Global food security: developing effective approaches to sustainable development

Anna A. Khryseva*, Irina A. Ezangina, Tatyana B. Boriskina, Olga E. Akimova, and Alexander V. Evstratov

Volgograd State Technical University, 28, Lenin avenue, Volgograd, 400005, Russia

Abstract. The agri-food complex is one of the most important sectors of the world economy, without which the very existence of mankind would be impossible. The relevance of studying the issue of global food security lies in the fact of the aggravation of the problem, which is expressed in the rapid growth of population in comparison with the growth of food production. Issues of food security remain relevant throughout the development of the economy, both at the national and global levels. This problematic issue is deeply studied by foreign and domestic researchers, who pay special attention to key aspects of national food security, such as the availability of food and the sustainability of its provision, as well as its safety and quality for human health and the environment. The insufficient knowledge of these issues, their practical significance, the controversial nature of the problems and their undoubted relevance determined the choice of research topic in this article. This review provides an analysis of the key issues and approaches that ensure the effective and sustainable functioning of the food system in the modern global economy.

1 Introduction

Food security at the present stage of social development is one of the main issues in scientific and international discussions, and its global impact on the main economic indicators of countries has become more significant [1].

Numerous indicators have been proposed for “food security” as an aggregate socio-economic entity, but it is unclear whether “these indicators equally reflect different aspects of food security”. It is also not known if they allow us to reliably assess the very level of food security of the state, which currently concerns every world power [2].

In 1996, the World Food Summit in Rome defined food security as “a situation in a country where all people at all times have physical, social and economic access to sufficient, safe and nutritious food that meets their dietary needs and food preferences for an active and healthy life” [3].

Food security research is an important aspect for solving the food problem. Firstly, studying this problem helps to establish the causes of malnutrition and hunger. This may be due to various factors such as economic difficulties, climate change, wars and conflicts,
human rights violations and many others. Understanding these causes helps develop effective strategies to combat malnutrition and hunger. Second, studying the food problem allows us to develop a more productive food system. This may be due to ensuring the sustainability of agriculture and the food industry, reducing food losses during production and transportation, and improving the quality and availability of food. Finally, the study of the food problem has important social significance. Addressing the problem of malnutrition and hunger has a positive impact on the lives and health of millions of people, and also helps improve social relations and strengthen social stability [4].

Thus, by “global (world) food security” in this study we mean the ability of humanity to fully provide itself with vital food products of proper quality and in accordance with physiological standards (healthy diet) while maintaining ecological balance (preventing irreversible changes in the human environment).

2 Materials and methods

The prevalence of undernutrition, which has remained stable for several years, increased from 8.0 to 9.3% in 2019-2020. In 2021, this figure continued to increase, although at a slower rate, reaching 9.8% [5].

The prevalence of undernutrition (PO – Sustainable Development Goal (SDG) indicator 2.1.1), which had remained roughly the same since 2015, increased from 8.0 to 9.3% between 2019 and 2020. In 2021, the rate continued to grow, although at a slower rate, reaching 9.8%. The percentage of pH calculated by the Food and Agriculture Organization (FAO) in the world on average over 3 years has also been growing since 2017 [6].

In 2021, there were between 702 and 828 million hungry people in the world (8.9 and 10.5% of the world population, respectively). Based on the midpoints of the forecast ranges (722 million and 768 million), 46 million more people suffered from hunger in 2021 than in 2020, and a total of 150 million more people than in 2019 year, before the start of the COVID-19 pandemic. Based on the upper range, this number could increase by almost 210 million in two years [7].

In 2021, one in five people in Africa (20.2% of the population) suffered from hunger; in Asia, the proportion of hungry people was 9.1%, in Latin America and the Caribbean - 8.6%, in Oceania - 5.8%, and in North America and Europe - less than 2.5%. Since the adoption of the Sustainable Development Agenda in 2015, the prevalence of undernutrition in Africa has increased by 4.4 percentage points, and in Latin America and the Caribbean and Asia by 2.8 and 1.1 percentage points, respectively.

Taking a closer look at the past two years, the COVID-19 pandemic increased the rate in Africa by more than 2 percentage points between 2019 and 2020, and by 0.6 percentage points between 2020 and 2021. Similar trends were observed in Latin America and the Caribbean and Asia, where the increase in undernutrition prevalence exceeded 1 percentage point between 2019 and 2020, and another 0.5 percentage point in 2021 [8].

Of the total number of undernourished people in 2021 (768 million), more than half are in Asia (425 million), more than a third in Africa (278 million) and almost 8 percent (57 million) in Latin America and the Caribbean. A closer look at the differences at the subregional level reveals that in 2021, the proportion of hungry people in North Africa (6.9%) was significantly lower than in almost all subregions of sub-Saharan Africa, and somewhat lower than in South Africa (9.2%).

Hunger increased in all subregions in 2020; in 2021, most of them continued to grow. In Central Africa, the prevalence of undernourishment increased by more than 2 percentage points for two consecutive years. In East Africa, the subregion with the largest population (more than 136 million people), prevalence increased by 2.7 percentage points in 2020 and remained virtually unchanged in 2021. Between 2020 and 2021, both Southern and Western
Africa saw growth decline from the previous year due to the impact of the COVID-19 pandemic. Differences between Asian subregions are also noteworthy. In Central and East Asia in 2021, the proportion of hungry people (about 3% and 10% and especially in South Asia (16.9%), where the number of undernourished people was greater than in other regions of the world - more than 330 million people. In 2015 the number of hungry people in most subregions decreased steadily in 2019, and it began to increase in 2020 [9].

In South and Central America, hunger continued to rise in 2020–2021. In South America, the prevalence of undernutrition has almost doubled in recent years compared to 2015. In 2020 and 2021, this figure in the region increased by 1.7 and 0.8 percentage points, respectively. The data shows a serious problem of malnutrition in South America and requires immediate action to ensure food security in the region.

3 Results and discussion

From the data analysis it can be concluded that the location of the undernourished population is most concentrated in the regions of Africa and Asia. The main reason for malnutrition in Africa is still the lack of competitiveness of countries in the world food market, and in Asia it is a permanently growing population, the backwardness of the countries' economies, the inability to provide jobs for the growing population, organize adequate wages, as well as limited land resources.

In addition to the listed factors aggravating the food problem, in the countries of Asia, Africa, and Latin America, there is another serious, ongoing problem - armed conflicts arising from religious and ethnic differences, political and economic contradictions, as well as due to external intervention and support from outside countries [10].

It should be noted that in 2021, economic recovery and GDP growth in different countries were uneven. High-income countries have demonstrated a strong recovery and are expected to return to pre-pandemic levels of real per capita income as early as 2024. However, low- and lower-middle-income countries have experienced much lower growth rates and most are not expected to return to their previous income levels. Economic disparities between different countries continue to be significant and pose challenges to achieving sustainable economic development.

Extreme poverty, coupled with rising income inequality, has increased throughout the world, a historic phenomenon over the past 20 years. However, it can be assumed that without strengthening social protection, poverty levels would have increased even more. From March 2020 to May 2021, 222 countries and territories took or planned social protection measures to combat the COVID-19 pandemic. However, these measures varied in coverage and quality. More than 40% of protection measures taken were one-time payments, with nearly three-quarters of these implemented in three months or less, while the effects of the pandemic continued to be felt for a long time [11].

The uneven impact of the pandemic and the uneven pace of recovery, as well as the limited coverage and short duration of social protection measures, have increased inequality. As noted earlier, inequality is one of the main causes of food insecurity. As inequality has increased in 2020, the economic recovery has not translated into improved food security, as evidenced by the rise in the number of people facing difficulties accessing food.

Prospects for ending hunger by 2030 (SDG target 2.1) do not look good. Projections regarding the estimated number of people who will go hungry in 2030 were already disappointing; are based on extrapolation of recent trends in three main variables used to calculate the prevalence of undernourishment in all countries: total food supply, population size and composition, and the degree of inequality in people's access to food [12].
In this regard, support for new approaches and the development of alternative foods and diets are recommended. Manufacturers are responding to these changes in consumer behavior by improving product formulations, reducing harmful ingredients, introducing natural and organic alternatives, and focusing on environmental sustainability.

As part of the modernization of the agro-industrial complex, attention should be paid to innovative methods of organizing production, the use of modern technology, the introduction of digital technologies and automation. Genetic selection has successfully taken root, making it possible to create new varieties of crops with improved characteristics; precision agriculture, with the help of which farmers can optimize soil cultivation and the process of fertilizing crops using modern sensors, geolocation and geographic information systems.

The development of biological technologies in agriculture is seen as a promising approach to ensuring food security. These innovations include biological pest management, genetic modification of plants, the use of biological fertilizers, and the development of cell-engineered products.

We draw attention to the prospects of branding rural areas - creating an attractive image of rural areas, emphasizing its potential in the production of high-quality and environmentally friendly products. One of the main goals is to create and strengthen its presence in the information space. It also aims to ensure the flow of financial resources to the territory and the effective communication of regional decisions and initiatives at the international level. The rural brand serves as an ambassador, attracting attention and interest to its features, achievements and potential. This approach gives an advantage to rural areas, attracts the attention of consumers and establishes trust in their high-quality and safe products, contributes to the growth of demand for environmentally friendly products and the development of agriculture.

Reforming the economy with an emphasis on regulating markets, establishing fair and secure trade relations between countries, and much more is essential.

On the other hand, a more educated population is more knowledgeable about agriculture and food production methods; knows how to increase the yield and quality of crops using modern and sustainable methods. Educated people drive innovation and development in agriculture, bringing new ideas, methods and approaches to improve the efficiency and sustainability of food production. This allows for more resilient food systems that can cope with food security challenges and threats.

Humanitarian assistance may include the delivery and distribution of prepared food, food parcels, or food vouchers that allow people to purchase food themselves from local stores or markets. The assistance also covers medical care and public health care. Another important aspect is supporting agricultural development and increasing its productivity: providing seeds, fertilizers, equipment and tools, training in agricultural skills and farming methods [13].

Finally, it is necessary to update the accelerated attraction of investments, primarily in agritech startups. The accelerated digitalization of agriculture, the diversity and innovativeness of startup solutions, and their wide coverage of related areas mediate the rapid growth of the need for sources of financing. In this context, state participation in the form of implementation of state, regional, and municipal programs is relevant. On the other hand, the importance of alternative sources of financing is emphasized: accelerators, business angels, crowdfunding, venture financing, convertible loans, bootstrapping. Finally, we consider it promising to increase the interest of banks in participating as institutional investors in agritech startups. Given the promise of the ecosystem approach, the role of banks in promoting agrotech startups, and therefore solving food security problems in an innovative way, is multifaceted: a participant in government co-financing programs, a participant in public-private partnership initiatives, a direct lender, an initiator of their own accelerator, a venture fund, and finally, own agroecosystem.
4 Conclusion

In modern conditions, international organizations, national governments and the global scientific community are faced with the urgent issue of developing new methods for ensuring food security. The following can be considered new approaches in this direction: qualitative and structural transformations in food consumption and production; modernization of the agro-industrial complex; development of biological technologies; branding of rural areas; economic reform; increasing the level of education of the poor in developing countries; providing humanitarian assistance to developing and underdeveloped countries; improvement of financial instruments for support and participation of institutional investors in the development of the agro-industrial complex. Thus, by combining all of the above approaches, we can overcome the problem of food security and ensure sustainable development of humanity. From an economic point of view, governments need to promote the consolidation and development of the food market, the trading hubs existing on it, and the establishment of partnership trading relations between food exporters and importers. It also seems important to maintain the current trend of increasing the volume of world trade in food and agricultural products in countries with different income levels. The constantly growing number of people on the planet means that it is worth paying attention to measures to regulate and control the population's birth rate in order to prevent an increase in the scale of the food crisis and hunger.

References

1. O. G. Ovchinnikov, International agricultural journal, 6, 564–596 (2021)
3. The United Nations Declaration addresses the issue of the human environment. Adopted by the Conference of Organizations as a result of solving the problem of the human environment, UN URL: https://www.un.org/ru/documents/decl_conv/declarations/declarathonenv.shtml
4. S. N. Kosnikov, Bulletin of the Academy of Knowledge, 47(6), 204–211(2021)
10. Y. Jafari, H. Engemann, A. Zimmermann, The evolution of the global structure of food and agricultural trade: Evidence from network analysis The State of Food Security and
