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DIGITAL TRANSFORMATION OF THE TRANSPORT COMPLEX AS A TOOL FOR SUSTAINABLE DEVELOPMENT IN WARTIME

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INTRODUCTION

In the face of unprecedented challenges posed by military conflict, the transport sector emerges as a critical domain requiring innovative approaches to ensure operational continuity and resilience. The research aligns with the United Nations Sustainable Development Goal 9: "Building resilient infrastructure, promoting inclusive and sustainable industrialization and fostering innovation" – a framework that takes on heightened significance in conflict zones where infrastructure vulnerability intersects with urgent humanitarian and economic needs.

The disruption of traditional transport networks during warfare necessitates rapid adaptation and technological innovation to maintain critical supply chains, enable humanitarian corridors, and support economic activity. Digital technologies offer transformative potential in this context, providing tools for real-time monitoring, alternative routing, infrastructure protection, and operational optimization when physical systems are compromised. This digital pivot not only addresses immediate wartime challenges but also lays groundwork for more resilient, efficient, and sustainable transport systems in post-conflict reconstruction.

As we examine the intersection of digital transformation, transport infrastructure, and conflict environments, this article provides insights into how technological innovation can support sustainable development principles even under the most challenging circumstances, contributing to long-term resilience building while addressing immediate operational imperatives in a war-affected transport ecosystem.

The Ukrainian transport complex plays a crucial role in the country's economy, ensuring connectivity between various sectors and regions, as well as interaction with other states. Today, it can be confidently stated that transport is a vital prerequisite for the functioning of industry, agriculture, trade, and other sectors. It is one of the fundamental branches of the economy, actively contributing to the creation of necessary conditions for defense capability, national security, state integrity, and the improvement of the population's living standards, as well as generating revenues for the State Budget of Ukraine[1].

The transport system also plays a key role in the functioning of the domestic market by ensuring the mobility of goods between different regions

[1] М.Гоцуляк, П.Лагоденко. Транспортна галузь в системі національної економіки Украни. URL: http://oldconf.neasmo.org.ua/node/1879 (дата звернення: 20.03.2025)

of the country. Additionally, it is a critical element of foreign economic activity, supporting export and import processes. Ukraine's strategic geographical location at the crossroads of trade routes creates significant potential for gaining additional benefits from globalization processes, provided that the transport infrastructure[2] is actively developed and fully utilized. This, in turn, facilitates Ukraine's integration into the European and global economic systems[3], opening up new opportunities for trade, investment, and economic growth.

Unfortunately, it must be stated that Ukraine's transport infrastructure faces numerous challenges, including a high level of wear and tear, insufficient funding, managerial issues, and significant destruction caused by the armed conflict.

For example, according to the European Business Association, Ukraine's Infrastructure Index has stood at 2.58 out of 5 possible points since 2020, indicating a moderate assessment of the country's infrastructure development level[4]. The performance of government agencies and transport monopolies also received low ratings. In particular, the activities of "Ukravtodor" were rated at 2.9 out of 5, indicating the need for improved management and a reduction in corruption within the sector[5].

The armed conflict with the Russian Federation has caused significant destruction to Ukraine's transport infrastructure. As of February 2025, direct losses in this sector are estimated at $38.5 billion. In particular, nearly 26,000 km of roads have been damaged or destroyed, accounting for approximately $28.3 billion in losses. The railway sector has suffered damages amounting to $4.3 billion, while port infrastructure has incurred losses of $0.85 billion[6].

Summarizing the above, it can be stated that the key challenges for Ukraine's transport sector today are – see Figure 1.

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[2] В.М.Бондаренко. Функціонування транспортного комплексу регіону та формування його оптимальних транспортно-економічних зв'язків. *Електронний журнал «Державне управління: удосконалення та розвиток»*. URL: http://www.dy.nayka.com.ua/?op=1&z=915 (дата звернення: 25.03.2025)

[3] М.Гоцуляк, П.Лагоденко. Транспортна галузь в системі національної економіки Украни. URL: http://oldconf.neasmo.org.ua/node/1879 (дата звернення: 20.03.2025)

[4] Стан розвитку транспортної інфраструктури в Україні: на трієчку. URL: https://logistics-ukraine.com/2020/12/04/%D1%81%D1%82%D0%B0%D0%BD-%D1%80%D0%BE%D0%B7%D0%B2%D0%B8%D1%82%D0%BA%D1%83-%D1%82%D1%80%D0%B0%D0%BD%D1%81%D0%BF%D0%BE%D1%80%D1%82%D0%BD%D0%BE%D1%97-%D1%96%D0%BD%D1%84%D1%80%D0%B0%D1%81%D1%82%D1%80 (дата звернення: 22.03.2025)

[5] Бізнес оцінив стан і визначив пріоритети розвитку транспортної інфраструктури, – опитування ЕВА. URL: https://eba.com.ua/biznes-otsinyv-stan-i-vyznachyv-priorytety-rozvytku-transportnoyi-infrastruktury-opytuvannya-eva (дата звернення: 22.03.2025).

[6] Це не лише енергетичні втрати. Проведено оцінку загальних збитків інфраструктури України внаслідок війни — який з секторів зазнав найбільших втрат? URL: https://25tv.com.ua/content/i-ce-ne-energetika-pidrahovano-zagalni-zbitki-infrastrukturi-ukrayini-cherez-viynu-yakiy-sektor-postrazhdav-naybilshe (дата звернення: 20.03.2025).

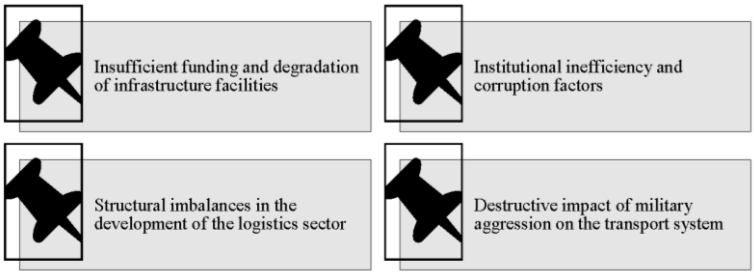

Fig. 1. Key Challenges for Ukraine's Transport Sector

Thus, these data highlight the urgent need for comprehensive reforms and significant investments to restore and modernize Ukraine's transport infrastructure.

1. Challenges of the transport complex in war conditions

With the onset of russia's full-scale invasion of Ukraine, the country's transport infrastructure has suffered extensive damage[7]. According to a report by the Kyiv School of Economics, as of January 2024, the direct losses from infrastructure destruction are estimated at $170 billion, of which $38.5 billion accounts for transport infrastructure[8]. In particular, over 26,000 km of roads have been damaged, costing the country $28.3 billion. The railway sector ($4.3 billion), port infrastructure ($0.85 billion), and aviation industry ($2 billion) have also suffered significant losses[9].

Furthermore, according to Ukraine's Prime Minister Denys Shmyhal, 15 out of the country's 20 civilian airports have been damaged as a result of hostilities[10]. These destructions have caused significant disruptions in passenger and freight transportation, limiting population mobility and complicating export-import operations.

The blockade of key ports on the Black Sea and the destruction of transport routes have forced Ukrainian businesses to redirect their supply

[7] Екологічні проблеми України: наслідки війни. / уклад. О.О.Найдьонова; Центральноукраїн. нац. техн. ун-т. Кропивницький: ЦНТУ, 2023. 19 с. URL: https://dspace.kntu.kr.ua/server/api/core/bitstreams/bc504da0-4d3a-43e5-bf3a-855bf50d72fd/content (дата звернення: 30.03.2025)

[8] Звіт про прямі збитки інфраструктури від руйнувань внаслідок військової агресії росії проти України станом на початок 2024 року. URL: https://kse.ua/wp-content/uploads/2024/04/01.01.24_Damages_Report.pdf (дата звернення: 25.03.2025)

[9] Руйнування інфраструктури України оцінили у $170 млрд – звіт KSE. URL: https://gazeta.ua/articles/economics/_rujnuvannya-infrastrukturi-ukrayini-ocinili-u-170-mlrd-zvit-kse/1208484 (дата звернення: 22.03.2025)

[10] Ukraine says war has damaged most of its civilian airports. URL: https://www.reuters.com/world/europe/ukraine-says-war-has-damaged-most-its-civilian-airports-2024-11-30 (дата звернення: 30.03.2025)

chain logistics[11]. The lack of access to maritime transportation has led to a shift toward land routes through Ukraine's western borders. This, in turn, has overloaded railway and road infrastructure, increasing costs and delivery times for goods.

Military actions have also caused significant environmental strain on Ukraine's natural surroundings. The destruction of infrastructure, particularly transport infrastructure, has led to soil and water pollution. For example, the shelling of the Kakhovka Reservoir in 2022 caused a rise in water levels, resulting in the flooding of 112 private homes[12].

Additionally, the growing reliance on digital technologies in the transport sector has made it vulnerable to cyberattacks. In March 2025, the state railway company "Ukrzaliznytsia" suffered a large-scale cyberattack that affected its online freight services. This led to a temporary shift to paper-based documentation and delays in transportation[13].

Mobilization has significantly impacted the workforce potential of Ukraine's transport sector. A large number of employees, particularly drivers, have been called up for military service, leading to a shortage of qualified personnel. According to the Association of International Road Carriers of Ukraine, only 5% of international transport drivers have deferments from mobilization, while the remaining 95% are at risk of being drafted into military service. This poses a threat of collapse for the country's logistics system[14]. Additionally, mobilization has led to a shortage of public transport drivers in Ukrainian cities, reducing the number of available routes and negatively affecting population mobility. Local authorities are forced to seek solutions to this issue, including recruiting new personnel and optimizing routes.

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[11] Ukraine says war has damaged most of its civilian airports. URL: https://www.reuters.com/world/europe/ukraine-says-war-has-damaged-most-its-civilian-airports-2024-11-30 (дата звернення: 30.03.2025)

[12] Удари по об'єктах критичної інфраструктури України під час російсько-української війни. URL: https://uk.wikipedia.org/wiki/%D0%A3%D0%B4%D0%B0%D1%80%D0%B8_%D0%BF%D0%BE_%D0%BE%D0%B1%27%D1%94%D0%BA%D1%82%D0%B0%D1%85_%D0%BA%D1%80%D0%B8%D1%82%D0%B8%D1%87%D0%BD%D0%BE%D1%97_%D1%96%D0%BD%D1%84%D1%80%D0%B0%D1%81%D1%82%D1%80%D1%83%D0%BA%D1%82%D1%83%D1%80%D0%B8_%D0%A3%D0%BA%D1%80%D0%B0%D1%97%D0%BD%D0%B8_%D0%BF%D1%96%D0%B4_%D1%87%D0%B0%D1%81_%D1%80%D0%BE%D1%81%D1%96%D0%B9%D1%81%D1%8C%D0%BA%D0%BE-%D1%83%D0%BA%D1%80%D0%B0%D1%97%D0%BD%D1%81%D1%8C%D0%BA%D0%BE%D1%97_%D0%B2%D1%96%D0%B9%D0%BD%D0%B8 (дата звернення: 20.03.2025)

[13] Ukraine railways say Sunday's cyber attack hit its online freight services. URL: https://www.reuters.com/technology/cybersecurity/ukraine-railways-say-sundays-cyber-attack-hit-its-online-freight-services-2025-03-25 (дата звернення: 30.03.2025)

[14] Наслідки введення нових норм мобілізації для транспортної галузі. URL: https://bizmag.com.ua/naslidky-vvedennya-novyh-norm-mobilizacziyi-dlya-transportnoyi-galuzi (дата звернення: 22.03.2025)

Under wartime conditions, Ukraine's transportation system has undergone significant transformations to meet defense needs. The Armed Forces of Ukraine face challenges in transport logistics, such as inefficient use of weapon and equipment delivery routes, poor road conditions in combat zones, weak transport infrastructure, and an insufficient number of standardized loading/unloading sites. To address these issues, it is necessary to implement modern information and telecommunication technologies and software, as well as to improve the state of transport infrastructure[15].

Overall, the war in Ukraine has highlighted the critical importance of protecting transport infrastructure and digital systems from physical and cyber threats, the need to adapt logistics chains to new realities, and the significance of preserving human resources and transforming the transportation system to meet military needs.

2. Digital transformation as a response to modern challenges

It is essential to note that digital transformation plays a key role in modernizing the transportation sector, contributing to increased efficiency, security, and adaptability to modern challenges. Research has shown that the main aspects of this transformation may include – see Figure 2.

Let’s examine these aspects in more detail.

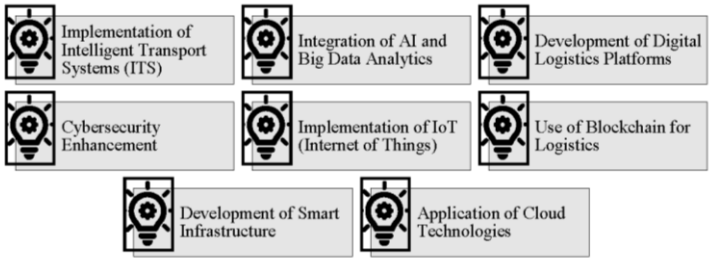

Fig. 2. Key Aspects of Digital Transformation for the Transport Sector

[15] Андрощук О., Березенський Р., Клименко В., Меленчук В., Мельник В. Стан, проблеми, перспективи розвитку транспортної логістики Збройних Сил України. URL: https://www.academia.edu/122679478/%D0%A1%D0%A2%D0%90%D0%9D_%D0%9F%D0%A0%D0%9E%D0%91%D0%9B%D0%95%D0%9C%D0%98_%D0%9F%D0%95%D0%A0%D0%A1%D0%9F%D0%95%D0%9A%D0%A2%D0%98%D0%92%D0%98_%D0%A0%D0%9E%D0%97%D0%92%D0%98%D0%A2%D0%9A%D0%A3_%D0%A2%D0%A0%D0%90%D0%9D%D0%A1%D0%9F%D0%9E%D0%A0%D0%A2%D0%9D%D0%9E%D0%87_%D0%9B%D0%9E%D0%93%D0%86%D0%A1%D0%A2%D0%98%D0%9A%D0%98_%D0%97%D0%91%D0%A0%D0%9E%D0%99%D0%9D%D0%98%D0%A5_%D0%A1%D0%98%D0%9B_%D0%A3%D0%9A%D0%A0%D0%90%D0%87%D0%9D%D0%98 (дата звернення: 20.03.2025)

Big Data analysis enables the optimization of traffic management, congestion forecasting, and improved route planning. The application of machine learning methods and neural networks enhances the accuracy of predictions and the efficiency of transport systems[16]. The use of Big Data also contributes to the development of smart city concepts and the improvement of infrastructure[17].

Intelligent Transport Systems (ITS) integrate modern technologies to improve traffic management and reduce congestion. In Ukraine, the feasibility of implementing such systems is being studied to mitigate traffic congestion in cities. For example, in Kyiv, the introduction of ITS is planned, which is expected to save road users up to 20% of their travel time[18].

The automation of processes and the use of artificial intelligence will enhance the efficiency of logistics operations, particularly through the implementation of intelligent transport systems in transportation processes. This will help reduce costs, improve forecasting accuracy, and elevate the level of customer service.

The use of electronic documents and digital platforms will simplify international transportation processes, reduce paper bureaucracy, and accelerate information exchange among logistics chain participants. This will enhance transparency, minimize the risk of errors, and improve collaboration between partners.

With the growing digitization of the transportation sector, cybersecurity has become a critical concern. The increasing reliance on digital platforms, smart infrastructure, and IoT devices makes transport systems more vulnerable to cyberattacks. Key measures for strengthening cybersecurity include: implementation of AI-based threat Detection Systems; use of Secure Communication Protocols; Multi-Factor Authentication (MFA) and Identity Management; regular cybersecurity audits and penetration testing; collaboration with National and International Cybersecurity Agencies.

IoT technology enables real-time monitoring and management of transportation networks, improving efficiency, safety, and reliability. And blockchain technology enhances the security and transparency of logistics

[16] Велігурський О.С. Управління транспортними потоками на основі машинного навчання. URL: https://ekmair.ukma.edu.ua/server/api/core/bitstreams/fe8b3286-adfa-4b8f-beb7-74eda7cb1abf/content (дата звернення: 22.03.2025)

[17] Марків О., Ришковець Ю. Використання технологій BIG DATA в галузі електротранспорту. URL: https://science.lpnu.ua/sites/default/files/journal-paper/2024/aug/35692/maket2402951-423-433_0.pdf (дата звернення: 22.03.2025)

[18] КОСТЯНТИН УСОВ: НОВА ІНТЕЛЕКТУАЛЬНА ТРАНСПОРТНА СИСТЕМА ДОПОМОЖЕ ЗАОЩАДИТИ ЧАС КОЖНОМУ УЧАСНИКУ ДОРОЖНЬОГО РУХУ. URL: HTTPS://KYIVCITY.GOV.UA/NEWS/KOSTYANTIN_USOV_NOVA_INTELEKTUALNA_TRANSPORTNA_SISTEMA_DOPOMOZHE_ZAOSCHADITI_CHAS_KOZHNOMU_UCHASNIKU_DOROZHNOGO_RUKHU (ДАТА ЗВЕРНЕННЯ: 20.03.2025)

operations by providing an immutable ledger for recording transactions. Key benefits of these technologies include:

– secure and transparent documentation of shipment details, reducing fraud and errors;

– self-executing contracts can streamline payments, customs clearance, and cargo handovers;

– stakeholders can track goods in real time, ensuring authenticity and reducing counterfeiting;

– blockchain can help combat smuggling and unauthorized modifications to cargo;

– digital records provide verifiable proof of transactions, reducing conflicts between logistics partners.

Overall, digital transformation is a necessary condition for the development of a modern transportation system that meets contemporary demands and ensures efficient operation in the face of global challenges.

3. Digital technologies as a factor of sustainable transport development

Digital technologies play a crucial role in ensuring the sustainable development of the transport sector by increasing efficiency, reducing environmental impact, and facilitating the integration of various modes of transportation. We have identified the following key aspects of this transformation – see Figure 3.

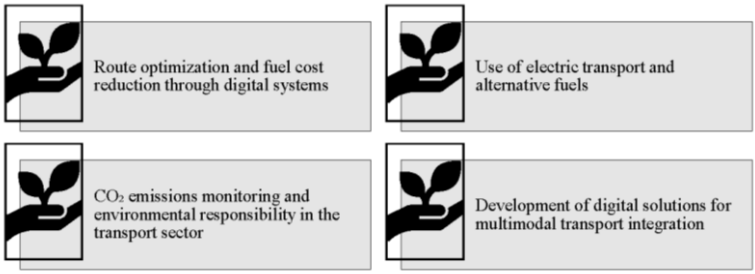

Fig. 3. Key aspects of digital transformation in the context of sustainable transport system development

Let’s consider each aspect in more detail.

1. Route optimization and fuel cost reduction through digital systems.

The use of modern digital technologies enables the optimization of transport routes, which helps reduce vehicle mileage and fuel consumption. For example, the company Meest China has already started implementing

intelligent routing systems to plan optimal delivery routes, which not only shortens transportation time but also reduces the carbon footprint[19].

2. Use of electric transport and alternative fuels.

The transition to electric vehicles and the use of alternative fuels are essential steps toward reducing greenhouse gas emissions. Electric vehicles are expected to become dominant on the roads, contributing to lower CO_2 emissions and the shift to clean energy sources. Additionally, the use of Sustainable Aviation Fuel (SAF) in air transport can reduce emissions by up to 80%, helping to accelerate the achievement of sustainable development goals[20].

3. CO_2 emissions monitoring and environmental responsibility in the transport sector.

Digital solutions enable efficient tracking and management of CO_2 emissions data. The use of unified software platforms to aggregate data from various sources allows companies to create a comprehensive emissions overview, forecast future trends, and evaluate different scenarios[21]. This approach contributes to greater environmental responsibility and compliance with international standards in the transport sector.

4. Development of digital solutions for multimodal transport integration.

Multimodal transportation, which combines different modes of transport, helps streamline infrastructure and reduce transportation costs[22]. The use of digital platforms to manage such logistics enables route optimization, reduction of empty runs, and improved planning[23]. This, in turn, contributes to lower energy consumption and a reduced carbon footprint across supply chains.

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[19] Зелена логістика: що це і які в неї переваги? URL: https://meest.cn/news/zelena-logistika-sho-ce-i-yaki-v-neyi-perevagi (дата звернення: 22.03.2025)

[20] Сталий розвиток авіаперевезень. URL: https://www.dbschenker.com/ua-uk/business/transport/air-freight/sustainability (дата звернення: 25.03.2025)

[21] Звіт про міжнародні добровільні та обов'язкові вуглецеві ринки з особливим акцентом на механізми, які застосовуються у випадку низьковуглецевого сільського господарства та потенційні можливості для українських розробників. URL: https://www.undp.org/sites/g/files/zskgke326/files/2022-11/FINAL%20REPORT%20UNDP%20LH%20CARBON%20FARMING%20UKR.pdf (дата звернення: 25.03.2025)

[22] Scientific and Analytical Report "Development of Multimodal Transport in the Context of Achieving the Goals of the European Green Deal: Experience of V4 Countries and Romania, Opportunities for Ukraine". URL: https://www.researchgate.net/publication/379832579_Scientific_and_Analytical_Report_Development_of_Multimodal_Transport_in_the_Context_of_Achieving_the_Goals_of_the_European_Green_Deal_Experience_of_V4_Countries_and_Romania_Opportunities_for_Ukraine_R (дата звернення: 20.03.2025)

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Overall, the implementation of digital technologies in the transport sector is essential for achieving sustainable development, enhancing transport efficiency, and minimizing environmental impact.

4. Prospects for post-war recovery of the transport sector

Post-war restoration of Ukraine's transport sector is a key task for ensuring sustainable economic development and integration into the European space. The main directions of this process should include restoration and modernization of infrastructure with an emphasis on digitalization, creation of "smart" logistics hubs, attracting international investments in digital infrastructure, and harmonization of Ukraine's transport standards with the EU.

Restoration should be accompanied by modernization and implementation of digital technologies to improve transportation efficiency and safety. This includes the use of intelligent transport systems, process automation, and integration of modern information technologies. The application of digital solutions will help optimize logistics processes and reduce costs.

The development of modern logistics centers equipped with advanced technologies is an important step towards improving transportation and logistics infrastructure. "Smart" hubs will ensure efficient management of goods flows, reducing cargo processing time and improving interaction between different modes of transport. The implementation of such hubs will facilitate Ukraine's integration into international logistics networks and increase competitiveness in the global market.

Modernization of the transport sector will require significant financial resources, so public-private partnership can be an important tool for attracting private investments into Ukraine's transport industry. Cooperation with international financial institutions and private investors will contribute to the implementation of large-scale infrastructure projects and the introduction of advanced technologies. A scientifically based approach involves applying the Life Cycle Assessment methodology for infrastructure objects, which will optimize capital and operational expenses in the long term[24].

Creating a favorable investment climate in the transport sector requires systemic changes in the regulatory field, including deregulation of excessively bureaucratic procedures, introduction of transparent tariff-setting mechanisms, and improvement of guarantees for investors. Econometric models demonstrate that attracting additional investments amounting to 1% of GDP annually over 5 years can provide a cumulative increase in industry productivity of 7-9%.

[24] Центр стратегічних і міжнародних досліджень запропонував модель реформи транспортної галузі України. URL: https://foreignukraines.com/2024/04/19/a-model-of-reform-of-the-transport-industry-of-ukraine (дата звернення: 20.03.2025)

Technological modernization of the transport complex should be based on the "Transport 4.0" concept, which includes intelligent transport systems, digitalization of logistics processes, and the use of big data to optimize cargo and passenger flows. Special attention will need to be given to implementing energy-efficient technologies and the gradual decarbonization of transport in accordance with the principles of the European Green Deal. According to expert calculations, comprehensive digitalization of transport processes can increase the operational efficiency of the industry by 15-20%.

Deepening cooperation with the European Union in the transport sector involves harmonization of the regulatory framework, technical regulations, and safety standards with the *acquis communautaire*. The harmonization of standards will facilitate border crossing procedures, improve transport safety, and enhance the quality of transport services. This will also open new opportunities for Ukrainian carriers in the European market and promote the development of international trade. A priority task is the inclusion of Ukraine's key transport arteries in the Trans-European Transport Network (TEN-T) and the implementation of projects within international transport corridors. According to economic and mathematical modeling results, full integration into the European transport system will increase Ukraine's transit potential by 30-35% in the medium term.

Overall, the post-war recovery of Ukraine's transport sector should be based on the principles of innovation, efficiency, and integration into international transport systems, which will ensure sustainable development and increase the country's competitiveness in the global market. It should also be implemented on the basis of a scientifically grounded transport policy with clearly defined performance indicators, which will ensure systematic development of the industry and enhance its competitiveness in the international arena.

CONCLUSIONS

Digitalization is a strategic imperative for ensuring stability and development of Ukraine's transport complex both during wartime and in the post-war period. It acts as a catalyst for fundamental changes in the transport industry, ensuring increased operational efficiency, infrastructure resilience, and environmental sustainability.

In the conditions of military conflict, digital technologies play a critically important role in ensuring operational management, coordination of logistics processes, and maintaining supply continuity. The implementation of integrated cargo flow monitoring systems, digital platforms for coordinating logistics chain participants, automated infrastructure diagnostic systems, and cyber protection mechanisms significantly increases the adaptability of the transport complex to crisis conditions.

In the context of sustainable development, digital innovations contribute to the optimization of transport flows, reduction of environmental impact,

improvement of road safety, and efficiency of logistics operations. Key areas include the implementation of intelligent transport systems, development of electrified and autonomous transport, digitalization of supply chains, and integration of transport systems into the "smart cities" concept.

In the perspective of post-war reconstruction, the digital transformation of the transport complex should become an organic component of the national recovery strategy aimed at creating a modernized, competitive economy integrated into the European space. Key priorities should be the development of digital infrastructure, implementation of e-governance, support for innovations, digitalization of key industries, development of digital education, and ensuring cybersecurity.

Successful implementation of a comprehensive digital transformation strategy will not only restore Ukraine's transport industry after the war but also create a high-tech, efficient, and sustainable transport system capable of meeting future challenges and ensuring sustainable economic development of the country.

SUMMARY

The research is dedicated to analyzing the current state of Ukraine's transport complex, which has suffered significant destruction as a result of military actions. The main challenges facing the industry are considered, including infrastructure destruction, restructuring of logistics chains, environmental consequences, and cyber threats. The possibilities of digital transformation as a tool for restoration and development of the transport system are explored, particularly the application of Big Data, intelligent transport systems, and logistics automation. Special attention is paid to the prospects of post-war industry recovery through infrastructure modernization, creation of "smart" logistics hubs, and harmonization of standards with the EU. In conclusion, the necessity of a comprehensive approach is emphasized, one that combines innovative technologies, strategic planning, and international support to ensure sustainable development of Ukraine's transport sector.

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