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ECONOMIC ASPECTS OF ORGANIZING THE DELIVERY OF OVERSIZED CARGO BY TRANSPORT ENTERPRISES IN UKRAINE

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The purpose of the article is to study the economic aspects of organizing the transportation of oversized cargo, as well as to develop practical recommendations for increasing the efficiency of the delivery of oversized cargo in Ukraine. In wartime, ensuring the movement of oversized and heavy cargo, in particular, such as: military equipment, building materials for the reconstruction of destroyed facilities and specialized equipment, is a priority, which makes this study extremely relevant. The work reveals the organization of oversized cargo transportation, identifies the main problems in logistics processes and their relationships with external factors, in particular: economic, technical. The nature and main types of oversized cargo, transportation requirements are determined. The study of segments of the transport and logistics system, the assessment of the costs of transporting oversized cargo allowed the authors to identify the main barriers in this area, to identify contradictions in the processes of organizing transportation of oversized cargo, in particular between regulatory requirements for transportation and the real capabilities of the transport infrastructure in conditions of hostilities, and to develop recommendations for their elimination. The use of economic analysis to determine the costs associated with the transportation of oversized cargo contributed to taking into account risk factors, route specifics, and the use of specialized equipment. The work also analyzed the components of costs for the transportation of oversized cargo and innovative approaches to optimizing logistics processes in terms of cost savings, thanks to the use of LIDAR systems for route planning. The work focuses on the need to integrate modern technologies by transport and logistics enterprises to increase the economic efficiency of transportation, ensure safety, and save costs. A conceptual model of the implementation of innovative technologies, such as LIDAR, into the transport and logistics system was built to increase the accuracy, economy, and efficiency of transportation of oversized cargo. Effective tools and measures were considered that could increase the economic efficiency of the use of specialized transport through the coordination of relations between all links and participants in the process. The synergistic approach in the study allowed the authors to identify the interdependence between the modernization of transport infrastructure, the integration of innovations, and the economic efficiency of oversized cargo transportation, as well as to develop practical recommendations.

Keywords: oversized cargo, transportation, logistics, transport enterprises, freight transport economics, freight transportation costs, innovative technologies in transport.

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Introduction and statement of the problem

Organizing the delivery of oversized cargo is a complex and multifaceted process that requires careful planning, effective coordination and management at every stage, both from a logistical and economic point of view. The transport of oversized cargo is characterized by increased requirements for the choice of vehicles, route development, compliance with regulatory requirements and cargo safety, which significantly complicates logistics operations. In today's globalized world and the constant development of transport technologies, it is important to improve delivery processes, increase the cost-effectiveness of transport and logistics solutions and introduce new management methods to remain competitive.

The importance of the research topic has increased significantly due to the impact of the war in Ukraine. Modern realities require increased attention to the organization of oversized transport, which has become critical both for maintaining the country's defense capability and for rebuilding infrastructure. In the context of war and post-war reconstruction, ensuring the movement of oversized and heavy cargo, such as military equipment, construction materials to rebuild destroyed facilities and specialized equipment, is a top priority.

Literature review on the research subject

The issues of organizing the transport of oversized cargoes are covered by the works of such domestic and foreign authors as: Samostyan V., Onyshchuk V. [1], Kotenko A., Lavrukhin O., Shilaev P., Svetlichna A., Shevchenko V., Pylypeiko O. [2], Alkema V., Romanyuk, O. [3], Melnyk O. [4-6], Cheberyachko S., Deryugin O., Prikhodko M. [7], Wuest T, Mak-Dadanski J., Kaczmarek B., Toben K.-D. [8], in which they analyze the specific characteristics of such cargoes, technological aspects of their transportation and logistics risks arising during transportation. Such studies were conducted in accordance with different types of transport - road, rail and sea. Accordingly, they identified the specifics of rolling stock, peculiarities of transport and technological schemes for the delivery of oversized cargo, advantages and challenges faced by carriers and freight forwarders [9].

Despite the growing role of oversized transport in the restoration of Ukraine's infrastructure, the research we have analyzed pays little attention to a comprehensive analysis of the cost-effectiveness of using the latest technologies in this process. There is no generalized approach to managing the transportation of oversized cargo to meet the critical needs for the restoration of destroyed infrastructure and economic recovery of the regions. There is insufficient research on how changes in transportation conditions as a result of hostilities affect coordination between logistics stakeholders and their economic efficiency. The use of road infrastructure for the transport of bulky goods, particularly in regions with damaged or limited transport routes, remains a poorly researched issue.

In practice, Ukrainian transport and logistics companies often cannot afford to implement modern innovative solutions due to their high cost and low level of staff training, although it is through the introduction of innovative technologies that the safety and accuracy of route planning is significantly improved, and the company can significantly reduce both the time and cost of delivery of oversized cargo. There are no simple and accessible economic models that would allow transport companies to accurately calculate transportation costs, taking into account factors such as downtime, fuel costs, depreciation and maintenance. Therefore, the study of the economic aspects of organizing the delivery of oversized cargo by transport and logistics companies in the context of military operations is relevant and practical.

Purpose of the article

The purpose of the article is to study the economic aspects of transport enterprises' activities in organizing the transportation of oversized cargoes, and also to develop practical recommendations for improving the efficiency of delivery of such cargoes in Ukraine in order to meet the needs for the restoration of civil infrastructure in a timely manner.

The research methodology is based on the integrated use of modern scientific methods and approaches. The systematic analysis revealed the organization of transportation of oversized cargo, identified the main problems in logistics processes and their interrelationships with external factors, in particular, economic and technical. The application of the analysis and synthesis method to study the segments of the transport and logistics system and estimate the costs of transportation allowed us to identify barriers and develop recommendations for their elimination. The dialectical method revealed contradictions in the processes of organizing the transport of oversized cargo, in particular between regulatory requirements for transportation and the real capabilities of the transport infrastructure in the context of hostilities.

The use of economic analysis to calculate the costs associated with the transport of oversized cargo helped to take into account risk factors, route specifics and the use of specialized equipment. The logical method was used to build a conceptual model for the introduction of innovative technologies, such as LIDAR, into the transport and logistics system to improve the accuracy, efficiency and effectiveness of transportation. The statistical analysis method was

used to process and interpret data on the volume of oversized cargo transportation, assess the costs and productivity of transport enterprises in modern conditions. The synergistic approach allowed us to identify the interdependence between the modernization of transport infrastructure, the integration of innovations and the economic efficiency of oversized cargo transportation.

Presentation of main points

Oversized cargo is large items that are too bulky or heavy for conventional transport. They require special transport because they do not fit into standard vehicle dimensions. There are different types of oversized cargo (Table 1).

Table 1

Types of oversized cargo

Name	Characteristics	Examples
oversized in width	width of cargoes exceeds 2.6 m	generators, building panels, wind turbines, boilers, transformers and other components for power plants
oversized in length	length of cargo exceeds 22 m	building beams, pipes, columns, piles, reinforced concrete structures, technical parts
oversized in height	height of cargo with transport exceeds 4 m above the road surface	large panels or elements of facades, mobile or tower cranes, turbine blades, metallurgical furnaces
bulky cargo	dimensions of cargoes exceed the permissible norms on two or three sides	agricultural machinery, harrows, seeders, construction machinery, industrial lines, cranes, cars, yachts
heavy cargo	cargo dimensions may be standard, but the weight exceeds 40 tones	special equipment, industrial tanks, machine tools, bulldozers, rollers, drilling rigs

Source: compiled by the authors

Due to the size and weight of oversized cargo, it is necessary to carefully plan routes in coordination with local authorities, optimize the fleet of vehicles, obtain permits, inspect bridges and tunnels for the safe transport of such cargo, arrange for supports with special vehicles or even temporarily close roads to avoid accidents and ensure uninterrupted traffic [4]. Sometimes the transport of oversized cargo even requires additional preparatory work, such as removing road signs, lifting electrical wires, and in some cases dismantling small structures.

The transport of oversized cargo requires clear coordination and well-coordinated work between all participants in the process: transport companies, local authorities and law enforcement agencies or special security services, if a convoy of vehicles needs to be supported. Each stage must be clearly thought out: from the moment of loading and securing the cargo to the moment of delivery to the destination [6]. Modern technologies greatly facilitate this process. The use of special software for route monitoring, GPS systems for tracking the location of vehicles, and digital platforms for quick approval of permits and documents make it possible to reduce preparation time and ensure more accurate adherence to delivery times, which ultimately ensures maximum safety, minimal risks, and the completion of transportation in the optimal time frame at minimal cost [2].

Of course, all these nuances have a significant impact on costs. The transport of oversized cargo is a rather costly process [8]. Transport companies must have specialized vehicles for the transport of oversized cargo, which are much more expensive than standard trucks. The cost of purchasing or renting such vehicles can account for a large portion of the cost of organizing delivery. At the same time, as oversized cargo often requires large vehicles or specialized machines, fuel costs can be significant. Transport companies not only need to provide specialized equipment and hire experienced drivers, but also spend money on obtaining all the necessary permits and approvals [3]. This is compounded by the costs of supporting, preparing infrastructure, and sometimes restoring damaged road sections after transport. In addition, some routes may be subject to special taxes or fees for the use of roads for oversized transport.

But on the other hand, proper planning and efficient transport organization can significantly reduce these costs. In particular, advance route planning or the use of digital technologies to optimize supply chains can avoid unnecessary delays and increase cost efficiency.

When assessing the cost of transporting oversized cargo, transport companies should consider the following cost components:

– fuel costs, which are determined based on the distance to be travelled, fuel consumption per unit distance (liters per 100 km), fuel type and price;

– drivers' wages, including hourly wages for travelling time, loading/unloading time and additional hours in case of delays;

– depreciation costs, which cover the wear and tear and obsolescence of vehicles, including the cost of maintenance, repairs and the decline in value of the asset over time. For large vehicles, depreciation is calculated on a proportionate basis based on distance and operating conditions;

– administrative costs, including the cost of obtaining permits for the transport of oversized cargo, insurance, customs duties and other official fees. Oversized shipments often require special approvals from the authorities;

– support and security costs: in most cases, the transport of oversized cargo requires the involvement of special support services to ensure road safety, especially in places with restricted conditions (bridges, tunnels, city roads). This includes the cost of special support vehicles, engineers, and logistics solutions;

– stop/downtime charges: if there are delays due to traffic, weather conditions or other restrictions, the cost of transportation can increase significantly due to vehicle downtime. This is especially critical when transporting through countries with strict customs regulations;

– additional costs for special equipment: to transport large or fragile goods, additional fastenings or specialized platforms may be required, such as lifts or modular transport systems for super-heavy cargo;

– maintenance and repair costs: breakdowns or damage may occur during transport and require prompt maintenance;

– unforeseen expenses, including fines for violation of the rules of carriage, costs of additional inspections, toll roads or additional stops along the way.

The post-war period involves the large-scale restoration of destroyed infrastructure and the construction of new facilities, which significantly increases the demand for the transport of various construction materials and equipment. This includes not only standard cargo, but also large and heavy structures that require specialized transportation. Therefore, the need for transport companies to have specialized rolling stock for the transport of oversized cargo is growing.

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The transport of construction materials, such as reinforced concrete structures, metal beams, large machinery and equipment, is critical to the rapid recovery of Ukraine's economy and infrastructure. Without adequate transport facilities and organized logistics processes, these works could be delayed, negatively impacting the overall stability and development of the regions.

Since oversized transport requires specialized vehicles with a low center of gravity and the ability to carry loads of large weight and size, the use of conventional transport is unacceptable and risky. This can lead to damage to the cargo or even road accidents, which can cause reputational risks and financial losses for the company.

Semi-trailers are key vehicles for the transport of oversized cargo, providing stability, safety and reliability of transportation. Different manufacturers offer their own versions of this equipment. Let's analyse the most popular trawl brands, their features and advantages (Table 2).

Table 2

Comparative characteristics of semi-trailers for the transport of oversized cargo

Brand	Faymonville	Goldhofer	Broshuis	Nooteboom	Kässbohrer
Model	TeleMAX	STZ-VHL7	3-axle Low Loader	MC0-50-04	Extendable Low-Bed
Maximum length, m	up to 50	up to 35	up to 30	up to 40	up to 28
Load capacity, t	70	80.5	34.5	29.4	50
Type of trawl	Low-frame	Modular	Semi-low-frame	Low-frame	Telescopic
Modularity	Yes	Yes	No	Yes	Yes
Price, USD	78,900	48,500	67,000	45,000	22,500
Features	Three telescopic sections, low platform height	SmartControl system, modularity	Spare parts availability, durability	Automatic load control	Low platform height, high load capacity

Source: compiled by the authors

When choosing a trawl for the transport of oversized cargo, you need to consider the lifting capacity, extension length, availability of spare parts and technical innovations. Each of the brands discussed in Table 2 has its own unique advantages.

In particular, the Faymonville TeleMAX offers the longest extension length, while the Goldhofer STZ-VHL7 provides high lifting capacity and modern control technology.

In order to compare trawl brands and choose the most suitable one for the needs of specific transport companies, several key criteria must be taken into account. The main criteria for comparison may include the following:

– load capacity – an indicator that determines the maximum weight that a trawl can transport. It is important to take into account the type of cargo that the company plans to transport and choose semi-trailers that have sufficient carrying capacity;

– type of trawl (low-frame, telescopic, modular). Different trawl models have different design features and are designed for different types of cargo. In particular, telescopic semi-trailers are suitable for transporting long cargoes such as wind turbine blades, while low-frame platforms are better suited for heavy and tall cargoes;

– expandability (modularity). Modular semi-trailers can be configured for different types of cargo by adding or removing sections. This makes them more versatile, but can also increase the cost. The company should assess whether it needs this flexibility and whether the additional cost is justified;

– acquisition cost. This criterion covers the initial cost of purchasing the semi-trailers. The cost may vary depending on the brand, model and specifications. The company should assess how much it is willing to invest in the purchase of new vehicles;

– maintenance and operation costs. In addition to the initial cost, it is important to consider the future maintenance and operating costs of semi-trailers. More reliable models may require less maintenance, which will reduce long-term costs;

– reliability and durability. This indicator determines how long the equipment will last without breakdowns and the need for major repairs. Brands that are known for their reliability can reduce repair costs and downtime;

– warranty and service. It is important to consider the availability of warranty and after-sales service from the manufacturer. Some brands offer longer warranties and better after-sales service, which can be a decisive factor when choosing vehicles;

– availability of spare parts. The availability and cost of spare parts for semi-trailers affects the time and cost of their repair. Brands with a wide spare parts supply network will ensure faster repairs and lower maintenance costs;

– technological innovation (security and automation). Some brands offer additional safety technologies, such as load monitoring systems, automated controls or monitoring systems. Investing in more modern technology can improve the safety and efficiency of transport.

In today's environment, transport companies involved in the transport of oversized cargo are faced with the challenge of improving accuracy and safety in planning and executing complex logistics operations. One of the most promising solutions is the introduction of LIDAR (Light Detection and Ranging) technology, which uses laser radiation to measure distances to objects and helps to significantly improve the efficiency of transportation. LIDAR sensors create accurate 3D models of the territory, which allows you to identify possible obstacles along the route, such as bridges, power lines or tunnels. This enables route adjustments or engineering solutions to be made in advance, reducing the risk of delays or accidents.

LIDAR allows you to collect information in real time, which is especially important when transporting oversized cargo, where accuracy is a critical factor. Modern LIDAR systems are capable of handling huge amounts of data and processing it in real time. This means that the data collected during the route scanning can be used instantly to adjust the transport plan. This is especially important when it is necessary to quickly adapt the route due to unforeseen obstacles or changes in infrastructure.

Implementing a LIDAR system by transport companies offers the following benefits:

– provides increased accuracy of route planning. LIDAR provides detailed information about the environment. Three-dimensional scanning allows you to accurately estimate distances to obstacles, determine their height and width, and prevent potential problems along the route in advance;

– helps to reduce risks and improve safety. In real life, the transport of bulky goods is fraught with risks due to poor route planning or unexpected obstacles. LIDAR helps to monitor the situation on the road in real time, which makes it possible to respond quickly to changing conditions. The use of LIDAR reduces the number of accidents on the roads, especially in conditions of poor visibility and difficult terrain. In large freight transport, the risk of accidents using LIDAR is reduced by approximately 46%, as the technology provides a 360-degree view and helps to avoid blind spots, which are critical for large vehicles. This increases the overall safety of drivers and other

road users [10-11];

– reduces the time required to prepare for transport. The use of LIDAR reduces the time required for preliminary route analysis and planning of logistics operations. On average, the technology can reduce preparation time by 30-40% due to the automated creation of 3D route maps and accurate identification of obstacles in real time [12];

– optimizes costs. Although the initial costs of installing LIDAR systems can be high, in the long run, the technology can significantly save on planning time and reduce the cost of emergencies or delays in the transport process. The introduction of LIDAR reduces overall transport costs by optimizing routes and reducing accidents. It is estimated that costs can be reduced by 15-25% due to more efficient planning, which includes reducing downtime, speeding up loading operations, and avoiding delays due to unexpected obstacles [13];

– provides automated report and documentation generation. LIDAR automatically generates detailed 3D maps and reports, making it easier to plan and manage projects. It also simplifies the process of approving transport with regulatory authorities, as all the necessary documentation can be provided quickly.

International practice shows that it is advisable to install LIDAR sensors on passenger cars to calculate and scan the route in advance before transporting oversized cargo. This provides detailed information about potential obstacles and difficulties along the way, including the height of bridges, tunnels, wires, etc.

Implementation of the LIDAR system in the activities of transport enterprises includes a number of stages, as shown in Table 3.

Table 3

Stages of LIDAR system implementation

Stage	What you need to buy or set up	Price, USD	Description
Purchase of LIDAR sensors	Velodyne VLP-16 Puck (360-degree scanning, 100 m range)	4,000 per sensor	One of the most affordable options for preliminary route scanning with high accuracy
Vehicle for scanning	Passenger car (off-road vehicle for the route)	42,300	Vehicle for preliminary route scanning before transportation
Fasteners and accessories	LIDAR fasteners and protective covers	500	Specialized fasteners for fastening LIDAR on a vehicle to ensure stable operation of the sensor
Integration with the electrical system	Cables and connectors	100	Connecting the sensor to the power supply and on-board system of the vehicle
Integration with an on-board computer	Controller for communication with on-board systems	200 - 500	Enables LIDAR integration with on-board systems for real-time data processing
System calibration	Service equipment and calibration services	1,000	Calibrate the sensor for accurate data display during route scanning
Testing and optimization	Test equipment for monitoring	500	Assessment of scanning accuracy and adaptation to the conditions of the real route
Personnel training	Educational materials and training	1,000	Organization of staff training on the use and maintenance of LIDAR systems
Support and maintenance	Regular maintenance of sensors	500 per year	Regular checks and software updates to maintain scanning accuracy
Total costs		50,300	

Source: compiled by the authors

The key stages are equipment procurement, system setup and staff training. To ensure correct operation of the system, high-precision LIDAR sensors, specialized vehicles, software and accessories for integration with the vehicle's electronic system are used. The implementation process also includes testing, calibration and ongoing maintenance of the system.

Estimating the total cost of LIDAR equipment and services will allow a transport company to build a detailed budget and prepare for the introduction of modern technology to improve the efficiency of its operations.

Conclusions

Oversized cargo is characterized by large dimensions, weight or design features that exceed the standard parameters for conventional transport.

Transportation of such cargo requires special conditions: obtaining special permits, using specialized semi-trailers, and developing individual routes with due regard to road infrastructure. The main challenges for outsized cargo logistics include limited road capacity, high transportation costs due to the use of specialized equipment and safety risks. Important efficiency factors include the state of road infrastructure, professionalism of staff, route optimization using modern technologies, and the adaptability of the vehicle fleet to different types of cargo.

In times of war, the transportation of oversized cargo is of strategic importance. It is important to ensure the uninterrupted delivery of transformers, generators, mobile power plants and other equipment needed to restore the energy infrastructure, as well as military and humanitarian supplies that support the country's defense capability. In these conditions, transport companies are faced with the task of building a fleet of specialized vehicles. Trawls are key vehicles for the transport of oversized cargo, ensuring stability, safety and reliability of transportation. An analysis of trawl models showed that semi-trailers from brands such as Faymonville and Goldhofer provide high flexibility in transportation due to the ability to expand the platform and adapt to different types of cargo. Their modularity allows them to transport both long items, such as wind turbine blades, and heavy industrial objects.

Implementing a LIDAR system in transport operations can reduce the risk of accidents and improve route management. In the long term, investments in LIDAR pay off through increased revenues and increased customer confidence. It is especially important to note that the introduction of these technologies is strategically important in times of war. LIDAR facilitates the rapid transport of energy equipment, which is essential for the restoration of Ukraine's infrastructure, and ensures safe transportation in a complex infrastructure.

The introduction of modern technologies will reduce the cost of transporting oversized cargo and strengthen the competitiveness of transport and logistics companies in Ukraine, reduce the risk of accidents and improve customer service. Investments in LIDAR and specialized trawls not only increase the efficiency of operations, but also ensure that companies can sustainably grow profitability in a changing market and face the challenges of restoring Ukraine's critical infrastructure.

The prospect of further research in this area is the development of business models for the transportation of certain types of oversized cargo in line with European and international standards, including multimodal transport and technological schemes, to optimize transportation costs and increase the economic efficiency of logistics.

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ЕКОНОМІЧНІ АСПЕКТИ ОРГАНІЗАЦІЇ ДОСТАВКИ НЕГАБАРИТНИХ ВАНТАЖІВ ПІДПРИЄМСТВАМИ ТРАНСПОРТУ В УКРАЇНІ

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Метою статті є дослідження економічних аспектів організації транспортування негабаритних вантажів, а також розробка практичних рекомендацій для підвищення ефективності доставки негабаритних вантажів в Україні. В умовах війни забезпечення переміщення великогабаритних і важких вантажів, зокрема таких: як військова техніка, будівельні матеріали для відбудови зруйнованих об'єктів і спеціалізоване обладнання, є пріоритетним, що робить дане дослідження надзвичайно актуальним. В роботі розкрито організацію транспортування негабаритних вантажів, ідентифіковано основні проблеми у логістичних процесах та їх взаємозв'язків із зовнішніми факторами, зокрема: економічними, технічними. Визначено сутність та основні типи негабаритних вантажів, вимоги до транспортування. Дослідження сегментів транспортно-логістичної системи, проведення оцінювання витрат на транспортування негабаритних вантажів дозволило авторам визначити основні бар'єри в цій сфері, виявити суперечності у процесах організації перевезень негабаритних вантажів, зокрема між регуляторними вимогами до транспортування та реальними можливостями транспортної інфраструктури в умовах бойових дій, розробити рекомендацій щодо їх усунення. Застосування економічного аналізу для розрахунку витрат, що супроводжують перевезення негабаритних вантажів, сприяло врахуванню факторів ризику, специфіки маршрутів та використання спеціалізованої техніки. Також в роботі було проаналізовано складові витрат при транспортуванні негабаритних вантажів та інноваційні підходи до оптимізації логістичних процесів з точки зору економії коштів, завдяки використанню систем LIDAR для планування маршрутів. В роботі акцентується увага на необхідності інтеграції сучасних технологій транспортно-логістичними підприємствами для підвищення економічної ефективності перевезень, забезпечення безпеки та економії витрат Було побудовано концептуальну модель впровадження інноваційних технологій, таких як LIDAR, у транспортно-логістичну систему для підвищення точності, економічності та ефективності перевезень негабаритних вантажів. Розглянуто дієві інструменти та заходи, що могли б посилити економічну ефективність використання спеціалізованого транспорту завдяки координації відносин між усіма ланками та учасниками процесу. Синергетичний підхід в дослідженні дозволив авторам визначити взаємозалежність між модернізацією транспортної інфраструктури, інтеграцією інновацій та економічною ефективністю перевезень негабаритних вантажів, а також розробити практичні рекомендації.

Ключові слова: негабаритні вантажі, транспортування, логістика, підприємства транспорту, економіка вантажних перевезень, витрати на транспортування вантажів, інноваційні технології на транспорті.

ECONOMIC ASPECTS OF ORGANIZING THE DELIVERY OF OVERSIZED CARGO BY TRANSPORT ENTERPRISES IN UKRAINE

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The purpose of the article is to study the economic aspects of organizing the transportation of oversized cargo, as well as to develop practical recommendations for increasing the efficiency of the delivery of oversized cargo in Ukraine. In wartime, ensuring the movement of oversized and heavy cargo, in particular, such as: military equipment, building materials for the reconstruction of destroyed facilities and specialized equipment, is a priority, which makes this study extremely relevant. The work reveals the organization of oversized cargo transportation, identifies the main problems in logistics processes and their relationships with external factors, in particular: economic, technical. The nature and main types of oversized cargo, transportation requirements are determined. The study of segments of the transport and logistics system, the assessment of the costs of transporting oversized cargo allowed the authors to identify the main barriers in this area, to identify contradictions in the processes of organizing transportation of oversized cargo, in particular between regulatory requirements for transportation and the real capabilities of the transport infrastructure in conditions of hostilities, and to develop recommendations for their elimination. The use of economic analysis to determine the costs associated with the transportation of oversized cargo contributed to taking into account risk factors, route specifics, and the use of specialized equipment. The work also analyzed the components of costs for the transportation of oversized cargo and innovative approaches to optimizing logistics processes in terms of cost savings, thanks to the use of LIDAR systems for route planning. The work focuses on the need to integrate modern technologies by transport and logistics enterprises to increase the economic efficiency of transportation, ensure safety, and save costs. A conceptual model of the implementation of innovative technologies, such as LIDAR, into the transport and logistics system was built to increase the accuracy, economy, and efficiency of transportation of oversized cargo. Effective tools and measures were considered that could increase the economic efficiency of the use of specialized transport through the coordination of relations between all links and participants in the process. The synergistic approach in the study allowed the authors to identify the interdependence between the modernization of transport infrastructure, the integration of innovations, and the economic efficiency of oversized cargo transportation, as well as to develop practical recommendations.

Keywords: oversized cargo, transportation, logistics, transport enterprises, freight transport economics, freight transportation costs, innovative technologies in transport.

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