

## INTEGRAL ASSESSMENT OF FOOD SECURITY IN THE AMUR REGION



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**The state estimate of the regional food security and performing functions of food demand and supply have been made. The ensuring of the region with agricultural products of its own production was comprehensively assessed by the system of generalized indicators. The assessment was conducted on the basis of generally accepted criteria reflecting all the main aspects of food security, namely, self-sufficiency, independence (dependence), sufficiency, availability and quality of products.**

**Key words:** region, food facility, self-sufficiency, independence (dependence), sufficiency, availability, quality of agricultural products, level of self-sufficiency

**Introduction.** Amid the introduction of the food import embargo from a number of foreign countries the issues of differentiation of the modern *food supply* system become presently topical. The emphasis on this issue is obvious, since the consumption of food products is a priority vital necessity of the population. The creation of conditions for ensuring residents with food of appropriate quality as needed and low-cost is one of the most important aspects of the state policy in the Federal food supply system. It requires a primary decision for present and future generations [1].

Currently, under the conditions of social-political and economic instability from a functional standpoint for the Federal food facility system food product provision for the administrative regions of the Federation is of particular importance [1, 2]. Regions of the country as its geographically determined subsystems participate in the formation of the nationwide food security, complementing, specifying and individualizing it [3].

The differentiation of food security conditions in administrative regions of the Federation is explained by differences of food products in required volumes, the level of agricultural production and the state of the material and technical base of agriculture, food independence, economic and physical availability, food quality, food traditions, market infrastructure, the devel-

opment of market relations and other factors. The problem of significant differences between the possibilities and the scale of output in the country's regions affects the differentiation of the food sector, its results and, as consequence, the maldistribution of foodstuffs causing the problem of food supply at the regional level [3].

The relevance of research is emphasized by the need to increase the food resources in the entire region as a guarantee of its territorial integrity in the fulfillment of the main tasks of the food market: the development of the regional food system in terms of expanded reproduction process (production, distribution, redistribution and consumption) and satisfying the requirements of the population with basic food products.

**Object, methods and research methods.** The problem of ensuring food security is relevant for all administrative regions of the Federation including the Amur Region which is an important economic and geopolitical region with a significant natural-resources potential. The study district with a total area of 361.9 thousand sq. km (2.2% of the RF area) is located in the South-East of the Asian part of the country [4].

The population size estimates of the Amur Region (by 1.06.2018) are 798.4 thousand people. Of the total population of the Amur Region, which is about 13% of the population of the Far East, 32.6% of the population lives in the rural area of the region, and only 4.9% of the population is employed in agriculture working in the economy of the region. Along the territory the population is distributed unevenly and sometimes even densely - 27 % of the population is concentrated in the regional center of Blagoveshchensk (by June 1, 2018) - 225 thousand people [5, 6].

In general the region is characterized by a unique agricultural resource; the basic industries are mining and metallurgical, oil and gas processing, energy industry. The food industry of the region is represented by three major industries – food-processing, meat and dairy, flour and cereals [7]. Agriculture has a suburban nature, it is developed near large cities, and its role is to ensure residents of industrial cities with food products [1]. In the structure of the gross regional product the agriculture is about 4%. The main areas of agricultural production are soybean cultivation, meat-and-dairy cattle farming, poultry breeding. The region accounts for almost 60 % of all arable land in the Russian Far East. The area of agricultural land is 38 % of the total land area of the region. 2.6 hectares of all agricultural land including 1.2 hectares of arable land are per capita. The last figure in the national average is known to be slightly more than 0.8 hectares per inhabitant [4, 8]. The farms of the regions are provided with arable lands located in the central part of it. The share of pastures in agricultural lands is increasing from north to south, reaching 54% in the southern regions. In the struc-

ture of sown areas 76% is soybean, 16% is occupied by grain crops, 5.5% is fodder, and the rest of the area is occupied by vegetables and cucurbits, potatoes and industrial crops.

The methodological basis of the study was an integrated approach in the unity of theoretical, structural and functional, organizational and economic analysis of the food facility state at the regional level. In the study of the spatial organization of the regional market for food resources we used methods of long-term planning and comparative analysis, analysis and synthesis when studying the territorial organization of certain sectors in agriculture, identifying differences in the production efficiency of the main types of products.

The study of the problem was carried out on the basis of the analysis of the existing scientific and practical ideas of specialists in various fields including the study of the territorial organization in agriculture, the assessment of natural-resources potential. The main sources of information were the materials of the Federal State Statistics Service and the Unified interdepartmental statistic information system on the development of the food system in the studied region within 2012-2016. Statistical information was processed in the context of the main types of agricultural products in crop production (cereals, vegetables, potatoes) and in animal husbandry (meat, milk, egg).

The state of the regional food security and performing functions of food demand and supply were assessed comprehensively by the system of generalized and specific indicators of regional economic security with agricultural products of its own production. The assessment was conducted on the basis of generally accepted criteria reflecting all aspects of food security (quantitative, qualitative, social and economic), namely: self-sufficiency, independence (dependence), sufficiency, availability and quality of products (Table 1).

**Table 1 - System of indicators of the food facility level at the regional level**

Index	Calculating formula
<b>Level of food self-sufficiency</b>	
Index of self-sufficiency ( $I_c$ )	$I_c = \frac{F}{N_i}$
Standard consumption figure	$N_i = P_j \times V_r$
<b>Level of food dependance</b>	
Figure of consumption volume ( $I_{fd}$ )	$I_{fd} = \frac{V_{import}}{V_{ac}}$
Figure of consumption volume ( $I'_{fd}$ )	$I'_{fd} = \frac{V_{ip}}{V_{ac}}$
<b>Level of food sufficiency</b>	

Index of actual food consumption ( $I_{ac}$ )	$I_{fd} = \frac{F_{fact}}{F_{norm}}$
Index of sufficiency ( $I_c$ )	$I_c = \frac{\sum \text{calorie actual}}{\sum \text{calorie daily (2950)}}$
Index of critical sufficiency ( $I_{c_c}$ )	$I_{c_c} = \frac{\sum \text{calorie actual}}{\sum \text{calorie daily. cr. (2150)}}$
<b>Level of economic availability</b>	
General index of food availability	$I_a = \frac{S_{cb}}{D}$
Share of population with incomes below the level of the living cost	$I_p = \frac{n_p}{n}$
Share of food expenses within household expenditure in final consumption	$I_c = \frac{P_c}{P}$

To obtain more complete picture of food security in the region it is necessary to consider the threshold values of the above mentioned indicators. The upper and lower borders stand out as signs of a crisis. The intermediate gradations of the considered indicators (Table 2) characterize the different degree of economic security of the region with the necessary amount of food of domestic production. And they are determined in terms of existing ideas in domestic and foreign theory, practice and can be put in order of 4 groups: *high; acceptable; low; unacceptable levels* [9,10,11].

**Table 2 - Key indicators of the selected criteria for assessing levels of regional food economic security with basic food products**

Indicators of levels for food facility	Level of food economic security			
	High	Acceptable	Low	Unacceptable
<b>Level of food self-sufficiency</b>				
Self-sufficiency index ( $I_{ss}$ )	$\geq 1,00$	$0,75 < I_{ss} \leq 0,99$	$0,5 < I_{ss} \leq 0,74$	$< 0,50$
Coverage index ( $I_c$ )	$\geq 1,00$	$0,75 < I_c \leq 0,99$	$0,3 < I_c \leq 0,74$	$< 0,30$
<b>Level of food independence(dependence)</b>				
Figure of consumption volume ( $I_{fd}$ )	up to 0,2	$0,2 < I_{fd} \leq 0,4$	$0,8 < I_{fd} \leq 0,4$	$> 0,80$
Figure of consumption volume ( $I'_{fd}$ )	$> 0,8$	$0,8 < I'_{fd} \leq 0,4$	$0,4 < \leq 0,2$	up to 0,20
<b>Level of food sufficiency</b>				
Index of actual food consumption ( $I_{ac}$ )	$\geq 1,00$	$0,75 < I_{ac} \leq 0,99$	$0,5 < I_{ac} \leq 0,74$	$< 0,50$
Index of sufficiency ( $I_c$ )	$\geq 1,00$	$0,75 < I_c \leq 0,99$	$0,5 < I_c \leq 0,74$	$< 0,50$
Index of critical sufficiency ( $I_{c_c}$ )	$> 1,00$	$= 1$	$0,83 < I_{c_c} \leq 0,99$	$< 0,83$
<b>Level of economic availability</b>				

General index of food availability ( $I_d$ )	20%	25%	30%	> 30%
Poverty index ( $I_p$ )	0	$0 < I_p \leq 0,10$	$0,11 < I_p \leq 0,20$	$> 0,20$
Consumption index ( $I_c$ )	up to 0,07	$0,08 < I_c \leq 0,20$	$0,21 < I_c \leq 0,70$	$> 0,70$
Income concentration index ( $I_{Ginnie}$ )	0 - 0,10	$0,11 < I_{Ginnie} \leq 0,30$	$0,31 < I_{Ginnie} \leq 0,50$	$> 0,50$
<b>Level of food quality</b>				
Quality index ( $I_q$ )	0	up to 0,10	$0,10 < I_q \leq 0,20$	$> 0,20$

The layering of food security is of practical use, which makes it possible to clearly determine the actual level of food economic security in the region and to see how it corresponds to the specified (acceptable) level [12].

**Research result.** Regional economic security of the population with food at the expense of agricultural producers of all categories (agricultural organizations, peasant (farmer) farms, individual entrepreneurs, population) are differentiated by different types of products over the past five years (Table 3). The Data of Table 3 show that the region has significant resources of crop products of its own production. Their structure and dynamics are characterized, for the most part, by positive trends for the period 2012-2016. According to the index of soybean production the Amur Region remains the leader among the regions of the Far East, for example, since 2012 soybean production has increased 1.3 times. The growth of crop production in 2016 was provided with increasing the bulk yield of grain crops as compared with 2012 there was a significant crop production increase of 75% but there was an increase of 35% in 2015.

**Table 3 - Production dynamics of the main types of agricultural products at farms of all categories in the Amur region**

Name of parameter	2012	2013	2014	2015	2016	Growth rate 2016, as % over 2012	Growth rate 2016, as % over 2015
Population size of the region, thousand persons	821,6	816,9	811,3	809,9	805,7	98,1	99,5
<b>Production of the main types of agricultural products at farms of all categories</b>							
Grain (in weight after processing), thousand tons	271,3	172,3	417,7	351,0	474,6	174	135
Soybean, thousand tons	682,4	649,7	766,3	884,9	893	130	100,9
Meat of cattle and poultry for slaughter (live weight), thousand tons	50,3	60,3	60,5	60,6	59,0	117	97,3
Milk, thousand tons	161,8	165,1	143,6	148,6	147,7	91,3	99,4
Egg, million pieces	231,0	239,4	240,1	203,1	199,6	86,4	98,3

Potatoes, thousand tons	296,0	118,0	298,1	286,6	278,1	93,6	96,4
Vegetables, thousand tons	69,3	35,0	67,8	69,7	67,2	96,4	97,0

As compared with 2012 the increase in meat production was 17%. As for the main types of products for the period of 2012 the production decreased: eggs - by 13.6 %, milk - by 8.7 %, potatoes – by 6.4%, vegetables – by 4.6 %. So, the production per person (figures for 2016) is: grain-589,1 kg (in Russia - 824 kg), potatoes – 345 kg (in Russia - 212 kg), milk - 183,3 kg (in Russia - 209 kg), meat- 73 kg (in Russia - 70 kg), eggs -248 pieces (in Russia- 297 pieces), vegetables- 83,4 kg (in Russia -111, 2 kg). According to the offer of livestock products the Amur Region in the all-Russian rating is on the 47th place for the production of eggs, on the 55th place for the production of meat and on the 60th place for milk production.

It should be noted that the share of the Amur Region in the Far Eastern Federal District (FEFD) amounts to 59% of grain, 32% of meat, 28% of milk, 25% of potatoes, 17% of eggs, 16% of vegetables. Thus, in 2016 the share of the Amur Region in the total production of agricultural products in the Far Eastern Federal District amounted to 28.6% or 423.8 million rubles (by comparison, in 2008-20.9%; in 2009 - 19.6%).

The calculated level of self-sufficiency for basic food products in the Amur Region is significantly higher than in the Far East as a whole (Table 4). Since 2012 the regional growth rates of agricultural production in grain and potatoes have been ahead of the overall growth rates recorded in the Far Eastern Federal District. According to the calculations the intra-regional market of food products is formed at the expense of its own resources by 80%.

As you can see from the research results presented in Table 4, consumer demand for five years (2012-2016) is not only provided but it is also significantly overlapped in grain and potatoes; the production of eggs is within the permissible limits as well.

**Table 4 - The level of food self-sufficiency in the Amur Region and the Far Eastern Federal District with basic food products**

Output	2012	2013	2014	2015	2016	2012	2013	2014	2015	2016
	The Amur Region					FEFD				
Grain crops (in weight after processing), thousand tons	3,30	2,01	4,90	4,13	5,61	0,83	0,65	1,18	1,04	1,24
Potatoes, thousand tons	3,60	1,44	3,7	3,54	3,45	2,10	1,65	2,09	1,91	1,81
Vegetables, thousand tons	0,60	0,31	0,6	0,61	0,60	0,49	0,45	0,51	0,46	0,48
Meat of cattle and poultry for slaughter (live weight), thousand tons	0,52	0,69	0,70	0,70	0,68	0,27	0,29	0,28	0,27	0,27

Milk, thousand tons	0,58	0,59	0,52	0,54	0,54	0,27	0,27	0,25	0,25	0,25
Egg, million pieces	1,08	1,13	1,1	0,96	0,95	0,72	0,70	0,73	0,73	0,73

Note: compiled by the author according to Federal State Statistics Service

Moreover, the region fully meets domestic needs for grain and potatoes and it also has the opportunity to sell them to other regions of the country and export them to the APR countries. It should be noted that the grain export, especially soybeans, increases annually (for example, soybean exports increased by 68% within five years) [13]. Most of the grown potatoes are used to provide the population of the region. The function of the food supply in the Amur Region is performed unevenly: high provision of grain and potatoes (over 110 %); the region is almost completely self-sufficient in eggs (95-108%) and it uses the resources of import within acceptable limits (20%), and very low provision of meat (60%, 27 %), milk (59%, 25 %) and vegetables (60%,51 %) where they completely depend on the import of this products (Table 5). The level of self-sufficiency in meat, milk and vegetables has not reached the thresholds yet, established by the Doctrine of food security in the Russian Federation [13].

Thus, to ensure a balanced diet of the population, the Amur Region buys products from domestic and foreign markets. In the region food products such as sugar, salt, tea, coffee, fruit and citrus culture are not produced and they are fully imported. And the lack of food is compensated for its comings-in from other regions of Russia and import deliveries.

**Table 5 - Ensuring the population of the Amur Region with food at the expense of its own production in 2016**

Name of the food	Production thous. tons (mil pcs)	Thresholds according to the RF Doc- trine	Percent of covering by their own account con- sumption	The deviation from the threshold in the RF Doc- trine	Share of imports / exports
Meat and meat products	40,6	85 %	68,2 %	-16,8	67% / 42,3%
Milk and dairy products	147,7	90 %	54,8%	-35,2	50% / 51,1%
Grain	474,6	95 %	в 2 раза	+106	- /
Potatoes	278,0	95 %	в 2,7 раза	+177	3% / 14%
Eggs*	200,0	-	95 %		18,3% / -
Vegetables*	67,2	-	60 %		68,5 %/ 10%

\*(not defined by Doctrine of the Russian Federation)

The import of the Amur Region includes products from distant foreign countries - fruit and vegetables (China (90%), Thailand, Vietnam, the Philippines, and the Republic of Korea), meat (Brazil (40%), Argentina, Australia, and the USA). The import of the products from the

neighboring countries includes fruit, butter and vegetable oil, meat, dairy products and various articles of food (Belarus, Kazakhstan, Uzbekistan, Turkmenistan, Republic of Moldova, Azerbaijan) [5,14]. In the internal market the Amur Region buys flour, animal oil, cereals, dry dairy products, canned meats and plant-based meat, salt, meat, sausages and soft drinks in the regions of the Siberian (46%) and Central (21%) Federal Districts, as well as in the regions of the Far-Eastern Federal District (14%) including Khabarovsk (9%) and Primorsky Krai (4%) [9].

Import of food products and agricultural raw materials in the Amur Region slightly varies from 32.8 to 37.5 million US dollars. At the same time the entire foreign trade turnover of the region is 506–1200 million US dollars (Table 6). Foreign trade turnover in the total volume of the FEFD amounted to 2.1% in 2016. In the structure of foreign trade turnover the largest share is the export of goods (58.2%). As compared with 2012 export volume of goods increased by 35%, while the imports decreased by the same amount. As compared with 2012 export-import coverage ratio increased almost 4.5 times. Compared to 2012 the import ratio of food varied from 67.7 to 32.5%, which gives the right to judge about the need to import food products for the region. As for the domestic export of food products, due to the increasing transport costs and high cost of goods, the geography of export is limited to the Far Eastern (80%) and Siberian Federal Districts (18%), a small part (less than 1 %) is supplied to the Central Federal District [9].

The consumer market of food products is characterized by a consistently high level of food saturation for all commodity groups.[9] Nevertheless, the satisfaction of the physiological needs of the population with basic food products does not develop well-balanced both in the Amur Region and in the Far Eastern Federal District as a whole. The observed imbalance in food consumption cannot but affect the health of the population negatively (Table 6).

Significant changes are observed in the reduction of animal product consumption - meat, milk, eggs; they are much replaced by cheaper unequally valued food - potatoes, sugar and bread products. Consumption of dairy products by the population of the region is almost 50% lower than the recommended rational consumption rates. [15] The specific weight of high-protein products in the total energy of the daily per capita ration decreased by 38%, and starch-containing and flour-based food increased by 30-55%. This is typical for the culture of consumption as a result of exacerbating the problem of low economic security of the population.

**Table 6 - Level of physiological needs satisfaction of the population in basic food products**

Food products	The Amur Region					On the average for the FEFD				
	2012	2013	2014	2015	2016	2012	2013	2014	2015	2016
Potatoes	1,52	1,52	1,54	1,55	1,52	1,32	1,32	1,35	1,32	1,32
Vegetables and cucur-	1,08	0,98	1,06	1,10	1,09	0,91	0,92	0,93	0,92	0,90



bits										
Meat and meat products	0,90	0,94	0,93	0,91	0,90	1,11	1,13	1,11	1,10	1,11
Milk and dairy products	0,52	0,56	0,54	0,56	0,56	0,60	0,61	0,60	0,60	0,60
Eggs	1,19	1,19	1,22	1,06	1,04	0,94	0,95	0,97	0,95	0,97
Sugar	1,50	1,50	1,54	1,46	1,50	1,54	1,54	1,54	1,54	1,50
Bread products	1,34	1,40	1,42	1,42	1,42	1,22	1,23	1,23	1,22	1,20

In the structure of the food profile the primary and traditional predominance of potatoes, bread and bread products can significantly reduce the cost of the consumer goods basket without reducing the overall energy value of the food set. As a result of the research carried out, it was determined that the Amur Region moved from the III level (minimum) to the IV level (sufficient), but not well-balanced in terms of caloric content and qualitative composition of the human diet and it retains this average daily provision till presents. According to the research of Pashina L. L. for 2000, this figure amounted to 2,413 kcal. [12]. In 2016 the caloric value of the daily diet reached 2948 kcal. The indices of sufficiency and critical sufficiency for 2012 and 2016 are approximately the same and they amounted to 0.86 and 1.23 respectively, which corresponds to the *low and high levels* of energy content for the population's diet.

The difference between science-based food standards and the actual level of food consumption is largely determined by the living standards of the population, their effective demand. The financial responsibility of the population forms the structure of food consumption to a large extent, considering that the main products have low price demand elasticity [16].

As you can see from Table 9 the proportion of the population with substandard income (poverty index - 0.16) in the region corresponds to the *low* level. The population of the Amur Region with money incomes which are lower of living cost level is constantly decreasing, the unemployment rate remains low, approximately 5.9% of the economically active population [17, 18]. In the region real disposable income per capita has decreased by more than 8% by the end of the period under review (2012-2016). In the items of household expenditure purchasing costs for food average 32%, which indicates the "poverty" of the inhabitants in the Amur Region. For comparison, in the consumer baskets of developed countries the share of food products is not more than 20%.

**Table 7 - Summary table of main indicators and levels of food security with basic food products**

Level indicators of food facility	The Amur Region			
	2012	Level of regional food security	2016	Level of regional food security

<b>The level of food self-sufficiency</b>				
Self-sufficiency index ( $I_c$ )	1,61	High	1,97	High
Coverage index ( $I_n$ )	0,52	Low	2,1	High
<b>Level of food independence dependence</b>				
Figure of consumption volume ( $I_{fd}$ )	0,33	Acceptable	0,25	Acceptable
Figure of consumption volume ( $I'_{fd}$ )	0,84	Acceptable	0,82	Acceptable
<b>Level of food sufficiency</b>				
Index of actual food consumption ( $I_{ac}$ )	1,15	High	<b>1,15</b>	High
Index of sufficiency ( $I_c$ )	1,19	High	1,23	High
Index of critical sufficiency ( $I_{c_c}$ )	0,86	Low	0,89	Low
<b>Level of economic availability</b>				
General index of food availability ( $I_a$ )	0,34		0,36	
Poverty index ( $I_p$ )	0,16	Low	0,16	Low
Consumption index ( $I_c$ )	0,30	Low	0,32	Low
Income concentration index ( $I_{Gimmie}$ )	0,376	Low	0,392	Low
<b>Level of food quality</b>				
Quality index ( $I_q$ )	0,05	Acceptable	0,227	Unacceptable
<b>TOTAL AVERAGE</b>		<b>Acceptable</b>		<b>Acceptable</b>

According to the data of 2016 in the group of the population with the lowest incomes for the purchase of food products in the Amur Region, 41.4% of cash resources was spent only on vital products, while in the group of the most affluent population this figure amounted to 24% of cash income for food, but it was already more diverse and saturated with nutritionally valuable products. Low income of the poor is characterized by the degree and qualitative food patterns.

If we judge about the quality of nourishment, the quality of products entering for the food market, according to the territorial administration of the Federal Service for Supervision of Consumers Protection and Welfare in the Amur Region, is low. In 2012, a small number of food products (11% of sausages, 20% of fish products, 32% of poultry egg, 21% of confectionery products, and 25% of spices) was rejected and downgraded by Russian Agency for Health and Consumer Rights. In 2016 the share of rejected goods increased 4.5 times. All the spices of foreign production were rejected; as for domestic products margarine and mayonnaise products (36%), butter (30%), cheese (26%), eggs (25%) were rejected [17].

The results of the calculations are presented in a summary table of changes in values of key figures of criteria for the assessment which allow determining the level of food security in the region (Table 7). On the basis of the Table data the ratio of food security criteria and its actual level in 2012 and in 2016 were determined. In both cases, the level may be called intermediate or within ACCEPTABLE LIMITS. However, it is worth noting that the estimates for the calculated indicators were distributed unevenly.

**Conclusion.** As a result of consideration of this issue we can say that the dynamics of food supply of the Amur Region is formed under the influence of multidirectional factors. The analysis identified the directions of further deepening of research: the search for new explicative variables, changes in the potential capacity of food supply and demand and its spatial impact, the analysis of variations in average income, turnover of consumer spending, actual consumption and production of food at the municipal levels, given that food import deliveries lead to the outflows of financial resources, as well as to the decrease in the level of the population health due to poor food.

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