Methodology for assessment of food security of countries

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Abstract
A comprehensive assessment of national food security should include an analysis of the physical and economic accessibility of food, the level and quality of nutrition of the population, the sustainability and competitiveness of agriculture, factors and trends of self-sufficiency in the main types of agricultural products, raw materials and food and the effectiveness of foreign trade in food. To assess the food security situation at the state level, it is necessary to conduct monitoring, which consists in determining the deviations of the main indicators from the criteria and thresholds established at the national level. The monitoring should determine the format of the national report on the country's food security. The number of indicators that make up its basis, should be optimal and sufficient to reflect the level of food security of the country and compare them with the situation in other countries. At the same time, it is necessary to analyze trends in ensuring food security at the global level in terms of the progress of countries and regions of the world in achieving the goals of sustainable development in agriculture, the elimination of hunger and poverty for the period up to 2030. Conducting a study of the components of the global food security index, formed at the world level to measure the policy and efficiency of government agencies in the field of food security, is relevant and in demand for positioning the country within the framework of international comparison of countries.

Keywords: food security, European Union states, integrated assessment, criteria, indicators, levels, index, products and food quality.

Introduction

At the present stage, there are several levels of provision of a state with the main types of food. The first level is the state's absolute self-sufficiency in the most important types of food, when domestic demand is less than national agricultural production and there is a possibility of exporting it. The second level is when a country produces only food necessary for domestic consumption, as a rule, by limiting overproduction in order to stabilize food prices and break even agricultural producers.

The third level is that the import of food products into the country does not exceed 15-20% of their annual consumption (optimal import).

The fourth level is when about 30% of food consumed in the country depends on imports (the threshold level at which there is already a threat to food security).

The fifth level is the state’s food dependence on supplies from other countries of the world. Imports exceeding 30% create risks of food crises, increasing impoverishment, natural migration and depopulation of the population. In the EU countries, there are strict restrictions on the import of food products from non-EU countries, both in terms of customs and tariff regulation, and in terms of technical control systems for the safety of imported food. The assortment variety, high quality and availability of food products in these countries are ensured by the absence of customs barriers when moving food products within the EU. The EU countries have developed agriculture and high...
shares of agricultural imports in the domestic market.

To assess the state of food security in the world, there are various methodologies based on different sets of indicators. At the international level, since 1996, FAO has been conducting annual monitoring that provides an ongoing analysis of food security in the world, in 2011 an open database was created on the FAOSTAT website, since 2012 the Global Food Security Index has been calculated. The FAO indicator system consists of four indicators: 1) physical availability of food; 2) food affordability; 3) stability of food supply; 4) food consumption. The definitions of indicators representing are given and combined into one statistical database on the FAOSTAT website.

Conducting a study of the components of the global food security index, formed at the world level to measure the policy and efficiency of government agencies in the field of food security, is relevant and in demand for positioning the country within the framework of international comparison of countries.

Material and methods

Assessment of the state of food security of the country, on the one hand, is determined by the stability of the population's access to food, that is:

- physical availability of food, which is understood as the availability of food throughout the country at any time and in the required range;
- economic accessibility of food products, which means that the level of income, regardless of social status and place of residence of a person, allows him to purchase food to maintain an active and healthy lifestyle;
- quality, completeness and balance of nutrition, which implies that food products should be safe for health, the diet should be high in calories and balanced in proteins, fats, carbohydrates, trace elements and vitamins.

On the other hand, the level of food security is characterized by the creation of the necessary insurance reserves of food and a reserve of foreign exchange resources necessary to import the missing food, to ensure the country's food independence, which is an important element of national security. In this context, the country's food security is ensured not only by a set of economic and social conditions associated with the development of agriculture and food production, but also by the general state of the national and world economy.

There is also significant sectoral differentiation in household income, exacerbated by inequality in food consumption. The stratification of society by the level of income is a threat to the national security of the country and therefore its assessment using income groups by the level of food consumption is also one of the aspects of the work on compiling a system of indicators characterizing food security.

The physical availability of basic food products for the population consists in a stable national production of food products, optimal imports, the availability of food products throughout the country, including remote settlements, in an assortment and volume that fully satisfies the demand of the population and corresponds to the recommended consumption rates, at every moment of time. It depends on domestic production, the ability to import food and the level of development of the commodity distribution infrastructure.

It should be borne in mind that in the modern world, only raw materials are found on a farm or in the field, a food product is formed in the areas of processing, packaging, storage, transportation and trade. In this connection, even if a country is able to independently produce a significant volume of agricultural products, but does not have a sufficiently developed market infrastructure, the physical availability of food will be low. Often, the functioning and expansion of retail chains leads to monopolization of this market segment, complicating access to it for agricultural producers, maintaining a high level of consumer prices for food.
Results and discussion

The most important means of achieving food security and import independence, as shown by world practice, is a properly organized system of foreign economic regulation in the agri-food sector. As directions for improving the quality of food, it is proposed to expand the production of environmentally friendly food products, which are currently a guarantee of safety and health of people (United Nations Standing Committee on Nutrition, 2020; Food and agriculture organization of the United Nations. World health organization, 2020).

The Global Food Security Index is calculated by the British research company The Economist Intelligence Unit (analytical department of the British magazine The Economist) with the support of the American multinational company Dupon, since 2012. Its purpose is to measure the policy and effectiveness of government agencies in the field food security. Based on a global study, a ranking of countries in terms of food security is compiled. The selection of countries for calculating the food security index is based on their economic importance, population size and taking into account that all regions of the world are represented. To calculate the food security index in 2018. four groups of indicators were used: food availability, food availability and sufficiency, food quality and safety, natural resources and sustainability. In total, 26 main indicators and 33 additional indicators were analyzed.

The report "Global Food Security Index 2019" provides a methodology for compiling the rankings of countries. The first three groups of indicators (food availability, food availability and sufficiency, food quality and safety) have been used to calculate the food security index since 2012, the fourth group of indicators (natural resources and sustainability) was added in 2017 to take into account the impact of risks associated with climate and depletion of natural resources. For each indicator obtained for all 113 countries, a normalization obtained for all 113 countries, a normalization procedure is carried out.

The methodology for compiling the global food security index is based on the opinion of international experts assessing national plans and strategies in the field of nutrition, risks of political instability, corruption, etc.

Criteria and indicators of the level of food security of European countries in the Global Food Security Index in 2019 are shown in Table 1.

The following levels are highlighted: very good (over 80 points), good (60-79.9), moderate (40-59.9), weak (20-39.9) and very weak (0-19.9).

Table 1 – Criteria and indicators of the level of food security of various European countries in the Global Food Security Index in 2019 (points - the maximum value of 100)

| Indicators                             | Germany | Poland | Spain | Greece | Hungary | Bulgaria | World average |
|----------------------------------------|---------|--------|-------|--------|---------|----------|---------------|
| ECONOMIC AVAILABILITY:                 | 84.9    | 81.1   | 82.3  | 77.8   | 80.8    | 79.0     | 67.5          |
| Change in average cost of food         | 99.0    | 99.0   | 99.2  | 99.5   | 98.7    | 98.9     | 96.4          |
| Share of population below poverty line| 100.0   | 99.4   | 98.7  | 98.1   | 99.3    | 98.0     | 83.5          |
| PPP GDP per capita                     | 41.8    | 25.0   | 31.1  | 23.4   | 24.3    | 17.1     | 17.8          |
| Level of import tariffs for agricultural products | 81.1    | 81.1   | 81.1  | 81.1   | 81.1    | 81.1     | 75.6          |
| Presence of food security programmes   | 100.0   | 100.0  | 100.0 | 100.0  | 100.0   | 100.0    | 74.3          |
| Availability of financing for farmers  | 100.0   | 100.0  | 100.0 | 100.0  | 100.0   | 100.0    | 63.9          |
| PHYSICAL AVAILABILITY:                 | 79.1    | 69.3   | 65.9  | 69.3   | 66.1    | 54.2     | 59.4          |
The data given in Table 1 show that Hungary, Poland, Spain and Germany have a very good level of food security; Greece and Bulgaria have a good level.

Based on the calculation of the Global Food Security Index (GFSI), the level of food security of various countries of the world is assessed using indicators of economic and physical accessibility, quality and safety (Figure 1).
The dynamics of food costs per person is shown in Table 2.

Table 2 – Dynamics of food costs per person, USD

| Years | Germany | Poland | Spain | Greece | Hungary | Bulgaria |
|-------|---------|--------|-------|--------|---------|----------|
| 2010  | 1468.0  | 2422.0 | 2541.0| 3085.0 | 1151.0  | 940.0    |
| 2011  | 1523.7  | 2540.3 | 2685.1| 3028.4 | 1290.0  | 955.9    |
| 2012  | 1421.9  | 2317.9 | 2224.9| 2649.5 | 1226.1  | 937.0    |
| 2013  | 1477.8  | 2469.0 | 2336.3| 2585.8 | 1286.1  | 944.9    |
| 2014  | 1450.3  | 2576.3 | 2355.5| 2677.0 | 1307.3  | 1002.6   |
| 2015  | 1220.6  | 2228.2 | 2018.3| 2272.3 | 1148.6  | 890.9    |
| 2016  | 1220.1  | 2256.9 | 2019.4| 2257.7 | 1162.0  | 938.6    |
| 2017  | 1342.9  | 2379.6 | 2059.5| 2333.4 | 1306.8  | 1008.8   |
| 2018  | 1480.3  | 2562.9 | 2217.9| 2510.6 | 1449.4  | 1172.1   |
| Growth rate % | | | | | | |
| 2018/ 2010 | 100.8 | 105.8 | 87.3 | 81.4 | 125.9 | 124.7 |

The data in Table 2 show the growth rate of food expenditures per capita for 2010-2018, in Germany it is 0.8%; in Poland - 5.8%; in Hungary – 25.9% and in Bulgaria - 24.7%.

In Spain, during the study period, there was a decrease in food expenses by 12.7% and in Greece by 18.6%.

In the field of food security, problems of economic and agro-industrial policy, objective trends in the development of agricultural products and food products, the state of the domestic market and the degree of its dependence on food imports, social status and the ability to pay of the population, food quality and a balanced diet are intersected.

To assess the physical availability of food, the following indicators can be used: production of basic food products per capita per year; consumption of basic food products per capita per year; the level of achievement of rational norms of food consumption per capita; prevalence of malnutrition; the level of moderate or severe food insecurity in the population (based on the food insecurity perception scale); the prevalence of stunting among children under five years of age (standard deviation from the median height-for-age of the child in accordance with the child growth standards established by the World Health Organization (WHO), is < -2); prevalence of malnutrition among children under five years of age, by type (wasted or overweight) (standard deviation from the median weight-for-age according to the WHO Child Growth Standards, is > +2 or < -2).

The economic affordability of food products is assessed by a number of indicators: the volume of GDP (calculated in PPP) per capita; the share of food expenditures in household consumption expenditures; funds ratio (income differentiation ratio); Gini coefficient (income concentration index); proportion of the population with incomes below the poverty line, established internationally (living on less than $ 1.9 a day); the share of the population with income (expenditure) levels below the subsistence minimum / poverty line established at the national level; the cost of the minimum set of food products in% of the subsistence minimum; growth rates of real money incomes of the population; the growth rate of the purchasing power of the population’s monetary income; the purchasing power of the average per capita disposable cash income of households; consumer price indices for food products; unemployment rate.

The level and quality of the population’s nutrition is assessed using the following indicators: the calorie content of consumed food products per household member per day – total, including from products of animal origin; protein consumption per household member.
per day - total, including animal products; fat consumption per household member per day - total, including animal products; carbohydrate consumption per household member per day - total, including animal products; the ratio of proteins, fats and carbohydrates in the diet; proportion of the population with access to drinking water.

To assess the level of development of agriculture, the following indicators can be used: index of agricultural production (in constant prices); production volumes of agricultural products and food products (in physical terms); agriculture orientation index determined by the structure of government spending; budget support for agricultural producers per unit of currency of products sold; the share of investments in fixed assets directed to agriculture in the total volume of investments in fixed assets; the ratio of the volume of investments in fixed assets, directed to agriculture, and gross agricultural output; profitability of agricultural products sold; the ratio of the size of accounts payable and receivable of agricultural producers.

Food independence of the country is determined on the basis of the following indicators: the share of strategic stocks of the most important types of food (grain, etc.) in the total volume of their annual consumption; the amount of genetic resources of plant and zoological origin, intended for food production and agriculture, which are stored in special facilities or medium-term (or long-term storage); the coefficient of self-sufficiency for the most important food products; the share of the volume of domestic production of the most important food products in the total volume of their resources; the coefficient of the country's import dependence on the most important food products; the balance of foreign trade operations for the most important food products; the ratio of food exports and imports; the ratio of the value of food imports to the total volume of export operations; general level of food independence.

Conclusions

A comprehensive assessment of national food security should include an analysis of the physical and economic accessibility of food, the level and quality of nutrition of the population, the sustainability and competitiveness of agriculture, factors and trends of self-sufficiency in the main types of agricultural products, raw materials and food and the effectiveness of foreign trade in food.

To assess the food security situation at the state level, it is necessary to conduct monitoring, which consists in determining the deviations of the main indicators from the criteria and thresholds established at the national level. The monitoring should determine the format of the national report on the country's food security. The number of indicators that make up its basis, should be optimal and sufficient to reflect the level of food security of the country and compare them with the situation in other countries. At the same time, it is necessary to analyze trends in ensuring food security at the global level in terms of the progress of countries and regions of the world in achieving the goals of sustainable development in agriculture, the elimination of hunger and poverty for the period up to 2030.

The main directions and measures to strengthen the food security of countries should be developed in the following areas:
- Production of agricultural products, raw materials and food;
- Increasing the affordability of food products for all groups of the population;
- Regulation of national food security;
- Increasing the competitiveness of production and sales of products;
- Cooperation and integration in the agri-food sector;
- Development of scientific and innovative potential for ensuring national food security.
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