].
***The indicator is borrowed from [4].
****The indicator is borrowed from [5].

Based on the proposed system for assessing the state of food security in the Arctic zone regions of the Russian Federation, it is possible to comprehensively characterize the current position of the analyzed territory, as well as identify the factors of the greatest influence on the level of food security of the regions.

3 Results and Discussion

As part of approbating this methodology, it is proposed to analyze the food security of the Murmansk region, which is part of the Arctic zone of the Russian Federation. It is important to note that approbation is not possible for all indicators and (or) food products. This is due to the lack of statistical data both in the analyzed region and in most of the territories of the Arctic zone of the Russian Federation.

Stage 1. Food safety criterion.

The level of self-sufficiency for individual food products in the region is below the threshold values (Table 2). This is due to the lack of food production capacity. On the territory of the Murmansk region, there are only 7 enterprises operating in the animal husbandry industry, and 2 enterprises in the plant growing industry. These enterprises, in total, do not produce enough food to meet the demand of the region's population.

Table 2. The level of self-sufficiency in the Murmansk region for 2015-2020, in %.

	2015	2016	2017	2018	2019	2020
Meat and meat products	-27.23%	n / a	-304.32%	-337.18%	-340.10%	-391.09%
Milk and dairy products	99.79%	99.71%	98.85%	98.18%	99.43%	99.31%

Stage 2. Food security indicators.

A) Assessment of the physical availability of food reflects a negative trend towards low production of vital food products, which in general is the main negative factor that forms a low level of food security (Table 3).

Table 3. Physical availability of food in the Murmansk region for 2015-2020, in %.

	2015	**2016**	**2017**	**2018**	**2019**	**2020**
Meat and meat products	84.02%	21.57%	23.36%	23.51%	23.80%	20.32%
Milk and dairy products	7.22%	6.75%	7.41%	7.45%	6.88%	6.86%
Potato	72.93%	76.53%	68.08%	68.49%	71.29%	87.67%
Vegetables	3.82%	2.81%	4.59%	4.62%	4.68%	6.36%

B) The assessment of the economic availability of food products is at a low level due to the lack of food in the region and because of the consumption specifics of certain types of food. Due to the high demand for meat products, the region imports them from the neighboring regions and from abroad (Table 4).

Table 4. Economic availability of food in the Murmansk region for 2015-2020, in%

	2015	2016	2017	2018	2019	2020
Bread products	71.25%	74.69%	74.48%	72.60%	68.96%	68.44%
Potato	56.56%	59.56%	57.89%	55.44%	54.67%	53.22%
Vegetables and melons	66.07%	71.14%	66.29%	66.64%	64.79%	66.57%
Meat products	116.03%	120.14%	123.56%	122.60%	116.30%	120.27%
Eggs	87.31%	95.00%	98.08%	94.23%	92.31%	94.62%
Milk	82.50%	85.09%	85.12%	84.71%	81.76%	82.82%

C) The assessment of the quality and safety of food products [7] is at a low level due to food spoilage at the stages of its implementation, which is caused by the underdevelopment of infrastructure and logistics in the Murmansk region (Table 5).

Table 5. The share of hazardous products of the total food supply, percentage recorded on the territory of the Murmansk region by the supervisory authorities

	2015	2016	2017	2018	2019	2020
Meat	1.6	4.1	4.5	5.0	6.4	6.6
Bakery products	2.0	3.8	4.1	4.1	2.6	3.0
Milk and dairy products	7.4	6.8	7.4	14.3	3.5	2.1
Eggs	11.1	8.8	13.8	5.4	8.2	2.5
Vegetables	1.4	0	0.3	0.2	2.0	0.7
Potato	0	0	0	0	0	0

Stage 3. Scorecard.

Indicator 1. The consumer price index for the main socially significant food products as a whole did not exceed the threshold values in quarterly periods (Table 6).

Table 6. Consumer price index for basic food products in the Murmansk region for 2015-2020, in percentage

		Potato	Milk	Bird	Eggs
2015	I	101	103	100	117
	II	107	104	100	95
	III	88	89	100	100
	IV	120	103	101	119
2016	I	74	108	n / a	90
	II	127	104	n / a	81
	III	77	99	n / a	99
	IV	119	104	n / a	118
2017	I	86	102	99	98
	II	124	99	102	94
	III	85	101	100	97
	IV	107	105	97	118
2018	I	88	101	96	105
	II	114	98	97	95
	III	84	94	107	99
	IV	101	107	107	123
2019	I	122	101	98	101
	II	80	101	93	96
	III	150	102	98	93
	IV	77	98	107	105
2020	I	111	101	101	105
	II	142	101	97	108
	III	76	99	98	95
	IV	74	99	108	90

Indicator 2. The underdeveloped storage facilities, food processing and transportation in the region (table 7) also cause the share of losses in the sold food products.

Table 7. Share of losses in the sale of food products.

	2015	2016	2017	2019	2020
Potato	19%	19%	ten%	eight%	5%
Milk and dairy products	1%	1%	1%	1%	1%
Vegetables and melons	100%	77%	67%	thirty%	twenty%
Eggs	n / a	2%	3%	n / a	n / a

Indicator 3. The share of food stocks in the total food consumption is below the norm also due to the lack of storage facilities for the produced foods (Table 8).

Table 8. Food stocks in the Murmansk region for 2018-2020, percentage of consumption.

	2018	2019	2020
Corn	0.51%	0.00%	0.00%
Milk	4.49%	2.82%	2.64%
Meat	3.65%	3.27%	3.27%

Indicator 4. There are no statistics on the availability of storage and processing facilities in the region. However, the media and speeches of local authorities indicate the presence of a significant problem in the development of infrastructure, which is the main factor shaping food security threats.

Indicator 5. The volume of state social assistance to low-income families and low-income citizens living alone significantly exceeds the required norms, which, on the one hand, has a positive effect on the social strata of the population and their level of consumption as well as on the economic availability of food. On the other hand, a disproportionate amount of allocated funds can lead to incorrect spending of the budget, which can also negatively affect the region in the future. At this stage, the authors recommend reallocating funds in the region (Table 9).

Table 9. The volume of state social assistance to low-income families.

	2015	2016	2017	2018	2019
The volume of state social assistance to low-income families	306%	363%	628%	931%	811%

Indicator 6. The volume of state support for legal entities and individuals engaged in the production of agricultural products per ruble of products sold is presented in Table 10. This indicator is within the normal range, which generally has a positive effect on agricultural enterprises in the production of products, but does not create the so-called "Donor needle" in the Murmansk region (table 11).

Table 10. The volume of state support for legal entities and individuals engaged in the production of agricultural products in the Murmansk region for 2015-2020 per ruble of products sold, %.

	2015	2016	2017	2018	2019
Murmansk region	6.43%	4.67%	4.74%	3.19%	3.98%

Indicator 7. Volume of state support for legal entities and individuals engaged in storage and processing of agricultural products per ruble of products sold. Currently, there is no state support in this direction, which poses the main threat to the food security of the entire region.

Indicator 8. The provision of areas for trade and catering per 1000 people has a positive trend towards growth, with the exception of a decrease in 2020. This decline was driven by the Covid-19 pandemic. In the authors' opinion, the growth of indicators will be able to continue and reach an acceptable level only if restrictions are reduced both for the local population and for the trade industry.

Table 11. Provision of areas for trade and catering per 1000 people, m^2

	2015	2016	2017	2018	2019	2020
Provision of areas	146.9	168.4	197.4	201	209.4	173.5

Summarizing the analysis carried out in accordance with our methodology, let us compare the data obtained in Table 12.

4 Conclusion

Thus, the level of food security of the Murmansk region in 2020 is assessed as low with high risks for this region in terms of self-sufficiency in food. At the same time, in general, the growth of indicators in dynamics is not significant, except for the improvement in food prices.

It is important to note that the main factor behind the backwardness of agricultural producers and forming the main threat to food security is the underdeveloped infrastructure that provides storage, processing and transportation of manufactured products. This lag is

also due to the lack of investment in the development of sub-sectors from both the state and the region.

Table 12. Final Food Security Assessment.

Stage	Assessment parameter title	Assessment parameter	Score obtained in 2015	Score obtained in 2020
Stage 1. Food security criterion	Self-sufficiency level	4 (2 for each type of product)	2	2
		Total for stage 1:	**50%**	**50%**
Stage 2. Food security indicators	Assessment of the physical availability of food	8 (2 for each type of product)	0	0
	Assessment of the economic availability of food	12 (2 for each type of product)	2	2
	Assessment of food quality and safety	12 (2 for each type of product)	2	2
		Total for stage 2:	**12.5%**	**12.5%**
Stage 3. Scorecard	Indicator 1. Consumer price index for the main socially significant food products	32 (2 points for each quarter for each type of product)	20	25
	Indicator 2. Share of losses in the sale of food products	6 (2 for each type of product)	0	0
	Indicator 3. Share of food stocks in total consumption by the population	6 (2 for each type of product)	0	0
	Indicator 4. Availability of capacities for storage and processing of crop products.	0 (no statistics available)	0	0
	Indicator 5. Volume of state social assistance to low-income families and low-income citizens living alone	2	2	2
	Indicator 6. Volume of state support for legal entities and individuals engaged in the production of agricultural products per ruble of products sold	2	2	2
	Indicator 7. Volume of state support for legal entities and individuals engaged in storage and processing of agricultural products per ruble of products sold	2	0	0
	Indicator 8. Availability of areas for trade and catering per 1000 people	2	0	0
		Total for stage 3:	**46.2%**	**55.8%**

References

1. Decree of the President of the Russian Federation of 30.01.2010 N 120 "On approval of the Doctrine of food security of the Russian Federation".
2. Food and Agriculture Organization of the United Nations. Assessment of food security and nutrition. https://www.fao.org.
3. Law of the Sverdlovsk region of January 31, 2012 N 6-OZ "On ensuring food security of the Sverdlovsk region".

4. Order of the Ministry of Industry and Trade of Russia dated 01.03.2013 N 252 "On approval of the norms of natural loss of food products in the field of trade and public catering" (Registered in the Ministry of Justice of Russia 05.04.2013 N 27999).
5. Government of the Murmansk region Resolution of December 10, 2010 No. 549-PP "On approval of standards for the minimum provision of the population with the area of retail facilities in the Murmansk region".
6. A. Pestryakov, E. Reutova, N. Sbrodova and A. Titovets. International Scientific and Practical Conference “Fundamental and Applied Research in Biology and Agriculture: Current Issues, Achievements and Innovations” (FARBA 2021), E3S Web of Conferences, **254** (2021)
7. Materials for the state report "On the state of sanitary and epidemiological well-being of the population in the Murmansk region in 2020" Department of the Federal Service for Supervision of Consumer Rights Protection and Human Well-being in the Murmansk Region.