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Food security and globalization

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Abstract:
Food security goes far beyond the traditional concept of food availability: it is a global challenge of intertwined geopolitics, economics, technology, and ecology. The current international and climate changes cause unpredictable fluctuations on food markets. As a result, sustainable food supply and a powerful agro-industrial complex have become a national priority. The North-South and East-West directions in traffic and logistics open up new, more cost-effective transit routes into a new geopolitical environment, which requires an active development of all related industries. Russia and China have excellent cooperation prospects in a wide range of areas, from agriculture and logistics to R&D and quality standardization. The Belt and Road Initiative creates additional infrastructural opportunities in mutual trade and Eurasian integration. In this respect, food security is a key factor of national and global stability, and it needs a robust agro-industrial complex, advanced infrastructure, active R&D investments, and international cooperation.

Keywords: Food availability, sustainable food supply, international cooperation, transport corridors, food systems, agricultural exports

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Food security is much more than supermarket shelves that burst with food. This global challenge is a maze of geopolitics, economics, technology, and climate. The FAO defines food security as a situation when 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 [1].

The paradox is that the 21st century with all its advanced technologies and unprecedented food production capacity still sees food shortage epicenters all over the world. A shocking 828 million people worldwide experienced famine in 2021 while another 2.3 billion (29% global population) faced moderate or severe food insecurity [2]. That means that one in ten people on the planet goes to bed hungry. Despite all global efforts, famine remains a looming threat in Africa, South Asia, and Latin America [1].

In 2020–2023, epicenters of abnormal or moderate food insecurity clustered in Africa, Asia, and Latin America (Fig. 1). Africa and Asia had the highest number of people facing famine. Even Europe and North America still demonstrate areas affected by food insecurity. These data clearly show the major imbalance and uneven distribution of food risks across the globe. While the so-called Western world enjoys a relatively stable basic food supply, most developing regions face critical food shortages. This situation obviously requires urgent measures.

By 2050, the working-age population will double in 52 countries, most of which are in Africa, not to mention Iraq, Afghanistan, Guatemala, and Papua New Guinea. Asia will give its title of the most overpopulated continent to Africa with its 50% of the global population growth. By 2100, African population will have increased from 1.1 billion to 4.2 billion people.

China's population is expected to peak around 2030 and begin to decline. India will have surpassed China by 2028. Both countries are projected to have approximately 1.45 billion people at that point. These processes are fueled by uneven distribution of resources and food availability. While some countries have to scrape by the basic food minimum, others enjoy food surplus of such a scale that it results in a mass food waste crisis. The FAO estimates that about 1.3 billion tons of food is discarded as wastes annually at different stages of the product life cycle [3], i.e., as much as one third of all global food production. In some places, people live in constant threat of

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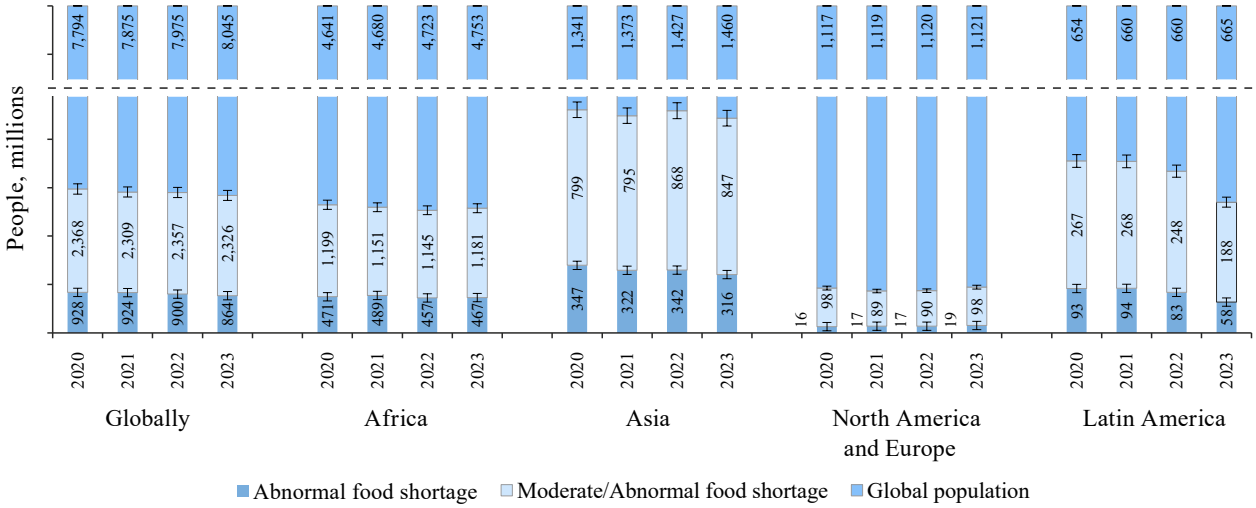


Figure 1 Moderate and abnormal food insecurity, 2020–2023

famine and starvation; in other places, excess consumption is seen as a national disaster. Big agricultural countries are also at risk. For instance, the countries of the Eurasian Economic Union keep lagging behind world leaders in agricultural land use efficiency.

The situation is aggravated by such global factor as climate change, which directly affects food systems. While food demand continues to grow, maize and wheat yields may drop by 10–25%, the Intergovernmental Panel on Climate Change (IPCC) prognoses for 2050 [4]. But in fact, droughts, floods, soil degradation, and desertification are not matters of some distant future but the reality that millions of farmers have to face every day.

Geopolitical instability is another important factor that affects global food security. Conflicts, trade wars, and unstable supply chains wear out national food systems. The FAO-WHO Food Price Index reached a historical maximum of 159.7 points in 2022 [5]. The situation could not but affects food availability because the global agri-food market is a complex system where everything is interconnected.

The recent COVID-19 pandemic revealed all the fragility of the traditional food supplies and logistics, especially in metropolitan cities. Mobility restrictions, border closures, agricultural job cuts, and disruptions in international logistics resulted in temporary shortages even in the countries with the most reliable food security. The pandemic demonstrated that even highly developed countries are not immune to food vulnerability [1].

The food insecurity map for 2015–2022 shows a steady increase in both moderate and abnormal food insecurity (Fig. 2). In Africa, the total share of food insecurity victims reached 60% in 2022, with 24% suffering from severe food shortage. In Latin America, the total moderate and abnormal food shortage exceeded 37% the same year. Even Asia, with its robust agricultural sector, had 20% of population facing food restrictions. Europe and North America slowed down at 6–8%, but these figures also demonstrate major risks [1].

Food security is rightly associated with poverty, health, and education. Poor diet affects the cognitive development of children, reduces labor performance of adults, and increases health care costs for all population groups. According to the World Bank, starvation and malnutrition annually cost $3.5 trillion of global GDP in low productivity and high morbidity [6].

Sustainable food supply is much more than production figures. It is a matter of fair access to means that could boost the development of local farming, agricultural technologies, storage techniques, and distribution systems. The current gap between rural and urban areas is as big as that between the global North and South. Even countries with advanced agriculture have areas where people get no access to fresh food due to poverty, remoteness, or logistical constraints.

Food security is a major priority task of Russian national policy, just like in any other country. Its priority has significantly increased in recent years, fueled by international challenges, climate change, and global fluctuations in food markets. The national food independence and agro-industrial sustainability are especially relevant issues. In Russia, they are regulated by the Food Security Doctrine, first approved in 2010 and updated in 2020 and 2025. In its latest version, the focus has shifted from strong domestic production to sustainable food systems that are resistant to external and internal challenges.

In 2023, Russia achieved high self-sufficiency indicators in some key food categories, the Ministry of Agriculture reports. In percentage from domestic demand, the results were 185.5 for grain production, 221.1 for vegetable oil, 153.2 for fish products, 103.2 for sugar, and 101.6% for meat [7]. The national food market apparently proved its stability in the face of global challenges. Grain production has achieved the best results. In 2022–2023, Russia hit a record of 156 million tons, thus strengthening its position as a leading wheat exporter. Having become a leader in a number of other commodity

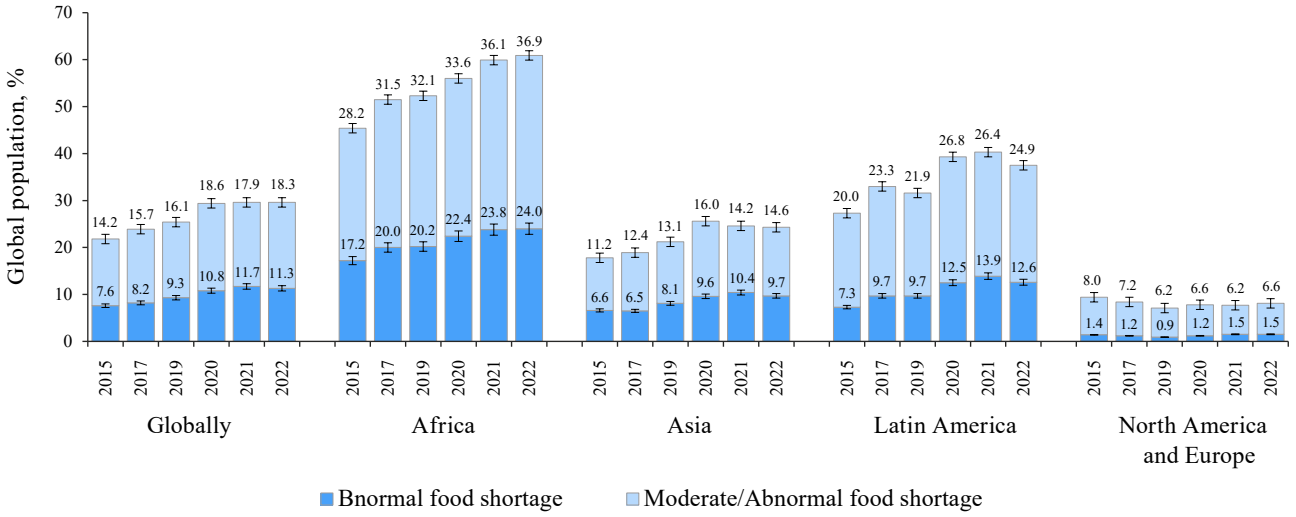


Figure 2 Moderate and abnormal food insecurity across the globe in 2015–2022

groups, Russia has been able to increase its agricultural exports, which reached $43 billion in 2023 [8].

Yet a number of areas are experiencing difficulties. Dairy self-sufficiency remains a major concern: it was as low as 85.7% in 2023. An even worse situation was observed the same year on the domestic market of vegetables (82%) and fruits and berries (60%) [9]. The seed sector also remains particularly vulnerable since Russia still relies on imported seeds. The share of domestic seeds is 3 for sugar beets, 9 for potatoes, 22 for sunflowers, and 42% for maize [10]. Should this situation persist, agricultural sustainability will find itself in jeopardy from the increasing international pressure.

The Western sanctions make Russia adjust its logistics to improve the national food security. The new transport corridors offer new logistics chains. The North-South and East-West transport and logistics corridors open up new opportunities for cheap transit, facilitating the trade in the actual geopolitical conditions and developing other economic sectors. As Russian agri-food exports are redirected to friendly countries, their total share has increased to 90%. In 2023, our largest importers were China, Turkey, Egypt, Kazakhstan, Belarus, South Korea, India, and Saudi Arabia. These new trade corridors simplify the import of agricultural equipment, vaccines, vitamins, animal feed, and seedlings to support the domestic agricultural production.

Climate change is another major stress factor to Russia's food security. As droughts, floods, and other extreme weather events strike the traditional centers of agricultural production (Volga Valley, South-Western Siberia, Central Black Earth Region), the crop yields go down while the production costs go up [10]. The national response includes melioration projects, drought-resistant cultivars, and advanced agricultural technologies.

Social availability of food is by no doubt a national priority. As the real income of some social strata continues to plummet, the state has to keep basic foods affordable. The current share of food expenses in the overall structure of consumer spending is about 35% [9]. However, some regions that are going through a difficult socio-economic phase are facing severe food insecurity with 20% of households struggling to purchase the basic food products [11].

In these conditions, the country tries to stimulate its export of agricultural products with high added value. Processed foods, organic products, and functional foods are to stabilize the domestic agricultural sector by reducing its dependence on fluctuations in raw materials markets. Another export option is R&D in biotechnology, agroecology, and climate-resistant varieties [8].

Food security requires an effective monitoring system for prompt response to internal and external threats. It includes an ongoing analysis of food market, supply and demand forecasts, and strategic food reserves. The new federal projects in veterinary and agro-industrial biotechnology launched in 2024 are aimed at producing domestic veterinary drugs, plant protection, enzymes, feed additives, etc. In addition, the State Program of Agrarian Science for the Future of Agro-Industrial Complex is to merge with another major State Project on Independence and Competitiveness of National Agro-Industrial Complex.

Investment projects in food security can be divided into four groups. Firstly, the transport and logistics infrastructure projects include the North-South corridor, terminals in the Far East, the Caspian Sea, and the Baltic Sea, as well as hubs, linear elevators, and wholesale distribution centers. Secondly, the storage projects include silo elevators and vegetable/fruit storage facilities in consumer regions. Thirdly, the agro-industrial R&D projects include the development of agricultural science in selection, seed production, livestock breeding, complex fertilizers, veterinary drugs, feed additives, agricultural machinery, etc. Finally, the list of import substitution projects in transport engineering includes a larger merchant fleet, as well as producing more storage

containers and refrigerated cars. These areas may reduce food security risks, both nationally and globally.

Russia and China are both world's largest powers with rapidly developing economies. As food security is becoming a major aspect of strategic planning, they are striving to build a sustainable food security system both in the national and cross-regional contexts. The current agricultural cooperation between Russia and China covers investment, scientific, technological, and infrastructure projects. Both countries see agricultural cooperation as an important step to a stronger economic stability and national independence.

Agricultural investment projects between Russian and Chinese companies are a rapidly developing area. The main efforts are concentrated in the Russian Far East and Eastern Siberia: despite their significant land potential, they are short of investments. Chinese investments in Russian agriculture account for 13% of China's total foreign investments [12]. Chinese agricultural technologies and seeds increase Russian crop yields and reduce production costs. These projects facilitate the implementation the Food Doctrine, which secures the growth of domestic agricultural production [9].

Russia and China also focus on logistics infrastructure to optimize food supplies. The international agricultural logistics center in Blagoveshchensk is a perfect example in this sphere. The center is supported by the Russian Export Center and Chinese enterprises. It will include elevators, warehouses, storage terminals, and transport hubs for agricultural products [13]. When integrated into transport routes, it will speed up deliveries between Russia and China, as well as expand the export capabilities of Russian producers in the Asian market.

Our participation in the global Chinese Belt and Road Initiative also strengthens our national food security. Launched in 2013, the Initiative presupposes new infrastructure and trade corridors to connect Asia, Europe, and Africa. The land and sea trade routes of the Belt and Road Initiative (Fig. 3) go across Asia, Europe, and Africa, with major hubs that proved global integration [14]. Due to its geographical location, Russia becomes the central link in the New Silk Road, which opens up broad prospects for boosting the international agricultural trade. When modernized, the railways and highways across Siberia and the Far East will reduce the delivery time and maintain the quality of agricultural products transported to China and other Asian countries. Other joint projects make it possible to create a more sustainable food supply chain, minimizing the risks associated with unreliable global logistics.

Organic farming is an important cooperation area. The Chinese demand for organic products grows annually by 10–15% [1]. Russia, with its vast unpolluted land resources, is a promising partner in the field of organic crop production. In 2022, Russian and Chinese companies sighed several cooperation agreements to export organic grain cultivation and oilseed crops to China. The products are to be certified and labelled in line with Chinese and international standards.

The ongoing R&D cooperation also strengthens food security in both countries. Joint research projects are aimed at developing highly productive agricultural cultivars that are resistant to adverse climate, e.g., soya, potatoes, and maize adapted to the harsh environment of the Far East and Siberia [15]. The research results increase the yields and reduce the national dependence on imported seeds.

Biosecurity in mutual food trade is a relevant aspect of international cooperation. In 2024, Russia and China signed an agreement on the mutual recognition of veterinary and phytosanitary certificates to simplify the export- agricultural import [16]. A weaker red tape and a stronger food quality control will improve the food security in both countries.

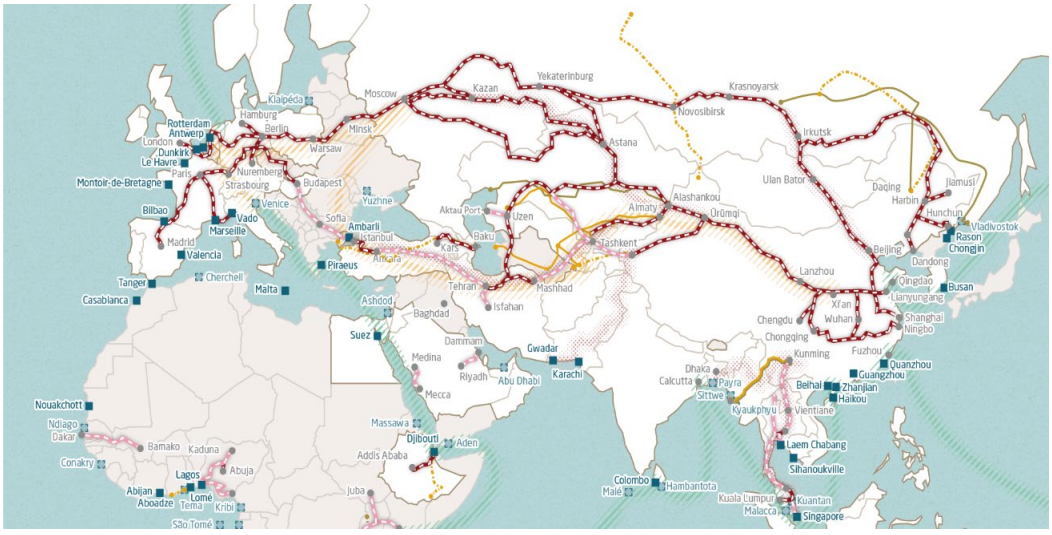


Figure 3 The Belt and Road Initiative: Red lines – economic corridors that link China with Central Asia, Russia, Europe and the Middle East; yellow lines – extra transport routes and branches; blue lines – maritime trade routes across the Indian Ocean, the Suez Canal, and the Mediterranean Sea

The joint projects between Russia and China in the field of food security range from agricultural production and logistics to R&D and quality standardization. The Belt and Road Initiative creates additional infrastructure opportunities, strengthening the trade ties and promoting the integration processes in Eurasia. In the context of global instability and increased competition, the strategic partnership between Russia and China is important for both countries. Major prospects lie in mutual agro-industrial investments, robust R&D cooperation, and strong foreign food trade regulations.

Food security is an integral part of national and global stability. In the context of overpopulation, climate change, geopolitical conflicts, and disrupted global supply chains, food security has become an (inter)national priority. As counties strive to improve their domestic agriculture, technologies, food storage infrastructure, and transport logistics, they seek international cooperation to create sustainable food systems.

CONFLICT OF INTEREST

The author declare no conflict of interest.

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