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TRANSPORT SYSTEM VULNERABILITY IN GLOBAL FOOD SECURITY. THE CASE OF WAR IN UKRAINE

INTRODUCTION

The Russian invasion of Ukraine has disrupted traditional food export routes, posing a significant threat to global food security. The study investigates how geopolitical conflicts reshape international food transport networks, using the example of Ukraine to examine the broader implications of war for global agri-food systems. Conflicts and wars are widely recognised as major drivers of food insecurity and malnutrition worldwide (FAO, 2023). The use of food as a tool of war has a long historical legacy, from siege tactics aimed at starving civilian populations, such as the Nazi blockade of Leningrad during the Second World War (Reid, 2012), to more recent policies of food deprivation and restriction employed as instruments of coercion and political leverage, as exemplified by Israel's starvation strategy in its conflict with Gaza (Kennedy, 2024). These historical and contemporary examples illustrate how the weaponisation of food not only inflicts suffering on targeted populations but also generates ripple effects across a globally interconnected food system. The war in Ukraine, as a case of such instrumentalization, has revealed how national conflicts can swiftly escalate into global food supply crises, underscoring the vulnerability of international food transport infrastructures to geopolitical shocks.

Ukraine, after Russia, is one of the world's major exporters of cereals and vegetable oils, particularly to markets in the Global South. The outbreak of war in 2022 led to the closure of the Black Sea export corridor, previously responsible for the majority of Ukraine's agricultural trade. This disruption significantly reduced global food supply volumes and triggered price volatility on international commodity markets. Countries such as Algeria, Somalia, Libya, Lebanon, Egypt, Sudan, and Yemen – highly dependent on Ukrainian grain – faced the risk of famine and social destabilisation.

The specificity of the Ukrainian war lies in its dual impact on food security: it poses a direct threat at the national level, especially to food-importing countries in the Middle East and North Africa, and simultaneously undermines the international stability of food trade networks, exposing structural weaknesses in global logistics. Ukraine's position as a logistical hub for agri-food flows thus links a regional military conflict to a system-wide crisis of access, affordability, and predictability in food markets.

Despite its significance, the transportation dimension of global food security remains conceptually and empirically underexplored in mainstream food policy and international relations literature. While research has increasingly addressed food production, market liberalisation, and food security governance (Clapp, 2020; Shaw, 2007), relatively few studies have examined the role of transport corridors as infrastructures of both economic exchange and geopolitical influence (Dosunmu, Mogbojuri, 2022; Nelson et al., 2021; Ayodele, Oluwagbenga, 2023). Food transport systems are not politically neutral. They are embedded in territorial logics, dependent on diplomatic alignments, and vulnerable to deliberate disruption. Physical chokepoints such as ports, railway junctions, and inland logistics hubs function not only as technical nodes but also as strategic leverage points. Bailey and Wellesley (2023) have argued that even short-term disruptions in key transport corridors can have outsized effects on food access and affordability at the global scale. When targeted during conflict, these corridors become fault lines of global security, affecting the flow of critical food commodities and intensifying hunger in regions already at risk.

The article tries to address this gap by problematising the link between conflict and transport in the context of food security, with a focus on the case of Ukraine. It aims to assess how wartime conditions expose the vulnerabilities of food transport systems and to reflect on the difficulties of reconfiguring trade routes under geopolitical pressure. The research question adopted for the purpose of analysis is: how has the Russia-Ukraine war exposed the vulnerabilities of food transport systems, and what are the strategic, economic, and geopolitical challenges to developing resilient alternative export routes from Ukraine? The article adopts a problem-setting perspective and does not aim to provide prescriptive policy solutions or new knowledge. Rather, it frames the key dimensions of the problem through a combination of geopolitical analysis and infrastructure-focused inquiry.

Methodologically, the study is based on desk research and uses secondary data from international institutions (FAO, WTO, European Commission), think tank reports, and peer-reviewed academic literature. Due to the problem-setting character of this article, empirical research, such as interviews or surveys with stakeholders, was deliberately not planned. Such methods are, however, envisaged as a crucial element of future research, including in the framework of a grant proposal submitted to the National Science Centre (NCN) in June 2025. Similarly, the preparation of layered cartographic visualisations of transport corridors, tailored to the specificities of food commodities and legal frameworks in transit countries, requires extensive empirical input and has been planned for subsequent stages of research.

The article is structured in three parts. It begins by situating transport systems within global food security, addressing why they have been insufficiently recognised in dominant governance frameworks. Then, on the example of Ukraine, it identifies

and analyses the transport vulnerabilities revealed by the war. The last part explores the broader strategic and economic challenges to building resilient food transport corridors in Ukrainian context.

THE ROLE OF TRANSPORT SYSTEMS IN GLOBAL FOOD SECURITY

Transport systems are a fundamental but frequently underexplored component of global food security. While prevailing scholarship and policy frameworks have traditionally emphasized agricultural production, trade flows, and food access, the logistical dimension, namely the physical movement of food, remains marginal in food security governance. This oversight is problematic, as the stability of food supply chains depends heavily on reliable and resilient transportation infrastructure (FAO, 2021a).

At the conceptual level, global food security is defined by the FAO (FAO, 1996) as a situation when "all people, at all times, have physical and economic access to sufficient, safe and nutritious food to meet their dietary needs and food preferences for an active and healthy life." This definition highlights four core dimensions: availability, access, utilization, and stability. Transport systems influence all of them. Efficient infrastructure enables the movement of agricultural surpluses to markets (availability), reduces the time and cost of delivery (access), supports the timely distribution of diverse food products (utilization), and provides alternative routing capacity in cases of supply chain disruption (stability).

Transport systems serve thus as the connective 'tissue' of global agri-food networks. They facilitate not only the domestic distribution of food but also the international flow of commodities from surplus to deficit regions. These systems span roads, railways, ports, inland waterways, and multimodal logistics corridors that together enable just-in-time delivery across increasingly complex global supply chains (Ayodele, Oluwagbenga, 2023). According to the Nelson et al. (2021), transportation resilience is now considered critical for maintaining food market stability in the face of systemic shocks. Yet despite this relevance, most food security policies and studies address transport issues only peripherally, if at all.

Recent disruptions have highlighted the systemic fragility of transport-dependent food systems. The COVID-19 pandemic, for example, led to widespread border closures, port slowdowns, and shipping container shortages, revealing the narrow logistical foundations on which global food trade is built (CWFS, 2020). More recently, the Russia-Ukraine war demonstrated how the loss of a single export corridor – the Black Sea – can dramatically destabilize food prices and access across multiple continents (WTO, 2023a). These crises underscore the extent to which physical trade corridors constitute a global food security infrastructure in themselves.

Structural chokepoints such as the Suez Canal, Panama Canal, Turkish Straits, and key railway hubs in Central and Eastern Europe and Central Asia are increasingly recognized as strategic vulnerabilities. Bailey and Wellesley (2023) have mapped these global chokepoints and argue that disruption in just one node of the transport network can ripple through global markets, affecting both food availability and affordability. These vulnerabilities are particularly severe for grains and oilseeds, where a small

number of maritime corridors handle a large percentage of global trade flows. For instance, over 50% of global grain exports transit through seven maritime chokepoints, making them critical nodes whose disruption can cause cascading effects across continents (Bailey, Wellesley, 2023). The Suez Canal blockage in 2021, although brief, resulted in shipment delays that affected food commodity prices across Africa and the Middle East (Glauber, Mamun, 2024). In fragile economies, chokepoint disruption can translate directly into food insecurity, political unrest, and humanitarian crises.

This risk is magnified in countries with fragile infrastructure or limited access to diversified trade routes, particularly in Africa, South Asia, and the Middle East. Many import-dependent countries rely disproportionately on a few export corridors, when these corridors are disrupted, they lack the logistical flexibility to substitute alternative suppliers quickly and cost-effectively. Moreover, transportation systems are not politically neutral. They are embedded in geopolitical configurations and are often instrumentalized as tools of influence or coercion. As Walker (2023) and Koch (2020) argue, states have historically used control over trade corridors and infrastructure projects to assert regional power and political leverage. Russia's blockade of Black Sea ports after the 2022 invasion of Ukraine offers a striking contemporary example of food transport weaponization, where the obstruction of grain exports became a strategic bargaining tool in diplomatic negotiations (Goncharenko, 2022). Similarly, China's Belt and Road Initiative has been interpreted by some scholars as an effort not only to enhance connectivity but also to consolidate geopolitical influence over key food supply corridors linking Asia, Africa, and Europe (Tortajada, Zhang, 2021)). Infrastructure projects that shape transport routes are thus deeply political choices with consequences for global food security, market dependencies, and regional hierarchies of power.

Despite these challenges, global food policy frameworks continue to underemphasize the role of transport. As Clapp and Moseley (2020) observe, global food security governance has prioritized production increases and trade liberalization, often overlooking the infrastructural requirements necessary for moving food efficiently. Similarly, the FAO (2021a) and WTO (2021) have only recently begun to integrate transport resilience into their assessments, usually in the context of post-crisis analysis rather than proactive planning.

Transport systems are thus a structural determinant of global food security. Their fragility, especially in times of crisis, transforms local disruptions into global threats. Understanding food security without accounting for the underlying transport infrastructure is therefore analytically incomplete. The following section explores how these vulnerabilities have materialized in the case of Ukraine, where war-induced disruptions to transport systems have exposed the urgency of rethinking resilience in global food logistics.

TRANSPORT SYSTEM VULNERABILITIES UNDER THE CONDITIONS OF RUSSIAN-UKRAINIAN WAR

The Russian-Ukrainian war has illustrated the multidimensional nature of transport system vulnerabilities in global food security. The disruption of agricultural exports

from Ukraine, one of the world's largest grain suppliers, revealed the extent to which modern food systems are embedded in fragile logistical and geopolitical frameworks. What initially appeared to be a regional war quickly evolved into a global food supply crisis, not only because of halted production, but because of the breakdown in the transportation systems that support global food flows.

From a theoretical perspective, vulnerabilities in transport systems can be broadly categorized into several dimensions: infrastructural, regulatory, political, geographical, and institutional (ITF 2024). Infrastructural vulnerabilities refer to inadequate or outdated physical systems, including ports, roads, railways, and inland waterways, that cannot accommodate shifts in traffic or emergency rerouting. Regulatory vulnerabilities emerge from inconsistent customs procedures, lack of harmonization in phytosanitary standards, and inefficient border management systems. Institutional vulnerabilities arise when coordination between national agencies, regional authorities, and international actors is insufficient or delayed. Geopolitical vulnerabilities arise when trade corridors pass through regions subject to military conflict, diplomatic tensions, or unpredictable policy shifts. Such vulnerabilities can paralyze supply chains through either intentional blockades or collateral damage to transport infrastructure. As Clapp (2020) and Rodrigue (2020) argue, supply chains have become more interconnected and globalized, but not necessarily more resilient. This contradiction creates systemic risk, where failure at one node, such as a port or rail crossing, can ripple across regions and markets.

The Ukrainian case illustrates these abstract vulnerabilities in concrete ways. The most visible weakness was the overdependence on maritime exports through the Black Sea. Before the war, over 90% of Ukraine's grain exports were shipped through three ports: Odesa, Mykolaiv, and Chornomorsk. The blockade of these ports transformed a localized conflict into a global crisis. The lack of alternative bulk export infrastructure meant that Ukraine's export system was unable to recover quickly, and the entire grain supply chain was exposed. Rail transport was hampered by technical vulnerabilities, particularly the incompatibility between Ukrainian (1,520 mm) and European (1,435 mm) rail gauges. As a result, transshipment at border crossings was slow and capacity-limited. Furthermore, critical terminals lacked the equipment to process the sudden increase in volume, resulting in backlogs and inefficiencies. The Danube River, another key export alternative, suffered from port congestion in Reni and Izmail, limited navigability of the Sulina Canal in Romania, and dependence on outdated shipping infrastructure.

Beyond technical challenges, Ukraine's situation revealed significant regulatory and institutional weaknesses. Border delays were not only caused by infrastructure but also by inconsistent customs procedures, lack of interoperable digital systems, and weak coordination among EU member states and Ukrainian authorities. Even initiatives such as the EU's "Solidarity Lanes," while well-intentioned, fell short due to their reliance on fragmented national logistics systems and ad hoc administrative processes rather than an integrated strategy.

Political vulnerabilities further complicated the situation. In 2023, several EU member states, particularly Poland, Hungary, and Slovakia, temporarily blocked the import of Ukrainian agricultural products to protect domestic farmers. Although these

restrictions were aimed at local markets, they disrupted transit flows and created uncertainty for exporters. The lack of a unified EU stance and the fragility of bilateral agreements exposed how politically sensitive cross-border transport remains even within allied frameworks.

Another overlooked vulnerability was the shortage of resilient storage infrastructure. With ports closed and export routes disrupted, Ukraine faced mounting surpluses of grain without the capacity to store them safely. Post-harvest losses increased, especially in areas affected by shelling, power outages, or logistical isolation. This lack of buffer infrastructure made Ukraine's food system even more susceptible to cascading failures (FAO, 2022).

These compounded vulnerabilities did not only impact Ukraine's exports, they also destabilized food access in import-dependent regions such as North Africa and the Middle East. The WTO (2023b) and UNCTAD (2024) noted that transport chokepoints had become the primary bottleneck in global grain markets, not the production shortfall per se. Therefore, addressing these vulnerabilities is not just a national priority for Ukraine, but a global food security imperative.

Even though war in Ukraine did not create vulnerabilities in global food transport systems, it revealed and intensified those already embedded in an increasingly interdependent world. Physical infrastructure, regulatory frameworks, political cooperation, and strategic planning were all tested and, in many cases, found lacking. Attempts to address these weaknesses focus on a broader reconfiguration of food transport systems, one that is both necessary and fraught with strategic challenges.

Ukraine and its international partners have taken steps to establish alternative transport routes, including land corridors through Poland and Romania, river transport via the Danube, and limited use of Baltic Sea ports. However, these alternatives revealed deep logistical and infrastructural constraints, such as rail gauge incompatibilities, limited port capacity, and border congestion (Åslund, 2022, France24, 2022).

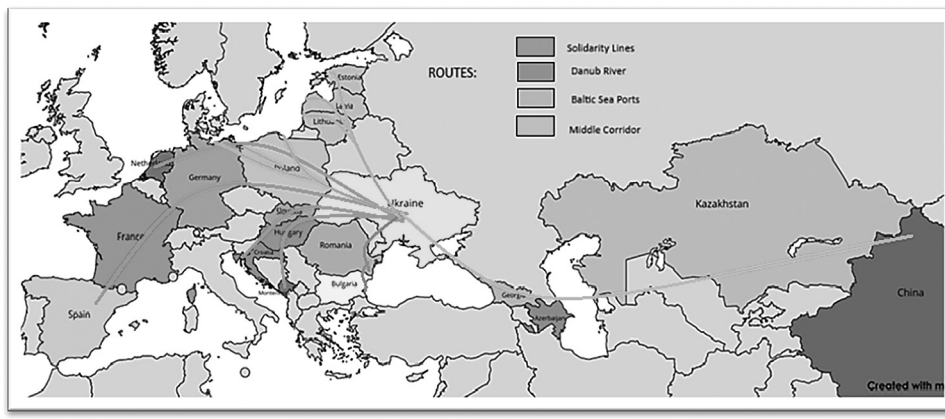
The "Solidarity Lanes" initiative by the European Union, launched in mid-2022, aimed to provide relief by creating land and river-based export channels. Yet, despite initial success in facilitating the export of over 60 million tonnes of agricultural products, the alternative routes remained plagued by structural issues. For instance, the incompatibility between Ukrainian and European railway gauges required labour-intensive and time-consuming transshipment processes at border crossings (European Commission 2023, 2025).

The rerouting of exports to the Danube River placed unexpected stress on port facilities in Reni, Izmail, and Kiliya. While these ports have seen a 40% increase in export activity compared to pre-war levels, their limited infrastructure and dependence on the Sulina Canal in Romania make them susceptible to delays and congestion (Rudyk et al., 2023). The canal itself is narrow and subject to seasonal navigation constraints, further compounding the problem. In 2023 alone, multiple week-long backlogs were reported, and some shipments missed international delivery deadlines.

Baltic ports such as Gdańsk, Klaipeda, and Riga offered another potential outlet for Ukrainian exports. However, the long overland distances to reach these ports added significant logistical complexity and cost. Transshipment requirements, inconsistent customs protocols, and the lack of streamlined digital documentation systems across

borders further slowed operations. Although Ukrainian exports through Baltic ports increased by over 50% compared to 2022 (Actia Forum, 2023), the process remains inefficient and heavily dependent on EU logistical and financial support.

The Middle Corridor, a multimodal route linking Ukraine through the Black Sea, the Caucasus, and the Caspian Sea with Central Asia and China, has been discussed as a possible long-term alternative. However, this option faces serious limitations. The corridor is fragmented and costly. Transport requires multiple changes of mode, at least five customs border crossings, and coordination among countries with very different regulatory systems. Infrastructure along the route is insufficient, intermodal terminals are scarce, and institutional cooperation remains weak. As a result, transit is slow, expensive, and vulnerable to delays (RailFreight, 2024). Due to these constraints, reliable food-specific logistics through this corridor remain a challenge and will require further in-depth investigation in future research. An overview of the main alternative transport routes for Ukrainian agri-food exports is presented in Map 1.



Map 1. Alternative transport routes for Ukrainian agri-food exports: Solidarity Lanes, Danube River, Baltic Ports and the Middle Corridor

Source: Own elaboration based on open-access sources.

THE NEED FOR RESILIENT TRANSPORT SYSTEMS: CHALLENGES TO THE RECONFIGURATION OF FOOD EXPORT ROUTES FROM UKRAINE

The disruption of Ukraine's food export system has underscored the necessity of enhancing transport resilience in global agri-food networks. In both policy and academic debates, resilience refers to the capacity of a system to absorb shocks, adapt to new conditions, and maintain its core functions in the face of disruption (Tendal et al., 2015; Mian et al., 2020; FAO, 2021b,c, 2024). In the context of food transport, resilience implies the ability to ensure continuity of supply through diversified, flexible, and politically secure trade corridors. The war in Ukraine has shown that without such resilience, entire regions can experience heightened food insecurity even if production levels remain constant.

The strategic challenge of building resilient transport systems begins with the need for corridor diversification. Ukraine's dependence on the Black Sea maritime corridor prior to the war exemplifies the dangers of overreliance on a single route. As Rodrigue (2020) argues, chokepoint dependency increases systemic risk, as localized disruptions can cascade across global supply chains. Reconfiguring Ukraine's export system requires creating alternative corridors that are not only physically viable but also embedded in supportive institutional and diplomatic frameworks. However, strategic reconfiguration also faces substantial geographical and technical limitations. Ukraine's landlocked western border lacks deep-water port access, and while Danube ports such as Reni and Izmail offer alternatives, their capacity is constrained by physical bottlenecks and seasonal river navigability. Similarly, rail corridors to Baltic ports are long, complex, and require transshipment due to track gauge mismatches. Infrastructure upgrades, including gauge adjustments, intermodal terminals, and improved customs facilities, are necessary but demand long timelines and substantial investment.

Beyond physical infrastructure, resilient transport systems require robust institutional coordination. Ukraine's post-2022 experience with the EU's "Solidarity Lanes" initiative revealed the importance of harmonized customs procedures, interoperable logistics systems, and integrated governance across borders (European Commission, 2023). However, the initial ad hoc nature of the response and recurring administrative barriers underscore how the absence of a strategic governance framework undermines resilience. Inter-institutional gaps, misaligned national regulations, and inconsistent enforcement have limited the effectiveness of these emergency corridors.

The economic challenges of reconfiguring food transport systems are equally significant. Alternative routes are generally less efficient and more expensive than the pre-war maritime corridor. There are estimations that transport costs for Ukrainian grain have increased by 30–40 USD per tonne due to the shift to land and river routes (Payne, Hunder, 2023). These higher costs reduce export competitiveness, strain public budgets, and ultimately affect global food prices. For many low-income importing countries, even minor cost increases are passed on to consumers, further exacerbating food insecurity. Moreover, the lack of sufficient grain storage facilities inside Ukraine has compounded export problems. The destruction of storage infrastructure due to military operations, combined with limited capacity in alternative collection hubs, created logistical bottlenecks even before transport could begin. Without adequate storage solutions near alternative routes, the flexibility to respond to market openings is reduced, and large quantities of grain face spoilage risks. Enhancing domestic storage capacity is thus an often overlooked, but crucial, element of building a resilient export system.

Furthermore, resilience-building demands large-scale capital investment in infrastructure and logistics, investments that Ukraine, amid wartime fiscal pressures, cannot fully provide. International support, including EU funding and multilateral development financing, has helped in the short term but remains insufficient for long-term transformation. For example, planned modernization of the Izmail port and expansion of cross-border terminals with Poland and Slovakia remain delayed due to financial and coordination hurdles. In addition, the cost of insurance and cargo security has risen sharply. Geopolitical risk premiums and limited availability of coverage for war-

related disruptions have discouraged private investment in transport logistics. This deters innovation and prolongs reliance on outdated infrastructure. As Clapp and Moseley (2020) note, food system resilience depends not only on physical supply chains but also on financial instruments and market confidence, both of which remain fragile in Ukraine's case.

From a geopolitical perspective, reconfiguring food transport routes in times of war introduces risks related to trust, sovereignty, and competing national interests. Although regional cooperation is often presented as a solution, it is constrained by diverging policy priorities and historical grievances. The border disputes and unilateral bans imposed by Poland, Hungary, and Slovakia in 2023 illustrate how solidarity among allies can be eroded by domestic political pressure. Moreover, many of these measures were taken unilaterally, bypassing EU-level coordination mechanisms (Gijs, 2023). These tensions are not limited to Ukraine's immediate neighbours. The use of the Trans-Caspian "Middle Corridor" route depends on coordination among Georgia, Azerbaijan, Kazakhstan, and China, countries with differing levels of institutional capacity, regulatory frameworks, and strategic goals. As the WTO (2023b) observes, multilateral coordination is particularly difficult under conditions of geopolitical fragmentation, and this creates a paradox: the need for collaboration increases as global trust declines.

Food transport reconfiguration is therefore not just a logistical task, but a deeply political process. It demands sustained diplomatic engagement, bilateral and multilateral agreements, and alignment with broader trade and security strategies. The integration of food security considerations into geopolitical decision-making remains limited, as most states continue to treat food logistics as a technical rather than strategic matter (Wieck et al., 2024). As a result, resilience-building efforts are reactive and short-term rather than anticipatory and structural. Looking ahead, future research must focus more intensively on integrating risk analysis, resilience modelling, and geopolitical forecasting into food transport planning. The development of scenario-based models that anticipate multiple crisis pathways, including military disruptions, climate events, and economic blockades, will be critical to designing flexible logistics frameworks. Strengthening the interface between food security research, transport policy, and international relations is thus a key academic and policy challenge for the coming decade.

Ukraine's case shows that efforts to reconfigure food transport are indispensable but fraught with complexity. While the creation of land, river, and Baltic routes has enabled the partial restoration of exports, these solutions are neither structurally stable nor politically secure. The challenge is not only to build alternative routes, but to institutionalize their governance, secure long-term funding, and embed them in coherent international frameworks. This will require rethinking the architecture of international food governance, placing logistics and transport infrastructure at the heart of global food security strategies. At the global level, the war has served as a warning: food transport systems are now frontline infrastructures in geopolitical conflict. They can be targeted, disrupted, or used as instruments of leverage. Ensuring resilience in such a context demands a fusion of technical innovation, international cooperation, and political will. The question is no longer whether to reconfigure, but how to do so in a way that promotes equity, sustainability, and stability in the long term.

CONCLUSIONS

The article has analysed how the Russia-Ukraine war has exposed the vulnerabilities of global food transport systems and explored the strategic, economic, and geopolitical challenges associated with developing resilient alternative export routes from Ukraine. It has argued that food transport system play a critical role in shaping global access to essential agricultural commodities. The disruption of maritime corridors in the Black Sea revealed how dependent global markets are on a limited number of chokepoints and how vulnerable they remain to geopolitical shocks. As Ukraine's traditional export routes were obstructed by conflict, the resulting volatility in food prices and supply availability resonated globally, especially in regions with high import dependency.

The analysis helped to answer a research question formulated in Introduction: How has the Russia-Ukraine war exposed the vulnerabilities of food transport systems, and what are the strategic, economic, and geopolitical challenges to developing resilient alternative export routes from Ukraine? Undoubtedly, the war has exposed the multidimensional fragility of food transport systems. This fragility stems from their reliance on singular corridors, their exposure to militarised zones, and their embeddedness in complex political relationships. Alternative routes have offered partial relief, but they are hindered by infrastructural mismatches, logistical bottlenecks, border congestion, and political tensions among transit countries. Thus the Ukrainian case underscores the urgency of integrating transport systems into food security frameworks as a strategic priority.

REFERENCES

(CWFS) Committee on World Food Security, High Level Panel of Experts on Food Security and Nutrition (2020), *Impacts of COVID-19 on food security and nutrition: Developing effective policy responses to address the hunger and malnutrition pandemic*, HLPE, Rome, https://openknowledge.fao.org/server/api/core/bitstreams/8abcbe13-833e-4658-a339-4e3be593b66e/content (03.05.2025).

Actia Forum (2023), *Report performance of the 10 largest Baltic ports in the first half of 2023*, https://actiaforum.pl/wp-content/uploads/2023/10/BalticPortsH12023_total_containers.pdf (03.05.2025).

Åslund A. (2022), *Russia's War on Global Food Security, Atlantic Council Issue Brief*, 1.06.2022, https://www.atlanticcouncil.org/in-depth-research-reports/issue-brief/russias-war-on-global-food-security (03.05.2025).

Ayodele D. V., Oluwagbenga M. (2023), *The roles of transportation systems in food security and stability in Osun State, Nigeria*, „British Journal of Multidisciplinary and Advanced Studies", Vol. 4, No. 1: 72–81, https://doi.org/10.37745/bjmas.2022.0116.

Bailey R., Wellesley L. (2023), *Chokepoints and vulnerabilities in global food trade*, Chatham House, https://www.chathamhouse.org/2017/06/chokepoints-and-vulnerabilities-global-food-trade (03.05.2025).

Clapp J. (2020), *Food*, 3rd ed., Polity Press, Cambridge.

Clapp J., Moseley W. G. (2020), *This food crisis is different: COVID-19 and the fragility of the neoliberal food security order*, „The Journal of Peasant Studies", https://doi.org/10.1080/03066150.2020.1823838.

Dosunmu V. A., Mogbojuri O. (2022), *The roles of transportation systems in food security and stability in Osun State, Nigeria*, „British Journal of Multidisciplinary and Advanced Studies", https://doi.org/10.37745/bjmas.2022.0116.

European Commission (2023), *Solidarity Lanes: Study on EU Rail Connections with Ukraine and Moldova Suggests Deploying European Track Gauge on Key Lines*, 11.07.2023, https://enlargement.ec.europa.eu/news/solidarity-lanes-study-eu-rail-connections-ukraine-and-moldova-suggests-deploying-european-track-2023-07-11_en (03.05.2025).

European Commission (2025), *Solidarity Lanes: Latest Figures – February 2025*, 20.03.2025, https://transport.ec.europa.eu/news-events/news/solidarity-lanes-latest-figures-february-2025-2025-03-20_en (03.05.2025).

FAO (1996), *Rome Declaration on World Food Security and World Food Summit Plan of Action*, https://www.fao.org/3/w3613e/w3613e00.htm (03.05.2025).

FAO (2021a), *Robust Transport Networks Support Agrifood Systems' Resilience*, FAO Agricultural Development Economics Policy Brief No. 42, FAO, Rome, https://doi.org/10.4060/cb7663en.

FAO (2021b), *Making Agrifood Systems More Resilient to Shocks and Stresses*, FAO, Rome, https://openknowledge.fao.org/handle/20.500.14283/cb4476en (03.05.2025).

FAO (2021c), *The State of Food and Agriculture 2021: Making Agrifood Systems More Resilient to Shocks and Stresses*, FAO, Rome, https://openknowledge.fao.org/handle/20.500.14283/cb4476en (03.05.2025).

FAO (2022), *Note on the Impact of the War on Food Security in Ukraine*, FAO, July 2022, https://openknowledge.fao.org/server/api/core/bitstreams/bab94e66-bac6-4519-9b4f-47e8b68b8d5f/content (03.05.2025).

FAO (2023), *The State of Food Security and Nutrition in the World 2023. Urbanization, Agrifood Systems Transformations and Healthy Diets Across the Rural - Urban Continuum*, https://openk nowledge.fao.org/items/445c9d27-b396-4126-96c9-50b335364d01.

FAO (2024), *Building Resilient Food Systems: HLPE-FSN E-Consultation*, FAO, Rome, https://assets.fsnforum.fao.org/public/contributions/2024/Global%20Network%20contribution_Building%20resilient%20food%20systems.pdf (03.05.2025).

FAO, IFAD, UNICEF, WFP, WHO (2023), *The State of Food Security and Nutrition in the World 2023: Urbanization, Agrifood Systems Transformation, and Healthy Diets Across the Rural–Urban Continuum*, FAO, Rome, https://doi.org/10.4060/cc3017en.

France 24 (2022), *Russian blockade of Ukraine's ports puts global food supply at risk*, 12.05.2022, https://www.france24.com/en/europe/20220512-russian-blockade-of-ukraine-s-ports-puts-global-food-supply-at-risk (03.05.2025).

Gijs C. (2023), *Poland, Hungary, Slovakia impose own Ukraine grain bans as EU measure expires*, „Politico", 16.09.2023, https://www.politico.eu/article/poland-hungary-slovakia-extend-grain-bans-despite-blocs-lift/ (03.05.2025).

Glauber J., Mamun A. (2024), *Impacts of Red Sea shipping disruptions on global food security*, „IFPRI Blog", 17.01.2024, https://www.ifpri.org/blog/impacts-red-sea-shipping-disruptions-global-food-security (03.05.2025).

Goncharenko O. (2022), *Ukraine grain deal: World must still confront Putin's Black Sea blackmail, Atlantic Council*, 4.08.2022, https://www.atlanticcouncil.org/blogs/ukrainealert/ukraine-grain-deal-world-must-still-confront-putins-black-sea-blackmail/ (03.05.2025).

ITF (2024), *Transport System Resilience: Summary and Conclusions*, ITF Roundtable Reports, No. 194, OECD Publishing, Paris.

Kennedy G. (2024), *Gaza: Weaponisation of food has been used in conflicts for centuries – but it hasn't always resulted in victory*, „The Conversation", 1.02.2024, https://theconversation.com/gaza-weaponisation-of-food-has-been-used-in-conflicts-for-centuries-but-it-hasnt-always-resulted-in-victory-221476 (03.05.2025).

Koch N. (2020), *Food as a weapon? The geopolitics of food and the Qatar–Gulf rift*, „Security Dialogue", Vol. 51, No. 4: 305–322.

Mian J., Huse J. R., Aldea-Borruel X. (2020), *Resilience and complex interdependencies within and between global food supply networks and transportation infrastructure*, „Cereal Foods World", Vol. 65, No. 1: 2–9, https://doi.org/10.1094/CFW-65-1-0002.

Nelson A., de By R., Thomas T., Girgin S., Brussel M., Venus V., Ohuru R. (2021), *The Resilience of Domestic Transport Networks in the Context of Food Security – A Multi-Country Analysis*, FAO Agricultural Development Economics Technical Study No. 14, FAO, Rome, https://doi.org/10.4060/cb7757en.

Payne J., Blenkinsop P. (2023), *Inside EU, no clear financial options to reduce Ukraine grain transport cost*, „Reuters", 27.07.2023, https://www.reuters.com/markets/commodities/inside-eu-no-clear-financial-options-reduce-ukraine-grain-transport-cost-2023-07-27/ (03.05.2025).

Payne J., Hunder M. (2023, July 27), *Inside EU, no clear financial options to reduce Ukraine grain transport cost*, Reuters, https://www.reuters.com/markets/commodities/inside-eu-no-clear-financial-options-reduce-ukraine-grain-transport-cost-2023-07-27/.

RailFreight (2024), *Kazakhstan's ambitious plans to modernise its railway network*, https://www.railfreight.com/beltandroad/2024/12/18/kazakhstans-ambitious-plans-to-modernise-its-rail-network/ (03.05.2025).

Reid A. (2012), *Leningrad: Tragedia oblężonego miasta 1941–1944*, Wydawnictwo Literackie, Kraków.

Rodrigue J.-P. (2020), *The Geography of Transport Systems*, 5th ed., Routledge, London–New York.

Rudyk Y., Bubela T., Maciuk K. (2023), *The Russian-Ukrainian war: Transport and logistical support of the grain supply chain in regional food security*, „Zeszyty Naukowe Politechniki Śląskiej. Transport Series", No. 119: 223–233, https://doi.org/10.20858/sjsutst.2023.119.13.

Shaw D. J. (2007), *World Food Security: A History Since 1945*, Palgrave, Basingstoke–New York.

Tendall D. M., Joerin J., Kopainsky B., Edwards P., Shreck A., Le Q. B., Krütli P., Grant M., Six J. (2015), *Food system resilience: Defining the concept*, „Global Food Security", Vol. 6: 17–23, https://doi.org/10.1016/j.gfs.2015.08.001.

Tortajada C., Zhang H. (2021), *When food meets BRI: China's emerging Food Silk Road*, "Global Food Security", Vol. 29, art. 100518, https://doi.org/10.1016/j.gfs.2021.100518.

UNCTAD (2024), *Review of Maritime Transport 2024*, UNCTAD, Geneva, https://unctad.org/system/files/official-document/rmt2024overview_en.pdf (03.05.2025).

Walker S. (2023), *Turning food into a weapon: How Russia resorted to one of the oldest forms of warfare*, „The Guardian", 9.08.2023, https://www.theguardian.com/world/2023/aug/09/mines-drone-strikes-organised-plan-to-export-ukraine-grain-via-danube-ports-is-no-easy-fix (03.05.2025).

Wieck C. et al. (2024), *Geostrategic Dimensions of Recent Food Policy Decisions*, „Applied Economic Perspectives and Policy", Vol. 46, No. 1, https://onlinelibrary.wiley.com/doi/full/10.1002/aepp.13479 (03.05.2025).

World Trade Organization (2021), *World Trade Report 2021: Economic Resilience and Trade*, WTO, Geneva, https://www.wto.org/english/res_e/booksp_e/wtr21_e/00_wtr21_e.pdf (03.05.2025).

World Trade Organization (2023a), *Crisis in Ukraine: Implications of War for Global Trade and Development*, WTO, Geneva, https://www.wto.org/english/res_e/booksp_e/imparctukraine422_e.pdf (03.05.2025).

World Trade Organization (2023b), *World Trade Report 2023: Re-globalization for a Secure, Inclusive and Sustainable Future*, WTO, Geneva, https://www.wto.org/english/res_e/booksp_e/wtr23_e/wtr23_e.pdf (03.05.2025).

World Trade Organization (2023c), *Resilient and Sustainable Global Value Chains in Turbulent Times*, WTO, Geneva, https://www.wto.org/english/res_e/booksp_e/gvc_dev_rep23_e.pdf (03.05.2025).

ABSTRACT

This article analyses the vulnerability of global food transport systems, using the Russia – Ukraine war as an example. It is an attempt to critically identify and conceptually frame an often overlooked problem in food security governance: the strategic fragility of transport infrastructure. Using a geopolitical and infrastructural lens, the article demonstrates how armed conflict can disrupt international food flows not only through production shocks but by undermining vital logistical corridors. While emergency solutions such as the EU's Solidarity Lanes provided partial relief, the article argues that more strategic, long-term approaches are needed. It concludes that building resilient food transport systems is not merely a technical matter but a geopolitical priority, especially for institutions engaged in global or regional food governance.

Keywords: food transport, global food aecurity, war in Ukraine, logistical chokepoint, strategic infrastructure

WRAŻLIWOŚĆ SYSTEMÓW TRANSPORTOWYCH W GLOBALNYM BEZPIECZEŃSTWIE ŻYWNOŚCIOWYM. PRZYKŁAD WOJNY W UKRAINIE

STRESZCZENIE

Artykuł analizuje podatność globalnych systemów transportu żywności na zakłócenia, na przykładzie wojny rosyjsko-ukraińskiej. Stanowi próbę krytycznej identyfikacji i konceptualizacji często pomijanego problemu w zarządzaniu bezpieczeństwem żywnościowym – strategicznej kruchości infrastruktury transportowej. W ujęciu geopolitycznym i infrastrukturalnym pokazano, że konflikty zbrojne destabilizują światowe przepływy żywności nie tylko przez zakłócenia produkcji, ale także przez przerwanie kluczowych korytarzy logistycznych. Choć doraźne inicjatywy, takie jak Szlaki Solidarności Unii Europejskiej, przyniosły częściową ulgę, konieczne są bardziej strategiczne i długofalowe rozwiązania. W konkluzji podkreślono, że budowa odpornych systemów transportu żywności to nie tylko kwestia techniczna, lecz geopolityczny priorytet, szczególnie dla instytucji zaangażowanych w globalne lub regionalne zarządzanie żywnością.

Słowa kluczowe: transport żywności, globalne bezpieczeństwo żywnościowe, wojna w Ukrainie, „wąskie gardła" w logistyce, infrastruktura strategiczna

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