Food Independence as Key Component of Food Security of the Far Eastern Federal District

S V Gubarkov¹,², I V Zhupley³, N A Tretyak⁴

¹Far Eastern Federal University, School of Economics and Management, Vladivostok, st. Sukhanova, 8, 690950, Russian Federation
²Vladivostok Branch of the Russian Customs Academy, Vladivostok, st. Strelkovaya, 16, 690034, Russian Federation
³Primorsky State Agricultural Academy, Ussuriysk, Blyukhera Ave., 44, 692510, Russian Federation
⁴Vladivostok Branch of the Russian Customs Academy, Vladivostok, st. Shooting, 16, 690034, Russian Federation

E-mail: gsv20031973@mail.ru, zirinavik@mail.ru, prepod-tretyak@yandex.ru

Abstract. This article considers the problems of providing food security in the Far East of the Russian Federation. The authors performed a comparative analysis of food independence indicators for the Russian Federation, Far Eastern, and Siberian Federal District. They made a conclusion that the food independence threats in the Far Eastern Federal District are lower than those in other macroregions. Trend models were developed to obtain forecast values of food independence indicators, and the quality of these models was tested. The authors analyzed the existing and potential food security threats in the Far Eastern Federal District. They formulated suggestions to improve the food independence of the Far Eastern Federal District.

1. Introduction

Considering the importance of human capital assets for the development of the country, it is not surprising that ensuring food security is in the focus of attention in both developed and the majority of developing countries. To achieve food security, it is necessary to provide access to amounts of quality food that is sufficient for the healthy living of all citizens of the country. The experience of developed countries shows that the sufficiency of local agricultural produce is a key component of national security.

Food security is largely determined by the development of such economic sectors as agriculture, fishery, and food industry. Only stable domestic production of food and sufficient amounts of raw materials necessary can help the country achieve the required food availability level [1].

The food security of a country is a significant component of national and economic security. Therefore, the problems of food security provision in the Russian Federation are thoroughly considered when drawing up the federal budget and implementing governmental policies.

Considering the problems of food security in the Far Eastern Federal District (FEFD), note that food security has not been provided in this region for quite a long time, which presents a significant threat to the national security. The land area of the Far Eastern region is 621 million square km with only 1.1% of those used for agriculture and 0.4% as plowland. That being said, a number of
researchers [2] claim that the FEFD can be self-sustainable (70-95%) in such products are soy, maize, potato, open ground vegetable crops, and partially in fruit and berry products. This can be possible if the production gets intensified and the workflows become increasingly automated, along with the support for agricultural producers from the authorities. The ways to solve these problems are determined to some extent in the Food Security Doctrine of Russian Federation (approved by decree No. 20 of the President of Russia dated 01.21.2020) and the Strategy of social and economic development of the Far East and the Baikal region up to 2025 [3, 4].

2. Relevance, scientific merit of the problem, short literature review
A capability to identify threats and create conditions for the entire country or a specific region to completely satisfy the needs of its residents in quality food that is accessible in terms of transportation and pricing is a priority task of national security.

The problems of food security are relevant and strategically important for all countries irrespective of the level of their economic development or population size, and they have been covered by many researchers. In 2020 alone, the problems of food security were discussed in the papers by Soltani, A., Alimagham, S.M., Nehbandani, A., Tokhayeva, Z.O., Almukhambetova, B.Z., Keneshbayev, B., Akhmetova, K., Gorbunova, O.S., Voronin, B.A., Bukhtiyarova, T.I., Mitin, A.N., Mokronosov, A.G., Winarno, H., Perdana, T., Handayati, Y., Purnomo, D., Stronge, D., Scheyvens, R., Banks, G., Ma, C.-C., Chen, H.-S., Chang, H.-P., Abebaw, D., Admassie, A., Kassa, H., Padoch, C., Abdolelhl, O.S., Schneider, M., Nugraha, L.M., Heptiyanggit, A., Hakim, L., etc. There is, however, no simple recipe for achieving food security, which allows countries to use different strategies [5, 6].

The reduction of food imports and exports due to the pandemic of 2020 exposed the problems of food security of both specific regions and Russia as a whole and led to a reassessment of the existing economic trends that signify that the existing domestic agricultural industry cannot satisfy residents needs in food [7].

The importance of this problem is stressed by the Food Security Doctrine of the Russian Federation (approved by decree No. 20 of the President of Russia dated 01.21.2020), which specifies the national interests in this area. This doctrine states that the “achievement of threshold values for the indicators of food independence, economical and physical availability of food and its compliance with the requirements of the technical regulations law of the Eurasian Economic Union” should be used as the main indicator in food security assessment [3].

Food independence is understood as the country's (region’s) overall level of sell-sufficiency equal to the proportion of the volume of national (regional) agricultural produce, raw materials, and food to the volume of their nation-wide (regional) consumption (in percentages). Food independence is deemed achieved if the level of self-sufficiency in vital groups of food is above the threshold values set out in the Doctrine (e.g. for grains it must be at least 95%, for meat and meat products (in meat equivalent) at least 85%; milk and dairy products (in milk equivalent) at least 90%, for potatoes at least 95%; vegetables and cucurbitaceous at least 90%; fruits and berries at least 60%, etc) [3].

We are also interested in the definition by K. A. Akhmetova: “food security is a state in which the break of food supply from abroad does not lead to a food crisis” [8].

The problems of food security assessment in a specific region of the Russian Federation have been discussed in a number of research, whose authors argue that such assessments are feasible [9], [10] or inefficient [11] depending on their positions.

The food security threats vary significantly across regions. All of the regions of the Russian Federation can be classified depending on the levels of self-sufficiency determined by their bioclimatic, industrial, and agricultural capacities [9].

For instance, the Far Eastern Federal District located in the Far East of Russia and Eastern Siberia and occupying 36.1% of the country's land area has significant problems with food security, which stipulates thorough monitoring of threats relevant to the food security of the region.
3. Materials and methods
The objectives set were achieved using the following research methods: the logical generalization method, the monographic method, grouping, comparison, and economical statistical methods. Forecasting the level of food independence in federal districts and Russia as a whole was carried out using econometric (factor) models.

The empirical basis of this article comprises the results of the research of food security problems and food independence achievement in the Far Eastern and Siberian Federal District and Russia as a whole performed by the authors.

4. Theory
Scientific papers interpret the notion of a security threat differently. A food security threat stands for a combination of conditions and factors leading to the aggravation of food availability for the majority of the country's residents [12].

The authors suggest considering food security threats as combinations of factors that can aggravate the current food security of the region.

The analysis of the food security of FEFD shows that the threats it faces are significantly more serious than in other macroregions. The region experiences the absorption of local agricultural producers and processing businesses by vertically integrated companies. This complicates the formulation of the regional food security strategy due to the longer vertical communication chain.

Agriculture plays a strategic role in supporting the economy of the region, especially in terms of improving food security and agricultural production [13]. Forming a universal national basis for the sustainable management of natural resources and the introduction of technologies and innovations necessary to improve labor productivity, profitability, and sustainability of the agricultural system [14] must be the top priority of the region.

State support must be directed to the expansion of greenhousing to produce sufficient amounts of local foods, especially vegetables [15]. The establishment of regional food centers will help arrange a food system that can aggregate and link agricultural producers with each other, as well as with weather data centers, insurance companies, and consumers directly [13].

Key conditions of ensuring food security in FEFD is supporting rural life. It is necessary to take some efforts to facilitate the continuity of rural life because this kind of lifestyle became unattractive [16] and because the difference in the standards of living in urban and rural areas is huge (today, 72.93% of the residents of the Far Eastern Federal District live in cities). The transition from private households producing food for their own consumption to profitable agricultural enterprises leads to the commercialization of agricultural systems [17], which has some adverse effects on food security.

The Far Eastern Federal District has maritime borders with Japan and the USA, and land borders with Mongolia, China, and North Korea. Therefore, the geographic location of the region may function as one of the key factors in ensuring food security. The presence of maritime and land borders requires some customs tariff regulations that will facilitate the production of competitive agricultural produce complying with security standards in terms of prices and quality [18]. However, when formulating customs tariff regulations, it is necessary to understand that agriculture largely depends on foreign technologies and requires selective use of tariff policy instruments.

5. Practical Significance, Proposals and Implementation Results, Experiment Results
Taking into account the importance of food independence, we will calculate the actual (2014-2018) and forecast (in the short term) values of self-sufficiency for Russia and the Far Eastern Federal District. The authors shall also analyze the levels of self-sufficiency for the main food groups in the Far East of Russia and compare them with the country as a whole and the Siberian Federal District (SFD) (Table 1).

Justification of the macroregion selection for comparison. The Far East is the largest region of Russia in terms of land area. It occupies 36.1% of the country but only 6% of its population lives there. The Siberian Federal District is the second-largest (after the Far East) macroregion in Russia. It
occupies 30% of the country’s territory and is home to 12% of its population. Both of these macroregions are distant from the administrative center of the country, which significantly complicates the agricultural logistics. Harsh nature-and-climate conditions of the FEFD and SFD classify agricultural activities initiating the primary flow of food products and agricultural raw materials in both regions as risky.

To find forecast values for self-sufficiency in the main groups of food products, the authors developed trend models that can be used to obtain reliable predictions (using a time series of 2010-2018 in the forecasting) (see Table 1).

Table 1. Trend models of self-sufficiency for Russia, FEFD, and SFD by main food groups.

| Food Product           | Calculation                                                                 | Determination factor / model interpretation |
|------------------------|------------------------------------------------------------------------------|---------------------------------------------|
| Potato                 | $L_{\text{potato}}^\text{Russia} = 0.3 \cdot t^3 - 4.4 \cdot t^2 + 16.1 \cdot t + 84.4$ | 0.6 / acceptable                           |
|                        | $L_{\text{potato}}^\text{Siberia} = -0.072 \cdot t^4 + 1.68 \cdot t^3 - 13.54 \cdot t^2 + 43.21 \cdot t + 56.3$ | 0.8 / quite good                           |
|                        | $L_{\text{potato}}^\text{FEFD} = 99.964 \cdot t^{-0.082}$                   | 0.6 / acceptable                           |
| Vegetables and food cucurbitaceous | $L_{\text{vegetables}}^\text{Russia} = 0.34 \cdot t^4 - 6.1 \cdot t^3 + 34.2 \cdot t^2 - 72.5 \cdot t + 132.8$ | 0.8 / quite good                           |
|                        | $L_{\text{vegetables}}^\text{Siberia} = 72.269 \cdot e^{-0.039 \cdot t}$   | 0.7 / acceptable                           |
|                        | $L_{\text{vegetables}}^\text{FEFD} = -3.178 \cdot t + 79$                   | 0.8 / quite good                           |
| Fruits and berries     | $L_{\text{fruit}}^\text{Russia} = 0.03 \cdot t^4 - 0.48 \cdot t^3 + 2.33 \cdot t^2 - 2.72 \cdot t + 32.0$ | 0.7 / acceptable                           |
|                        | $L_{\text{fruit}}^\text{Siberia} = -0.08 \cdot t^3 + 1.1 \cdot t^2 - 3.59 \cdot t + 18.9$ | 0.6 / acceptable                           |
|                        | $L_{\text{fruit}}^\text{FEFD} = 0.0357 \cdot t + 11.429$                    | 0.5 / acceptable                           |
| Meat and meat products | $L_{\text{meat}}^\text{Russia} = 3.53 \cdot t + 72$                         | 0.9 / quite good                           |
|                        | $L_{\text{meat}}^\text{Siberia} = -0.1905 \cdot t^2 + 2.1667 \cdot t + 78.286$ | 0.8 / quite good                           |
|                        | $L_{\text{meat}}^\text{FEFD} = 0.4405 \cdot t^2 - 1.2024 \cdot t + 23.286$ | 0.8 / quite good                           |
| Milk and milk products | $L_{\text{milk}}^\text{Russia} = -0.833 \cdot t^3 + 1.238 \cdot t^2 - 4.464 \cdot t + 83.143$ | 0.9 / quite good                           |
|                        | $L_{\text{milk}}^\text{Siberia} = -0.025 \cdot t^5 + 0.617 \cdot t^4 - 5.671 \cdot t^3 + 23.625 \cdot t^2 - 42.562 \cdot t + 118$ | 0.9 / quite good                           |
|                        | $L_{\text{milk}}^\text{FEFD} = 0.111 \cdot t^3 + 2.167 \cdot t^2 - 8.865 \cdot t + 50.571$ | 0.8 / quite good                           |

The analysis of data from table 1 shows that food self-sufficiency in Russia in 2018 was achieved for such products as potato, vegetables, and meat. Besides, the current positive trends for these product groups will continue in 2021. Indeed, threshold achievement coefficients will be 1.11, 1.20, and 1.26 respectively by 2021. For fruit and dairy products, there is no evidence that food independence thresholds will be met. However, there is a positive trend toward the thresholds of self-sufficiency (Table 2).
Table 2. Comparative analysis of food self-sufficiency for Russia and its macroregions (in percentages) [19].

|          | 2014  | 2015  | 2016  | 2017  | 2018  | Forecast | Deviation | Threshold coefficient |
|----------|-------|-------|-------|-------|-------|----------|-----------|----------------------|
|          | 2020  | 2021  | 2021 to 2020 | 2018  | 2021  |
| Potato   |       |       |       |       |       |          |           |                      |
| Russia   | 101   | 105   | 97    | 91    | 98    | 92       | 105.4     | 4.4                   | 13.4                 | 1.03                  | 1.11                  |
| Siberia  | 102   | 101   | 102   | 95    | 100   | 100.8    | 94.4      | -7.6                  | -6.4                 | 1.05                  | 0.99                  |
| FEFD     | 101   | 85    | 82    | 84    | 91    | 83.4     | 82.4      | -18.6                 | -1.0                 | 0.96                  | 0.87                  |
| Vegetables and food cucurbitaceae |       |       |       |       |       |          |           |                      |
| Russia   | 90    | 94    | 95    | 88    | 90    | 84.5     | 107.7     | 17.7                  | 23.2                 | 1.00                  | 1.20                  |
| Siberia  | 70    | 72    | 74    | 62    | 55    | 59.8     | 53.7      | -16.3                 | -6.1                 | 0.61                  | 0.60                  |
| FEFD     | 74    | 64    | 68    | 59    | 54    | 50.4     | 47.2      | -26.8                 | -3.2                 | 0.60                  | 0.52                  |
| Fruits and berries |       |       |       |       |       |          |           |                      |
| Russia   | 34    | 34    | 37    | 33    | 34    | 43.1     | 57.8      | 23.8                  | 14.7                 | 0.57                  | 0.96                  |
| Siberia  | 14    | 16    | 17    | 16    | 16    | 17.4     | 13.0      | -1.0                  | -4.4                 | 0.27                  | 0.22                  |
| FEFD     | 10    | 12    | 11    | 16    | 9     | 11.1     | 11.8      | 1.8                   | 0.7                  | 0.15                  | 0.20                  |
| Meat and meat products |       |       |       |       |       |          |           |                      |
| Russia   | 82    | 89    | 91    | 94    | 96    | 103.0    | 107.3     | 25.3                  | 4.3                  | 1.13                  | 1.26                  |
| Siberia  | 82    | 85    | 85    | 84    | 84    | 82.3     | 80.9      | -1.1                  | -1.4                 | 0.99                  | 0.95                  |
| FEFD     | 26    | 23    | 26    | 36    | 35    | 48.1     | 55.3      | 29.3                  | 7.2                  | 0.41                  | 0.65                  |
| Milk and milk products |       |       |       |       |       |          |           |                      |
| Russia   | 79    | 80    | 81    | 83    | 84    | 82.7     | 79.3      | 0.3                   | -3.4                 | 0.93                  | 0.88                  |
| Siberia  | 94    | 95    | 95    | 94    | 95    | 86.3     | 73.9      | -20.1                 | -12.4                | 1.06                  | 0.82                  |
| FEFD     | 41    | 42    | 43    | 56    | 55    | 65.4     | 67.6      | 26.6                  | 2.2                  | 0.61                  | 0.75                  |

In the Far East of Russia, the food independence criteria have not been met in any of the analyzed food groups. The dangers associated with such situations in this macroregion became obvious in February 2020 when trading connections with China were stopped because of the coronavirus pandemic. As a result, the food prices grew, and for some products, the increase amounted to 200–300%.

6. Conclusion
The research conducted made the authors draw the conclusion that the achievement of food security and, in particular, the food independence criteria in the Far Eastern and Siberian Federal District requires the establishment of specific conditions to develop agriculture and increase the volume of local produce. The authors agree with S. A. Rodomanskaya, who stresses the necessity of considering regional specifics in the achievement of food security of a given macroregion [20].

In the FEFD, it is necessary to account for the remoteness from the European Russia, which calls for the reduction of transport costs, as well as the constant reduction of population leading to the lack of labor resources in agriculture, the misbalance between the exports and imports of food and agricultural raw materials, which, in the end, drags down the regional economy and its competitiveness in national and foreign markets.

“The improvement of credit and finance relations” is a key aspect in the efficiency improvement for agriculture “because up to 65% of the profits in agriculture nowadays are spent on loan servicing, while in oil and gas industries, this figure is only 14%” [21].
The analysis of food independence level in the Far Eastern Federal District in the long term shows that it is feasible to introduce the adaptive landscape specific agriculture, which will facilitate the sustainable and eco-friendly development of agriculture and the improvement of food production efficiency.

Thus, to provide the food security of the country or any of its macroregions, it is necessary to improve the efficiency of the agricultural economy through intensification. It will help achieve the necessary criteria for food independence and restore adequate and rational nutrition for residents through quality and safe products.

7. References
[1] Smertina E S, Tupikina E N and Turunova E V 2018 Analysis of Food Security in the Primorsky Krai National Interests: Priorities and Security 6 1125–1134
[2] Kiselev E P, Vdovenko A V, Kim L V and Nazarova A A 2018 Basic foundations of food security in the Far Eastern Federal District Far Eastern Agrarian Bulletin 1 110-117
[3] Food security doctrine of the Russian Federation Decree of the President of the Russian Federation of January 21, 2020 № 20. https://www.garant.ru/products/ipo/prime/doc/73338425/
[4] Strategy of socio-economic development of the Far East and the Baikal region until 2025 Order of the Government of the Russian Federation of December 28, 2009 № 2094-p (Electronic resource) https://www.garant.ru/products/ipo/prime/doc/6632462/
[5] Stronge D, Scheyvens R and Banks G. 2020 Donor approaches to food security in the Pacific: Sustainable development goal 2 and the need for more inclusive agricultural development Asia Pacific Viewpoint 1 102-117
[6] Mughal M and Fontan Sers C 2020 Cereal production, undernourishment, and food insecurity in South Asia Review of Development Economics 2 524-545
[7] Gorokhova T, Pushkareva L and Pushkarev M 2020 Modern problems of the product market of Russia 2020 E3S Web of Conferences 164 09034
[8] Akhmetova K A 2009 Food security: state, problems, solutions Problems of the modern economy 2 (Electronic resource) http://www.m-economy.ru/art.php?nArtId=2568
[9] Kurbatova S M, Vlasov V V and Aisner L Y 2020 Impact of risks and threats on the region's food supply in the context of import substitution E3S Web of Conferences 161 01089
[10] Ma C-C, Chen H-S and Chang H-P 2020 Crisis response and supervision system for food security: A comparative analysis between mainland China and Taiwan Sustainability 12 3045
[11] Kostrova Y B, Shibarshina O Y, Tuarmenskiy V V and Lyauschuk Y O 2020 Ensuring Regional Food Security in the Ryazan Region IOP Conf. Ser.: Mater. Sci. Eng 753 062022
[12] Sergeeva I A and Sergeev A Yu 2014 Threats to food security in Russia Food Policy and Security 1 13-24
[13] Winarno H, Perdana T, Handayati Y and Purnomo D 2020 Regional Food Hubs for Distribution of Regional Food Logistics (Case Study on the Establishment of a Food Distribution Center in Banten Province, Indonesia) IOP Conf. Ser.: Mater. Sci. Eng 771 012068
[14] Tokhayeva Z O, Almukhambetova B Z, Keneshbayev B and Akhmetova K 2020 Innovative processes’ management in agriculture and food security: Development opportunities Entrepreneurship and Sustainability Issues 3 1565-1579
[15] Zhong T, Si Z, Shi L, Ma L and Liu S 2020 Impact of state-led food localization on suburban districts’ farmland use transformation: Greenhouse farming expansion in Nanjing city region, China Landscape and Urban Planning 202 103872
[16] Abebaw D, Admassie A, Kassa H and Padoch C 2020 Can rural outmigration improve household food security? Empirical evidence from Ethiopia World Development 129 104879
[17] Abdoellah O S, Schneider M, Nugraha L M, Heptiyanggit A and Hakim L 2020 Homegarden commercialization: extent, household characteristics, and effect on food security and food sovereignty in Rural Indonesia Sustainability Science 3 797-815
[18] Kotenev A, Ustinova L, Zakharova G, Otarov A and Kryzhevskaya N 2020 Optimization of customs and tariff policy instruments in the system of import substitution in the agricultural E3S Web of Conferences 164 11040

[19] Balances of food resources (recalculated data taking into account the results of VSHP - 2016) (Electronic resource) https://www.gks.ru/compendium/document/13277

[20] Rodomanskaya S A 2018 Evaluation of the level of food ensuring the Amur region Moscow Economic Journal 2 61-83

[21] Ushachev I G 2015 From speeches at a meeting of the agro-industrial complex commission under the chairman of the Federation Council ECO 3 59