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RESILIENT LOGISTICS AND INFRASTRUCTURE IN THE GRAIN MARKET OF UKRAINE: CHALLENGES AND ADAPTIVE STRATEGIES

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Abstract. This article examines the resilience of logistics and infrastructure in Ukraine's grain market amid geopolitical disruptions, particularly since the onset of Russia's full-scale invasion in 2022. Ukraine, a global leader in grain exports, faced unprecedented challenges to its logistics network, including extensive damage to critical transportation routes, storage facilities, and port infrastructure. The study identifies the primary vulnerabilities exposed by these disruptions and analyzes adaptive strategies adopted by stakeholders within the grain supply chain. Emphasis is placed on innovative logistical adjustments such as diversified export routes via railways, road transport, and river ports, as well as the strategic shift towards temporary grain storage solutions and enhanced regional infrastructure. The analysis further highlights the role of international partnerships, governmental initiatives, and private sector flexibility in maintaining grain export continuity. Data-driven insights illustrate how effective coordination and investment in resilient infrastructure have mitigated losses and sustained operational efficiency. The findings underscore the importance of proactive, diversified logistics planning and infrastructure adaptability to secure Ukraine's position in global grain markets despite ongoing instability. The article concludes with strategic recommendations aimed at strengthening long-term infrastructure resilience and logistical flexibility to ensure sustainable agricultural trade under persistent geopolitical uncertainties.

Keywords: resilient logistics, grain market, infrastructure resilience, adaptive strategies

Introduction

This research is pertinent due to the substantial disruptions and notable alterations in Ukraine's grain market infrastructure and logistics resulting from Russia's full-scale invasion in 2022. Historically, Ukraine has been a significant global contributor to grain production and export, essential for maintaining global food security. The logistical delays caused by the invasion have significantly impacted Ukraine's economic stability and international food supply systems. Confronting these problems is essential for maintaining agricultural productivity and trade robustness.

The grain market in Ukraine depends significantly on a comprehensive logistical network that includes highways, railways, waterways, storage facilities, and port infrastructure. Since February 2022, numerous essential infrastructural components have incurred substantial damage. The immediate repercussions include the obliteration and deterioration of essential transportation routes, grain storage facilities, and processing units, exacerbated by the extensive contamination of agricultural grounds with mines and unexploded munitions. Consequently, essential agricultural assets, such as machinery and storage facilities, have incurred significant losses.

The object of the research is the infrastructure and logistics system of Ukraine's grain market under conditions of geopolitical instability, specifically focusing on the post-2022 period.

The study aims to evaluate the resilience of Ukraine's grain market logistics and infrastructure, identify vulnerabilities exposed by geopolitical disruptions, and analyze adaptive strategies implemented by stakeholders to sustain export continuity.

The research objectives are to analyze adaptive logistical and infrastructural strategies to develop practical recommendations aimed at strengthening infrastructure resilience and logistical flexibility to ensure sustainable agricultural trade under ongoing geopolitical uncertainty.

The research methods employed include qualitative and quantitative analyses, statistical data analysis from international and federal publications, and a comparison of export logistics before and after the geopolitical upheavals. The study also takes into account real-world implementation examples of adaptive logistics systems and lessons from frameworks for international collaboration. Given the scope and complexity of the problems facing Ukraine's grain market, this study offers important new information about how infrastructure modifications, creative logistics planning, and improved international cooperation might strategically increase resilience. The findings are intended to give policymakers, farmers, and logistics companies practical ways to protect Ukraine's crucial position in the world's grain markets in the face of ongoing geopolitical threats.

Theoretical Foundations of Resilient Logistics and Infrastructure

Resilient logistics is defined as the ability of supply chains to anticipate, prepare for, respond to, and recover from disruptive events while ensuring the continuity of operations (Christopher, Peck, 2004). In a broader context, resilience refers not only to physical robustness but also to adaptability, flexibility, and redundancy within critical infrastructure systems (Folke et al., 2010).

Agricultural logistics and infrastructure encompass transportation networks, storage facilities, and border-crossing capacities that collectively determine the efficiency of grain markets (Notteboom, Rodrigue, 2017). The literature highlights three primary pillars of resilience: flexibility, redundancy, and visibility. Flexibility enables rapid adjustments in supply chains, redundancy provides backup routes and capacities, while visibility and information sharing enhance coordination among stakeholders (Vlajić, 2017; Ivanov et al., 2020).

The Ukrainian grain market illustrates how these theoretical concepts translate into practice. The diversification of export routes through western railway crossings and Danube ports, the adoption of temporary modular storage facilities, and the expansion of digital logistics management systems represent practical applications of resilience theory under conditions of geopolitical instability.

Challenges to Grain Market Infrastructure in Ukraine

Ukraine is now faced with an immense challenge in this respect, as an estimated 16 million hectares are at risk of mine contamination, which is more than a quarter of the country's total area. Out of these 16 million hectares, about 11.2 million hectares are farmland. To put this in perspective: this figure is comparable to the entire stock of all farmlands in Germany and poses an immense challenge. A huge and sustained effort is needed to demine these lands to enable their safe cultivation once again. According to KSE (2023), the total cost of farmland demining in Ukraine is currently estimated in the range of $12.8–26.6 billion.

The largest category of damages is agricultural machinery, constituting almost 57% of all damages, or $5.8 billion; damages to tractors lead the way in terms of subcategories, with up to $1.6 billion lost. Overall, more than 21% of all available stock of agricultural machinery and equipment in Ukraine is completely or partially damaged.

The second-largest damaged category of assets is grain and oilseed stocks. This category faced not only physical destruction but also systematic theft by Russia, a topic widely covered in leading global media outlets. The estimated damages attributed to the destruction and theft of stored products amount to $1.9 billion, involving an estimated 4 million metric tons of grain and oilseeds.

The third-largest damaged category of assets is storage facilities, which account for 17.5% of all damages, or $1.8 billion. According to the assessment, out of Ukraine's initial storage capacity of 75 million tons before the invasion, nearly 11.3 million tons of storage capacity have been destroyed, and a further 3.3 million tons have been partially damaged. The impact on storage capacity becomes even more pronounced when considering that some facilities, though physically intact, are situated in occupied territories and are thus inaccessible to Ukrainian agricultural producers. Granaries are a category that suffers damage even at relatively far distances from the front line. Although only 37.5% of agricultural land in Kharkiv Oblast was under occupation at the peak of the invasion, 61% of storage facilities in the region were fully or partially damaged, according to the IPSOS (2023) study. As discussed earlier, we cannot include storage facilities destroyed by missile strikes due to methodological limitations. This resulted in a 19.5% reduction in agricultural storage capacity, not including storage facilities that remain intact but are inaccessible due to the occupation.

Table 1. Agricultural losses from war by species

	Completely destroyed (units)	**Partially destroyed (units)**	**Damage in millions of US dollars**
Agricultural machinery	–	–	5831.9
Tractors	130 529	18 184	1611.3
Trucks	78 678	9 899	511.0
Combine harvesters	31 588	4 663	978.7
Grain cleaners	21 591	3 016	63.9
Granary (t. tone)	11 351	3 341	1802.9
Grain crops, ha	4 857	–	121.4

In 2024, despite difficult conditions and military risks, several grain elevators were built and expanded in various regions of Ukraine. Some of them are small farm elevators, while others belong to large enterprises or international projects. Typically, modern equipment is used during construction, and alternative fuels for grain dryers are increasingly being chosen. Many projects have received financial support or grants from

international organizations, in particular USAID, or from large Ukrainian agricultural companies. The total additional capacity, according to preliminary open data from IPSOS (2023), exceeded half a million tons. The active attraction of funds for the construction and modernization of grain storage facilities indicates the interest of agribusiness in expanding infrastructure. It is especially noteworthy that several new terminals and transshipment complexes have appeared in the western and border regions, where producers seek to strengthen export logistics. Thus, even in difficult times, the domestic agricultural sector continues to develop and invest in high-quality grain storage.

Table 2. Regional distribution of grain storage capacities in Ukraine and their development after 2022

Region	Total Storage Capacity, mln t	Number of Grain Storages	Capacity Built Since 2022, thousand t
Chernivtsi	0.26	11	30
Zakarpattia	0.7	7	20
Ivano-Frankivsk	0.58	15	35
Lviv	1.2	42	85
Ternopil	2.0	56	170
Volyn	1.1	33	192
Rivne	1.1	25	73
Zhytomyr	2.8	52	50
Kyiv	2.6	70	40
Chernihiv	3.3	75	240
Sumy	2.6	49	47
Cherkasy	2.8	67	90
Khmelnytskyi	3.4	75	300
Vinnytsia	4.4	104	230
Kirovohrad	3.6	92	50
Zaporizhzhia	0.42	10	-1828.7
Poltava	5.3	107	240
Kharkiv	2.2	64	10
Luhansk	0.0	0	-880
Donetsk	0.36	7	-727
Dnipropetrovsk	3.0	90	40
Mykolaiv	3.5	60	10
Odesa	5.1	90	50
Kherson	0.2	6	-1686.5

The compiled data reveal a marked disparity between regions actively enhancing grain infrastructure (Chernivtsi, Zakarpattia, Volyn, Khmelnytskyi, Vinnytsia) and those that have incurred substantial losses from hostilities and occupation (Zaporizhzhya, Kharkiv, Luhansk, Donetsk, Kherson). The former are constructing new elevators, augmenting storage capacities, and initiating processing complexes, whereas in the eastern and southern regions, certain grain storage facilities are either damaged or inaccessible, with loss volumes in some areas exceeding one million tons, highlighting a significant disparity in the development and accessibility of agricultural capacities under wartime conditions.

The total operational length of railway tracks in Ukraine is 19.760 km (Ukrainian Railways, 2023), reflecting significant infrastructure development required for efficient grain market logistics. The distribution of track lengths across areas is unjust. The most extensive railway networks are situated in regions with substantial concentrations of industrial, agricultural, and port infrastructure.

- Mykolaiv region – 1.695 km (essential for grain exports)
- Dnipropetrovsk region – 1.552 km (notable industrial hub and grain transit point)
- Kharkiv region – 1.520 km (essential railway hub)
- Lviv region – 1.263 km (connection to western borders for EU exports)
- Odesa region – 1.035 km (port access)

Nonetheless, the railway system faces numerous obstacles. A fundamental problem is the limited capacity on specific essential routes, leading to delays in grain transportation, especially during peak harvest periods. The limited availability of grain wagons during the harvest season often causes delays and increases transportation expenses.

Adaptive Strategies and Logistical Adjustments

The Polish railway emerged as a conduit to the global market for Ukrainian exporters following the onset of the conflict. In 2022, 16.9 million tons of freight were conveyed over railway border crossings between Ukraine and Poland. It is a 36.7% increase compared to 2021. From January to April 2024, 7.4 million tons of merchandise were moved by rail to Poland. It is a 28% increase compared to the corresponding period in 2023. There exist six railway border crossings between Ukraine and Poland; however, only four are now active. As stated by Ukrainian Railways (2023), they are employed by 40–60%.

Numerous impediments obstruct the optimal usage of existing capacities at railway border crossings between Ukraine and Poland. Specifically, almost 10 Polish carriers operate at the Yagodyn – Dorokhusk and Mostyska-2 – Medika crossings. The issue pertains to the prioritization of infrastructure access among various Polish rail companies.

Companies also report a shortage of grain trucks, fitting platforms, and Eurorail locomotives. Transshipment capacities at the border are insufficient for Ukrainian exports. Control measures are redundant as they are executed by both Polish and Ukrainian agencies.

The European logistics infrastructure is not able to fully process the entire flow of Ukrainian exports for several reasons. Firstly, EU ports are relatively small and often do not have sufficient capacity to receive Ukrainian cargo, which leads to delays when wagons line up at border crossings. Secondly, the railway systems of Ukraine and the EU differ in track gauge: Ukraine uses a wide track (1520 mm), while in Europe the standard is 1435 mm, which requires additional operations for cargo handling. In addition, European railway carriers have a shortage of wagons and locomotives, which further reduces their ability to transport promptly. Also, there is a lack of handling capacity at border crossings, and the limited capacity of certain sections of European railways creates additional obstacles to the timely delivery of goods.

Institutional and International Response

Since May 2022, the Solidarity Lanes have facilitated the movement of about 174 million tonnes of goods from Ukraine, comprising around 83 million tonnes of grain, oilseeds, and other agricultural items. Simultaneously, they have enabled the importation of almost 70 million tonnes of vital products into Ukraine, including military and humanitarian assistance, fuel, and other important supplies. The overall trade value created through these corridors is estimated at €211 billion, with around €149 billion attributed to imports into Ukraine as reported by the European Commission (2023).

The Solidarity Lanes have been crucial in sustaining economic flows; nonetheless, they cannot entirely replace maritime exports. These terrestrial routes are constrained in capacity and incur substantially elevated logistics expenses. In contrast, the Black Sea Grain Initiative (BSGI) provided a more effective export route. Nonetheless, its potential was limited by heightened dangers and persistent uncertainty stemming from Russia's activities.

Notwithstanding the establishment of new routes via the BSGI and initiatives to bolster the EU-Ukraine Solidarity Lanes (ESL), Ukraine's agricultural exports have seen significant disruptions since the onset of the war. Wheat shipments declined by approximately 39% from 2021 to 2022. Conversely, oilseed shipments surprisingly increased throughout the same timeframe. This was primarily influenced by advantageous export pricing, which exceeded domestic processing margins and encouraged direct seed exports. Consequently, total vegetable oil exports decreased by 15%, with rapeseed oil exports falling by 60%, sunflower seed oil by 16%, and other oils (HS 1510) by 50% (United Nations, 2023).

This alteration in export composition resulted in a notable decrease in domestic vegetable oil reserves. USDA data (2023) indicates that initial inventories declined by 72% (a reduction of 93 thousand tonnes), while final stockpiles diminished by 52% (44 thousand tonnes) by autumn 2022 relative to the same period in 2021.

Corn continues to be the predominant grain in Ukraine's export composition, bolstered by substantial carryover stocks and advantageous logistics to key EU markets. Despite a slight recovery in wheat export shares since July 2023, volumes continue to fall far short of 2021 levels. In 2023, sunflower seed exports have reached unprecedented levels, contrasting with Ukraine's usual export trend, in which over 95% of sunflower seeds are typically processed domestically into oil and meal (USDA, 2022). This atypical rise was once more propelled by comparatively improved export prices, notwithstanding escalating transportation expenses and obstructions at Ukraine's western rail frontiers (MAPF, 2023).

In 2023, the USAID Economic Support to Ukraine Project (USAID Project), as part of the Agricultural Sustainability Initiative in Ukraine (AGRI-Ukraine), assisted Ukrainian agricultural exporting companies by procuring advanced equipment to enhance and expedite grain exports from Ukraine.

The USAID Project acquired 146 units of equipment valued at approximately $12 million for 16 partner companies. This encompasses hopper wagons, maxibags for grain conveyance, scales for weighing vehicular transport, grain samplers, telescopic loaders, generators, and additional equipment. Due to the utilization of this equipment, the enterprises shipped more than 203.000 tons of grain last year. Despite the opening of transport routes through the BSGI and efforts to enhance trade via the ESL, agricultural exports from Ukraine have been significantly hindered since the start of the war (USDA, 2023).

Ukraine has implemented the diversification of export channels as a crucial adaptation strategy to bolster the resilience of grain market logistics in the face of geopolitical volatility. This method is directly associated with two fundamental components of supply chain resilience theory (Christopher, Peck, 2004; Folke et al., 2010): flexibility and redundancy. In this context, flexibility is demonstrated by the capacity of Ukrainian exporters to rapidly transition from conventional seaports—such as Odesa and Mykolaiv, which sustained considerable damage—to alternative pathways via land borders with the European Union (e.g., the Yahodyn-Dorohusk and Mostyska-Medyka railway crossings), as well as river ports along the Danube. This swift reorientation mitigated disruptions in grain supplies and preserved export capacity despite the destruction of a portion of the conventional infrastructure.

Redundancy in this context was evident through the existence and utilization of many backup export pathways. Before the crisis, Ukraine's logistics infrastructure primarily depended on exports via Black Sea ports. Damage to port facilities necessitated the establishment and enhancement of supplementary routes through western railway networks and road travel. Despite their limited capacity and elevated costs, the availability of these alternate channels substantially mitigated the likelihood of a total cessation of export operations.

Consequently, the diversification of export channels exemplifies the practical implementation of infrastructure resilience concepts. This illustrates the significant adaptive potential of Ukraine's logistical systems and infrastructure in reaction to crisis shocks and validates the efficacy of incorporating resilience theory into the operation of the nation's grain market amidst ongoing geopolitical instability.

However, despite international initiatives, Ukraine's agricultural exports have not reverted to pre-war levels. While the BSGI and ESL have offered some alleviation, they have also underscored the pressing necessity for diversifying logistics routes and strengthening international collaboration. Maintaining the resilience and sustainability of Ukraine's agricultural commerce during wartime presents a significant challenge.

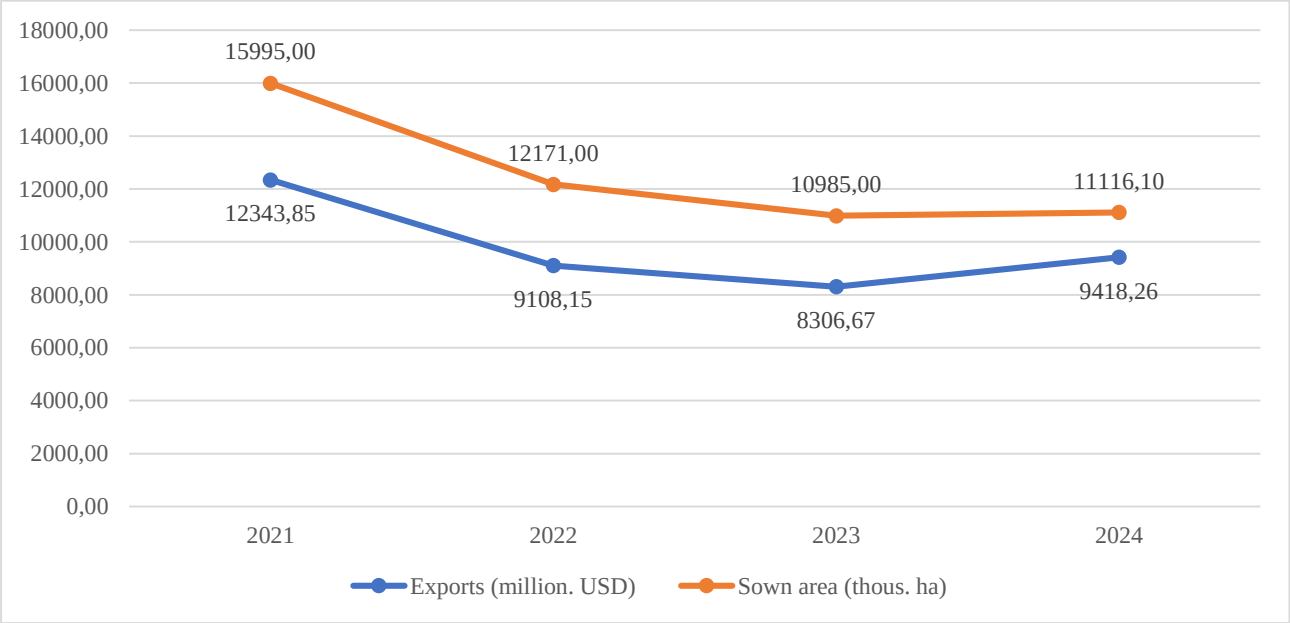

Fig. 1. Dynamics of Sown Area and Grain Exports (2021–2024)

As the graph provided by the SSC of Ukraine (2024) illustrates, both the sown area and grain exports in Ukraine have shown a steady decline from 2021 to 2024. Despite the implementation of initiatives such as the Black Sea Grain Initiative and the EU's Solidarity Lanes, the data clearly indicate that these measures have not been sufficient to restore pre-war levels of agricultural activity and trade. The sustained drop in both indicators reflects the ongoing challenges faced by Ukraine's grain sector, including logistical disruptions, infrastructural damage, and geopolitical instability. This trend underscores the limited impact of current support mechanisms and highlights the need for more comprehensive and long-term solutions.

Recommendations for Sustainable Infrastructure Development

Based on the analysis conducted in this study and supported by international experiences, several strategic recommendations are proposed to enhance infrastructure resilience and logistical flexibility within Ukraine's grain market.

Firstly, Ukraine should prioritize the development of multimodal logistics hubs integrating rail, road, and river transport. Such hubs effectively reduce dependency on single transportation methods and enhance overall logistical flexibility. A notable example of this is the Duisburg intermodal logistics hub in Germany, which efficiently integrates rail, river, and road transport, enabling swift adjustments to disruptions and ensuring continuous operations (Notteboom, Rodrigue, 2017).

Secondly, given significant reductions in storage capacity due to conflict-related disruptions, the adoption of modular, temporary grain storage systems is recommended. For instance, mobile grain storage solutions developed by Canadian firms such as Ag Growth International (AGI) have successfully provided rapid and flexible storage options during emergencies, significantly enhancing resilience in affected regions (AGI, 2023).

Thirdly, integrating digital logistics management platforms is critical for enhancing supply chain visibility. Platforms such as FreightWaves SONAR, widely implemented in the United States, have demonstrated effectiveness in providing real-time transportation and logistical data, thus enabling more responsive and efficient supply chain management (FreightWaves, 2023).

Fourthly, Ukraine should expand the adoption of alternative fuels and energy-efficient technologies, notably biogas and solar energy, to ensure greater operational autonomy for grain storage and drying facilities. Successful examples include agricultural enterprises in Germany and the Netherlands, which have substantially reduced vulnerabilities related to energy disruptions through these technologies (European Commission, 2022)

Fifthly, enhancing logistical efficiency through technological innovations in border and customs procedures is essential. Automated X-ray scanning and digitized documentation systems at the Polish-German border have reduced border crossing delays for freight traffic by approximately 30–40%, offering a robust model for Ukraine's logistics infrastructure improvements (European Union Agency for Railways, 2021).

Additionally, investment in smart infrastructure, employing Internet of Things (IoT) sensors and artificial intelligence for infrastructure monitoring and maintenance, should be pursued. The Port of Rotterdam's successful application of IoT-based monitoring demonstrates substantial gains in infrastructure reliability and reduced downtime (Port of Rotterdam Authority, 2022).

Lastly, fostering international cooperation through joint infrastructure projects with neighboring EU countries can enhance border infrastructure capacity and resilience. The Rail Baltica project, a joint initiative of Estonia, Latvia, and Lithuania supported by the EU, serves as a successful example of how multinational cooperation can significantly strengthen regional logistical capabilities (Rail Baltica, 2023).

These recommended practices and technological innovations will collectively contribute to the substantial strengthening of Ukraine's grain market infrastructure resilience, thus ensuring sustainable agricultural trade amidst ongoing geopolitical uncertainties.

Conclusion

Based on comprehensive analysis and in-depth exploration of resilient logistics and infrastructure within Ukraine's grain market, several critical insights and contributions can be articulated.

This study thoroughly examined the significant disruptions and vulnerabilities faced by Ukraine's grain market infrastructure following the geopolitical crisis initiated by Russia's full-scale invasion in 2022. The unprecedented challenges, including extensive damage to transportation routes, storage facilities, and port infrastructure, highlighted the crucial need for resilient and adaptive logistical frameworks. Employing qualitative and quantitative methodologies, this research identified key areas of vulnerability and systematically analyzed adaptive strategies adopted by stakeholders within the grain supply chain.

The analysis demonstrated that diversified export routes through railways, road transport, and river ports effectively mitigated risks associated with infrastructural damage. Notably, the strategic implementation of modular grain storage solutions, increased reliance on alternative fuels, and advancements in regional infrastructure significantly enhanced the flexibility and redundancy of logistics systems. Furthermore, the findings underscored the pivotal role played by international partnerships and governmental initiatives, such as the Solidarity Lanes and the Black Sea Grain Initiative, in sustaining Ukraine's agricultural trade under complex and challenging circumstances.

Drawing upon international best practices and technological innovations, several strategic recommendations were proposed to further strengthen the resilience of Ukraine's grain market infrastructure.

Key recommendations included the development of multimodal logistics hubs, the adoption of modular grain storage systems, integration of digital logistics management platforms, expansion of alternative energy solutions, streamlining border and customs procedures, investment in smart infrastructure, and fostering international collaborations. These measures are supported by successful international examples, such as Germany's Duisburg logistics hub, Canada's temporary grain storage solutions, the United States' FreightWaves SONAR platform, automated border control technologies used in the EU, and the Rail Baltica infrastructure initiative.

The practical implications of this research are substantial, offering policymakers, agricultural stakeholders, and logistics companies actionable strategies to enhance infrastructural resilience and logistical flexibility. The recommendations provided not only aim to address immediate vulnerabilities but also prepare Ukraine's grain market infrastructure for sustained performance and recovery under ongoing and future geopolitical uncertainties.

Ultimately, this study contributes valuable insights to the academic discourse on supply chain resilience, particularly in conflict-affected regions, and provides a robust framework for future research. Continued focus on infrastructure resilience and adaptive logistical practices is essential to safeguard Ukraine's crucial position within global agricultural trade networks, underscoring the broader implications of resilient logistics systems for global food security and economic stability.

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ATSPARI LOGISTIKA IR INFRASTRUKTŪRA UKRAINOS GRŪDŲ RINKOJE: IŠŠŪKIAI IR PRISITAIKYMO STRATEGIJOS

Santrauka

Šiame straipsnyje nagrinėjamas Ukrainos grūdų rinkos logistikos ir infrastruktūros atsparumas geopolitinių sukrėtimų kontekste, ypač nuo 2022 m. prasidėjus visapusiškai Rusijos invazijai. Ukraina, būdama viena iš pasaulinių grūdų eksportavimo lyderių, susidūrė su precedento neturinčiais iššūkiais savo logistikos tinklui – buvo smarkiai pažeisti svarbūs transporto maršrutai, sandėliavimo objektai ir uostų infrastruktūra. Tyrime atskleidžiamos pagrindinės šių sukrėtimų pažeistos vietos ir analizuojamos grūdų tiekimo grandinės dalyvių taikomos prisitaikymo strategijos. Dėmesys skiriamas logistikos naujovėms, tokioms kaip diversifikuoti eksporto maršrutai geležinkeliais, kelių transportu ir upių uostais, taip pat strateginiam perėjimui prie laikino grūdų sandėliavimo ir regioninės infrastruktūros stiprinimo. Analizėje taip pat pabrėžiamas tarptautinių partnerysčių, vyriausybinių iniciatyvų ir privataus sektoriaus lankstumo vaidmuo siekiant išlaikyti grūdų eksporto tęstinumą. Duomenimis pagrįstos įžvalgos parodo, kaip veiksmingas koordinavimas ir investicijos į atsparią infrastruktūrą padėjo sumažinti nuostolius ir išlaikyti veiklos efektyvumą. Rezultatai pabrėžia aktyvaus, diversifikuoto logistikos planavimo ir infrastruktūros prisitaikymo svarbą siekiant užtikrinti Ukrainos poziciją pasaulinėje grūdų rinkoje nepaisant esamo nestabilumo. Straipsnis baigiamas strateginėmis rekomendacijomis, skirtomis stiprinti ilgalaikį infrastruktūros atsparumą ir logistikos lankstumą siekiant užtikrinti tvarią žemės ūkio prekybą esant nuolatinei geopolitinei įtampai.

Reikšminiai žodžiai: atspari logistika, grūdų rinka, infrastruktūros atsparumas, prisitaikymo strategijos

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