PERSPECTIVES OF FARM DEVELOPMENT UNDER THE WAR CONDITIONS IN UKRAINE

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ABSTRACT

The article discusses the existing structure of agricultural production in Ukraine and defines the key role of farmers in providing the population with food products at the beginning of a full-scale war. The high adaptability of the small goods sector of the agrarian economy and insufficient attention to its development in the pre-war period have been proven. An assessment of the main challenges, general losses and measures taken regarding the development of agriculture in Ukraine during the war period is given, and the importance of international financial support is emphasized. The need for a balanced model of the corporate and small commodity sectors development in the postwar period with a change in priorities to support small farmers is emphasized. It is proposed to develop a National Action Plan for the Development of Farming, which should be an integral part of the post-war reconstruction plan for Ukraine.

KEY WORDS

farm enterprises, martial law, National Action Plan for the Development of Farming, compensation for losses, international financial support

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D20, Q13, Q18

1 INTRODUCTION

The Ukrainian agricultural sector is a strategic sector of the national economy which contributes a significant share of the state budget and ensures the country's food security. The evolutionarily formed structure of agricultural production in Ukraine, consisting of the corporate and small commodity sectors, with the beginning of a full-scale war witnessed the strengthening of the tendency towards stagnation of large agricultural holdings and

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other agrarian companies while the role of farmer-owned and private family-run farms has grown. According to the United Nations, in 2021 farms in the developed countries of the world produced more than 85 percent of the agricultural products volume, while in Ukraine this indicator barely reached 10 percent of GDP, having decreased by 4 percent compared with 2020 (Odarchenko, 2023). Moreover, in contrast to Ukraine, the main trend in the West is the development of small farms. According to Food and Agriculture Organization of the United Nations (2016), about 97 percent of all farms in the EU-28 should be considered family farms. The Netherlands has the largest share of such farms – 98 percent. In neighboring Poland, this number is 90 percent. As of 2016, in the EU-28, only 27.5 percent of the area was cultivated by corporate farms, and the majority of the rest – by family farms.

Despite the pre-war successes in the production and export of products (Kolodiichuk, 2020) of the corporate segment of Ukrainian agriculture, Russia's aggression significantly complicated the functioning of agricultural holdings due to a significant loss of control over the production system, as well as the breakdown of logistics chains, catastrophic material losses and losses of fixed assets, environmental disasters on corporate livestock complexes and poultry farms, blocking of sales markets, etc.

According to preliminary estimates by scientists, by the beginning of September 2022, the potential direct damage caused to the country's agricultural infrastructure and assets as a result of Russia's full-scale aggression against Ukraine exceeded 6 billion dollars. Instead, farmers and private farms have demonstrated their key role in the preservation and development of local markets and food supply chains and have become a reliable source of providing the population with agricultural products and food.

Before the full-scale war started, agricultural holdings and large agricultural enterprises with a significant foreign capital share, oriented towards constant monoculture expansion and export effectively monopolized state support for the entire agricultural sector in Ukraine. Despite high incomes from the main activity and having a powerful lobby in the state authorities, 5–10 percent of the largest agricultural enterprises of Ukraine before the war concentrated 70–80 percent of the national funds allocated for the agriculture support (National Academy of Science of Ukraine, 2022). In addition, these subjects, meeting certain criteria, received significant investment resources from such institutions as the World Bank, the International Monetary Fund, the European Bank for Reconstruction and Development, and also had more opportunities for borrowing from the national banking sector.

At the same time, the incomes of agricultural holdings are taxed according to a simplified system, and a significant amount of income is absorbed through offshore zones, which negatively affects the formation of budgets at various levels and causes minimization of expenditures on social programs (Yatsiv and Kolodiichuk, 2018). All these aspects of the agricultural holdings functioning lead to unfair competition with farmers and family-owned farms, and, obviously, the post-war agrarian policy of Ukraine requires a review of the priorities of structural development on the basis of ensuring equal conditions for all economic entities, regardless of ownership form and production scale.

2 THEORETICAL FRAMEWORK

Implementing the model of post-war balanced structural development of agriculture in Ukraine, in the article, we focus on the prospects for the development of family farms, which are the weakest link in the national agricultural structure, as agricultural holdings have largely adopted Western models of management, use a wide range of investment resources, and are sufficiently efficient. Balanced structural development is also relevant in the context

of the lifting of the moratorium on the sale of agricultural land from 1st July 2021 as the future model envisions a change in agricultural policy to be based on fairness and providing equal opportunities for all participants in the agricultural production, including transparent and fair access to agricultural and other land, production resources, free access to sales and competition on a fair basis.

3 METHODOLOGY AND DATA

To achieve the article goal, we solved the following tasks: using the dialectical method of knowledge of objective reality and the comparison method, evaluate the state and conditions of development of agricultural and personal farms. Systematization and grouping of problems that arose from unprecedented military challenges and state neutralizing actions precede the critical adoption of decisions regarding the prospects for development of the small-scale agricultural sector. The monographic method of study of the activities of economic subjects was used in the context of existing problems, and the abstract-logical method of research was used to formulate the results and proposals of scientific research.

The methodological basis of our research is the use of alternative approaches to gathering information and estimating problems under the conditions of full-scale war. The lack of systematic statistical information on agribusiness throughout the territory of Ukraine requires the search for sources of analytical and empirical data by analyzing cases and comparing the opinions of civilian and military experts, national institutional structures and authoritative international organizations. The main difficulties are connected with the estimation of the front-line and temporarily occupied territories of Ukraine. For the objectivity of the estimation of agricultural production, we will use, in particular, the methods of applying satellite data of Earth observation to benefit food security, agriculture, and human and environmental resiliency in the US and worldwide of the NASA Global Consortium for Food Security and Agriculture – NASA Harvest. This organization estimates the production of major grain and oilseed crops, both in controlled and temporarily occupied territories, using methods based on satellite data to obtain these estimates. NASA Harvest research will help us understand the real situation regarding crops and the general state of production in the temporarily occupied territories, and it is an important tool for estimating the nature and scale of agricultural activity under occupation. Satellite information, especially when combined with economic data, is being used to anticipate supply chain challenges and to help to prevent food shortages by providing necessary insights that inform policy and mitigation responses.

The methodology of bringing satellite imagery into the damage analysis process increases the capacity to map unexploded ordnance across Ukraine's farmlands. The satellite imagery also provides an archive of Ukrainian agricultural lands, enabling the historical monitoring of any field in Ukraine; before, during, and after the conflict. This information is impossible to gather by any other means. This is why NASA Harvest is actively working on mapping craters and potential unexploded ordnance to prepare for assisting demining organisations in the future (NASA Harvest, 2023a). By incorporating this satellite-derived data, demining agencies are able to prioritise demining efforts in support of continued agricultural production, ultimately bolstering local food production and by extension global food security.

4 RESULTS

The agricultural sector in Ukraine is an important source of tax revenue for the government budget. According to the National Bank of Ukraine data, the share of agriculture in the GDP in 2021 was 10.2 percent, which was 1 percent higher than in 2020 (National Bank of Ukraine, 2022). Agriculture products account for the largest share of Ukraine's total exports, about 41 percent per year, and the livelihood of 13 million rural residents directly depends on the state of the national agricultural sector (Shulha, 2023). In 2022, Ukrainian farmers exported agro products for $20 billion, but these figures are 50 percent lower than the year before the full-scale Russian invasion in Ukraine. All this affects the world markets, because, to a large extent, due to the war in Ukraine, world food prices on average in 2022 were 14.3 percent higher than in 2021.

Tax revenues from the agro-industrial sector of the economy in 2021 amounted to almost UAH 50 billion, or 11 percent in the structure of all tax revenues. In addition, agriculture showed the highest increase in production in 2021, 14.4 percent, and by the end of 2021, production in the agricultural sector had grown by 19.2 percent. However, with the start of 2022, significant problems arose in the formation of budget revenues, as the full-scale war significantly weakened the financial capabilities of agribusinesses, especially, agricultural holdings which faced the problem of realizing their export potential due to the interruption of established logistics chains and the loss of significant material, technical and land resources in the areas of hostilities and in the front-line areas.

The experts of the Food and Agriculture Organization of the United Nations (FAO) calculated and estimated the actual losses from the damage to the assets of Ukrainian agricultural enterprises in 9 months of the war at 6.5 billion dollars (Ministry of Finance of Ukraine, 2021). As a result of the war, more than 10 thousand farmers lost the ability to work, which significantly changed the structure of the agricultural sector. As a result of the war, more than 10,000 farmers lost the ability to work, significantly reducing the fiscal revenue from the agriculture sector to budgets at all levels. Due to the decrease in the realization of agricultural products at the domestic market, a reduction in tax revenues for the three quarters of 2022 was 23.7 percent, compared to 2021 (Pepelia, 2022).

Tab. 1 shows the analysis of the quantitative and qualitative indicators of agricultural formations, based on their structure. The small commodity sector includes family and farmer households. Agricultural holdings and other types of entities are represented in the table as the corporate sector.

Over the past few years, the profitability level of farming has been competitive with the corporate sector, and in livestock and overall has exceeded the indicators of agribusinesses by 5–10 percent. In our opinion, it became the result of the implementation of affordable credit and government subsidies programs, as well as international grant support. However, the lack of modern multifunctional equipment and financial circulating assets in general is holding back the progressive farming movement.

After the declaration of martial law in Ukraine on 24th February 2022, agriculture, as the basis of food security and a component of national security, requires increased attention and all-around support from the government. Such support is being provided not only by Ukraine itself but also by many countries and international institutions. Tab. 2 provides an overview of the main challenges facing agriculture since the start of the war and the measures taken to address current problems.

With the beginning of a full-scale war, in order to preserve the traditional status of a world food exporter, Ukraine faced new security challenges in the use of maritime routes in the Black Sea. The grain agreement, which was concluded in Istanbul on 22nd July 2022 in order to protect merchant ships from Russian threats, with Turkey and the UN acting as guarantors, made it possible to create a "grain corridor" and temporarily unblock food exports

Tab. 1: Dynamics of individual quantitative and qualitative indicators of agricultural activity (based on State Statistics Service of Ukraine, 2021)

	Small commodity sector			Corporate sector			Percentage in the overall structure 2021	
Indicators	**2019**	**2020**	**2021**	**2019**	**2020**	**2021**	**Retail**	**Corporate**
Total farms (thousand)	45.6	46.9	46.7	10.8	10.9	10.7	81.4	18.6
Crop areas (thousand hectares)	3908.7	2981.1	2817.5	16334.7	16827.8	16526.5	14.6	85.4
Revenue from the sale of agricultural products (million euros)	1662.4	1684.8	1725.4	8285.8	8452.1	8525.1	16.9	83.1
Including crop production (million euros)	1363.1	1378.2	1381.3	6214.4	6358.6	6455.2	17.7	82.3
Including grain crops (million euros)	176.1	182.5	193.1	1895.1	1956.7	2019.1	8.8	91.2
Yield of grain crops (%)	44.0	37.4	38.5	53.7	46.4	48.2	*	*
Including animal husbandry (million euros)	299.3	306.6	344.1	2071.4	2093.5	2069.9	14.3	85.7
The level of profitability in crop production (%)	16.5	23.8	25.6	18.8	24.0	22.1	*	*
The level of profitability in animal husbandry (%)	30.1	28.3	28.1	18.1	18.0	18.1	*	*
Availability of agricultural machinery	88733	89205	89156	166343	165896	165754	34.9	65.1
Including combines	19986	20245	20165	44429	44513	44483	31.2	68.8
Tractors	41783	42563	42550	70746	71012	70982	37.5	62.5
Seed drills	18107	17510	17500	32538	33026	32984	34.7	65.3
Plant protection machines	8857	8887	8941	18630	17345	17305	34.1	65.9

from the ports "Odessa", "Chornomorsk" and "Pivdenny". Despite systematic sabotage by Russia to inspect ships and the risk of maritime corridor bypass, Ukraine was able to send 629 ships from 1st August 2022 to 8th January 2023, exporting 16.9 million tons of Ukrainian food to Asia, Europe, and Africa, making a significant contribution to the elimination of the global food crisis. In particular, 54 percent of the agri-food transported through the "grain corridor" reached the ports of European states, 28 percent to Asian countries, 12 percent to African countries, and 6 percent to countries in the Middle East.

To strengthen Ukraine's export positions, the official start of the Humanitarian Food Program "Grain from Ukraine" for the supply of grain to the most in need African countries, where there are already hunger problems, took place on 26th November 2022. The program foresees the dispatch of 60 ships with Ukrainian grain to mid-2023 to provide food for at least 5 million people. Under the Program, part of the export grain could be purchased by 30 participating countries and international organizations. Germany and Japan have already joined this program, paying for the freight of two ships. The United States Agency for International Development (USAID) has agreed to provide up to 20 million dollars for this initiative.

In order to ensure stable Ukrainian export, the process of effective implementation of the production potential of agricultural enterprises becomes important. Hostilities on the territory of Ukraine significantly complicate the production of agricultural products, prevent field work, and also cause significant financial losses to agricultural enterprises due to the loss of cultivated areas, the destruction of livestock and poultry farming, production buildings and structures, technical equipment, etc. Many livestock complexes and elevators were looted or

Tab. 2: The main challenges and measures taken regarding the development of agriculture in Ukraine during the war (data for January 2023)

No.	The main problems	Negative consequences	Implemented measures
1	Military blockade of the Black Sea (maritime roads)	Reduction of traditional export volumes in Ukraine	• Opening of the "grain corridor" and the elimination of the narrow fairway in the Black Sea waters • Humanitarian food program "Grain From Ukraine"
2	Losses of fixed assets (crop area, losses of livestock and poultry farming, buildings and structures, technical equipment)	Decrease in the productive capacity of agricultural production	• Adaptation of the "5-7-9" agribusiness lending program to the war situation • Substantial international financial support • Industry programs and measures for support and partial compensation for losses
3	Increase in the price of circulating assets (fuel, fertilizers)	Disruption in technology and terms of the agricultural works	• Temporary suspension of import excise tax on petroleum products and reduction of VAT • State monitoring of fuel prices • Ban on the export of mineral fertilizers
4	Shortage of circulating funds	Deficiency of seed material, protective measures, fuel	• Grants for farmers and family owned farms • Extension of agricultural lending programs • Financial support from FAO
5	Logistics chain disruptions	Stoppage or complicating functions of supply, production, and distribution of products	• Partial relocation of processing capacities
6	Mined fields	Phase out of farmlands due to danger of agricultural works	• EU provides financial support for programs aimed at demilitarizing territories
7	Migration and mobilization of industry workers	Shortage of workers in agribusiness	• Reserving workforce for agribusiness
8	Lack of electricity	Disruptions in technological cycles	• Cancelled VAT and customs duties on import of generators, transformators, batteries, etc. • International aid and preferential credits for alternative energy sources
9	Compensation for losses under insurance contracts	Force majeure circumstances of loss of plant and animal products	• Government support for insurance of agricultural products and recommendations for formation of evidence base for future loss compensation

blown up, and tractors, combines, agricultural machines and cars were stolen or destroyed. Moreover, these were fairly modern production complexes and technical equipment, which were actively updated in recent years.

NASA Harvest satellite analysis revealed a relatively high-yielding 2023 season for the Black Sea region for both wheat and sunflower, Ukraine's two main export crops. However, a significant part of this production was collected in the territories temporarily occupied by Russia, namely about 6.4 million tons of wheat and almost 1.5 million tons of sunflower seeds. All these products were stolen by Russia, as well as about 15–16 million tons of all agricultural crops produced in the occupied territories.

NASA Harvest, based on satellite analysis, estimates total wheat production in Ukraine in 2023 to be between 25 and 26.5 million tons, with between 21 and 22 million tons coming from the Ukraine-controlled territories and between 4.1 and 4.4 million tons coming from Russian-occupied territories (Fig. 1).

Yield is estimated to be higher than last season, at 4.27 ton/hectare for all of Ukraine (4.53 ton/hectare within Ukraine-controlled territories and 3.3 ton/hectare in Russian-occupied territories). On the other hand, planted area has decreased relative to last year, with between 5.8 and 6.2 million hectares planted across Ukraine (between 4.6 and 4.9 million hectares on Ukraine-controlled areas, and between 1.2

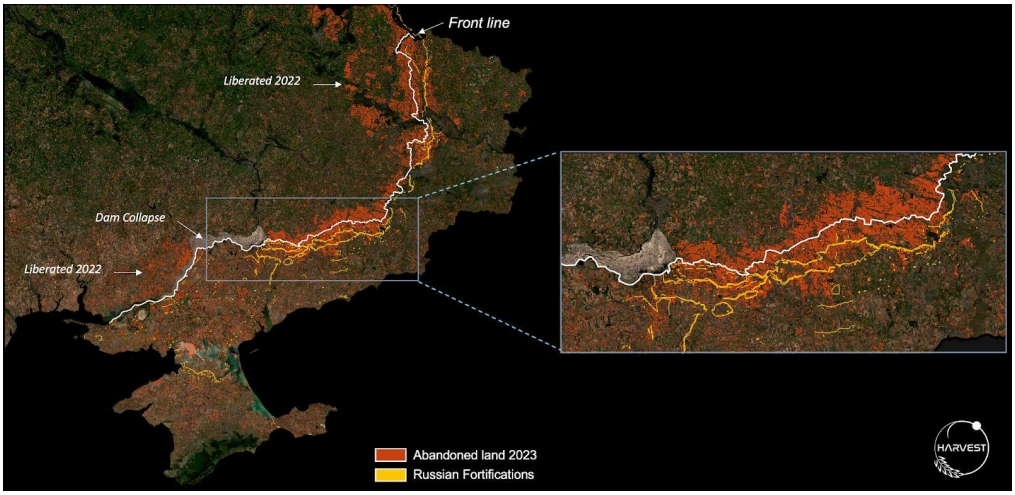

Fig. 1: Derelict Farmland Along the Front Line and NASA Harvest Satellite Estimates for July 2023 (Satellite Data Source: PlanetScope, Russian fortifications source: Brady Africk)

and 1.3 million hectares planted on the Russian-occupied territories).

Overall, this year's wheat production estimate is close to last year's estimate – driven by lower planted area and higher yields relative to last year – but it is slightly below the 5 year average (prior to the war) of 27.9 million tons. It is important to admit that this assume that all planted wheat will be harvested, and that satellites cannot provide information on who would harvest the wheat and whether Ukraine will see the economic benefits of its fertile farmlands (NASA Harvest, 2023b).

Damaged fields, loss of irrigation infrastructure, the dangers of planting in a warzone, and the long term impacts of abandoned farmlands are also gradually coming to light. NASA Harvest preliminary analysis estimates that between 5.2 and 6.9 million acres (2.1–2.8 million hectares) of farmland have been abandoned as a result of the war since its beginning. These abandoned fields represent between 6.5 and 8.5 percent of Ukraine's total cropland and unsurprisingly lie along the war's front lines. Additionally, NASA Harvest estimates that just this year alone Ukraine has seen around $2 billion in economic losses due to lost harvest on the now-fallow fields and that these lost crops could have fed upwards of 25 million people for an entire year (NASA Harvest, 2023a).

In order to neutralise the catastrophic consequences for the national economy in Ukraine, alongside the adaptation of existing credit programs, other stabilisation measures were taken to support agricultural production.

The "5-7-9" program was launched in February 2020 which allowed small businesses to obtain preferential loans with interest rates ranging from 5 to 9 percent and a maximum loan amount of 50 million hryvnias. As of the beginning of the program, businesses have received a total of 161.86 billion hryvnias, 72.24 billion of which was received during the war period. This is the main preferential lending program in Ukraine.

Since the start of full-scale war, the government promptly responded to the urgent need of farmers for preferential lending and the program was expanded to include agricultural businesses with the possibility of obtaining loans at 0 percent interest (with rates ranging from 0 to 9 percent). The loan amount for agricultural enterprises ranges from 100 thousand to 90 million hryvnias and the state has provided 80 percent guarantees for this loan and allowed grain to be included as collateral. Within this program, farmers have received about 40 billion hryvnias, and some banks have launched targeted loan programs at 0 percent interest within the framework of "5-7-9" for

the purchase of generators, Starlinks, and other equipment.

In general, in 2022, farmers received loans for a total amount of more than UAH 90 billion, and the EU provided 50 million euros in the form of subsidies and grants for the cultivation from 1 to 120 hectares of agricultural land per year and for the keeping from 3 to 100 cows. Until 5th June 2023, the import duties on Ukrainian goods to the countries of the European Union are cancelled. The decision of the European Parliament under No. 2022/870 states that all tariff quotas for agricultural products and anti-dumping duties on imports of goods originating from Ukraine are suspended. In addition, the European Union has a transport visa-free regime for Ukraine.

Considerable international financial support for Ukraine is provided by USAID, in particular, agronomic support for three thousand agricultural producers who were particularly affected by the war is provided for a total amount of 35 million USD. Also, credit unions of Ukraine, which are USAID partners, within the framework of the "Credit resources for agricultural producers" project, will provide small agricultural producers with loans in the amount of 8.9 million USD.

Considering the main resources losses since the beginning of the full-scale war, the state support for the Ukrainian agricultural sector, in addition to credit programs, included:

- simplification of the procedure for obtaining land plots (leases) for their cultivation;
- partial reimbursement of the cost of purchased breeding animals for further reproduction;
- partial reimbursement of the cost of constructing and/or reconstructing livestock farms, processing agricultural products and grain storage enterprises;
- financial support for the development of horticulture, viticulture and hops, subsidies for beekeeping, grants for the creation of greenhouses;
- financial support for the farms development;
- exemption from import duty taxation of products and equipment for storage, transportation, loading and unloading of grain and/or oil crops (polymer sleeves for grain storage (Kolodiichuk and Dubnevych, 2019), trailers and semi-trailers for transportation of agricultural products);
- simplified procedure for registering agricultural machinery and state inspection of its technical condition.
- reduced VAT on fuel and lubricating materials, etc.

Average fuel prices rose even before the start of a full-scale war, which was explained by high oil prices on world exchanges and the decline in the hryvnia exchange rate. Only since the beginning of 2022, the prices of gasoline and diesel fuel in Ukraine have increased by 14–15 percent. After the start of hostilities, the purchase of Belarusian fuel was stopped, the sea channels for the oil and petroleum products supply were lost, and control over oil refining facilities in the east of Ukraine was lost as well. Significant volumes were also needed for the front, and all this caused shortages and restrictions on the supply of fuel, speculation and an uncontrolled rise in prices. Against the background of panic, with the aim of stimulating imports and restraining domestic prices, the state intervened in the regulation of the fuel market by cancelling the excise tax on imports and reducing VAT. These measures had a positive effect on providing agricultural producers with fuel during spring field work. In order to prevent artificial price increases and speculation, the State Consumer Service of Ukraine conducts daily price control of 26 items of basic socially significant goods, including fuel prices.

The shortage and significant increase in the cost of fertilizers has made agriculture in Ukraine much more difficult, as most of the facilities for their production have already been stopped, as a large part of them are located nearby or directly in the war zones. For example, the "Sumykhimprom" plant suffered from shelling and it caused the ammonia leakage. The "Azot" chemical plant in Severodonetsk (15.3 percent of Ukraine's nitrogen fertilizer production) is situated in an area beyond Ukrainian government control and doesn't work. The Odessa Port Chemical Plant

(14.4 percent of Ukraine's nitrogen fertilizer capacity) has been shut down since the conflict began, and "Rivneazot" is situated in a potentially hazardous zone where rocket attacks are possible. Even on remote fertilizer production plants, there is a significant threat to the lives of employees and residents of nearby communities, as the enemy conducts shelling with missiles and drones, while workers have to work with the explosive and poisonous materials.

Starting from 12nd March 2022, Ukraine has implemented a ban on the export of fertilizers to preserve the market balance during the ongoing war. In 2021, almost 45 percent of Ukrainian exports of nitrogen fertilizers were accounted for by the EU. The largest importers of Ukrainian nitrogen fertilizers (SuperAgronom.com, 2023) were Romania (190,000 tons), Italy (138,000 tons), France (104,000 tons), Hungary (88,000 tons), Spain (56,000 tons), Bulgaria (50,000 tons), and Poland (40,000 tons). Under current circumstances, EU countries will need to search for alternative sources of nitrogen fertilizer supply. Meanwhile, the production of complex fertilizers is not sufficiently developed in Ukraine. In 2021, 1.9 million tons of them were imported. The largest source was Belarus (617 thousand tons), which was 32.1 percent of the total volume (SuperAgronom.com, 2023) and after breaking economic relations with it, Ukraine needs to find alternative sources of imports.

In general, the issue of disruption of logistics chains (Kolodiichuk et al., 2020) became extremely acute with the beginning of full-scale hostilities. The loss of enterprise resources and the destruction of the transport infrastructure made it impossible to use traditional channels of supply and distribution of products, and in many cases paralyzed the production and marketing activities of agricultural enterprises. A partial solution of this issue was achieved due to the relocation of enterprises to the rear regions of Ukraine, but this is impossible for agricultural production.

In order to conduct the effective agricultural production, farmers need working capital to purchase seed material, plant protection products, equipment repairs, and so on. In the first quarter of 2023, a shortage of working capital will be a limiting factor in the development of agricultural production, and for this reason the state has extended the state program "Affordable loans '5-7-9" to provide targeted support for agricultural producers.

An unexpected challenge for the Ukrainian agricultural sector in 2022 was the issue of mining fields and dirt roads in the de-occupied territories, which posed significant risks to the life and health of machine operators. Funding of the programs for demining the territory has been a question for a decade not only for Ukraine, but also for international donors. According to estimates of the Ukrainian Association of Sappers (`https://www.uda.org.ua/`), in particular, by the beginning of 2023, about 139,000 square meters. km contaminated with various types of explosive objects.

According to the commander-in-chief of the Armed Forces of Ukraine Valery Zaluzhny (`https://cutt.ly/PwFod51o`), in August 2022, the Russians fired 40–60 thousand shells at Ukrainian positions every day (Fig. 2). According to various estimates, up to 20 percent of the fired ammunition does not explode. In addition, if the Russians stay in a certain area for a long time, they place mines in forests and fields. According to the assessment of the Ukrainian Club of Agrarian Business (`https://www.ucab.ua/en/`), about 2 million hectares of fields have been mined in the liberated regions. Each year of idleness of these lands will cost the country's economy up to 800 million USD. There are 6 million hectares under temporary occupation, which will also require inspection after liberation (Miroshnychenko, 2023).

The shortage of skilled labor in the agricultural sector has been felt for some time, and the introduction of a state of emergency in Ukraine due to the Russian-Ukrainian war, and with it, a general mobilization, has led to an even greater shortage of industry professionals, including drivers, tractor operators, agronomists, and zoo technicians. Additionally, Russia's full-scale armed aggression against Ukraine has caused one of the most rapid crises of forced displacement of people both within the country and abroad. Since the agrarian rear is no less

Fig. 2: The state of the fields near the village of Dovhenke in Kharkiv Oblast (satellite images by Maxar Technologies)

important for the state defence, and holding the 2022 sowing year is one of the strategic goals, under such conditions the government included employees of agricultural enterprises in the list of professions that can receive a postponement from mobilization.

Massive rocket attacks on Ukraine's energy infrastructure facilities, which Russia systematically makes, have a significant negative impact on the agricultural sector and have resulted in a considerable deficit of capacity in Ukraine's energy system. Under these conditions, the risks of halting technological processes in agriculture are significantly increasing, and in some sectors, such as animal husbandry or poultry farming (incubators, etc.), these risks become critical. The absence of electricity is particularly noticeable in horticulture, during post-harvest crop treatment (drying, sorting), and so on. To solve these issues partially, Ukraine has abolished VAT and import duties on generators, transformers, batteries, and other similar equipment. According to Ukrinform (Ukrinform, 2023), the World Bank will provide USD 50 million in 2023 to ensure that Ukrainian elevators are equipped with generators or boilers, allowing each elevator to partially offset the purchase of new generators, up to a sum of 5 million UAH or switch to LPG.

Despite the fact that agricultural insurance is an important tool for effective agrarian policy, only slightly more than 5 percent of agricultural lands in Ukraine are insured, while in the United States, this figure reaches 90 percent. Generally, farmers had to prioritize insurance of agricultural equipment since it is a condition for purchasing it on credit or leasing schemes, while there is often not enough funding for crop and livestock insurance. This is also due to the reluctance of insurance companies to take on potentially high risks. This fact significantly increases the cost of insurance products. In view of global climate changes and growing risks of loss of products important for national security, it is obvious that the process of agricultural insurance requires state support as well. In Ukraine, an important law "On the features of insurance of agricultural products with state support" was adopted on 24th July 2021, as well as the Resolution of the Cabinet of Ministers "On approval of the procedure for providing state support for insurance of agricultural products" dated on 12th February 2022. State support for the insurance of agricultural products involves compensation from the state budget up to 60 percent of the insurance payment.

However, with the beginning of a full-scale war, which caused the temporary occupation by Russia a significant agricultural territory, the prevention of agricultural work due to shelling of fields, their mining, fires, etc., significant problems arose with insurance compensation for losses of agricultural products. If the insured event occurred during the period of martial law and the insurance contract provides for it, the insurance company is not released from its obligations to the client. Since, as a rule, damage caused as a result of hostilities is not determined by an insured event, the institution of force majeure may be applied accordingly, which means depriving the business entity of compensation for losses. Therefore, the main task for agricultural producers, at the moment, is to record and document (if possible) all the facts of losses of products and material assets, as an evidence base for compensation of losses in the post-war period.

5 DISCUSSION

The model for post-war agricultural structure in Ukraine is envisioned as a balanced development of corporate and smallholder sectors, with a shift in priorities towards the development of small peasant and farmer households, as the foundation for ensuring the stability of the national food system, ecological safety, and rural development in the context of the administrative reform in Ukraine. The farmer structure with strong peasant family farms is more socially oriented, contributes to employment, and provides high-quality food using local resources. While large agricultural holdings, with alternative sources of financing, often having foreign beneficiaries, or powerful lobbyists in government structures, are self-sufficient, however the development of small agriculture enterprises requires strong government support.

For the successful development of farming in Ukraine, it is necessary to develop an appropriate National Plan with a non-declarative nature, but with clear spatial and temporal criteria for the relevant implementation. This plan should be an integral part of the reconstruction plan of Ukraine with appropriate guarantees of financing, implementation and control (Fig. 3).

For the successful implementation of the perspective plan, an appropriate conceptual-legal and organizational-institutional basis should be created, with further functional support for the implementation of its stages.

The conceptual-legal basis (see Fig. 3) will include the national and international context, which requires legislative guarantees and compliance with international guidelines. We believe that it is primarily necessary to establish farming as the basis of the national agrarian system by making appropriate changes to the Constitution of Ukraine, which will officially define farming as the basis for the formation of a powerful middle class in the countryside. In Poland, for example, the priority of family farming is enshrined at the constitutional level: Article 23 of the Constitution of Poland defines that "… the basis of the agricultural system of the state is family farming" (Bilousova, 2021). The status of agricultural entities should be defined in the Budget Code, and other legislative changes should be made to guarantee them systematic state financial support.

The National Action Plan for the Development of Farming should be adapted to the Common Agricultural Policy (CAP) of the European Union, which is especially relevant in the context of Ukraine's European integration aspirations. At the same time, it is necessary to ratify and take into account the provisions of the UN Declaration "On the Rights of Peasants and Other People Working in Rural Areas" (UNDROP). Also, one of the significant contemporary trends and guidelines for the development of agriculture and rural areas in Ukraine should be the UN Decade of Family Farming (2019–2028), which will significantly facilitate the attraction of international finance for sectoral reform, as well as promote the development and consultative support for the farming movements in Ukraine.

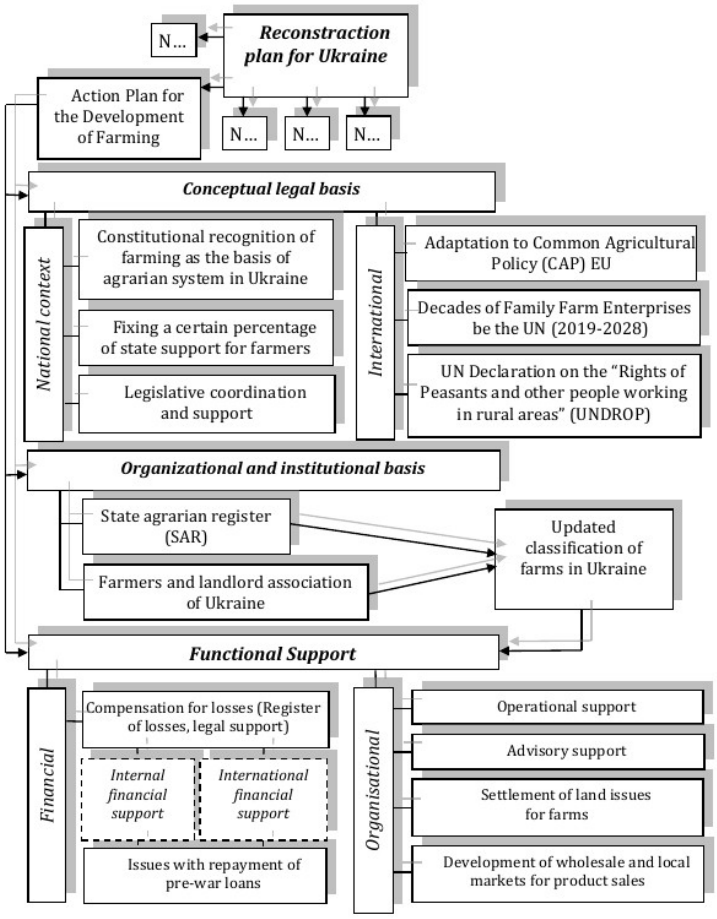

Fig. 3: Preconditions for the development of the National Action Plan for the Development of Farming

The organizational and institutional basis for the development of the national farming development plan (see Fig. 3) should provide conditions for the structural-functional realization of its stages. For this aim the State Agrarian Register (State Agrarian Register, 2022) already operates in Ukraine, which is an automated electronic system created by the Ministry of Agrarian Policy for the effective and transparent mobilization and allocation of all types of support for Ukrainian agrarians, both from the state budget and in the form of preferential loans, international grants, or technical assistance. The Association of Farmers and Private Landowners of Ukraine should play an important role in ensuring effective control over the distribution of financial resources and targeted support for agricultural entities, as the most professional and competent structure in the industry's problems, which is organizationally represented in all regions of the state.

In Ukraine, there is no clear classification of farms, and this complicates the process of state support for the development of farming, because the cultivated areas of different farmers can differ hundreds of times. In our opinion, it is necessary to classify farms clearly based on the criteria of scale of activity and their specialization with the introduction of appropriate changes to the laws of Ukraine "About farming" (Verkhovna Rada of Ukraine, 2003), "About amendments to some laws of Ukraine regarding the functioning of the State Agrarian Register and improvement of state support producers of agricultural products" (Verkhovna Rada of Ukraine, 2020).

The goal of the Plan is to implement practical stages for the development of farming, which should be based on the principles of predictability and long-term planning. To achieve this, it is necessary to introduce longer planning periods for the development of the agricultural sector – by analogy with the five-year budget planning within the EU's Common Agricultural Policy (CAP).

Functional support for the National Action Plan for the Development of Farming (see Fig. 3) includes financial and organizational components, which should ensure the implementation of reforms at the empirical level. Along with compensation for direct losses due to hostilities, it is necessary to address the issue of the return of loans taken out by farmers before the war to purchase equipment, planting material, etc., which were destroyed or stolen (including the harvest) in the zone of hostilities. The Plan should also clearly define the structure of internal and international sources of funding.

In order to ensure the effective implementation of the agricultural reform in Ukraine, operational support, which involves the coordination and start of the implementation of relevant strategies and action plans in the field of reform, becomes important. This is preceded by the legislative regulation of land issues in the agrarian sector of the economy and the provisions of legislation on the market circulation of land.

For the successful implementation of the National Action Plan for the Development of Farming, the advisory institute, the development of wholesale and local markets for the sale of products, logistics infrastructure (Kolodiichuk et al., 2023), outsourcing (Kolodiichuk et al., 2021), etc., are of great importance. Most of such projects should, in our opinion, be implemented within the framework of public-private partnership.

6 CONCLUSIONS

Thus, farming is the weakest link of the national agrarian structure, as a result of inadequate state support and unfair competition from agricultural holdings. However, with the start of full-scale war, farmers and individual peasant farms have demonstrated the highest adaptability in preserving and developing local food markets and supply chains and have become a reliable source of food for the population. Nevertheless, almost all agricultural producers of Ukraine were affected by the hostilities, which faced unprecedented challenges, among which we highlight: military blockade by the aggressor of sea routes for the traditional export of grain crops; catastrophic losses of capital assets due to their destruction and theft; disruption of traditional logistics chains of sales of products and supply of working capital, which, against the background of the decline of the national economy, caused their shortage and significant increase in prices and significantly limited the access of business entities to their purchase due to the lack of working capital. The mining of fields in the de-occupied territories and in the war zone significantly increases the risks of conducting field work, and the forced migration and mobilization of workers in the industry causes a shortage of labor resources, which, against the background of forced power outages and the destruction of infrastructure, inhibits their effective use.

Quantifiable and timely information received from satellite data regarding the amount of food produced by both free-Ukraine and Russian-occupied Ukraine provides us with critical tools needed for making balanced policy and trade decisions, for adapting to changes, and for managing resources more effectively. While the war continues, NASA Harvest continues using Earth observations to shed light on the state of agriculture throughout the Black Sea region. Understanding changes in planted area, types of crops being produced, crop yields, damaged lands, and changes in farming practices due to the war are very helpful to inform policy makers locally, and ultimately help to stabilize food supply and reduce market volatility on the global level.

We see the model of the post-war structure of Ukraine's agriculture in the balanced development of the corporate and small commodity sectors with a shift in priorities to the development of small peasant and farm holdings. For this, it is necessary to develop a National Action Plan for the Development of Farming, which should be an integral part of the post-war reconstruction plan of Ukraine, with appropriate guarantees of funding, implementation and control. For the successful implementation of the long-term plan, it is necessary to create an appropriate conceptual-legal and organizational-institutional basis with further financial and organizational support for the implementation of its stages. Compensation for losses caused by the war and changes in the state's agrarian system in the direction of supporting the development of farming will contribute to the stability of the national food system, environmental security and socially oriented development of rural areas in the context of land and administrative reform in Ukraine.

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