Analysis of the food security situation in Ukraine

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Abstract. The dynamics of Global Food Security Index (GFSI) values and Ukraine's place in the world ranking for 2013-2022 are studied. The GFSI calculation methodology is considered. Ranking of countries by GFSI value for 2022 is analyzed. The analysis of the components of the Ukraine's GFSI for the last ten years is carried out. It was established that the state of food security in Ukraine has undergone significant changes over the past 10 years. According to the results of 2022, Ukraine took 71st place among 113 countries of the world. It was found that the best situation with food security in Ukraine was observed in 2013. In recent years the situation has worsened. An analysis of the closeness of the relationship between the GFSI for Ukraine and its components ("Affordability", "Availability", "Quality and safety", "Sustainability and adaptation") for 2018-2022 is conducted. The closest connection between the GFSI and "Affordability" is established. The factors influencing "Affordability" are analyzed and the ways in which the value of this group of indicators can be increased are determined. The group of indicators "Change in average food costs" is studied. The components of the GFSI for Ukraine for 2022 in value terms are considered. Measures to strengthen the level of food security in Ukraine are proposed.

1 Introduction

Traditionally Ukraine's agricultural sector has played a key role in ensuring food security for the population as well as in supporting other countries in the world. This became especially apparent when the war destroyed part of the food chain. Domestic agricultural actors are forced to work in conditions of constant risk to their own lives. Often, the population, especially in the de-occupied territories and frontline areas, does not have access to sufficient nutrition.

However, ensuring Ukraine's food security largely illustrates the effectiveness of the agricultural sector.

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Food security is a state in which the population of different countries has different types of access to sufficient food (physical, social, economic), which is adequate to a healthy and active lifestyle.

Its absence can destabilize societies, exacerbate hunger and malnutrition, cause migration and conflict, and lead to serious economic consequences. Food security can also be seen as sufficient, safe and nutritious food availability. In addition, food security can be interpreted as provided with appropriate resources and potential, the state's ability to guarantee the population of the country as a whole, regardless of internal and external conditions and threats, based on the principles of self-sufficiency and to every citizen, in particular, the physical and economic availability, quality and safety of food and drinking water in the necessary volume and assortment at the level of physiological norms, which provides physical and intellectual development of the individual, contributes to the expanded reproduction of the population and guarantees socio-political stability in the country, its stable economic development, contributes to the strengthening of the country's position at the international level. War has a devastating impact on global food security. Ukraine is a leading producer and exporter of wheat, corn, barley, and sunflower oil. That is why it is called the "breadbasket of the world".

However, Russia's naval blockade on the Black Sea prevents Ukraine's harvest from reaching its usual destinations. The Russian attack has reduced the export capacity of the grain terminal by at least a third. Russia's unjustified invasion of Ukraine has worsened an already dire situation by denying the most vulnerable, hungry and at-risk groups access to the food they desperately need. Some of the world's most vulnerable countries depend heavily on Ukrainian exports. Military operations on the territory of Ukraine have become a significant threat to ensuring food security not only for Ukraine but also for many underdeveloped countries of the world that depend on the domestic export of legumes and grain crops. A high level of corruption, gross domestic product per capita, insufficient financing of scientific research, the latest developments in the agricultural sector, and risks of political instability stand out among the problems related to food security in Ukraine. Also, unlike the world's developed countries, Ukrainian agricultural producers have problems with access to cheap loans. The significant negative impact on the food security situation in Ukraine is caused by factors that do not belong to purely agrarian problems but are related to the general state of the economy: a high level of corruption, too expensive loans, and the risk of political instability.

The problem of food security is not limited to the agricultural sector. It is macroeconomic in nature and includes political, economic, social and international trade aspects. Providing food for the country's citizens and ensuring food security in the current environment is an important task at the global level, given the significant population growth, climate change and environmental pollution. In the case of Ukraine, the issue of food security is becoming particularly relevant due to the crisis in various sectors of the economy, shrinking life expectancy, labor migration, and other problems. Ensuring food security at an adequate level indicates that under any conditions the state guarantees the population the necessary amount of food. The achievement of food security is possible only thanks to the solution of a whole complex of problems, among which the production of agricultural products, their storage, processing and sale occupy an integral place.

One of the critical indicators reflecting the level of food security is The Global Food Security Index (GFSI), designed and constructed by Economist Impact and supported by Corteva Agriscience. It is recognized as an international food security assessment. GFSI indicator has been used for 11 years to analyze, solve and forecast food security problems. Currently, it is calculated based on available data for 113 countries and includes indicators for such critical components as "Affordability", "Availability", "Quality and safety", and "Sustainability and adaptation" [1].

The study of the dynamics of this indicator, as well as its comparison on a global scale, definitely deserves additional research.

2 Related works

The problems of state's food security have been researched in the works of many scientists. The publication [2] discusses strategic alternatives for the development of the agricultural sector, which are definitely related to ensuring the country's food security and affect its level. The connection of digital technologies with sustainable development, its global trends and food security is emphasized in the work: [3]. The importance of digital technologies in agri-food supply chains in the context of COVID-19 in developing countries has become the subject of research by S. Joshi and M. Sharma [4]. They have studied the role of technology in ensuring food security for the agricultural supply chain during the COVID-19 pandemic. The impact of digitalization on modern marketing strategies including agriculture is explored in the publications: [5, 6, 7]. Z. Irani and A.M. Sharif [8] have investigated the genesis of food security and related factors. The authors also outline the challenges created by food security. The thesis that food security is important from the standpoint of society, organization and individuals is proven. The relevance of the political, economic and environmental strategic planning tool in solving food security problems is emphasized also in their publication: [9]. The negative impact of the financing of agricultural products on food security in countries with a developing economy is proven in the publication by R.L. Manogna, N. Kulkarni [10]. Accurate estimates of CO2 emissions per capita by considering the interaction of food security and energy intensity in the context of developing economies are given in the study of M.M. Hasan and A.T.M. Adnan [11]. The connection between the consequences of the COVID-19 pandemic and the markets of agricultural products in the world is highlighted in the publication by A. Kowalska, S. Lingham, D. Maye, L. Manning [12]. The authors emphasize the negative impact of the loss of part of the income and increased food prices on food security. The GFSI for Poland in 2019–2022 was studied. It was concluded that state measures are necessary to ensure food security. It has been established that food self-sufficiency in Poland is a key strategy for sustainability increasing of the polish food system.

The impact of the COVID-19 pandemic on food security is also discussed in the study by A.V. Alade, A.I. Ureki and C.O. Adekoya [13]. It proves an interesting fact – that the services of academic libraries contribute to improving the level of food security. H.A. AlNemer conducted research on trends in knowledge discovery about COVID-19 and food security [14]. To do this, the author analyzed 40 scientific papers about COVID-19 and food safety using the VOSviewer and RStudio programs. His research is valuable from the perspective of using knowledge about the connection between food security and the pandemic.

Analysis of the current state of food security in Ukraine is intricately linked to various research endeavors. I. Bashynska et al. [15] delve into the assessment of investment and innovation in Ukrainian regions, which directly impacts agricultural productivity and, consequently, food security. Their examination of smart agro-clustering highlights potential strategies for enhancing agricultural sustainability and ensuring a stable food supply [16].

O. Prokopenko et al. [17] provide insights into economic estimation under transformational conditions, offering crucial perspectives for resource allocation in the agricultural sector, a cornerstone of food security initiatives. Furthermore, their conceptual framework for innovation policy development [18] underscores the importance of technological advancements in bolstering agricultural productivity and resilience against food insecurity.

V. Hrosul et al. [19] and A. Kuczabski et al. [20] explore organizational and management aspects relevant to sustainable agricultural practices, essential for long-term food security objectives. Additionally, research on taxation and economic growth by A. Shapovalova et al. [21] and governance institutional effectiveness by M. Masyk et al. [22] provides insights into broader economic factors influencing food security policies and implementation strategies. O. Prokopenko et al. [23] shed light on the impact of green entrepreneurship on local economies, highlighting its potential contribution to sustainable agricultural practices and food security in Ukraine.

The study by N. Bahnasy [24] examines the relationship between the tourism industry and local agricultural practices and how this affects Egypt's food security. The level of food security is also affected by economic sanctions. This is stated in the publication: [25]. However, R. Ray and J.A. Siddiqui prove that unilateral economic sanctions affect food security in the countries targeted by these sanctions and other countries cooperating. The food security factors based on data from 57 developing countries are explored in the publication of E.B. Abbade [26]. S. Srinita has investigated the factors of food security in Indonesia (in particular, availability, access, and absorption) [27]. F. Feng, N. Jia and F. Lin [28] have quantified the impact of the Russian-Ukrainian war on food production and global food security. As a consequence of the war, the author singles out a sharp increase in prices for agricultural products and a decrease in food security, especially for countries that largely depend on grain imports from Ukraine and Russia, particularly Egypt and Turkey.

Innovations should be used and periodically analyzed to ensure adequate food security. It is especially worth analyzing the costs incurred for the introduction of innovations. This is emphasized in publications [29; 30]. Food security problems have also become the focus of Ukrainian scientists. D. Krylov [31] considers food security as a fundamental element of achieving long-term sustainable development because the solution to its problems will provide adequate nutrition for the country's population and thus allow determining prospects. He is convinced that a comprehensive analysis of Ukraine's food security should be conducted at three hierarchical levels. The first level – national or macroeconomic – characterizes the activity of legislative bodies and the government to ensure economic growth stability, state funds creation, and coordination of demand and supply in the domestic food market. The second level – the regional or meso level – ensures food availability in the necessary quantity and quality for the population in the relevant territory and takes measures to obtain the necessary income level to purchase such food products. The third micro-level is presented by households that organize total and balanced consumption for their member's thanks to spending available cash incomes or conducting an individual subsidiary economy.

L. Kuchechuk [32] emphasizes that at the beginning of 2022, the world began to recover from the consequences of the COVID-19 pandemic, but before global food security gave rise to a new challenge, the Russian-Ukrainian war. The suspension of Ukrainian exports resulted in record prices for food, which again significantly worsened low-income people's access to food products. The situation stabilized after signing the grain agreement and restoring the Ukrainian ex-grain port. However, L. Kuchechuk is inclined to think that the negative dynamics will persist [32]. It also introduces new aspects, such as nutritional rationality, safety and compliance with the declared food quality, conditions for growing safe products, and others food production [33]. N. Khmil [33] distinguishes between individual and country aspects, highlighting social, economic and environmental components [34]. There is no need to identify new food security indicators, as they are already included in the GFSI indicator. Given the above, the analysis of Ukraine's food security based on data published on a global scale requires special attention.

3 Methods

It is thanks to the GFSI index that it is possible to determine how successfully a country is addressing domestic food security issues, including in comparison with other countries in the world. It allows us to track the main problems of economic affordability, physical availability and quality of food in the country. The methodology for calculating the GFSI was developed by Economist Impact. Numerous consultations were held with many experts. Every year, this methodology is reviewed and new experts are involved. This is done to ensure that the index remains a reliable source of information for stakeholders seeking to better understand the global food security environment.

"Affordability" illustrates the ability of consumers to buy food and reflects their vulnerability to price shocks. It indicates the existence of programs and policies to support consumers in the event of shocks. Availability is used to calculate agricultural production, illustrates the capacity available on farms, indicates the risk of supply disruption, reflects national capacity to distribute food, and illustrates the research efforts needed to expand agricultural production. Quality and safety indicates the level of diversity and nutritional content of average diets, and captures food safety. Sustainability and adaptation reflects the vulnerability of a particular country to the impact of climate change. This component of the index also reflects exposure to natural resource risks and shows how the country can adapt to these risks [1]. Every year, a report is published on the website [1], which shows the ranking of 113 countries in terms of the above components, as well as the ranking of countries by the aggregate value of the GFSI indicator. The dynamics of the GFSI indicator for Ukraine over the past 10 years is shown in Fig. 1.

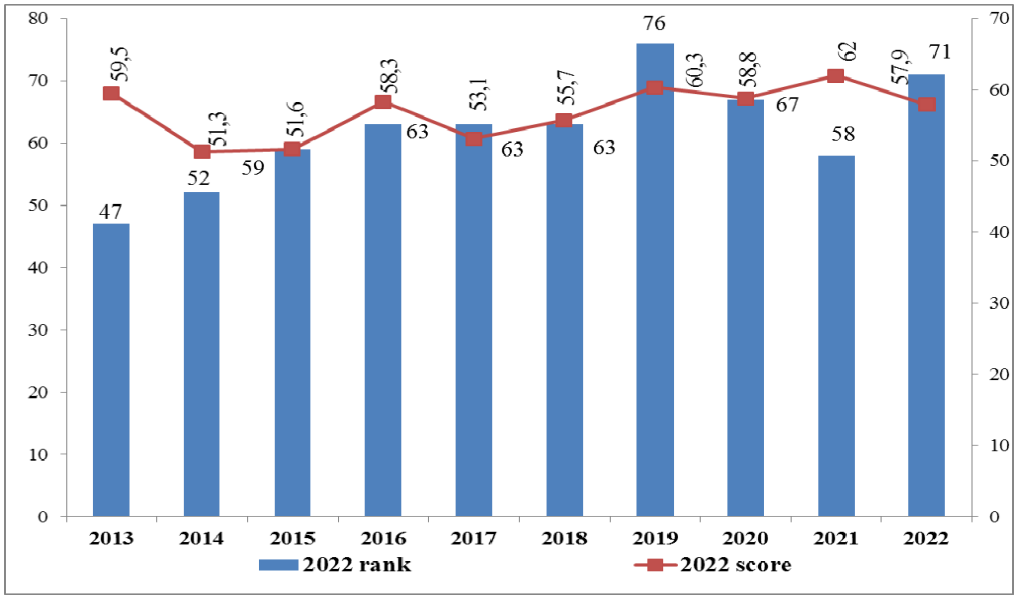

Fig. 1. The dynamics of GFSI values and Ukraine's place in the world ranking for 2013-2022 [1].

The state of food security in Ukraine has undergone significant changes over the past 10 years. According to the results of 2022, our country ranked 71st among 113 countries in the world according to the GFSI (57.9 points out of 100). But compared to the value in 2013, it was 47th (59.5 points out of 100). That is, in 2013 Ukraine had the best food security situation. It can be noted that the state of food security in Ukraine has deteriorated significantly in 2022, as the country ranks 71st among 113 countries, although last year it was 58th.

In terms of the methodology for calculating the indicator, including critical indicators of the food security environment that link agricultural initiatives to food security is an innovation

for 2022. Food security also remains highly vulnerable to climate impacts, such as droughts, floods, and insufficient water for agriculture. Compared to other European countries, Ukraine is on the list of countries with an average value. In general, European countries are characterized by high GFSI values. For example, Finland, Ireland, Norway, France, and the Netherlands have the highest values (group "Very good"). Japan, Canada, Sweden, the United Kingdom, Portugal, Switzerland, and others are characterized by high values (group "Good"). Ukraine belongs to the group "Moderate"; Bangladesh, Laos, etc., belong to the group "Weak". Haiti and Syria have the lowest index values (group "Very Weak"). The ranking of countries depending on the GFSI value for 2022 and their division into the respective groups (Very good; Good, Moderate, Weak, Very Weak) is presented in Table 1.

Table 1. Ranking of countries by GFSI value for 2022 [1].

Range	Country	GFSI	Indicators			
			"Affordability"	"Availability"	"Quality and safety"	"Sustainability and adaptation"
Very good						
1	Finland	83.7	91.9	70.5	88.4	82.6
2	Ireland	81.7	92.6	70.5	86.1	75.1
3	Norway	80.5	87.2	60.4	86.8	87.4
4	France	80.2	91.3	69.0	87.7	70.3
5	Netherlands	80.1	92.7	70.7	84.7	69.2
Good						
6	Japan	79.5	89.8	81.2	77.4	66.1
7	Canada	79.1	88.3	75.7	89.5	60.1
8	Sweden	79.1	91.9	68.3	85.0	68.3
9	United Kingdom	78.8	91.5	71.6	77.6	71.7
10	Portugal	78.7	90.0	77.0	79.8	64.5
Moderate						
41	Malaysia	69.9	87.0	59.5	74.7	53.7
42	Saudi Arabia	69.9	83.2	67.2	71.6	53.7
43	Mexico	69.1	76.0	60.0	78.9	60.2
45	Romania	68.8	95.1	60.6	77.9	47.1
71	Ukraine	57.9	66.6	48.1	71.3	43.5
72	Myanmar	57.6	62.1	53.5	64.4	49.0
73	Uzbekistan	57.5	52.7	56.4	64.6	57.9
74	Nepal	56.9	52.7	70.9	57.8	46.2
75	Tajikistan	56.7	59.8	56.3	56.5	53.1
76	Nicaragua	56.6	64.4	50.2	57.5	52.7
77	Egypt	56.0	65.2	54.2	45.9	55.8
78	Cambodia	55.7	74.3	54.5	54.0	33.9
79	Sri Lanka	55.2	61.0	57.2	55.0	45.3
Weak						
80	Bangladesh	54.0	52.1	61.5	58.4	43.9
81	Laos	53.1	59.7	51.8	51.7	47.0
82	Kenya	53.0	41.7	52.5	68.8	52.6
83	Ghana	52.6	59.9	52.4	50.5	45.1
84	Pakistan	52.2	59.9	58.3	49.4	37.7
Very Weak						
112	Haiti	38.5	32.8	49.6	37.9	34.2
113	Syria	36.3	32.0	26.6	50.8	38.4

Note: Scores are normalized 0-100, where 100=best conditions.

Consequently, we have selected 5 countries from each group (exept "Moderate" and "Very Weak"). Out of the five groups of countries, the first one with the highest GFSI scores ("Very good") is made up of European countries. However, as we can see, it is not always the case that a country with the highest overall GFSI rating has the highest values in all four groups of indicators. For example, Ireland has a higher value of "Affordability" than Finland (92.6 vs. 91.9), or Norway is characterized by a higher value of the Quality and safety group of indicators than Ireland (86.8 vs. 86.1). It should be noted that Finland has been at the top of this ranking for many years. France scores higher than Norway in three groups of indicators: "Affordability" (91 vs. 87.2), "Availability" (69.0 vs. 60.4), "Quality and safety" (87.7 vs. 86.8). However, the value of the "Sustainability and adaptation" group indicators is significantly lower (70.3 vs. 87.4). This had the greatest impact on the generalized value of France's GFSI index (80.2), which is only slightly lower than Norway's (80.5). Haiti (GFSI – 38.5) and Syria (GFSI – 36.3) are the lowest in the ranking of countries (112 and 113 places respectively). However, it should be noted that Syria has higher values than Haiti in the "Quality and safety", "Sustainability and adaptation" group of indicators (50.8 vs. 37.9 and 38.4 vs. 34.2, respectively).

While overall the GFSI scores show that the availability of agricultural inputs has improved over the past few years, there are still some weaknesses in agriculture, including a lack of public spending on agricultural research and development, irrigation infrastructure, and soil fertility improvement. Increasing the resilience of the food system is key. Making long-term structural investments can prevent significant risks in the global food system. Hence, Ukraine is in the group that is attracted by the Moderate value of the GFSI indicator. It is advisable to track the dynamics of the GFSI components over the past 10 years (Fig. 2).

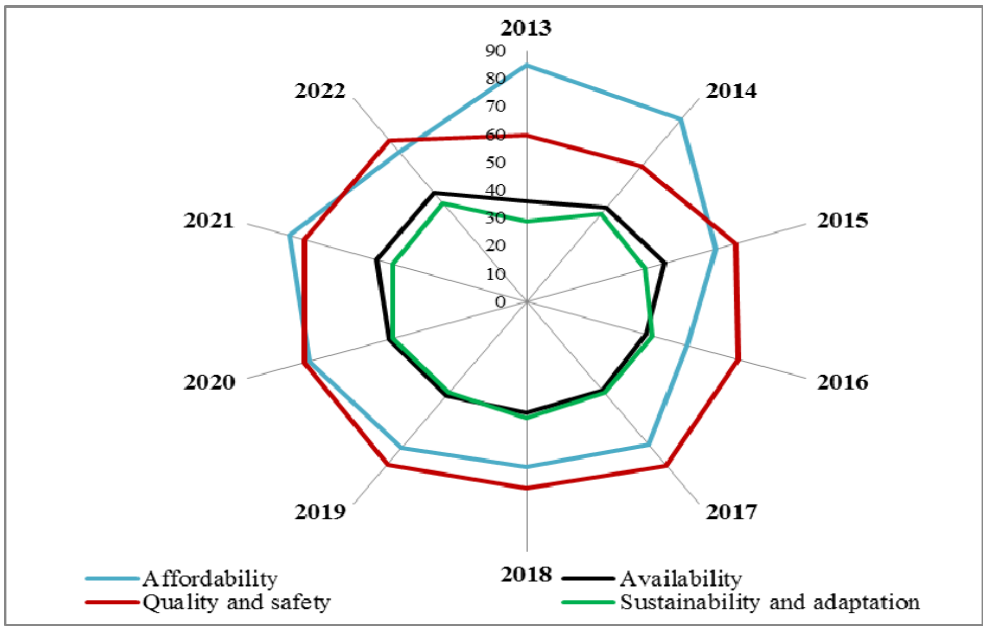

Fig. 2. The components of the Ukraine's Global Food Security Index for 2013-2022 [1].

Therefore, according to the data in Fig. 2 the formation of the GFSI value for Ukraine is influenced by certain indicators, the dynamics of which in 2022 is as follows:

- "Affordability" – decreased by 9.6 units;
- "Availability" – decreased by 3.7 units;
- "Quality and safety" – decreased by 0.1 units;
- "Sustainability and adaptation" – increased by 0.3 units.

First of all, it is Change in average food costs, which decreased by 40 points, and Supply chain infrastructure, which decreased by 16.5 points. In general, the decrease in the GFSI index for Ukraine in 2022 and the deterioration of the rating positions are assessed negatively. These dynamics are largely related to the war in Ukraine.

It is advisable to determine which of the GFSI components ("Affordability", "Availability", "Quality and safety"," Sustainability and adaptation") has the closest relationship with the values of the index under study(GFSI). In modern economic conditions, among all methods of conducting research, and especially in planning and analytical work, correlation analysis should be considered the most progressive, which makes it possible to measure the degree of influence of individual factors on the performance indicator and their aggregates. Correlation analysis is a method of a wide range of action, so its results can serve as a basis for planning for the future.

The word "correlation" was introduced into statistics by the English biologist and statistician Francis Galton at the end of the 19th century. Translated, it means "correspondence, ratio". Moreover, this meant not just a relationship, but rather a correlation, that is, a relationship not in the usual functional form. F. Galton and K. Pearson are considered to be the founders of correlation theory. Directional correlations are direct and inverse. A direct relationship is one in which the resulting factor increases with an increase in the factor characteristic. An inverse relationship is a relationship in which the resulting factor decreases with an increase in the factor characteristic.

This formula should be used for calculations:

$$r = \frac{\sum[(x-\bar{x})\times(y-\bar{y})]}{\sqrt{\sum(x-\bar{x})^2\sum(y-\bar{y})^2}} \quad (1)$$

where, r – correlation coefficient; x –1st variable (GFSI); y – 2nd variable (accordingly, the following indicators: "Affordability", "Availability", "Quality and safety", "Sustainability and adaptation").

To display the initial data and the results, a Table 2 should be created.

Table 2. Analysis of the closeness of the relationship between the GFSI for Ukraine and its components for 2018-2022 [1].

No	Indicators	2018	2019	2020	2021	2022
1.	GFSI	55.7	60.3	58.8	62.0	57.9
2.	"Affordability"	59.5	65.3	69.9	76.2	66.1
3.	"Availability"	40.1	41.9	44.1	48.1	48.1
4.	"Quality and safety"	67.2	72.5	71.4	71.4	71.3
5.	"Sustainability and adaptation"	41.8	40.7	43.2	43.2	43.5
6.	*Correlation coefficient:*		-			
6.1.	- GFSI, "Affordability"			0,859927617		
6.2.	- GFSI, "Availability"			0,523052679		
6.3.	- GFSI, "Quality and safety"			0,776570219		
6.4.	- GFSI, "Sustainability and adaptation"			0,072211031		

The strength of the relationship is traditionally judged according to the following rule:

- if the correlation coefficient is equal to one, the relationship is complete;
- if it is 0.66-0.99, the relationship is strong;
- if it is in the range of 0.33-0.66, the relationship is medium;
- if the correlation coefficient is less than 0.33, the relationship is weak.

Thus, the strongest relationship is observed between GFSI for Ukraine and "Affordability" (0.8599). The relationship between GFSI, "Quality and safety" is also quite

strong (0.7766). It should be noted that the relationship between GFSI and "Availability" is medium (0.5231). However, the relationship between GFSI, "Sustainability and adaptation" is rather weak. The direction of the relationship is determined by the sign of the correlation coefficient: if it is positive, the correlation is direct, and if it is negative, it is inverse. In our case, the correlation is direct. Since the closest connection is between GFSI and "Affordability", it is advisable to pay more attention to the indicators that are used to calculate the generalized value for the "Affordability" group.

The generalized methodology for forming the value of the GFSI indicator for Ukraine for 2022, which is used in the calculations by Corteva Agriculture, is presented in Fig. 3.

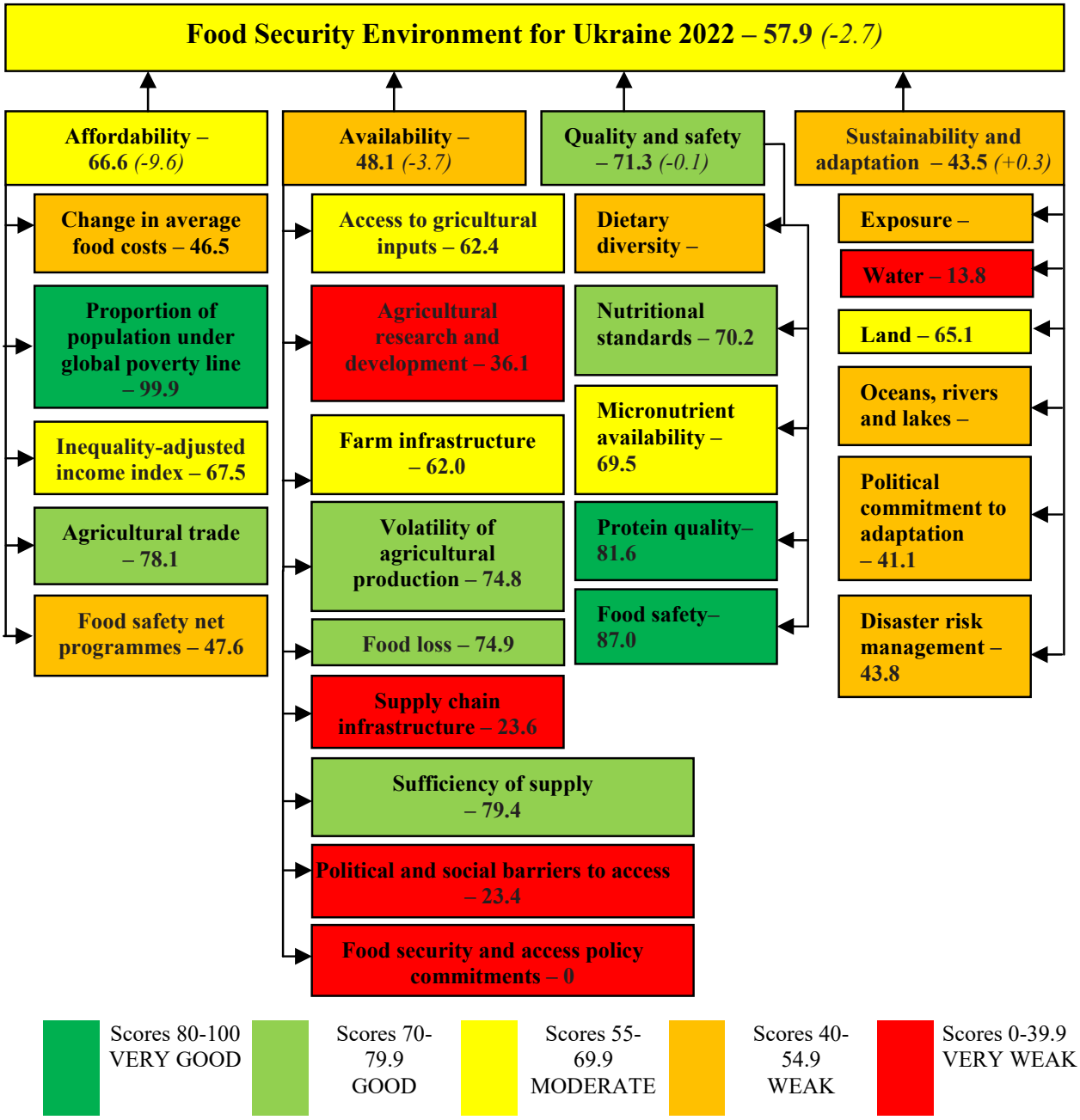

Fig. 3. Global Food Security Index (GFSI) for Ukraine for 2022 [1].

Ukraine received 66.6 points out of 100 in the "Affordability" indicator. It ranked 65th in the world. The "Weak" category of this group of indicators includes "Change in average food costs" and "Food safety net programs".

In 2022, the value of the indicator "Change in average food costs" decreased by 40 units, while the value of the indicator "Food safety net programs" remained unchanged. In turn, the Food Safety Net Programs indicator depends on the following aspects: Presence of food safety net programs, Funding for food safety net programs, Coverage of food safety net programs and Operation of food safety net program. The following should be emphasized when studying "Change in average food costs". After the full-scale invasion of Ukraine, prices for most of the products in the grocery basket rose significantly. The Dmytrivska poultry farm in Donetsk region and a branch of the Bohodukhivska poultry farm in Kharkiv region have stopped working or reduced production. In addition, the Chornobaivsky poultry complex was located in the temporarily occupied territory. It was one of the largest egg producers in Ukraine. In 2023, prices for chicken fillet (+15 UAH compared to October 2022) and rice (+5.3 UAH) increased the most. The price of apples and milk also rose by a few hryvnias. In 2023, the price of red meat, poultry, and dairy products increased the most. In particular, the reasons for this were the impact of the war, rising production costs, fuel and energy prices, and changes in production and logistics. At the same time, dairy products became more expensive, in particular due to the drought in the second half of summer, which led to a decrease in milk yields ahead of the seasonal period. In addition, fuel costs increased, and hence the cost of logistics, from production to retail chains. Potatoes have doubled in price over the year, and sometimes even tripled. The supply of substandard products has also decreased, as supplies from warehouses not equipped for long-term storage have fallen to a minimum.

Ukraine received 48.1 points out of 100 in the "Availability" indicator. It ranked 93rd in the world and 26th out of 26 European countries. The weakest factors in this category are political and social barriers, supply chain infrastructure, agricultural research development, and food access strategy.

Ukraine's worst food security indicator is "Sustainability and adaptation" (43.5 points out of 100, or 94th place globally) that reflects significant problems with access to and management of water resources, as well as shortcomings in the risk management system. Ukraine ranks worst in Europe and 65th globally in terms of food supply, due to significant price increases, changes in average food costs, and the lack of strong government protection programs.

The only indicator that demonstrates a better situation is "Quality and safety", in which Ukraine scores 71.3 points out of 100 (52nd place in the global ranking). According to experts, Ukrainians consume enough high-quality protein, and food is generally safe, although the average Ukrainian's diet is not diverse.

The following measures can be taken to increase the level of food security in Ukraine:

- cessation of hostilities and demining of agricultural lands (implementation of measures for the security of rural areas);
- completion of the land reform and recognition of the agricultural sector as a priority sector (ensuring the stability and transparency of the land reform; support and development of the agricultural sector as a key economic industry);
- attracting investments in the food sector and credit support (stimulation of investments in the agricultural sector and the development of modern technologies; provision of financial support for agricultural enterprises);
- development of public-private partnership and agro-industrial integration (creating favorable conditions for cooperation between the state and the private sector in agriculture; search for optimal forms of ownership, integration and cooperation);
- approaching the world standards of standardization and certification (improvement of standards and certification procedures for entering global markets; ensuring high quality of agricultural and food sector products);

- increase in wages and social security (increasing the economic availability of products for the population);
- activation of the production of environmentally friendly products (support for the production of safe and environmentally friendly products);
- solving the problems of financial, material and technical, personnel, scientific and informational and advisory support (strengthening support and development of the agricultural sector at all levels);
- ensuring free access of the population to food products (ensuring equal access to food resources for the entire population) [19].

4 Conclusions

Hence, food security can be viewed in several ways: as a condition in which the population of different countries has different types of access to sufficient food to lead a healthy and active lifestyle; availability of sufficient safe and nutritious food; and the ability of the state to guarantee the physical and economic availability, quality and safety of food and drinking water in the required volume and range to the population of the country, provided that it has the appropriate resources and capacity.

The components of the GFSI for Ukraine for 2013-2022 are analyzed in the study. It is established that according to the results of 2022, the "Affordability" indicator decreased by 9.6 units, Availability decreased by 3.7 units, Quality and safety – decreased by 0.1 units, Sustainability and adaptation – increased by 0.3 units. Such dynamics are largely related to the war in Ukraine. The performed analysis of the closeness of the connection between the components of GFSI ("Affordability", "Availability", "Quality and safety", "Sustainability and adaptation") and the index GFSI itself gives reason to state that the strongest connection is observed between GFSI for Ukraine and "Affordability" (0.8599). With this in mind, the greatest attention is paid to the indicators on the basis of which the generalized value for the "Affordability" group is calculated.

The deterioration of food security in the country due to the war is primarily caused by destroyed logistics chains and infrastructure, destroyed farms and industries, a decrease in the amount of food produced by operating enterprises, and an increase in basic food needs in the most affected regions of the country. In fact, the country's food security is becoming the responsibility of business - agricultural holdings, small and medium-sized farms, and their partners who supply inputs.

The problem of ensuring food security, as one of the factors shaping the prerequisites for sustainable development, should not be limited to increasing food production. This approach is usually accompanied by unreasonable management practices that harm nature and people and contradict the principles of sustainable development. The latter is a recognized international ideology of human development in the twenty-first century. The main obstacle to achieving sustainable development in agriculture is that its components often compete for scarce resources. For example, economic growth often takes up a significant portion of resources, while reducing the resources allocated to address social and environmental issues. Priorities for addressing the global food insecurity include de-mining the Black Sea, strengthening air defense of Ukraine's port infrastructure, and humanitarian aid for the most vulnerable countries. Russia is the biggest challenge to global food security. The best contribution to global food security is to provide Ukraine with weapons to keep the Black Sea grain corridor operational.

The use of modern, powerful technologies that allow for the control of agricultural production and predictability of results, the application of the latest crop protection products and differentiated seeding allow agricultural producers to obtain high yields and ensure sustainability.

Despite a number of measures aimed at addressing food security, the country's food system remains vulnerable to economic, climatic and geopolitical factors. These problems will be solved by fulfilling the tasks set for the agro-industrial complex to create proper living and working conditions in villages, increase the level of quality food supply to the population, expand the export orientation of domestic agricultural production, improve its reliability and develop it at the level of the world's leading agricultural countries.

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