MITIGATING THE IMPACT OF WAR ON RURAL UKRAINE

Nataliia Dehtiar
Ph.D., Senior Lecturer, Sumy National Agricultural University, Ukraine
ORCID ID: 0009-0006-2799-0624

War has a devastating impact not only on people's lives and the destruction of infrastructure, but also alters all projections of societal existence and the functioning of the economy. However, rural areas experience the devastating pressure of war particularly acutely, due to the economic, ecological, and social peculiarities of their existence. The economic instability of Ukraine's rural areas is further exacerbated by the crisis challenges of post-pandemic economic dynamics. The pandemic transformed global supply chains, triggered a cost-of-living crisis, and provoked an increase in food prices, which negatively affected the efficiency of Ukraine's agricultural sector. The war, whose devastating effect was superimposed on the post-pandemic crisis, has made Ukraine's rural areas even more vulnerable.

The crisis in Ukraine's rural areas has a dual impact: external and internal, due to the regional and global role of Ukraine's agricultural sector. As one of the major global producers of agricultural products, Ukraine is often referred to as the "breadbasket of Europe." Agricultural land (41.3 million hectares) occupies 68.5% of Ukraine's total territory. Arable land in Ukraine amounts to 32.7 million hectares, which constitutes approximately 30% of the total arable land in Europe. The unique agricultural potential of Ukraine is due to the presence of valuable black soils (chernozem). According to FAO estimates (FAO, 2022), the area of chernozem in Ukraine is 34.2 million hectares [1].

With its unique agricultural potential, determined by favorable natural and climatic conditions, rich soil resources, and a strategic geographic location, in the pre-war marketing year of 2021–2022, Ukraine supplied about 10% of the world's wheat, 15% of corn and barley, and 50% of sunflower oil. Ukrainian agricultural exports make a critically important contribution to global food security. In the pre-war period, the agricultural sector accounted for 10.9% of the country's GDP and 43.9% of the country's exports (2021) [2]. Overall, 17.2% of the economically active population worked in agriculture.

The war has a devastating impact on Ukraine's rural areas, primarily due to the high level of dependence of these areas on agriculture. In the pre-war period, 30.3% of Ukraine's population resided in rural areas [3], the employment rate in rural areas was only 53.6% of the economically active population, which prompted rural residents to become self-sufficient in food production within their own households..

The war has altered the basis for the existence of the Ukrainian population in rural areas, paralyzing agricultural activities, particularly in areas close to the front line, and complicating the process of its recovery. Particularly vulnerable to the shocks of war have been rural households that rely on their own production to cope with income loss, as well as for additional income and improving their diet. In particular, more than a third of peasant households near combat zones experienced at least one military shock, which significantly worsened their food security and led to a decline in incomes [4].

Military actions make it impossible or difficult to carry out agricultural activities, which undermines food security not only on the local level but also on national and global markets. With the onset of hostilities in 2022, there was a significant decline in economic activity, as evidenced by a 28.8% decrease in GDP (Figure 1), and gross added value in the agricultural sector decreased by 25.5% compared to the pre-war 2021.

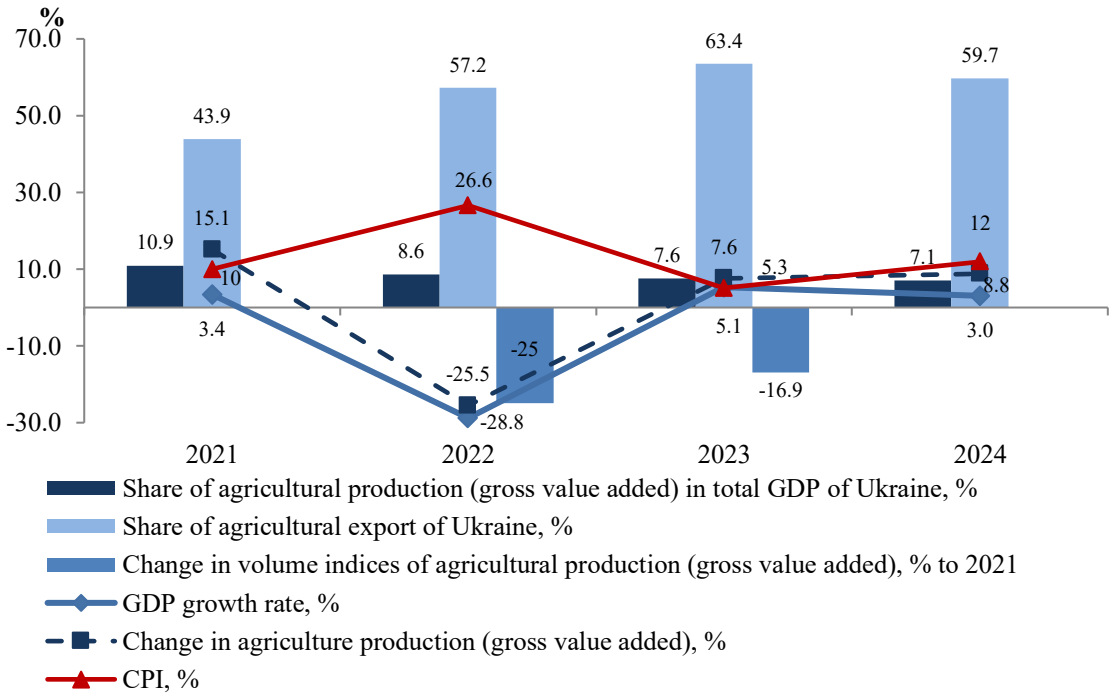

Figure 1. *Changes in the trends of agricultural potential in Ukraine from 2021 to 2024 (2024 – forecast based on IMF data).*
Source: State Statistics Service of Ukraine. International Monetary Fund.

In 2023 and 2024, there was a gradual recovery in economic growth compared to the low base of 2022, both in the overall economy and in the agricultural sector. The share of agricultural exports in Ukraine's total export structure also increased significantly. However, the physical volumes of agricultural production have not yet reached pre-war levels. The sown areas for agricultural crops have decreased under the conditions of military actions, particularly in 2024 compared to the pre-war 2021, by 18.5%, although sown areas increased slightly compared to 2023. The main factors behind this decrease include combat operations in agricultural territories, landmining, soil and water contamination, crop destruction, and the destruction of agricultural infrastructure. According to estimates by Ukrainian soil scientists, more than 5 million hectares of chernozem soils were affected during the military operations, resulting in their military degradation of varying intensity and direction, including physical, physicochemical, biological, and mechanical degradation [5]. Fires caused by military actions disrupt the temperature regime of soils and harm microorganisms. As a result of the use of munitions, remnants of military equipment, and chemical substances, large areas of agricultural land in Ukraine are contaminated with heavy metals such as lead (Pb), cadmium (Cd), copper (Cu), and mercury (Hg) [6]. As experts note [7], the explosion of munitions not only causes chemical contamination but also an explosive wave that leads to soil erosion, global climate changes, desertification, and heat shocks, which in turn inactivate the biological activity of the soil.

As of the beginning of 2026, the area of potentially mined land in Ukraine amounts to 13.2 million hectares [8], and demining could take several decades. The existing mine craters destroy crops and contaminate the soil. Ukraine is now the country with the largest mined land areas in the world, surpassing Afghanistan, Cambodia, and Syria. However, the actual situation may be much more complex, as some areas remain difficult to access due to their proximity to the front line.

The total losses and damage caused by the war to Ukraine's land and soils amount to $34.4 billion USD [9].

The inability to process agricultural land is also caused by the complete or partial damage to 21% of the existing agricultural machinery and equipment, as well as 36.5% of the total direct losses in the agricultural sector, which were incurred due to the damage or destruction of agricultural warehouses, grain, and oilseed stocks. The total direct damage to the physical assets of agriculture is estimated at $12.1 billion USD [10].

During the war, there was also a significant decline in livestock production in Ukraine. This trend is especially noticeable in the 25% decrease in the number of cattle compared to the pre-war 2021 [11]. The least decline was observed in the meat production sector, which decreased by 8% compared to 2021.

Additionally, there was a drastic change in the regional structure of livestock production, caused by the large-scale destruction of livestock farm infrastructure in the most war-affected regions and the loss of livestock due to direct shelling. A significant factor in the reduction of livestock production and the change in its regional structure was also the disruption of traditional logistics chains in the industry, which greatly reduced the ability to deliver feed, vaccines, and finished products. However, alongside the decline in 2023, which saw more than half of livestock production volumes in certain regions (Donetsk (67%), Zaporizhzhia (90%), Sumy (50%), Kharkiv (53%), and Kherson (83%)), some regions demonstrated positive dynamics and managed to slightly increase the volumes of livestock breeding and sales (Ivano-Frankivsk and Lviv regions saw a 7% increase, and Khmelnytskyi – a 17% increase) [12]. However, due to the relatively small share of livestock production value in the overall agricultural output structure, these positive trends could not compensate for the total losses in Ukraine's agricultural sector.

It should be noted that the livestock industry is not an export-oriented sector for Ukraine, but it makes a significant contribution to ensuring the country's food security, forming resilience to crisis phenomena. With the onset of military actions, part of the large and medium-sized agricultural enterprises closed, with their number decreasing by 20%. According to FAO estimates, more than 150,000 farmers were directly affected by the war and were forced to emigrate [13]. Due to the war, 25% of rural populations in Ukraine employed in agriculture ceased or reduced production, and in the frontline areas, this figure reached 38%.

One of the significant challenges to maintaining the resilient functioning of Ukraine's agricultural sector has been the shortage of human resources, caused by: a high level of forced emigration and internally displaced persons; military mobilization of the population; an increase in the number of people with disabilities, who require rehabilitation and recovery. As of the end of December 2024, according to the UN, the total number of registered refugees from Ukraine is 6.8 million, and 3.5 million internally displaced persons [14].

These factors have led to a decrease in agricultural production volumes in 2024 [15], which was also caused by lower yields, energy shortages due to damage and destruction of critical energy infrastructure, and inflationary pressure.

The blockade of Ukraine's seaports became a critical factor that imposed significant restrictions on both the functioning of the agricultural sector in wartime and global food security. Before the war, Ukraine's seaports, located along important international transport corridors, accounted for over 70% of Ukrainian agricultural product exports and served as strategic hubs for the transportation of grain to Africa, the Middle East, Asia, and Europe. The blockade of seaports disrupted global food supply chains, leading to an increase in the price of agricultural products, particularly grain, on global markets, and caused a temporary shortage of these products in countries dependent on such imports. The three-dimensional crisis, which includes the rising global prices for agricultural products, coupled with the energy crisis and falling incomes in the post-pandemic economy, has pushed billions of people into the worst cost-of-living crisis in a generation [16].

For Ukraine, the restriction on exports through seaports led to a significant decrease in budget revenues. The inability of agricultural producers to sell products in foreign markets forced them to sell goods on the domestic market at reduced prices. These issues caused a reduction in profitability and further impaired the solvency of Ukrainian agricultural enterprises, as well as a decline in production in the processing industry and an increase in consumer prices for food products, which constitute a significant share of the consumer basket of the Ukrainian population, including rural areas.

The reorientation of Ukrainian agricultural product export flows to railway and road routes through Ukraine's western borders and river ports (Danube River) helped partially offset the losses from the seaport blockade. However, these alternatives proved less effective due to insufficient throughput capacity, unpreparedness of logistics infrastructure, high logistics losses, and a significant increase in transportation duration.

The introduction of the "grain corridor" in August 2022 (Initiative on the Safe Transportation of Grain and Foodstuffs from Ukrainian Ports) [17] aimed at ensuring the safe export of Ukrainian agricultural products from three Black Sea ports (Odesa, Chornomorsk, Pivdennyi), including grain, other food products, and fertilizers. The resumption of exports via Ukraine's seaports allowed the transportation of agricultural products to 45 countries worldwide, primarily to China, Spain, Turkey, Italy, and the Netherlands [18]. The implementation of the "grain corridor" led to a 23% decrease in the FAO Food Price Index compared to its record-high levels in March 2022 [19]. Partially due to the gradual increase in agricultural exports from Ukraine, global food prices continued to decline throughout 2024 [20].

However, during 2022–2024, there were short-term blockages of certain checkpoints at Ukraine's border with the EU, creating additional barriers to agricultural exports, increasing transportation time, and causing corresponding losses for agricultural producers.

Thus, the total losses and damage caused by military actions to Ukraine's agricultural sector are estimated at $90.1 billion USD as of the end of 2025 [9]. Considering the scale of the losses and damage suffered by agricultural producers in Ukraine, the total reconstruction and restoration needs over the next 10 years amount to $56 billion USD. It should be noted that the actual losses in the agricultural sector are currently much higher, as the armed conflict continues, the damage is increasing, and the assessments require updating.

Despite the above-mentioned challenges to the functioning of Ukraine's agricultural sector caused by the war and the shocks to the rural population, processes of adaptation and recovery of the sector's activity are taking place, ensuring its resilience in wartime conditions. A key prerequisite for such economic recovery during the war was primarily the stabilization of the export logistics system and adaptation to new conditions of market interaction.

War is a shock not only for the population of the country but also for the ability of ecosystems to generate services. These services are particularly important for rural populations as they are a means of subsistence and directly or indirectly form their well-being. Military actions devastate ecosystems and the services they generate, creating a chain reaction that undermines the living conditions and economic activities of rural populations. The ability of ecosystems to provide ecosystem services depends on the scale of military damage, the duration of the conflict's impact, and the ecosystems' potential for recovery. Military actions harm all ecosystems and significantly reduce or halt the flow of various types of ecosystem services (provisioning, regulating, cultural, and supporting services).

Since February 2022, Ukraine's ecosystems have suffered both direct and indirect damage caused by military actions. The largest volumes of estimated environmental damage due to the impact of military actions have been inflicted on land resources (Table 1).

Table 1. Estimation of Total Damage Costs to Ukraine's Environment Due to Military Actions (Period: February 2022 – April 2026)

Type of damage	Damage cost, mln. US Doll.	Damage characteristic	Destructive impact on Sustainable Development Goals
Total damage caused by the war to the environment	**65 370**		
Atmospheric air	**26 380**	-	
Oil product fires	4 110	Discharge into atmospheric air 13 460 750 ton Oil products were burned 4 123 051 ton	SDG 1, SDG 2, SDG 3, SDG 13, SDG 15
Forest fires	22 120	Discharge into atmospheric air 88 926 695 ton Forests were burned 158 573 ha	SDG 1, SDG 2, SDG 3, SDG 13, SDG 15
Burning of other objects	150	Discharge into atmospheric air 333 354 ton Other objects were burned 3 516 815 m²	SDG 1, SDG 3, SDG 13, SDG 15
Destroyed military equipment	94 370 units of equipment	Emissions into the atmosphere 129 584 ton Waste 1 458 032 ton	SDG 3, SDG 13
Land resources	**36 160**	**-**	
Soil pollution	520	Contaminated soil 1 402 012 m²	SDG 1, SDG 2, SDG 3, SDG 6, SDG 10, SDG 13, SDG 15
Clogging of lands	35 640	The land is littered 25 261 485 m²	SDG 1, SDG 2, SDG 3, SDG 10, SDG 13, SDG 15, SDG 16
Aquatic resources	**2 830**	**-**	

Water pollution	1 800	Contaminated water bodies 36 111 ton	SDG 1, SDG 2, SDG 3, SDG 6, SDG 14
Clogging of water bodies	230	Mass of foreign objects, materials, waste and/or other substances in water bodies 42 363 534 kg	SDG 1, SDG 2, SDG 3, SDG 6, SDG 14, SDG 16
Arbitrary use of water	800	The amount of water collected/used is arbitrary 21 073 364 707 m³	SDG 1, SDG 2, SDG 3, SDG 6, SDG 14, SDG 16

Source: Based on data from Ministry of Economy, Environment and Agriculture of Ukraine. *Consequences of military actions and impact on the environment*. Eco Zagroza. [9]

The damage caused by the war to the air in Ukraine amounts to nearly USD 26 billion. The greatest harm to the atmosphere during the war is caused by forest fires, the burning of petroleum products, methane leaks from damaged gas pipelines, and the destruction of energy infrastructure. Military vehicles and transport, including those destroyed, also contribute to increased emissions into the atmosphere, particularly CO2, nitrogen oxides, hydrocarbons, and sulfur dioxide. According to the Ministry of Environmental Protection and Natural Resources of Ukraine, greenhouse gas emissions resulting from military actions during the first year of the war amounted to about 180 million tons of CO2, which is equivalent to Belgium's annual emissions [21]. The increase in such emissions negatively impacts climate change and creates long-term consequences for the resilience of ecosystems and public health, especially in rural areas near the combat zones. For example, the mortality rate from air pollution in Ukraine stands at 78.6 people per year per 100,000 population, while in Poland, this figure is significantly lower at 44.5 [22].

The damage caused by the war to Ukraine's water resources is currently estimated at USD 2.83 billion [9]. These losses are primarily due to the contamination and pollution of surface, groundwater, and marine waters. In 2024, due to these factors, 15% of women and 14% of men in Ukraine lack access to clean drinking water. Thus, destructive changes and the loss of ecosystem services are leading to a decline in the well-being of rural populations and depriving them of access to basic goods and services.

It should also be noted that these damage assessments are not complete. They do not include the damage caused to the environment in areas that are difficult to access due to security reasons, nor do they account for the loss of biodiversity and most ecosystem services (regulating, cultural, and supporting services).

Rural populations, which are heavily dependent on ecosystem services, are particularly vulnerable to their loss due to the devastating impacts of war. The decline in ecosystem productivity reduces the potential of the agricultural sector and the local economy, and the complete degradation of certain ecosystems also contributes to increased migration.

To mitigate the pressure of the war's consequences on rural areas, there is a need to develop and implement a comprehensive mechanism that includes relevant adaptation, support strategies, as well as development and recovery strategies for territories in wartime conditions. In 2024, Ukraine adopted the "Strategy for the Development of Agriculture and Rural Areas in Ukraine until 2030" [23], which includes a systematic list of directions and actions for the development of Ukraine's agricultural sector. However, it should be noted that the implementation of such measures can only occur in the post-war development context for the long term.

Currently, supporting the existence and development of rural areas in Ukraine, and overcoming the challenges of martial law and the consequences of military actions, requires first and foremost urgent measures, namely:

- De-mining agricultural lands to ensure the safety of people and the possibility of agricultural work;
- Comprehensive assessment of soil contamination and implementation of restoration programs to return soils to their productive state;
- Reconstruction and restoration of destroyed and damaged transport, logistics, and agricultural infrastructure to overcome barriers to agricultural production and transportation of goods;
- Diversification of logistics chains and increasing the capacity of key transport routes for Ukraine's agricultural sector, as well as the full restoration of the operation of seaports for the export of Ukrainian agricultural products;
- Restoration and purification of water resources and increasing access to clean drinking water for the population;
- Rebuilding energy infrastructure to ensure uninterrupted electricity supply throughout the year;

- Implementation of a new system of tax benefits for agricultural enterprises;
- Development and implementation of financial support programs for farmers, including preferential loans for a wider range of enterprises, state support programs and grants, as well as encouraging foreign investment in agricultural enterprises located far from combat zones;
- Implementation of a state program to stimulate the development of agricultural production with high added value;
- Introduction of innovative technologies, the use of artificial intelligence, and increasing the level of automation in agricultural processes;
- Encouraging the return of migrants to Ukraine in order to stabilize the existence of rural areas and overcome the labor force deficit in the agricultural sector;
- Implementation of training programs for veterans to engage them in agricultural production;
- Rebuilding social and medical infrastructure in rural areas to prevent population migration.

The implementation of these measures in the initial phase will help mitigate the effects of military actions on rural areas and stimulate their support for their economic, social and ecosystem resilience.

REFERENCES

1. Global status of black soils. Food and Agriculture Organization. 2022. Rome. URL: https://doi.org/10.4060/cc3124en
2. Gross domestic product by production method and gross value added by type of economic activity for (2010-2023). State Statistics Service of Ukraine. URL: https://www.ukrstat.gov.ua/operativ/operativ2020/vvp/vvp_rik/vtr_rik10-23_2021_100.xlsx
3. The population of Ukraine as of January 1, 2022. State Statistics Service of Ukraine.URL: http://db.ukrcensus.gov.ua/PXWEB2007/ukr/publ_new1/2022/zb_%D0%A1huselnist.pdf [in Ukrainian]
4. Ukraine food security and livelihood cluster (FAO, WFP) *FSLC 2024-2025 Winter Response Strategy*. URL: https://fscluster.org/sites/default/files/documents/%5BUA%5D%20FSLC%202024-2025%20Winter_Response_Strategy.pdf [in Ukrainian]
5. Balyuk, S. A., Kucher, A. V., & Romashchenko, M. I. (Eds.). (2024*). Soil cover of Ukraine in the context of military actions: State, challenges, and restoration measures*. Kyiv: Agrarian Science. [in Ukrainian]
6. Assessment of the Impact of War on Chernozems as a Prerequisite for Restoring Their Fertility. URL: https://agroportal.ua/blogs/ocinka-vplivu-viyni-na-chornozemi-yak-peredumova-vidnovlennya-jihnoji-rodyuchosti [in Ukrainian]
7. The annual review (2024). Russia-Ukraine War: Environmental Impact. The second edition. URL: https://www.topleadprojects.com/eng-2024-ua-war-environmental-impact
8. National mine action program "Demining Ukraine" (2026). URL: https://demine.gov.ua/en
9. Ministry of Economy, Environment and Agriculture of Ukraine. Consequences of military actions and impact on the environment. Eco Zagroza. Retrieved April 10, 2026, from https://ecozagroza.gov.ua/en
10. World Bank, Government of Ukraine, European Commission, & United Nations. (2026). Ukraine: Fifth rapid damage and needs assessment (RDNA5), February 2022 – December 2025. https://documents1.worldbank.org/curated/en/099022026094036395/pdf/P514499-22f93f3a-4278-42bc-b907-db9553d12069.pdf
11. Livestock (1990-2023). *State Statistics Service of Ukraine*. URL: https://www.ukrstat.gov.ua/operativ/operativ2021/sg/sg_rik/tvar_1990-2020_ue.xls (acceded 10 January 2025)
12. Animal production in 2023 (final data). *State Statistics Service of Ukraine.* URL: https://www.ukrstat.gov.ua/operativ/operativ2022/sg/vpt/vpt2023.xls (acceded 10 January 2025)
13. Ukraine: Impact of the war on agriculture and rural livelihoods in Ukraine – Findings of a nation-wide rural household survey. *Food and Agriculture Organization*. 2022. Rome. https://doi.org/10.4060/cc3311en
14. Ukraine Situation Flash Update № 76. United Nations High Commissioner for Refugees Regional Bureau for Europe. 30 December 2024. URL: https://data.unhcr.org/en/documents/details/113507
15. Ministry of Economy of Ukraine. (2024). Monitoring of key events in the economy of Ukraine: October 2024. URL: https://me.gov.ua/view/fa16545f-5af9-4731-baab-f4bed34710e2 [in Ukrainian]
16. Global impact of the war in Ukraine: Billions of people face the greatest cost-of-living crisis in a generation. UN Global Crisis Response Group on Food, Energy and Finance. Brief № 2. URL: https://unctad.org/system/files/official-document/un-gcrg-ukraine-brief-no-2_en.pdf
17. Initiative on the Safe Transportation of Grain and Foodstuffs from Ukrainian Ports. Black Sea Grain Initiative Joint Coordination Centre. *Unaited Nation*s. URL: https://www.un.org/sites/un2.un.org/files/black_sea_grain_initiative_full_text.pdf
18. Black Sea Grain Initiative. *Unaited Nations*. URL: https://www.un.org/sites/un2.un.org/files/bsgi_facts_and_figures_final.pdf

19. Trade against hunger. Exploring trade actions to fight acute food insecurity and the threat of famine. United Nations Conference on Trade and Development. URL: https://unctad.org/system/files/official-document/ditc-tad-trade-against-hunger_en.pdf
20. World Economic Situation and Prospects 2025. United Nations Department of Economic and Social Affairs. URL: https://desapublications.un.org/file/20954/download?_ga=2.253809231.65783063.1737321412-398757163.1735301612
21. Ministry of Environmental Protection and Natural Resources of Ukraine. *Russian-Ukrainian war: Impact on the environment. The second edition of the study on the ecological consequences of the war was presented in Kyiv.* URL: https://mepr.gov.ua/rosijsko-ukrayinska-vijna-vplyv-na-dovkillya-u-kyyevi-predstavyly-druge-vydannya-doslidzhennya-pro-ekologichni-naslidky-vijny/ [in Ukrainian]
22. The annual review (2024). Russia-Ukraine War: Environmental Impact. The second edition. URL: https://www.topleadprojects.com/eng-2024-ua-war-environmental-impact
23. Cabinet of Ministers of Ukraine. (2024). *On approval of the Strategy for the development of agriculture and rural areas in Ukraine until 2030 and the approval of the operational plan for the implementation of its measures in 2025-2027.* Resolution No. 1163-r, November 15, 2024. [in Ukrainian]