Международный журнал прикладных наук и технологий "Integral"

Original article

UDC 910.3

DOI 10.55186/27131424_2024_6_2_3

ASSESSMENT OF FOOD BALANCE OF BASIC FOODSTUFFS: REGIONAL ASPECT

ОЦЕНКА ПИЩЕВОГО БАЛАНСА ОСНОВНЫХ ПРОДУКТОВ ПРОДОВОЛЬСТВИЯ: РЕГИОНАЛЬНЫЙ АСПЕКТ

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Abstract. The relevance of these studies is due to the need to simplify the food security assessment system. The main objectives of the study were the development of typological tools and, with its help, the typology of regions in terms of food balance. Within the framework of these studies, the authors propose to express the balance of the producing and consumed volumes of food in a more generalized sense of the balance indicator. The typification of regions was based on positive, zero and negative values of the balance sheet indicator. As a result of the research, the regions of Russia were divid-

ed into three types: donors, recipients, and relative self-sufficient regions. It was found that donor regions have a positive balance and are “food footholds”; regions with a zero balance of basic food resources have a minimum value of food security, and recipient regions are characterized by a lack of production at all or slightly developed, with low socio-economic indicators. For the main food products (grain, meat and milk), using the MapInfo 12.0.5 program, small-scale maps (1: 45,000,000) the food balance of the regions of the Russian Federation in 2018 were compiled. The spatial differentiation of the food balance of the regions of the Russian Federation was studied. It was revealed that the regions of the North Caucasus, Central Chernozem, Volga, Southern Urals, Western Siberia are traditionally characterized by developed agricultural production. They are major producers of the bulk of grain, meat and milk. At the same time, it was also revealed that a number of regions of the Central Federal District, the Northern and North-Western regions of the European part of Russia, the regions of Siberia and the Far East are characterized by a lower level of production intensity and, accordingly, have a low food supply. On the whole, Russia remains a grain-producing power, and continues to strive for self-sufficiency in meat and dairy products. In conclusion, it is noted that this typology of regions can be the basis for the creation of insurance and mobilization food reserves, where donor regions will take an active part.

Аннотация. Актуальность данных исследований обусловлена необходимостью упрощения системы оценки продовольственной безопасности. Основными задачами исследования являлись разработка типологического инструментария и с его помощью типология регионов по продовольственному балансу. В рамках этих исследований авторы предлагают выражать баланс производимых и потребляемых объемов продуктов питания в более обобщенном смысле показателя баланса. Типизация регионов проводилась на основе положительных, нулевых и отрицательных значений балансового показателя. В результате исследования регионы России были разделены на три типа: доноры, реципиенты и относительно самодостаточные регионы. Установлено, что регионы-доноры имеют положительный баланс и являются «продовольственными плацдармами»; регионы с нулевым балансом основных продовольственных ресурсов имеют минимальное значение

продовольственной безопасности, а регионы-реципиенты характеризуются отсутствием производства вообще или слабо развитым, с низкими социально-экономическими показателями. По основным продуктам питания (зерну, мясу и молоку) с помощью программы MapInfo 12.0.5 составлены мелкомасштабные карты (1:45 000 000) продовольственного баланса регионов РФ в 2018 году. Изучена пространственная дифференциация продовольственного баланса регионов Российской Федерации. Выявлено, что регионы Северного Кавказа, Центрального Черноземья, Поволжья, Южного Урала, Западной Сибири традиционно характеризуются развитым сельскохозяйственным производством. Они являются крупными производителями основной массы зерна, мяса и молока. При этом также выявлено, что для ряда регионов Центрального федерального округа, Северных и Северо-Западных регионов европейской части России, регионов Сибири и Дальнего Востока характерен более низкий уровень интенсивности производства и, соответственно, имеют низкую обеспеченность продовольствием. В целом Россия остается зернопроизводящей державой и продолжает стремиться к самообеспечению мясом и молочными продуктами. В заключение отмечается, что данная типология регионов может стать основой для создания страховых и мобилизационных продовольственных резервов, в которых регионы-доноры примут активное участие.

Key words: food security, food balance, balance sheet, region, territorial differentiation, donation, recipient, relative self-sufficiency

Ключевые слова: продовольственная безопасность, продовольственный баланс, баланс, регион, территориальная дифференциация, пожертвование, получатель, относительная самообеспеченность.

1. Introduction

Each country cares about preserving its sovereignty and the right to an independent foreign policy without external dictates, while striving for the food self-sufficiency in key food products [1]. For any country, regions play a significant role in solving the problem of food security. [2;3].

The territorial differences that have developed in Russia in terms of opportunities, the scale of production in the regions of the country, the placement of productive forces in them, affect the differentiation of the structure of the food sector, its results and, as a consequence, the irregularity of food consumption, giving rise in turn to the problem of the food supply at the regional level. At the same time, emerging new economic conditions from a functional position for the food system of the state only reinforce this problem, since the development of the country's regions is often characterized by instability and disequilibrium, violation of the scientifically based criteria for the territorial organization of industries, insufficient elaboration of issues of adaptation to changing market conditions [4].

The specifics of the problem of food security have been studied and continue to be studied by many domestic researchers and specialists in related fields of sciences: L.I. Abalkin, V.G. Agaev, E.N. Antamoshkina, I.V. Bumbar, A.Yu.Volkov, M.S. Donskova, N.A. Ermolina, V.A. Ivanov, M.V.Kandelya, A.A. Lysochenko, R.E. Mansurov, V.N. Ryabchenko, V.V. Terentyev, P.S. Yunusova, L.L. Pashina and others. [5-15]

The author of this study notes that the above-mentioned works and a number of other unmentioned works have a "hidden" challenge to geographical sciences, leaving a reserve for establishing topological and typological differences, possible division into food clusters, territorial "growth zones" and establishing boundaries between them. However, the "nature" of the formation of food clusters and territorial "growth zones" has not yet been studied by geographers. But at the same time, the prerequisites for identifying the territorial differentiation of the level of self-sufficiency in food by regions were still undertaken by R.V. Filippov, N.V. Rogovskaya, S.A. Rodomanskaya [16; 17; 18]. In their research, they prefer the geographical approach, assuming that it contributes to the creation of optimal models of the territorial organization of the supply of food products to the population.

The author of the article comes to a consensus that the wide range of food security issues under consideration dictates the need for systematization and structuring of a large accumulated experience in the study of food security. Since there is a need to find

methods and ways to smooth out those interregional differences that differentiate by territory, while developing a policy for solving the food problem and corrective measures not to one territorial entity, but to their group. In other words, there is a need to identify a group of regions with similar features of the food problem and create typological groupings, leaving in this case "the field of activity" in the competence of geographical sciences. Since their task is not only to study and analyze, but also to structure and systematize the way in which decisions taken in the political, economic and business sphere are in accordance with territorial features.

To the Russian Federation food security is a system of mutual complementarity of its regions that produce and consume food with different annual balances of these processes, and as a whole bring together a nationwide positive balance.

The country's food security lies not only in the efficient production of the volumes of food necessary for consumption, but also in the correlation of the geography of production and consumption processes [19]. The geography of food security has not yet taken shape in the family of geographical sciences as a separate direction. Although it can be noted that the geography of food consumption has already emerged as a separate area of social geography, as evidenced by the work of S.Y. Kornekova [20; 21]. The geography of food security connects two directions: the geography of production and the geography of food consumption.

The scientific novelty of the presented research lies in the combination of these two directions in a single format of the geography of food security.

The practical significance of the proposed methodology lies in its possible application as a more generalizing element (without considering more detailed indicators) of food security monitoring system in the Russian Federation, the creation of which is provided for by Presidential Decree No. 20 of January 23, 2020 "On the approval of food security Doctrine of the Russian Federation" [24].

2. Models and Methods

The main purpose of this study is to identify the features of the territorial organization of food security in Russia as an interregional balance of food production and consumption. The goal-oriented tasks are as follows: 1) simplification of tools in the implementation of typological generalizations that allow to develop a policy for solving the food problem and corrective measures simultaneously for a group of territorial objects; 2) the proposal of a formula for calculating the balance indicator of the region's food supply; 3) typification of Russian regions based on quantitative values of the balance sheet indicator into donor regions, recipient regions and regions with relative self-sufficiency.

The methodological basis of the research was a systematic approach in the unity of philosophical, general scientific and geographical methods in order to analyze the spatial dynamics of food security for key food products in the regions of the Russian Federation. The materials of the Federal State Statistics Service and the Unified Interdepartmental Information and Statistical System on the development of the food system of the studied regions for 2018 were used as the main sources of information [22; 23]. Statistical information was processed in the context of the main types of agricultural products of crop production (cereals and legumes; vegetables and melons) and animal husbandry (meat, milk, egg). Within the framework of this article, research is presented on three main food products: crop production - grain, and livestock products - milk and meat.

The dialectical method of research, as a philosophical method, acquires a completely geographical form of the duality of the geography of food security. The dialectical correlation of two territorial-differentiated processes of food production and consumption determines the essence of a new geographical direction that may later find expression in the content of cartographic material. The cartographic method of research is implemented in cartographic works that visually complement the scientific explanation.

To assess the territorial differentiation of Russia's food security, a balanced indicator of the region's food supply was introduced, which is defined as the degree of op-

timality (balance) of food production and consumption volumes in a more generalized sense.

This indicator was considered at the level of positive, zero and negative values. The basis for calculating the balance sheet indicator was the author's selection of four main indicators: 1) the total volume of agricultural production (agricultural raw materials, semi-finished products and finished products) for all types of farms in the region (district) in question (million tons, 2018); 2) consumption of this product by the region (district) (million tons, 2018); 3) available stocks of this product in the region (district) at the beginning of the year (million tons, 2018) and 4) the available stocks of products in the region (district) at the end of the year (million tons, 2018).

In formula 1, the balance indicator of the region's food supply is positive only if the volume of food production and carry-over food stocks at the beginning of the year exceed the actual needs of the population of the region and carry-over stocks of food at the end of the year. In the other two cases, formula (2) can take zero and negative values, respectively.

$$\mathbf{PRODUCTION + STOCKS_b > CONSUMPTION + STOCKS_e} \quad (1)$$

or

$$\mathbf{PRODUCTION + STOCKS_b - CONSUMPTION - STOCKS_e > 0} \quad (2),$$

where $stocks_b$ – stocks of food at the beginning of the year; $stocks_e$ - stocks of food at the end of the year

In formulae 1 and 2, the production was taken into account as the main source of food, and the consumption was the main channel of its use. The actual volumes of agricultural products produced were taken into account for all categories of farms: agricultural organizations (large, medium, small, subsidiary), households of the population (horticultural, livestock, dacha plots of citizens in rural and urban areas) and peasant farm economy. Also, the stocks of agricultural products at the end and beginning of the reporting period were taken into account, the availability of which is considered as an opportunity for the region to provide its population with food before the start of the new harvest.

The smallest unit of analysis was the region of the Russian Federation – as a geographically integrated and industrial and economic complex that has the ability to produce agricultural products based on favorable climatic and resource conditions. Further, the balance indicators of the regions made it possible to assess and determine the food balance for the district, and then for the whole country.

The quantitative values of the balance indicator, reflecting dynamically variable changes in the selected indicators as the basis for its calculation, made it possible to divide the regions of Russia into areas of three main types: donors, recipients and relatively self-sufficient regions. The total volumes of food production and consumption with their available mobilization reserves were used for detailed characterization of the main types of allocated areas.

The areas of donors have a positive balance between production and consumption of basic food resources. Donors are located in agricultural regions. Their production capacities tend to the agro-climatic potential of the territory. In general, their territories, as a rule, occupy a leading position in the production of any agricultural products and are distinguished by a high level of food security, since they produce food products in excess of their norms of domestic needs, and the surplus can be sold to other regions of Russia. For this type of regions, simple and expanded food production takes place on the basis of innovative implementation and development of the main branches of the agro-industrial complex. Here, agriculture, as a key type of economic activity, is formed in conditions of the greatest agricultural development of the territory, which in turn are characterized by a wide variety of types of enterprises (agricultural holdings, large agricultural organizations, collective farms, LLC, SEC, PFE and sole proprietors), the formation of which is due to the peculiarities of the economic and geographical location. The level has a wide industry specialization. The agricultural holdings and large agricultural organizations of this level develop a complete food production chain – from the production of agricultural raw materials to the production of finished food products.

The formation of areas of relatively self-sufficient regions is due to the zero balance of basic food resources. Such regions have an agrarian-industrial orientation and average conditions for the introduction of agriculture. Having no stocks of products,

these regions are slightly dependent on the import of products. Areas of this type occupy intermediate positions between donors and recipients and have equally likely positions to occupy the position of one or another type due to changes in the selected indicators up or down.

The formation of areas of food recipients is due to the negative balance between production and consumption of certain types of products. To a greater extent, these regions are distinguished either by the absence of agricultural production at all, or by extremely poorly developed, as well as by low socio-economic indicators. Basically, these regions consume more than they produce, and literally "survive" by importing food, not to mention the existence of available stocks and their exports. The territories of recipients, for example, may include territories of extensive anthropogenic impact with irreversible processes in natural and economic systems, highly urbanized territories or northern areas that combine both territories with a denser population density, with a high degree of concentration of large industry, urban development, and territories with mining and industrial land use and land use based on the traditional nature management of the indigenous population.

3. Result and Discussion

Structural and geographical issues of food security are presented by the author in a series of works on the Earth sciences [17; 18; 25]. This article is the final exit to the level of practical generalizations, which is implemented using a simplified typological toolkit based on the interregional balance of food production and consumption. Within the framework of these studies, all the presented numerical values for the characteristics of the regions were obtained by the author.

The territorial differentiation of Russia's food security is largely determined by the regional contrast of food processes: production and consumption. At the same time, the smoothing of interregional differences in food consumption is carried out through the national system of its distribution.

The values of the balance indicator calculated for 85 regions reflected, on the one hand, a significant spread in the range of values and in the whole country, and on the

other hand, a high correlation dependence of the selected indicators on the final result of the food balance. According to the calculated values of the balance indicator, three types of areas on the territory of the Russian Federation (donors, recipients and relatively self-sufficient) corresponding to the actual level of food security in 2018 were identified. At the same time, the entire food system within Russia is considered as a set of identified areas that have certain volumes of food production and consumption, and the share of the region's involvement in the reduction of the food balance in the whole country.

The results of the research indicate that food security for the main food products selected for the study (grain, milk and meat) in Russia develops unevenly. In general, there is a surplus of grain in the country, which allows to exceed the needs of the Russian population by 5.5 times, but at the same time there is a small shortage of meat and dairy products (a negative food balance, a shortage of meat is 4% and milk is 7%). Calculations have shown that 72 donor regions have a positive grain balance in the country, which accounted for more than 97% of Russian grain production (table 1, fig.1).

Table 1

Indicators of the main volumes of production and consumption of cereals and legumes by federal districts in 2018 (in farms of all categories)

Federal subjects	Production, (million tons)	Consumption (million tons)	Stocks at the beginning of the year, (million tons)	Stocks at the end of the year, (million tons)	Type*	Surplus (+) and deficit (–) of the balance of production and consumption of products
The Russian Federation	**112,9**	**24,5**	**71,3**	**90,7**	**D**	**5,5 times**
Central Federal District (CFD)	31,8	4,1	17,1	19,2	D	7,7 times
North-Western Federal District (NWFD)	0,75	0,4	1,4	1,3	D	1,8 times
Southern Federal District (SthFD)	35,8	4,4	15,0	17,4	D	8 times
North Caucasus Federal District (NCFD)	13,3	1,9	5,8	6,7	D	6,9 times
Volga Federal District (VFD)	30,6	7,4	19,6	24,6	D	4 times
Ural Federal District (UFD)	6,7	6,7	4,4	5,4	D	3,8 times
Siberian Federal District (SbFD)	15,7	4,2	13,2	15,5	D	3,7 times

Far Eastern Federal District (FEFD)	0,76	0,3	0,6	0,6	D	2,5 times

*Type of territory in terms of food balance (D – donor; RSS – relatively self–sufficient; R- recipient)
Source: [Compiled by the author]

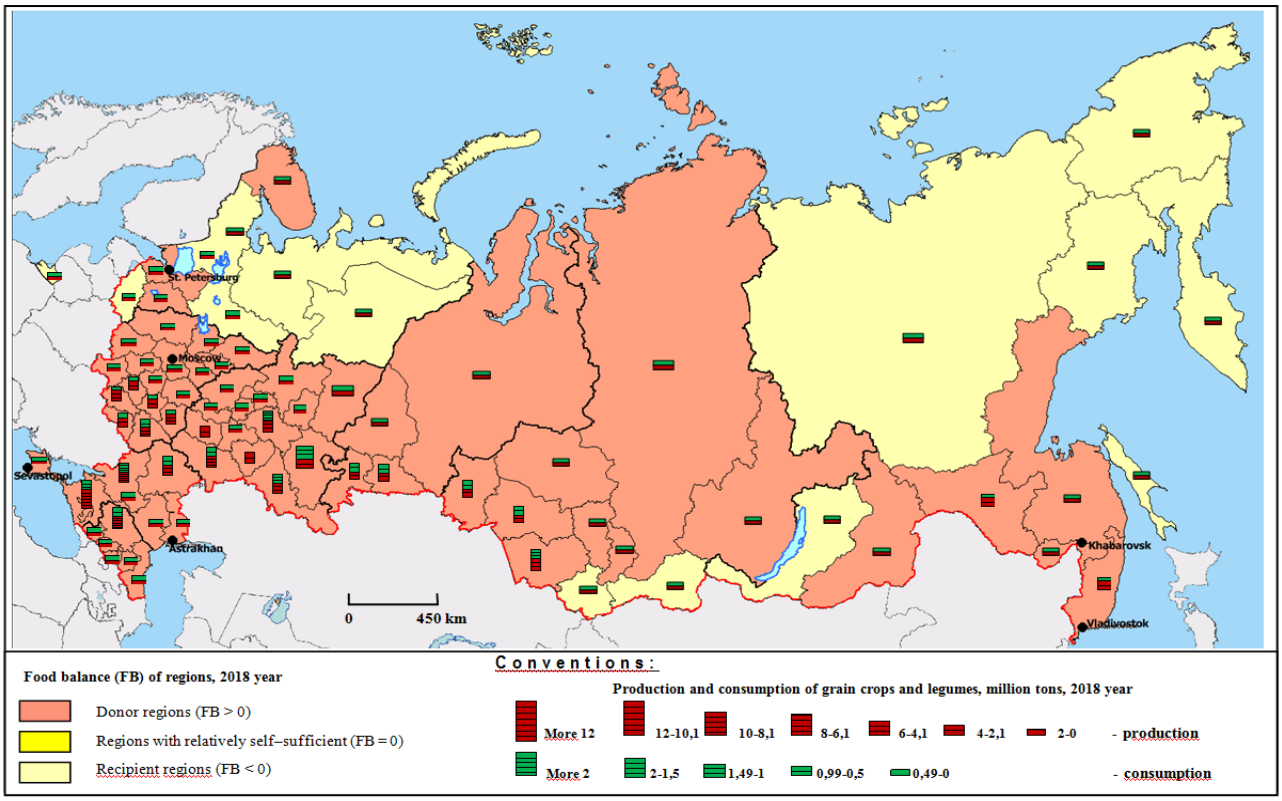

Figure 1. Food balance of grain crops and leguminous regions of the Russian Federation Source: [Compiled by the author]

In these regions, the leader among all cereals is spring and winter wheat, which occupies 34.8% of the total area for cereals in 2018. The next is barley (10.4%), oats (3.5%), legumes (3.5%) and corn (3%).

For the donor regions of the Southern, Volga and Central Federal Districts, one of the reasons for the high production indicator is their grain specialization with a total grain share of 70-80% and a high return on the cultivated area. In terms of grain production, regions of this type are united mainly by the predominant extensive agricultural land and fairly highly developed agricultural production. Among the donor regions, there are regions that combine low consumption over production and high export potential. These are 8 regions, including guarantors for Russia for the production and export of grain, such as the Krasnodar Krai (12% of the total Russian production), the Rostov

Region (10.4%), the Stavropol Krai (9.8%), the Saratov Region, the Voronezh Region, the Volgograd Region, the Kursk Region and the Altai Krai. These regions are the largest donors for Russia, in terms of production capacity, exports and the possibility of providing food aid to other regions.

All the rest of the 13 regions, which make up about 3% of the total Russian grain production, were classified as recipients. For them, the main recipient factor in grain production is that these are mainly the territories of the northern regions, low-land and densely populated territories, where the introduction of agriculture due to unfavorable climatic conditions is difficult or extremely poorly developed. These include: the Arkhangelsk Region, the Vologda Region, the Kamchatka Krai, the Komi Republic, the Republic of Karelia, the Magadan Region, the Sakhalin Region, the Chukotka Autonomous District, the Republic of Tyva, the Republic of Sakha (Yakutia), the Kaliningrad Region, as well as the federal cities of Sevastopol and St. Petersburg.

Several regions with high productivity have already been observed for the production of meat and milk. The positive balance in the production of meat products is brought together by 28 donor regions with a specific weight of 66.5% of the total Russian volume. Among them, a large group of donor regions is concentrated in the Central and Volga Federal Districts with the largest share of production of 38.2% and 20.4% of the total Russian volume, respectively. (table 2, fig.2).

Table 2

Indicators of the main volumes of production and consumption of meat and meat products ((in slaughter weight) by federal districts in 2018 (in farms of all categories)

Federal subjects	Production, (million tons)	Consumption (million tons)	Stocks at the beginning of the year, (million tons)	Stocks at the end of the year, (million tons)	Type*	Surplus (+) and deficit (–) of the balance of production and consumption of products
RF	**10,6**	**11,1**	**0,86**	**0,91**	**R**	**– 4 %**
CFD	4,2	3,2	0,20	0,27	D	24 %
NWFD	0,72	1,1	0,06	0,05	R	– 32 %
SthFD	1,0	1,2	0,08	0,07	R	– 17 %
(NCFD	0,68	0,62	0,04	0,04	RSS	0,9 %
VFD	2,23	2,13	0,2	0,2	D	10 %
UFD	0,75	0,86	0,08	0,08	R	– 12%
SbFD	1,0	1,2	0,10	0,13	R	– 16 %
FEFD	0,13	0,62	0,07	0,06	R	– 79 %

*Type of territory in terms of food balance (D – donor; RSS – relatively self–sufficient; R- recipient)

Source: [Compiled by the author]

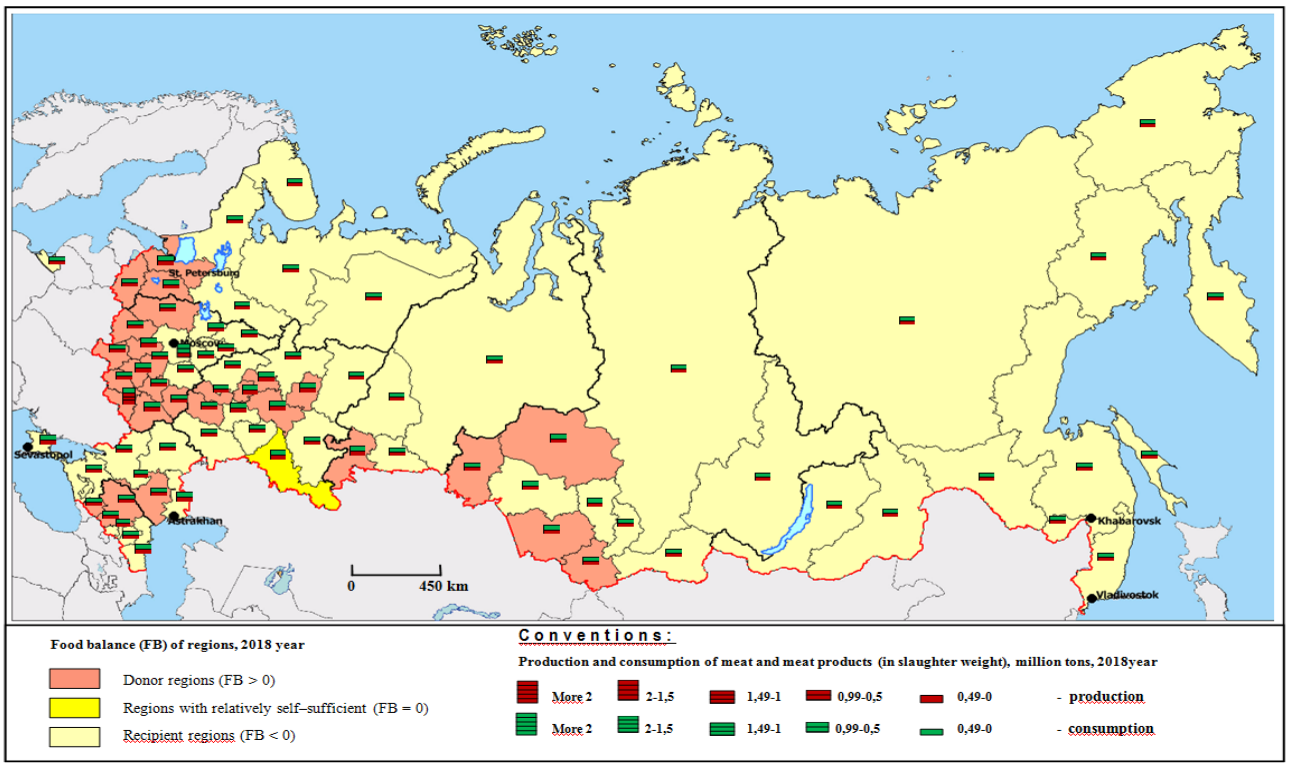

Figure 2. Food balance of meat and meat products (in slaughter weight) of the regions of the Russian Federation [Compiled by the author]

For this type regions the poultry meat predominates in the structure of production of all types of meat - 47.2%. The remaining recipient regions (57 regions) with a negative food balance are characterized by an excess of consumption indicators over meat production indicators. For example, federal cities – Moscow, St. Petersburg and the Moscow Region - stand out from the territories with an increased consumption index, as combining the lack of established production and a high demographic burden.

The high milk productivity is observed in 40 donor regions, which together accounted for 21% of the total Russian volume. Of the donor regions, the regions of the Volga (9.4 million tons), Central (5.7 million tons) and Siberian (4.3 million tons) federal districts show the greatest dynamics in providing milk, which amounted to 30.7%, 18.6%, 14% of the all-Russian production volume, respectively. (table 3, fig.3). There is a status of recipients of milk production in 35 regions of Russia. The regions of the Far Eastern Federal District have the lowest milk production indicators. For example, the volume of milk production in the Magadan Region amounted to 6.1 thousand tons, in the Jewish Autonomous Region 9.1 thousand tons, in the Kamchatka Territory 20.9

thousand tons, in the Khabarovsk Territory 26.6 thousand tons. While the indicator of consumption of dairy products in these regions exceeds 2-6 times.

Table 3

Indicators of the main volumes of milk production and consumption from all types of animals by federal districts in 2018 (in farms of all categories)

Federal subject	Production, (million tons)	Consumption (million tons)	Stocks at the beginning of the year, (million tons)	Stocks at the end of the year, (million tons)	Type*	Surplus (+) and deficit (–) of the balance of production and consumption of products
RF	**30,6**	**33,0**	**1,7**	**1,6**	**R**	**–7 %**
CFD	5,7	7,9	0,44	0,42	R	– 28 %
NWFD	1,8	3,6	0,14	0,16	R	– 49 %
SthFD	3,6	3,5	0,15	0,15	RSS	0,2%
NCFD	2,6	2,3	0,09	0,08	D	14 %
VFD	9,4	7,8	0,46	0,46	D	21 %
UFD	1,9	2,5	0,14	0,13	R	– 22 %
SbFD	4,3	4,0	0,2	0,2	D	7 %
FEFD	0,97	1,2	0,06	0,03	R	– 16 %

*Type of territory in terms of food balance (D – donor; RSS – relatively self–sufficient; R- recipient)
Source: [Compiled by the author]

Within the framework of these studies, in general, it is worth highlighting that the areas of the donor regions have a pronounced agricultural specialization, export-oriented policy, developed transport and business infrastructure, innovative introduction into agricultural production. The specialization of these regions is based both on commodity balanced production of products and on the processing of valuable consumer properties of agricultural crops. The agriculture, as a key type of economic activity, is formed in conditions of the greatest agricultural development of the territory, which in turn are characterized by a wide variety of types of enterprises (collective farms, limited liability companies (LLC), agricultural production enterprises (SEC), peasant farm economy (PFE) and sole proprietors (SP)), the formation of which is due to the peculiarities of the economic and geographical location.

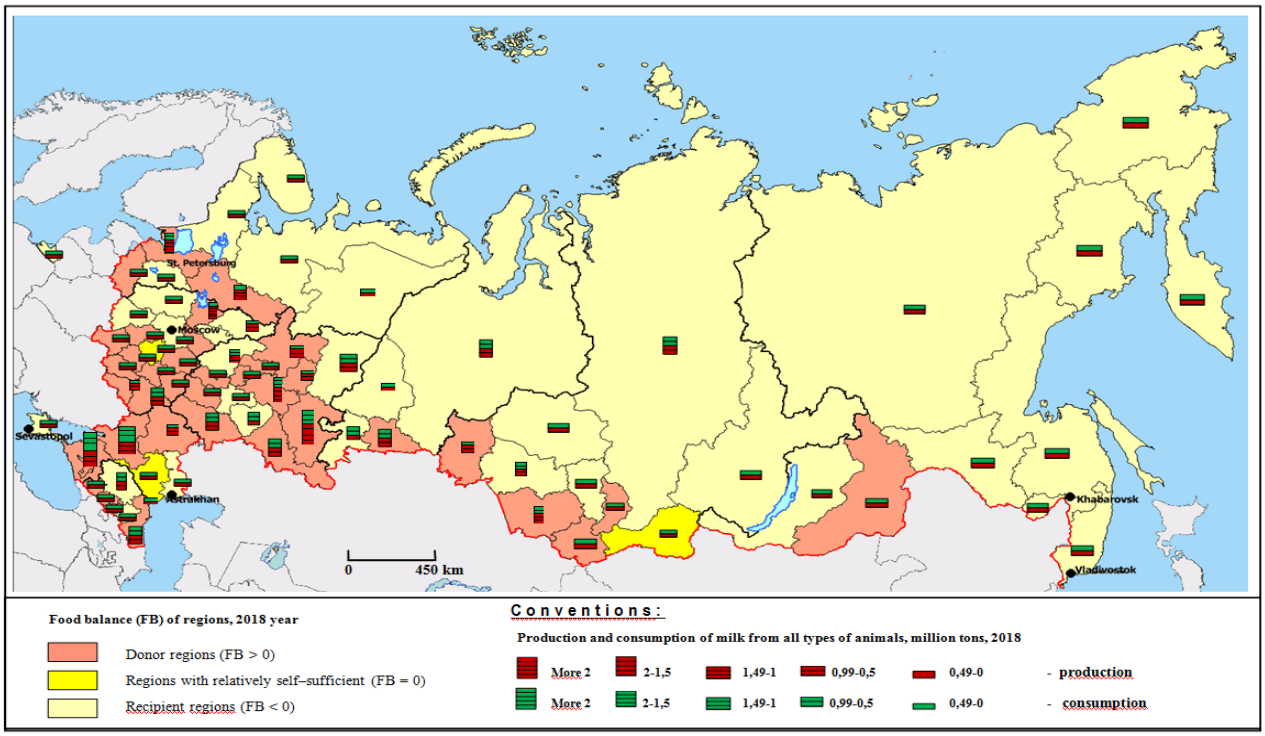

Figure 3. Food balance of milk from all types of animals in the regions of the Russian Federation Source: [Compiled by the author]

While the recipient regions are territories of extensive anthropogenic impact with irreversible processes in natural and economic systems, highly urbanized territories or northern areas that combine both territories with a denser population density, with a high degree of concentration of large-scale industry, urban development, and territories with mining land use and land use based on the traditional nature management of the indigenous population. Due to the extremely low agroecological potential of the lands and permafrost, very low self-sufficiency rates for all food products are observed for these areas [17, 26; 27; 28].

4. Conclusion

In conclusion, it is worth noting that the balance indicator proposed by the author demonstrates the degree of balance of producing and consuming food products, taking into account the available stocks of products at the beginning and end of the year, and can become the main generalizing indicator in the all-Russian food security monitoring system. This indicator allows us to establish correlations of production processes (pro-

duction and consumption) with the zonal-sectoral differentiation of territories and their different levels of socio-economic development.

In the course of these studies, the type of region and the level of food self-sufficiency were determined for each food product, both the region itself and its share in the total volume of production and consumption of agricultural products in the country. There are also regions that act as locomotives of food growth and strive to produce as much food as possible, and those regions that need serious state support and are focused at least on increasing the incoming food from donors. In its turn, it makes it possible to determine the production load on the donor regions and the number of recipient regions for the state, whose territories as a whole pose the greatest threat, since they entail an increase in the state's dependence on food supplies from outside.

From the national federal positions, this typology of regions can be the basis for the construction of such a food supply system, which will eliminate food asymmetry in the level and quality of life of the population of territories, overcome the "automation" of territories with competitive types of resources, remove contradictions in the strategic interests of territories and exports, overcome the negative trends of economic development in a number of territories and, through the development of the potential of territorial cooperation, ensure the spread of economic activity from donor regions to recipients. The formation of a network of food clusters as tools for resource mobilization for dynamic economic growth, increasing competitiveness and diversification of the regional economy based on mechanisms for managing the interaction of regional industries can act as a system-forming priority direction for the development of the food system at the regional level.

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Для цитирования: С.А. Родоманская Assessment of food balance of basic food-stuffs: regional aspect// Международный журнал прикладных наук и технологий «Интеграл», № 2/2024