THE STRATEGIC PLANNING OF TRANSPORT INFRASTRUCTURE AND MANAGEMENT OF LOGISTICS SOLUTIONS IN CONDITIONS OF WAR

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Abstract: This article examines the challenges faced by Ukraine, which is embroiled in a military conflict within its borders, particularly the imperative to ensure the efficiency of its transport infrastructure and logistics processes. It has been identified that military actions result in damage to transport networks, restricted access to critical resources, and alterations in logistics operations. It has been established that in wartime conditions, strategic planning of transport infrastructure and effective management of logistics solutions become particularly pertinent as they dictate the country's capacity to meet its own needs and accomplish strategic objectives. Furthermore, it has been determined that Ukraine's future integration into Europe necessitates reforming its transport and logistics system to align with EU standards. Strategic approaches to restoring the transport network and addressing logistics challenges during conflict are discussed, primarily focusing on alternative routes, the development of effective supply chain management systems, and enhancing system redundancy. Strategies for adaptation and response to changes aimed at ensuring the reliability and efficiency of transport and logistics processes in Ukraine have been explored.

Keywords: strategic planning; logistics; transport infrastructure; logistics systems; logistics management.

1 Introduction

Amidst hostilities within its borders, Ukraine faces significant difficulties in logistics development and ensuring the efficiency of its transport infrastructure and logistics processes. Military actions destroy and damage transport networks, significantly limiting access to critical resources and causing adverse changes in the logistics systems of both private enterprises and the government. Therefore, in wartime conditions, strategic planning of transport infrastructure and the search for effective logistics management become particularly relevant, as they determine the country's capability to address its needs and accomplish strategic objectives amidst wartime adversity.

Under significant military and economic pressure, Ukraine faces multiple challenges in planning, executing, and controlling transport and logistics processes. This highlights the necessity to optimize strategic planning and logistics management to ensure the reliability, efficiency, and stability of the state's transportation infrastructure. Military conflict necessitates swift adaptation and response to evolving strategic conditions. Consequently, changes in transportation routes, resource redistribution, and access restrictions to key transport hubs require an operational response from logistics managers and relevant government agencies. A lack of precise management methods and strategies in these conditions may exacerbate the country's economic and humanitarian crises.

At the same time, Ukraine's future integration into Europe necessitates the formation of a competitive market for transport services, while existing issues in the functioning of transport infrastructure highlight the need for strategic planning by state administration bodies in this area. Considering international trends towards transferring the functions of forming and commercially operating transport infrastructure to the private sector through public-private partnerships, this direction of industry reform holds the most promise for financing its development. Furthermore, there are several issues related to increasing the environmental sustainability and inclusivity of transportation, aligning with EU standards. Finding solutions depends on strategic planning in infrastructure development management.

Thus, the aforementioned issues underscore the importance of studying strategic planning and management of logistics processes, considering the complexities of the military conflict, to ensure the stability and development of Ukraine's transport infrastructure, not only during the conflict but also in the context of its future European integration.

2 Literature Review

The study of strategic planning and management of logistics solutions has long attracted the close attention of researchers and practitioners. However, the scientific community is relatively new to considering the impact of military conflict on the country's transport infrastructure and logistics systems.

A key element shaping the strategy for managing logistics processes within the country is the strategic aspects of developing the country's transport infrastructure. It's notable that research by N. Antoniuk [1], M. Buryk [14], Y. Danshina [15], N. Hurzhyi [26], O. Laburtseva [30], J. Reitšpís [34], I. Sadlovska [36-37], I. Tofan [48], and S. Voloshyna [51] is dedicated to ensuring the effective functioning of the mechanism of strategic planning of transport infrastructure and related industries in the economic system. These studies provide insights for forming practical recommendations to manage transport infrastructure development planning amidst resource constraints.

Another critical area of research in this field is the study of strategies and technologies for managing logistics systems, with a particular focus on supply chain risk management. The works of I. Arakelova [2], M. Dziamulych [16-24], N. Khomiuk [27], M. Masl'an [31], T. Pertsovych [32], M. Rudenko [35], I. Tsymbaliuk [49], and A. Zaverbny [52] address this issue, focusing on strategies and approaches to ensure the sustainability of supply chains, mainly through sustainability and risk management.

In addition, it is worth noting that studies examining the adaptation and response of transport and logistics systems to external threats are evident in the works of I. Arutiunian [3], I. Britchenko [4-13], O. Fedorova [25], T. Kulinich [28-29], O. Ramos [33], T. Shmatkovska [38-44], R. Sodoma [45-47], and A. Verzun [50]. These authors explore methodologies for assessing the stability of transport systems and develop adaptable approaches, applicable even in conditions of military threats.

In general, amidst the constant threat of military operations and crises in modern times, examining the challenges related to effective management of transport and logistics systems in wartime conditions is essential for ensuring stability and efficiency for both governmental and commercial interests.

3 Materials and Methods

Several general and special scientific research methods were used to study both the strategic planning of transport infrastructure and the management of logistics solutions. These methods aim to analyze, synthesize, and compare available information, as well as to generalize and abstract data to develop practical strategies and solutions.

In particular, systems analysis was used to analyze the strategic management principles of transport infrastructure and logistics

chains. This method facilitated the identification of relationships between various system elements, assessment of their impact on system integrity, and the formulation of approaches to develop a management strategy aimed at optimizing the system's performance during wartime.

The synthesis method was used to develop new solutions and strategies by combining different approaches and techniques. In the research, this method facilitated the development of a scheme outlining the interaction of elements aimed at achieving economic results within the mechanism of strategic planning for transport infrastructure development. This scheme takes into account the unpredictability of the impact of military actions on the transport infrastructure.

Comparative analysis was used to compare strategies and solutions to determine their advantages and disadvantages. This facilitated the decision-making process to identify the most effective and optimal directions for improving the logistics solutions of Ukrainian enterprises during wartime.

The abstraction method was applied to generalize and simplify complex information to highlight key aspects and patterns. This method also aided in identifying the primary issues and factors influencing strategic planning and logistical decision-making in wartime conditions, thereby directing attention towards finding solutions.

Overall, the application of these methods in combination facilitated a comprehensive analysis and the development of approaches to formulate a strategy for strategic planning of transport infrastructure and management of logistical solutions in wartime conditions.

4 Results and Discussion

The modern problems of strategic planning of transport infrastructure and management of logistics solutions in wartime are complex challenges faced by the state or private companies in difficult times. Specifically, during hostilities, the efficiency and productivity of transport infrastructure can be significantly reduced due to the destruction of infrastructure facilities, closure of transport routes, restriction of access to critical resources, and alterations in transportation routes.

Furthermore, war creates instability, unpredictability, and increased risk for logistics supply chains. Moreover, the management of logistics decisions in wartime requires rapid adaptation and response to changes in strategic conditions. Hence, developing effective strategies to adapt to new situations and ensure an uninterrupted supply of essential goods and services poses a significant challenge. Additionally, consideration must be given to the humanitarian aspects of logistics management during wartime, such as supplying medical, food, and other critical goods to the civilian population in war-affected areas. In conclusion, the challenge in strategic planning for transport infrastructure and logistics management during wartime lies in establishing effective methods to ensure stability, safety, and reliability amidst challenging wartime conditions.

From a practical standpoint, the mechanism of strategic planning for the development of transport infrastructure encompasses technological procedures and rules for formulating a strategic plan, along with key elements that, through their interaction, embody the essence of planning and justify calculations to achieve necessary economic performance within a strategic timeframe. Additionally, the specified mechanism should account for the possibility of mitigating significant adverse effects, primarily from external environmental factors related to military operations, on the functional development of transport infrastructure. These elements of the strategic planning mechanism encompass fundamental and distinct functional strategies aimed at achieving the goals set for the transport infrastructure. Simultaneously, measures to implement these strategies are executed within a specific timeframe, amidst the influence of an unstable external environment.

At the same time, the management system of transport infrastructure comprises a range of elements, including state management bodies, target strategic settings, principles, methods, functions, tools, technologies, competencies, and resources. These interdependent components form a mechanism that influences the development of the transport system, infrastructure, and reproductive potential, ultimately ensuring the competitiveness of the economy. The primary objective of strategic planning is to facilitate practical collaboration among stakeholders to gather information about the needs and goals of transport infrastructure entities, and determine the tools required for their achievement. Furthermore, general issues regarding demand forecasting for transport services and its impact trends necessitate an analysis of market supply within the framework of strategic planning activities conducted by public administration bodies. Strategic planning in this regard relies on forecasting supply and demand, assessing transport industry opportunities, and analyzing infrastructure capacity to support long-term goals [14].

In war conditions, it is objectively necessary to form and rationalize the interaction of elements within the strategic planning mechanism for developing transport infrastructure. This is due to the limitations of the extrapolation method, making it challenging to predict the specific timing of the negative impact of external environmental factors on transport infrastructure. Elemental interaction within this framework should ensure the implementation of the following components:

- obtaining the most significant amount of balance sheet profit, aligning with the interests of both the transport infrastructure and the national economy;
- establishment of equality and balanced development for all business entities involved in the formation of transport infrastructure;
- increasing the level of competitiveness of services, products, and the entire transport infrastructure;
- ensuring the objectivity of planning and calculation justifications, resource and organizational capabilities, based on which the necessary economic results will be achieved, subject to the negative influence of external environmental factors;
- promotion of internal economic and structural-organizational changes, driven by the rising level of innovation in both current operations and future development of the transport infrastructure.

Ensuring the effective functioning of this mechanism, based on the use of various forms of financing and combined implementation of innovative legislative, financial, administrative, and other measures, is able not only to preserve existing elements of the transport infrastructure but also to ensure its development in the context of European integration. Even in wartime, each enterprise bears financial, administrative, organizational, and other types of responsibility for strategic development and infrastructure within the limits of financial plans and strategic goals defined at the national level. This presents an opportunity to rationalize the interaction of elements within the strategic planning mechanism for developing transport infrastructure. This can be achieved through analytical justification and systematic analysis to define its constituent elements. Additionally, quantitative parameters of the interaction of these elements are included in guiding the orientation of transport infrastructure to achieve necessary economic development results and enhance transport production efficiency in a strategic period (Figure 1).

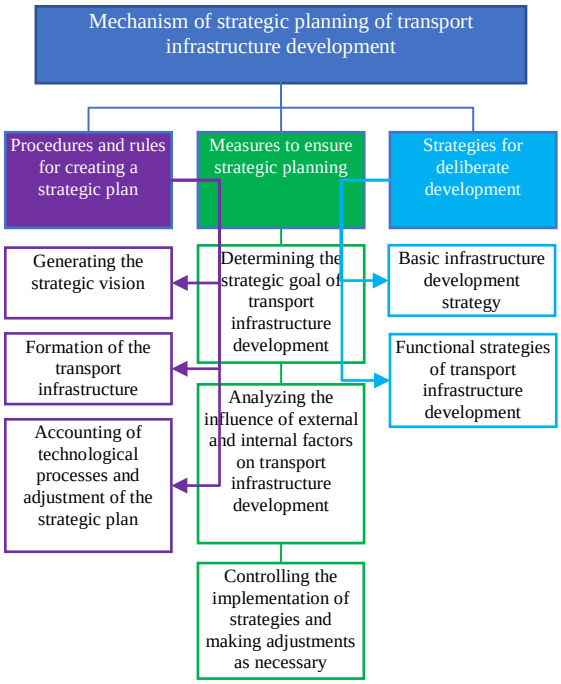

Figure. 1. Scheme outlining the interaction of elements aimed at achieving economic results within the strategic planning mechanism for the development of transport infrastructure Source: systematized by the author based on [36].

The effectiveness of implementing the strategic plan for transport infrastructure development can be evaluated using fundamental economic indicators adapted to the requirements of strategic planning. In particular, the following indicators are proposed:

1. Labor productivity of management personnel involved in the strategic planning process:

$$P_{lm} = \frac{\Delta I_{tc}}{N_{pm}}$$

where ΔI_{tc} is the increase in the volume of implementation of transport services;
N_{pm} is the number of managers employed in the strategic planning system during the year.

2. Capital return on fixed assets in the strategic planning system:

$$F_r = \frac{\Delta I_{tc}}{A_f}$$

where A_f is the average annual cost of fixed assets involved in the strategic planning system.

3. Material yield of material elements of working capital in the strategic planning system:

$$M_r = \frac{\Delta I_{tc}}{R_m}$$

where R_m is the average annual cost of material resources consumed in the strategic planning system.

4. Profitability of the strategic planning system:

$$P_{sp} = \frac{\Delta P \times 100}{A_f + C_w}$$

where ΔP is the average annual profit growth in the process of implementing the strategic plan for the development of transport infrastructure;

C_w is the average annual cost of working capital involved in the strategic planning system.

5. The overall efficiency of resource consumption in the process of strategic planning:

$$E_{rc} = \frac{\Delta P}{A_f + C_t}$$

where C_t is the average annual total cost of consuming all types of resources in the strategic planning system [37].

The efficiency of logistics systems is closely related to the technologies they employ. These technologies not only assist enterprises in implementing new logistical solutions and introducing new equipment during wartime but also enhance the efficiency of their activities by enabling the implementation of procedures that were previously inaccessible. This necessity is particularly evident in the need to improve the quality and efficiency of transportation management. Domestic enterprises are increasingly adopting innovative network production and logistics concepts to meet the requirements of the integral logistics paradigm. However, the non-standard business conditions caused by martial law have compelled enterprises to pay more attention to improving and adapting logistics systems to ensure the necessary level of competitiveness.

There are also certain aspects of logistics operations that, in wartime, prompt companies to widely adopt the latest technologies to ensure the efficiency of their operations. In particular, in wartime conditions, there is an absence of simple rules of the game, usually defined in the regulatory and legal fields. Therefore, logisticians are forced to seek alternatives to maintain the integrity of logistics chains. Some of these chains exhibit elasticity, while others do not. Consequently, optimizing these processes becomes challenging without the introduction of specialized databases that take into account new restrictions for the logistics system.

Logistics specialists also need to know the exact characteristics of products, including their physical attributes, value, and flow characteristics, alongside understanding material flows. Otherwise, products may be damaged during transportation due to improper handling or conditions. To ensure the continuity of material flows, modern warehouse complexes equipped with specialized equipment are necessary. This can be achieved by regional logistics enterprises, forming the basis for logistics systems in crisis conditions. The information flow in the field of logistics is dynamic, requiring constant monitoring of transportation development stages, market analysis, logistics innovation implementation, and tracking of transportation tariff dynamics. Considering these elements can significantly reduce logistics operation costs and further optimize processes, essential for enterprises in wartime conditions to reduce costs while achieving desired results.

Therefore, reorganizing storage, warehousing, risk forecasting, and route diversification are priority directions for forming an effective logistics system during the war. The optimization of logistics supply chains in such conditions, characterized by a high level of uncertainty, should be implemented based on monitoring the main logistics operations (Figure 2).

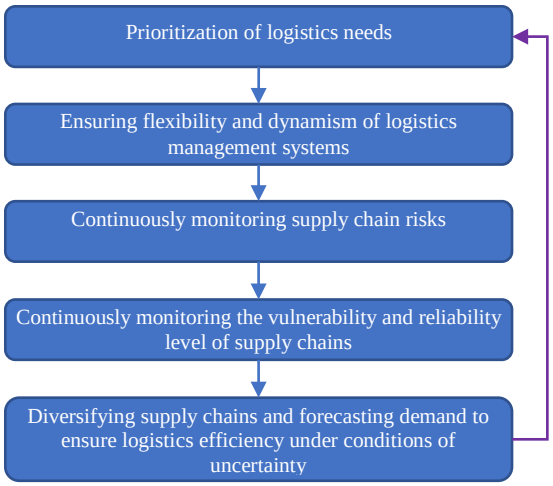

Figure. 2. The optimization sequence of logistics supply chains under conditions of uncertainty
Source: systematized by the author based on [52].

Based on the determined principles of optimisation, it is possible to determine the main directions of improvement of logistics solutions of Ukrainian enterprises during the war, to which it is appropriate to include the following:

- refusing to accumulate and store commodity stocks in significant volumes;
- ensuring a high level of dynamism in warehouse conditions;
- systematically complicating logistics operations by extending and diversifying supply chains;
- maximizing focus on consumer needs through effective demand forecasting and appropriate planning of sales and logistics operations.

During wartime, strategic decisions aimed at optimizing logistics processes, prioritizing efficiency and adaptability in conditions of instability, became crucial for Ukrainian enterprises. Consequently, understanding market needs, planning, and forecasting emerged as critical components of a successful logistics strategy in these circumstances.

5 Conclusion

We conclude that during wartime, which resulted in significant damage to Ukraine's supply chain system, it is imperative to diversify these chains, especially for critically important groups of goods. The primary cause of existing problems in logistics systems is a policy aimed at reducing logistics costs, which has increased the overall risk level at all supply chain stages. One effective solution to this problem is to utilize a sequence for optimizing logistics chains amidst uncertainty. Specifically, critical directions for improving the logistics systems of Ukrainian businesses during wartime should include refusing to accumulate stockpiles, increasing warehouse dynamism, and meticulously planning logistics operations.

In addition, strategic planning for transport infrastructure in Ukraine during wartime requires a comprehensive approach and careful analysis. Military actions pose significant challenges for transport systems, necessitating the development of strategies for adaptation and response to changing strategic conditions. Key priorities in this regard include enhancing the stability and reliability of the transport infrastructure, developing alternative routes, optimizing logistics process management, and ensuring transportation safety. An essential component of such a strategy should also involve cooperation with international partners and adopting innovative solutions to enhance the stability and development of Ukraine's transport system during wartime.

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