https://doi.org/10.3311/PPtr.38137

Periodica Polytechnica Transportation Engineering, 53(3), pp. 277–291, 2025

Organization of Transport Services and Transport Process Safety

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Received: 20 August 2024, Accepted: 08 May 2025, Published online: 26 May 2025

Abstract

The research aims to address the basic principles and methods of organizing transport and ensuring safety in the transport process to improve the efficiency and security of logistics operations. The study addressed key aspects including selecting the right mode of transport, route planning, selecting reliable carriers, ensuring cargo and vehicle security, staff training, legal compliance and risk management, which helped to optimize logistics operations and minimize risks. Particular attention was devoted to ensuring the safety of cargo and vehicles, including measures to protect against theft, damage and other risks. The study found that the efficient organization of transport services and ensuring the safety of the transport process are key factors in optimizing logistics operations and minimizing risks. An analysis of transport mode selection, route planning and security methods helped identify strategies to improve processes. The importance of choosing reliable carriers and complying with the law confirms the importance of proper management of logistics operations. Effective management of the transport process and safety leads to cost savings and improved customer service. In addition, the study revealed the need for regular staff training in security and effective risk management to successfully implement logistics strategies. Thus, an integrated approach to transport and security is the basis for successful logistics operations. The study provides recommendations for improving transport efficiency and safety, which is of practical importance for logistics companies.

Keywords

logistics operations, risk management, competitiveness, regular training, selection methods

1 Introduction

In 2024, the world is rapidly developing means of ensuring the mobility and efficiency of cargo and passenger transportation (Ceder, 2021). These innovations include the use of high-tech vehicles, the introduction of automated logistics management systems and the development of infrastructure for multimodal transport. Modern solutions, such as intelligent transport systems (ITS) and real-time cargo tracking technologies, significantly improve the efficiency and safety of transportation (Gholamhosseinian and Seitz, 2021). Simultaneously, sustainability considerations are driving the transition towards environmentally friendly transport solutions, contributing to a reduced carbon footprint and supporting global sustainable development goals. The increasing complexity of logistics networks and the dynamic nature of global supply chains necessitate continuous improvements in the organization and management of transport systems to meet evolving economic demands.

The research relevance is determined by the dynamics of the economic environment, where efficient logistics and transport safety play a key role in business success. As global trade grows, freight volumes increase and technology constantly evolves, new challenges and opportunities arise that require an integrated approach to transport and security. Understanding the basic principles and methods in this area will provide effective strategies for managing logistics processes, minimizing risks and ensure market competitiveness. This research will

Cite this article as: Dolzhenko, N., Assilbekova, I., Konakbay, Z., Garmash, O., Muratbekova, G. (2025) "Organization of Transport Services and Transport Process Safety", Periodica Polytechnica Transportation Engineering, 53(3), pp. 277–291. https://doi.org/10.3311/PPtr.38137

help businesses and logistics companies adapt to rapidly changing conditions, optimize operational processes and improve customer service, which contributes to their sustainable development and growth in the market.

Research in the field of organizing transport services and ensuring the safety of the transport process attracts the attention of many researchers. For instance, Ding et al. (2021) noted the importance of using information technology to optimize logistics processes. Gayialis et al. (2022) analyzed the role of a geographic information system in route planning and logistics network management.

Kostrzewski and Melnik (2021) investigated methods of improving the safety of freight transport through the introduction of modern tracking and monitoring technologies. Njoku et al. (2023) addressed the problems and prospects for the development of global transport systems and their impact on logistics processes. Wu et al. (2022) addressed the issues of maritime transport and shipping safety.

Karwowski and Zhang (2021) focused on the role of the human factor in ensuring the safety of the transport process. Azadani and Boukerche (2021) investigated the problems of risk management in road transport and proposed appropriate strategies. Liu et al. (2020) analyzed the trends in air transport and their impact on the safety and efficiency of logistics operations.

Leng and Li (2022) presented mathematical models for optimizing transport networks and routes. Mavi et al. (2022) investigated the effectiveness of risk management strategies in the context of freight transport. However, there are still gaps in the literature on integrating new technologies and security methods into a single logistics management system, as well as in research on the human factor in ensuring the security of the transport process.

Despite extensive research on transport logistics and safety, current literature exhibits a significant gap in integrating efficiency and security aspects across multimodal transport networks. While scholars have explored information technologies, geographic systems, transport safety, and human factors as separate domains, there remains insufficient investigation into how these elements interact within a unified system. Most studies focus on isolated aspects within single transport modes, failing to address the complex interplay between emerging technologies (AI, IoT, and blockchain) and comprehensive security frameworks in contemporary global supply chains. This research addresses this gap by adopting a holistic approach that examines the interconnection between transport mode selection, route optimization, security measures, and human factors as part of an integrated logistics management system, offering practical strategies for developing more resilient, efficient, and secure transport operations in today's complex logistics landscape.

The study aims to review the basic principles and methods of organizing transport services and ensuring the safety of the transport process to increase the efficiency and security of logistics operations. Study addresses:

1. How can organizations optimize transport mode selection and route planning to maximize logistics efficiency and safety?
2. What proactive security measures are essential to mitigate risks such as cargo theft, damage, and operational disruptions?
3. How can regular staff training and a systematic approach to risk management enhance the security and competitiveness of logistics companies?

By addressing these questions, this research will contribute to a deeper understanding of how emerging technologies, multimodal logistics strategies and human factors can be effectively integrated into transport security frameworks. The findings will provide practical strategies for businesses and logistics companies to adapt to the evolving transportation landscape, optimize operational processes and improve service reliability, ultimately contributing to sustainable and secure supply chain management.

2 Materials and methods

One of the important criteria for choosing a vehicle is its environmental impact. To gain a deeper understanding of this issue, a study was carried out to determine the level of CO_2 emissions per ton of cargo transported for various modes of transport, including road, rail, sea and air transport. Comparative analysis of this data in Kazakhstan and other countries identified the most environmentally friendly modes of transport. The findings served as the basis for developing recommendations to reduce the carbon footprint of logistics operations, which is important for preserving the environment and reducing the negative impact on the climate.

To determine the structure of the workforce in the logistics and transport sector, an analytical assessment of the number of employees employed in this area was carried out, including their distribution by region of Kazakhstan. This study identified the regions with the highest concentration of logistics companies and the potential for optimizing the use of labor resources. In addition, trends in

the growth or decline in the number of employees in the logistics sector were analyzed, which were used to conclude the dynamics of the industry in different regions of the country. The data obtained provides valuable information for the development of HR strategies and optimization of business processes in the logistics sector.

The primary data sources mentioned in the document include the Bureau of National Statistics (2024), which provided statistical data on transport types in Kazakhstan, including freight volumes, passenger traffic, and CO_2 emissions data. The KazLogistics (2024) contributed employment data for logistics and transport companies across different regions of Kazakhstan. Additionally, case studies from two major companies were utilized: DHL Group (2023) served as an international benchmark for logistics practices, while Kazakhstan Railways (2023) functioned as a national case study for railway operations. The document doesn't explicitly mention the specific collection methods for the statistical data, such as surveys, administrative records, or direct measurements, which would be important to add for transparency and reproducibility.

Regarding analysis methods, the document describes several analytical approaches but lacks a detailed explanation of specific methodologies. A comparative analysis was conducted to compare CO_2 emissions across different transport modes in Kazakhstan. For workforce structure analysis, an "analytical assessment" of employee numbers in logistics was conducted, including regional distribution, but the method for this assessment isn't detailed, such as whether it involved statistical sampling, complete census data, or industry surveys. Statistical data analysis examined traffic volumes, route lengths, and transport mode usage, without specifying the analytical techniques applied like trend analysis, regression, or descriptive statistics. Case study analysis mentions a "detailed comparative analysis" of DHL Group and Kazakhstan Railways but doesn't explain the framework used for this comparison or how findings were systematically extracted.

The justification for methodological choices regarding transport mode selection appears to be based on comprehensive coverage, as road, rail, sea, air, and pipeline transport represent the complete transportation ecosystem in Kazakhstan. This selection also enables environmental impact assessment by allowing for comparative CO_2 emission analysis. The economic significance of these modes is evident as they represent 100% of the freight transport market in Kazakhstan, as shown in Table 1. Despite Kazakhstan being landlocked, aquatic transport on inland waterways was included for completeness, demonstrating regional relevance in the analysis.

Table 1 Statistics by type of transport in Kazakhstan, 2023, Source: compiled by the authors based on (Bureau of National Statistics, 2024)

Type of transport	Freight transported (million tons)	Passenger traffic (million people)	Share in total volume (%)
Automotive	511.8	1,400	80.5
Railway	98.7	27.1	15.4
Aquatic	0.04	0.04	0.02
Airborne	0	11	6.1
Pipeline	30.3	-	4.1
Total	640.8	1,438.2	100

For risk factors analysis, the study examines several elements related to transport, though the justification for these specific factors could be more explicitly stated. Cargo security risks focus on theft, damage, and loss, which appear based on their prevalence in logistics operations. Vehicle safety factors such as technical condition monitoring and traffic rule compliance were analyzed, likely due to their direct impact on accident prevention. Human factors, particularly personnel training, were emphasized, presumably due to their critical role in safety outcomes. Regulatory compliance and legal factors were analyzed due to their impact on operational viability and potential financial penalties.

The selection of regions with high logistics activity was based on multiple criteria, including total freight volume handled, number of registered logistics companies, employment figures, and key transport corridors. These data points were gathered from national transport infrastructure reports and industry registries. The selection process prioritized regions demonstrating a consistent growth trend in logistics activity over the past five years, as indicated by statistical records.

The study accounted for human factors in transport safety through an analysis of training programs, regulatory compliance levels, and workforce experience. Data were obtained from industry reports on training programs and regulatory adherence assessments conducted by Kazakhstan's transport authorities. While driver fatigue and behavioral aspects were not explicitly measured, the study incorporated compliance metrics such as safety training participation rates and reported violations.

The justification for the selection of transport modes was based on their economic significance and comprehensive representation of the logistics ecosystem in Kazakhstan. The inclusion of inland waterways was

necessary due to their role in regional cargo transportation, despite Kazakhstan being a landlocked country. Data on inland water transport were collected from official reports on domestic river transport.

The risk factor analysis focused on theft, cargo damage, and regulatory compliance due to their high prevalence in industry reports and their direct impact on logistics efficiency. While other risks, such as geopolitical factors and supply chain disruptions, were acknowledged, they were not included in the primary analysis due to the lack of standardized national data sources.

In addition, an analysis of the use of modern GIS technologies and rolling stock condition monitoring systems in the activities of Kazakhstan Railways was carried out. These case studies highlighted the impact of advanced technologies and management methods on improving the efficiency and safety of transportation, which is a key aspect of optimizing logistics operations. The data and conclusions obtained as a result of the analysis served as the basis for developing recommendations for the implementation of modern approaches and technologies in the field of logistics and freight transportation.

3 Results

The study primarily focuses on Kazakhstan's logistics and transport sector, analyzing various aspects such as environmental impact, workforce structure, and transport efficiency. However, many of the findings have broader implications and may be applicable to other emerging markets with similar economic and infrastructural conditions. The comparative analysis of CO_2 emissions across different transport modes, while centered on Kazakhstan, incorporates international benchmarks, allowing for general insights into sustainable transport practices. The recommendations for reducing the carbon footprint of logistics operations are therefore relevant not only within Kazakhstan but also to other landlocked and resource-dependent economies with similar transportation infrastructures.

In the logistics and transport industry, the choice of a suitable mode of transport plays a critical role, affecting the efficiency, cost and safety of transport. This choice depends on many factors, including the type of cargo, the distance of transport, delivery time and other important aspects. First, the type of cargo has a significant impact on the choice of vehicle (Guo et al., 2020).

For example, refrigerated trucks or air transport are ideal for transporting perishable products, which helps to keep products fresh in the shortest possible time. For bulky and heavy goods, such as construction materials or industrial equipment, rail or sea transport is preferred, as it provides stability and the ability to transport large volumes. Transport distance is also a key factor when choosing a vehicle. Road transport can be most efficient for short and medium distances, offering flexibility and door-to-door delivery.

However, for international transport or long-distance movements, rail or sea transport may be more suitable, as, despite longer travel times, it is often more cost-effective and can handle larger volumes of cargo (Boiko et al., 2023). Delivery times are another important aspect to consider. Air transport is the fastest way to deliver goods, making it ideal for urgent shipments. However, the high cost of air travel can be a significant limitation. Road transport offers a good balance between speed and cost for short and medium distances, while rail and sea freight can offer cost-effective solutions for less urgent shipments.

Economic aspects also play a decisive role in the choice of transport. Transport costs can vary significantly depending on the mode of transport chosen, and logistics companies need to consider the balance between cost and quality of service. Shipping by sea and rail often offers lower rates for larger volumes, while road and air can be more expensive but offer greater speed and flexibility. Table 1 presents data on domestic freight and passenger traffic. Freight data does not include transit traffic. Passenger transport by water is carried out on inland waterways.

The analysis of freight and passenger transportation in Kazakhstan for 2023 reveals the dominant role of road transport in both sectors. With 511.8 million tons of freight transported and 1,400 million passengers, road transport accounts for 80.5% of the total transportation volume. Its widespread use is attributed to its flexibility, ability to provide door-to-door delivery, and suitability for short- and medium-distance logistics. The second most significant mode is railway transport, which handled 98.7 million tons of freight and 27.1 million passengers, representing 15.4% of the total transportation volume. Rail transport is particularly crucial for heavy and bulk goods, such as raw materials and industrial cargo, as it offers stability and cost efficiency over long distances.

Pipeline transport plays a notable role in freight logistics, moving 30.3 million tons of oil and gas, which comprises 4.1% of the total freight volume. Although it does not serve passenger transportation, its economic and infrastructural significance in energy logistics is substantial.

Air transport, while facilitating the movement of 11 million passengers (6.1% of the total volume), has an almost negligible role in freight transport, as air cargo remains costly and is generally reserved for urgent, high-value shipments. Waterborne transport, including inland waterways, is the least utilized, accounting for only 0.04 million tons of freight and an equal number of passengers, reflecting Kazakhstan's limited access to navigable water routes.

These transportation trends indicate that Kazakhstan's logistics network is primarily structured around road and rail transport, with minimal reliance on alternative modes. The predominance of road transport suggests an opportunity for further investment in railway and multimodal transport to enhance efficiency, sustainability, and cost-effectiveness. Additionally, given the country's reliance on pipeline infrastructure for energy transportation, ongoing improvements in safety, maintenance, and regulatory compliance are essential. Understanding these dynamics allows for the identification of strategic priorities in optimizing transport networks, reducing environmental impact, and improving overall logistics performance.

Lastly, environmental considerations are becoming increasingly important when choosing transport. With the growing focus on sustainability and reducing carbon emissions, companies are increasingly addressing the environmental impact of their transport choices. Rail and sea transport have a lower carbon footprint than road and air transport, making them preferred by companies seeking to minimize their environmental impact. Thus, the choice of a suitable mode of transport is a complex and multifaceted process that requires consideration of various factors to ensure optimal efficiency, economy and safety of transportation. A comprehensive analysis of the type of cargo, distance, delivery time, and economic and environmental aspects can be used to make an informed choice that contributes to the successful implementation of logistics operations.

Route planning is one of the key aspects of the efficient organization of transport services, which directly affects the timeliness, safety and cost-effectiveness of transportation. This process requires coverage of many factors, from road conditions and weather conditions to infrastructure constraints and the use of modern technology. Route optimization is a priority in transport planning (Hörcher and Tirachini, 2021).

Modern technology provides a wide range of software that can be used to build routes with minimal time and money. These apps analyze various data, including traffic conditions, traffic jams and delays, to assist in choosing the fastest and most cost-effective route. Automated route planning systems significantly reduce the human factor and reduce the likelihood of errors, which contribute to increased transport efficiency.

Road conditions play an important role in the route planning process. By accounting for road conditions, weather conditions and other factors affecting traffic, logistics companies can avoid unexpected delays and problems along the way. For example, knowing about upcoming road works or unfavorable weather conditions enables early route adjustments and prevents disruptions to delivery schedules. In addition, information about current road conditions helps drivers to be prepared for difficulties and adapt their behavior on the road, which increases the overall safety of the transport process.

Infrastructure constraints are another important aspect to consider when planning routes. The presence of bridges, tunnels and other infrastructure may restrict the movement of vehicles of certain sizes and capacities. This is especially true for the transport of bulky and heavy cargo, which may require special permits and detours. Taking these restrictions into account at the planning stage helps to avoid fines, delays and cargo damage, which in turn helps to improve the reliability and efficiency of transportation.

The use of geographic information systems (GIS) significantly improves the route planning process (Singh and Katiyar, 2021). GIS provides accurate and up-to-date data on roads, infrastructure and other geographical features, allowing for more accurate route planning and real-time traffic tracking. The introduction of GIS technologies in logistics helps to increase the accuracy of planning, improve coordination and promptly respond to changes in the traffic situation. This, in turn, leads to cost savings and improved customer service.

Route planning also includes risk assessment and the development of contingency plans in case of unforeseen circumstances. This may include identifying alternative routes and preparing for deviations from the original plan. This approach minimizes the impact of various factors, such as accidents, roadworks or adverse weather conditions, on the delivery process.

Proactive risk management helps to increase the resilience of the logistics system and reduce the likelihood of disruptions. The choice of reliable carriers is one of the most critical aspects in the organization of transport services (Gulamov Abdulaziz and Sarimsakova Malokhat, 2021).

A reliable carrier not only guarantees timely and safe delivery of goods but also helps to improve the overall efficiency of logistics operations. In the context of global competition and increasing demands on the quality of service, choosing a partner for cargo transportation is becoming a strategic decision that affects the reputation and success of a business.

One of the first steps in choosing a reliable carrier is to assess its reputation. This includes analyzing customer reviews, ratings and past performance. Positive reviews and high ratings indicate that the carrier is trustworthy and able to fulfil its obligations in a quality manner. Moreover, a carrier's reputation may indicate its experience in the industry, level of professionalism and degree of responsibility to its customers.

Transparency and openness in providing information about their activities are also important indicators of reliability. Tenders are an effective way to select carriers on a competitive basis. Tenders are used to objectively evaluate offers from different companies and select the most suitable partners in terms of price and quality. This process helps to increase transparency and competition among carriers, which leads to improved service quality. When conducting tenders, it is necessary to consider not only the cost of services but also factors such as the availability of the necessary equipment, staff qualifications, geographical coverage and flexibility in terms of changing the terms of transportation.

Signing contracts with carriers is the next important step. Contractual obligations should clearly define the terms of cooperation, including delivery times, responsibility for the safety of the cargo and the procedure for dealing with unforeseen situations. Having detailed and legally sound contracts reduces the risk of conflicts and misunderstandings, protecting the interests of both parties. Contracts should also provide control and reporting mechanisms that allow monitoring of the fulfilment of obligations and timely identification and remediation of problems. One of the key factors in choosing a carrier is its financial stability.

Reliable carriers must have sufficient financial resources to support their operations, including regular vehicle maintenance, employee salaries and contingencies. The financial stability of a carrier demonstrates its ability to meet long-term obligations and reduces the risk of disruptions in the delivery of goods. The technological equipment of the carrier also plays an important role. Modern technologies, such as GPS tracking systems, telematics and transport management software, can significantly improve the efficiency and safety of transport. Carriers implementing the latest technological solutions can offer their customers a higher level of service, including real-time cargo tracking, forecasting delivery times and prompt response to changes in transport conditions.

Another important aspect is the carrier's compliance with regulatory requirements and standards. Reliable carriers must have all the necessary licenses and certificates confirming their right to carry out transport activities. Compliance with legislation and international transport standards ensures that the carrier operates within the legal framework and adheres to high safety and quality standards. The training and qualifications of the carrier's personnel are also significant indicators of its reliability.

Carriers that invest in the training and development of their employees can provide a higher level of service and safety. Qualified drivers and vehicle operators know how to properly handle cargo, comply with traffic rules and act in emergencies. Ensuring cargo security is one of the most important tasks in the logistics and transport industry. Goods can be exposed to various risks during transport, such as theft, damage or loss (Liang, et al., 2022). Effective cargo protection requires a comprehensive approach that includes modern technology, insurance, proper staff training and the development of clear security procedures.

An important step in ensuring the safety of cargo is the use of sealed containers and special packaging materials. Sealed containers prevent unauthorized access to cargo and protect it from theft and damage. Special packaging materials provide additional protection against physical impacts such as shock, vibration and adverse weather conditions. The use of high-quality packaging solutions helps to preserve the integrity and presentation of the cargo throughout the entire transport process.

Modern technologies play a key role in ensuring the safety of cargo. One of the most effective technologies is GPS tracking. GPS tracking allows real-time monitoring of the location of cargo, which significantly reduces the risk of theft and loss. GPS not only tracks the route of a shipment but also responds quickly to deviations from the planned route. This is especially important when transporting valuable or dangerous goods that require increased control and attention.

GPS systems in logistics in Kazakhstan require precise technical specification. Real-time kinematic (RTK) GPS provides centimeter accuracy compared to standard GPS systems with an accuracy of 5–10 m. This is critical for

urban logistics and dense traffic. Differential GPS (DGPS) uses fixed reference stations for signal error correction, which is particularly effective in Kazakhstan's varied terrain. In the northern regions of the country, GLONASS (Russian Space Systems, 2025) or multi-star receivers provide improved coverage.

Integration of telematics with GPS requires specific communication protocols – 4G/5G in urban areas and satellite communications in remote areas with a minimum of 5 Mbps bandwidth for real-time telemetry transmission. The battery life of trackers varies: passive trackers last 3–5 years, active trackers last 1–2 weeks, which is important to consider when planning long-distance routes across the vast territory of Kazakhstan.

Risk assessment parameters include quantitative thresholds: weather risk increases when visibility is less than 500 m, theft risk increases after 30 min of an unexpected stop. Re-routing algorithms are activated when traffic density is above 70 per cent of normal or delays exceed 15 min.

Implementing RTK GPS systems reduces route deviations by 15–20%, while standard GPS systems reduce deviations by only 5–10%. Installation costs range from $200–500 for basic units to $1,000–2,500 for advanced systems. The payback for an average truck in Kazakhstan travelling 100,000 km per year is 8–12 months due to fuel savings (5–7%) and reduced downtime (12–15%).

Cargo insurance is another important aspect of ensuring safety. Insurance programs are developed considering the specifics of the goods transported and potential risks. The insurance covers losses in the event of theft, damage or loss of cargo, which reduces financial risks for the company and increases customer confidence in the reliability of the services provided. With global trade and increasing traffic volumes, insurance is becoming an integral part of effective risk management.

Staff training also plays a significant role in ensuring the safety of cargo. All employees involved in the organization and execution of transport must be professionally trained and educated in safety measures. Regular training and briefings help staff to be prepared to deal with emergencies, such as accidents, theft or natural disasters. Qualified personnel know how to properly handle cargo and how to prevent and respond to potential threats, which significantly improves the overall safety of transport operations.

The development and implementation of clear security procedures and protocols are an integral part of the cargo security system. These procedures include checking and controlling all stages of transport, from loading to delivery. An important element is the implementation of a reporting and control system that monitors compliance with security procedures and detects violations in a timely manner.

Regular audits and checks on compliance with security standards contribute to the continuous improvement and development of the cargo protection system. It is also necessary to address the specific safety requirements depending on the type of cargo. The transport of dangerous goods, such as chemicals or explosive materials, requires a special approach and additional security measures. This includes the use of specialized vehicles, compliance with international norms and standards, and regular inspections and certifications.

Finally, cargo security is not a one-off event, but an ongoing process that requires regular updates and adaptation to new threats and challenges. In the rapidly changing world of logistics and technology, companies must be prepared to implement innovative solutions and continuously improve their security systems. Vehicle safety is one of the key factors in the logistics and transport industry. Regular technical checks and maintenance of vehicles, as well as compliance with traffic rules, help ensure the safety of the vehicle and the cargo being transported (Guo et al., 2021).

These measures help minimize the risk of accidents and incidents, ensuring the reliability and efficiency of logistics operations. Maintenance includes routine inspections and repairs of vehicles, which identify and eliminate malfunctions promptly. Regular checks of the brake system, engine, tires and other key components help prevent unexpected breakdowns and accidents. It is also important to monitor the condition of the vehicle's body and chassis to avoid potential problems resulting from corrosion and wear and tear. These preventive measures significantly improve the safety and reliability of vehicles.

Compliance with traffic rules is another important aspect of safety. Drivers must be well-trained and aware of the rules of the road, which include knowing and obeying speed limits, maneuvering rules and road priorities. Companies should conduct regular training and knowledge checks on drivers to ensure that they are qualified and able to operate vehicles safely. Particular attention should be paid to the rules for the transport of dangerous goods and compliance with special requirements related to such transport.

Modern technologies play an important role in improving vehicle safety. The introduction of vehicle condition monitoring systems allows for real-time monitoring of vehicle technical parameters. Such systems can include sensors,

diagnostic equipment and telemetry that help to quickly identify and resolve faults. For example, tire pressure monitoring systems can alert the driver when tires need to be inflated or replaced, reducing the risk of tire-related accidents.

Engine monitoring and diagnostic systems can also signal the need for maintenance, preventing serious breakdowns. Driver training and development also play a significant role in vehicle safety. Drivers should receive regular training, including refresher courses and safe driving training. Such training helps drivers improve their skills in driving in a variety of road conditions, including adverse weather conditions, heavy traffic and complex routes. It is also necessary to train drivers on the correct actions to take in emergencies, such as accidents or breakdowns on the road so that they can respond quickly and effectively to unforeseen circumstances.

Developing and implementing clear vehicle safety procedures and protocols is an integral part of a systematic approach to safety management. These procedures may include regular pre-departure inspections of vehicles, enforcement of road traffic regulations and monitoring vehicle conditions throughout the route. It is also important to develop and implement internal policies and standards that comply with legal requirements and best practices to ensure a high level of safety at all stages of the transport process.

In addition, the impact of the human factor on vehicle safety should be considered. Drivers need to be not only well-trained but also physically and mentally prepared for their duties. Fatigue, stress and other factors can negatively affect a driver's ability to drive safely. Therefore, companies should implement programs to manage driver health and well-being, including work and rest schedules, psychological support and medical examinations.

The introduction of innovative technologies, such as automated driving and driver assistant systems, can also significantly improve vehicle safety. These technologies help to reduce the likelihood of human error and increase the overall reliability of transport operations (Kliuiev et al., 2024). For example, emergency braking, lane control and automatic parking systems can significantly reduce the risk of accidents and incidents on the road.

Personnel training plays a key role in the organization and execution of transport, especially in terms of safety and emergency response. In logistics, where the slightest mistake can lead to significant losses, staff training becomes a critical aspect to ensure smooth and safe operations. Table 2 shows the data for the 5 largest regions of Kazakhstan.

Table 2 Number of employees employed in logistics and transport companies in Kazakhstan (by region), Source: compiled by the authors based on (KazLogistics, 2024)

Region	Number of employees employed in logistics and transport companies	Share of the total workforce
Almaty	300,000	7%
Astana	200,000	6%
Shymkent	100,000	5%
East Kazakhstan	50,000	4%
Karaganda	40,000	4%
Total	700,000	5%

Table 2 presents data on the number of employees employed in logistics and transport companies across the five largest regions of Kazakhstan. The table provides insights into the workforce distribution within the logistics sector, highlighting regional variations in employment concentration. Almaty has the highest number of logistics and transport employees, with 300,000 workers, accounting for 7% of the total workforce. Astana follows with 200,000 employees, representing 6% of the total workforce. Shymkent has 100,000 workers engaged in logistics activities, making up 5% of the total employment. East Kazakhstan and Karaganda have smaller shares, with 50,000 and 40,000 employees, respectively, each contributing around 4% of the workforce in the transport sector. The total number of employees in the logistics and transport sector across these five regions amounts to 700,000, which constitutes approximately 5% of Kazakhstan's total workforce.

The data indicate that Almaty and Astana serve as major logistics hubs, likely due to their advanced infrastructure, high economic activity, and strategic geographic location. The concentration of logistics employment in these urban centers suggests significant transport operations and supply chain activities. In contrast, the lower employment figures in East Kazakhstan and Karaganda reflect either lower transport demand or a reliance on other economic sectors. This workforce distribution provides essential insights for policymakers and businesses in optimizing human resource allocation, planning transport infrastructure, and developing strategies to enhance logistics efficiency in Kazakhstan.

All employees involved in logistics operations should undergo initial training, including familiarization with the basics of the transport process, traffic rules and basic safety principles (Wahab et al., 2021). This training should

cover both theoretical aspects and practical application of knowledge. For example, drivers must not only know the rules of the road but also be able to apply them in different road and weather conditions.

Operators and managers need to understand the planning and coordination processes and be able to react quickly to changes in plans or routes. Employees should be trained in the correct methods of handling cargo, especially when it comes to transporting hazardous or fragile materials. They should know how to use safety equipment and what precautions to take to prevent accidents. An important aspect is training in the correct loading and unloading of vehicles to avoid damage to the cargo and injury to employees. It is also important that employees know how to use monitoring and tracking systems to ensure the safety of the transport process.

Training in emergency procedures is equally important. Emergencies can occur at any time – from road traffic accidents to natural disasters. Employees must be prepared for such situations and be able to act quickly and efficiently. This includes knowledge of evacuation plans, use of emergency equipment and first aid skills. Conducting regular training and emergency simulations will help employees to be better prepared and reduce stress in real-life situations.

Professional training is not limited to the initial stages of work. Continuous updating of knowledge and skills through regular refresher courses and training is a prerequisite for maintaining a high level of professionalism. The logistics industry is constantly evolving, with new technologies and working methods being introduced. To keep pace with these changes, employees need to be regularly trained and familiarize themselves with the latest trends and best practices in their field.

Companies that invest in the training and development of their employees gain significant benefits. Trained employees are more competent and confident in their actions, which contributes to the efficiency and safety of transport operations. In addition, a high level of training can be used to adapt to changes and cope with unforeseen situations more quickly. This, in turn, leads to cost savings, improved customer service and a stronger market reputation. Staff training should be comprehensive and systematic.

It is important not only to provide theoretical knowledge but also to ensure its practical application. Regular training and simulations, as well as constant updating of knowledge and skills through advanced training courses, play a key role in maintaining a high level of professionalism. This approach not only helps to improve the quality and safety of transportation but also creates the basis for the company's sustainable development and long-term competitiveness.

Compliance with transport and safety legislation is a fundamental aspect of transport organization. Legislative norms and requirements form the basis for safe and efficient logistics activities, ensuring the protection of all participants in the transport process – from companies to customers and society. Failure to comply with these regulations may result in severe fines, sanctions and other negative consequences, including damage to the company's reputation.

Transport legislation, similarly to any other area of law, is subject to regular updates and amendments (Agbelie et al., 2021). Therefore, companies need to respond quickly to new legislation governing transport operations, safety and environmental standards. This requires qualified specialists to monitor legislative changes and inform management of new requirements. Fig. 1 shows the average values for Kazakhstan. The level of CO_2 emissions can vary depending on various factors.

Consultation with legal experts is essential to ensure compliance with legal requirements. Professional lawyers can provide valuable advice on the legal aspects of a company's business, help interpret complex legislation and offer strategic solutions to minimize legal risks. Regular cooperation with legal advisers helps to identify and eliminate violations promptly, as well as to develop internal policies and procedures that comply with legal requirements.

The development and implementation of internal policies and procedures is another key element in compliance. Companies should create clear guidelines and regulations

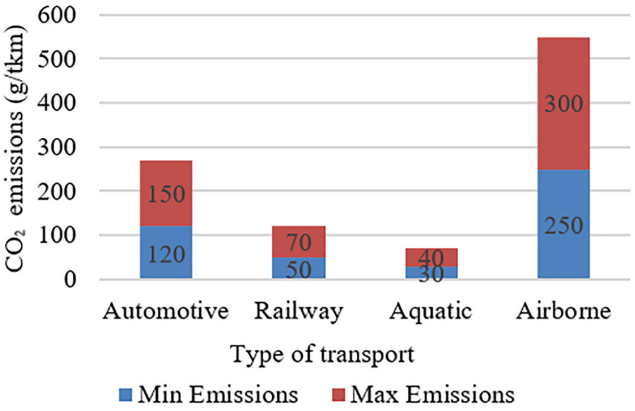

Fig. 1 CO_2 emissions per ton of freight transported by different modes of transport in Kazakhstan, Source: compiled by the authors based on (Bureau of National Statistics, 2024)

that will govern all aspects of the transport process. These documents should cover safety issues, rules for transporting various types of cargo, environmental standards and emergency procedures. Internal policies and procedures should be clear and accessible to all employees so that everyone knows their duties and responsibilities for compliance.

Compliance also includes regular inspections and audits of transport operations. Internal and external audits help to assess the extent to which the company's activities comply with the established norms and requirements. These audits help to identify weaknesses and areas for improvement and develop corrective action plans. Regular audits help maintain a high level of legal discipline and help avoid fines and penalties. Failure to comply with the law may result in negative consequences for the company.

Fines and penalties imposed for violations of the rules may significantly increase operating costs and adversely affect the company's financial condition. Moreover, violations of the law may lead to litigation and damage to the company's reputation. A loss of trust from customers and partners can result in a decline in orders and a reduction in market share. Compliance with transport and safety legislation is also of great social importance. Safe and legal transport operations help to protect the environment, reduce the risk of accidents and incidents on the road, and ensure the safety of employees and society. Compliance with environmental standards helps to reduce the negative impact on the environment and contributes to sustainable development.

Monitoring and managing risks are key aspects of organizing efficient and safe transport. In the global economy, where logistics processes are becoming increasingly complex and interconnected, the ability to quickly identify and manage risks is becoming a competitive advantage. Continuous monitoring of the transport process helps to minimize unexpected situations and optimize operations, ensuring the reliability and safety of transport.

The first step in managing risks is to implement monitoring systems that track the status and movement of cargo and vehicles in real-time. The use of GPS and other tracking systems provides accurate information about the location of the vehicle, its speed and environmental conditions. This can be used to respond quickly to any changes and deviations from the planned route, which reduces the likelihood of theft, damage and other risks.

Risk identification is an important component of the monitoring process. Regular data analysis and audits help identify potential threats at various stages of the logistics chain. For example, seasonal changes in weather conditions, road infrastructure, geopolitical factors and other external conditions can have a significant impact on the safety and efficiency of transport. Understanding these factors allows companies to anticipate potential problems and develop measures to prevent them in advance.

After identifying risks, it is important to assess them and develop strategies to minimize them. This may include creating backup routes, using insurance to protect against financial losses, and implementing additional security measures to protect cargo and vehicles. Applying a comprehensive approach to risk assessment allows the company to better prepare for possible unforeseen situations and minimize their impact on operational processes.

One of the most effective methods of risk management is the development of contingency plans that include alternative solutions in case of emergency. These plans should be detailed and tested so that they can be implemented quickly and efficiently if necessary. For example, if the main route is closed due to weather conditions or roadworks, alternative routes prepared will avoid delays and maintain delivery times.

Reporting and analyzing the effectiveness of risk management measures are the final stages of this process. Regular reporting assesses the effectiveness of the measures taken and identifies areas for improvement. Analyzing data on incidents, delays and other problems helps to identify the causes of them and develop new strategies to prevent them in the future. This creates the basis for continuous improvement of risk management processes and their effectiveness.

Monitoring and managing risks are not only operational but also strategic tasks for a company. Effective risk management can reduce costs associated with unforeseen situations, improve the quality of customer service and increase the overall sustainability of the business. In a highly competitive logistics market, this can be a crucial factor in attracting and retaining customers and enhancing a company's reputation. In addition, risk management helps to ensure compliance with regulatory and safety standards. Many industries are governed by strict regulations regarding the transport of goods and vehicle safety. Meeting these requirements not only prevents fines and penalties but also demonstrates a company's commitment to high safety and quality standards.

Continuous monitoring of the transport process and risk management also play an important role in the company's

sustainable development. Optimizing routes and using environmentally friendly modes of transport help to reduce the carbon footprint and minimize the negative impact on the environment. This not only meets modern environmental protection requirements but also improves the company's image in the eyes of the public and customers. Successful organization of transport services and ensuring the safety of the transport process require a comprehensive approach and careful consideration of all the above aspects.

Real-life examples were used to confirm the theoretical conclusions. In Europe, an example of the successful application of theoretical methods is what the DHL Group (DHL Group, 2023), one of the world leaders in the field of logistics and freight transport has implemented. DHL Group actively uses GPS tracking to monitor the movement of its vehicles and cargo. GPS systems track the location of vehicles in real-time, ensuring transparency of logistics operations and prompt response to any deviations from the planned route.

In addition, DHL Group uses specialized software (DHL Group, 2025) to optimize logistics routes. These programs analyze various factors, such as traffic, weather conditions and infrastructure constraints, to plan the most efficient routes and reduce transport costs. The company has also implemented strict security measures to protect cargo. DHL Group uses sealed containers to prevent unauthorized access to the shipment during transport. Cargo insurance is another important security measure applied by the company, providing financial protection in the event of theft, damage or loss of cargo.

For example, the company Kazakhstan Railways (2023) demonstrates the successful application of these approaches on a national scale. This company, being the largest railway operator in Kazakhstan, is actively implementing modern technologies and practices to improve its logistics operations. In its reports, Kazakhstan Railways points to the use of modern GIS for route planning. GIS technologies allow the optimization of train routes, considering the state of the infrastructure and road conditions, which ultimately helps to reduce travel time and operating costs.

In addition, Kazakhstan Railways is implementing rolling stock condition monitoring systems, including the installation of various sensors and diagnostic equipment on locomotives and wagons. These systems allow real-time monitoring of the technical condition of transport, promptly identifying and eliminating malfunctions, and preventing possible accidents and downtime. This approach significantly improves transport safety and the reliability of the logistics network.

These examples illustrate how theoretical methods and recommendations are applied to achieve efficient and safe transport of goods. They demonstrate that the use of modern technologies and risk management strategies plays a key role in organizing transport services and ensuring the safety of the transport process.

4 Discussion

The organization of transport services and ensuring the safety of the transport process plays an important role in the modern logistics and transport industry. An important aspect is the choice of the right type of transport. The efficiency of transportation depends on the right choice of vehicle, addressing the type of cargo, transport distance, delivery time and other factors. For example, for the transport of bulky or heavy goods, it may be preferable to use rail or sea transport, while for the delivery of goods over short distances, road transport is often chosen.

This was also investigated by Aminzadegan et al. (2022), where the results confirmed that the choice of the appropriate mode of transport plays a key role in ensuring the efficiency of cargo and passenger transportation. This process requires an analysis of various factors, such as the type of cargo, transport distance, delivery time, and economic and environmental aspects.

For example, long-distance transport of bulky or heavy goods may be best achieved by rail or sea, due to their large carrying capacity and relative cost-effectiveness. However, for the delivery of goods over short distances or to places inaccessible to other modes of transport, road transport may be preferable.

Aloui et al. (2021) also determined that in addition to the characteristics of the cargo, it is also necessary to consider the infrastructure, availability of transport routes, risks and delivery time requirements. For example, the use of air transport can be most efficient for urgent shipments or long-distance transport, despite its higher cost.

Thus, the right choice of vehicle helps to optimize logistics processes and ensure their efficiency. It is worth noting that the choice of vehicle may depend on the type of cargo and route conditions. For example, road transport is preferable for transporting goods over short distances, while specialized modes of transport may be suitable for goods requiring special storage conditions.

Furthermore, it is necessary to address route planning. Optimal route planning helps to minimize time and cost

and increases the efficiency of the transport. Road conditions, presence of mountain passes, infrastructure constraints and other factors that may affect the delivery process must be considered. This aspect has attracted the attention of many scholars, among them Bilal et al. (2021), who stress that the study of factors related to the selection of the appropriate mode of transport and planning the optimal route is important for the efficient organization of transportation services and the safety of the transport process.

Kaewfak et al. (2021) concluded that proper transport selection, considering cargo characteristics, distance and delivery time, as well as optimal route planning taking into account road conditions and infrastructure constraints, can minimize risks and reduce transport costs. These results support the above study, as optimal transport selection and route planning play a key role in ensuring the successful and safe delivery of goods. The factors considered, such as cargo characteristics, transport distance and route infrastructure, confirm the importance of considering all aspects of the logistics process to achieve optimal results. Such an approach contributes to more efficient logistics operations and ensures more reliable and safe delivery of goods.

The choice of reliable carriers also plays a key role in ensuring the successful transport of goods. The selection of qualified and reliable carriers affects the safety of the cargo, delivery times and the overall quality of service. Holding tenders, assessing carriers' reputations and entering contracts with clear terms and conditions are important steps in this process. Gurzhiy et al. (2021) studied this phenomenon, noting that the choice of reliable carriers is important for ensuring the quality delivery of goods and the efficient functioning of the supply chain. A reliable carrier ensures the safety of the cargo during transportation, compliance with delivery times and a high level of service, which contributes to customer satisfaction and maintaining the company's reputation. The optimal choice of carriers is based on a thorough assessment of their reputation, tenders and contracts with clear terms and conditions, which ensures reliability and transparency in the logistics process.

The study by Mehanović and Ezgeta (2023) also considered several important aspects affecting the efficiency of logistics operations as part of the carrier selection strategy. The carrier's reputation plays an important role, as it affects its reliability, quality of service and cargo safety, so assessing reputation through reviews, ratings and experience of cooperation is a priority when choosing a carrier. Furthermore, organizing tenders can be used to select the most suitable carriers on a competitive basis, which helps to optimize the cost of transportation and ensures the best price-quality ratio.

Finally, the conclusion of contractual obligations with carriers, containing clear terms and conditions and responsibility for meeting deadlines and cargo safety, is an important step in the carrier selection strategy, ensuring transparency and efficiency of logistics operations. This data is consistent with the theses presented in the previous section. The data on the selection of reliable carriers confirms the importance of paying due attention to this issue as part of the overall logistics and transport strategy. It also highlights the need for a systematic approach to evaluating and selecting partners, which helps to reduce risks and ensure more efficient operation of the entire logistics system.

Ensuring the safety of cargo is an integral part of organizing transport services. Cargo can be exposed to various risks during transport, including theft, damage or loss. Appropriate security measures, such as the use of sealed containers, GPS tracking and insurance, help to minimize risks and ensure the safety of cargo.

A study by Dzemydienė and Burinskienė (2021) found that ensuring cargo security is one of the key aspects of the successful organization of transport services. This is important not only to protect the cargo itself but also to ensure customer confidence and maintain the company's reputation. Risk analysis allows the identification of potential threats, such as theft, damage or loss of cargo, and to development of strategies and protection measures aimed at minimizing them. Applying appropriate security measures, such as the use of sealed containers, GPS tracking, insurance and others, helps to ensure the safety of goods throughout the transport process and reduce the risk of incidents.

It is worth noting the study by Ding et al. (2023), which also showed that ensuring cargo security in logistics operations requires an integrated approach and the use of various strategies to prevent threats and minimize losses. One of the key methods is the use of thorough screening and training of personnel, which helps to prevent incorrect loading, mishandling and other human errors that can lead to loss or damage to cargo.

The findings of this study have significant practical implications for logistics companies, policymakers, and transport service providers. A systematic approach to selecting transport modes based on cargo characteristics, route

conditions, and delivery time requirements can enhance logistics efficiency and reduce costs. Companies can apply these insights by optimizing transport strategies, considering economic and environmental factors, and leveraging technology for better decision-making. The study reinforces the necessity for businesses to adopt advanced route optimization tools, predictive analytics, and risk assessment models to enhance logistics operations.

From a policy perspective, the research highlights the need for government regulations to support the adoption of environmentally sustainable transport solutions. Policymakers should consider incentivizing the use of low-emission vehicles, expanding rail and inland water transport infrastructure, and implementing stricter safety regulations to minimize transport-related risks. The study suggests that regulatory frameworks should be refined to include mandatory safety training programs, standardized vehicle maintenance protocols, and digital tracking systems to ensure compliance with security measures. Furthermore, enhancing public-private partnerships in logistics could lead to better infrastructure development and the adoption of best practices in transport management.

In addition, modern technologies, such as GPS tracking, video surveillance and remote monitoring, can be used to respond quickly to any threats and prevent potential incidents in real-time. Comparing the data obtained during the research with real-life situations in logistics practice, it is possible to note that the application of these measures reduces the likelihood of incidents and improves the overall level of cargo security during their movement. In this way, the organization of transport services can effectively manage risks and provide a high level of service to customers.

Lastly, ensuring the safety of the transport process includes regular vehicle maintenance, staff training and compliance with transport and safety legislation. Regular inspections of vehicles and training of personnel in safety procedures help to prevent accidents and ensure the safety of both the transport vehicle itself and the transported cargo. In turn, Vlkovský et al. (2021) concluded that is consistent with the results of this study and identified methods to ensure the safety of the transport process that include not only a thorough analysis of risks and vulnerabilities but also training of personnel in safety rules and compliance with the legislation regulating activities in the field of transport.

The analysis helps identify potential hazards and establish effective strategies to prevent them, while staff training ensures competent response to emergencies and compliance with safety protocols, and compliance with legislation ensures that the company's actions comply with requirements and regulations, reducing risks and increasing the level of safety in the transport process.

In addition, the study by Kam-Fung and Bell (2021) determined that the effectiveness of security strategies in logistics operations depends on two key factors: vehicle maintenance and staff training. Regular maintenance of vehicles helps to prevent emergencies and ensures their reliable operation during transportation, while personnel training improves employees' awareness of security measures, helps them to respond to emergencies and follow established procedures, which increases the level of security of logistics operations.

When analyzing the results of the study, it becomes clear that an integrated approach to ensuring the safety of the transport process and cargo reduces the likelihood of unforeseen situations and increases the overall efficiency of logistics operations. Regular staff training, the introduction of modern monitoring technologies and active engagement with reliable carriers are key strategies to ensure the safety and successful delivery of goods.

Thus, the organization of transport services and ensuring the safety of the transport process are key aspects of modern logistics and require a systematic approach and constant monitoring. At the same time, the use of statistical data and analytics helps to improve processes and make transportation more efficient and safer, which contributes to an increase in the level of service and customer satisfaction.

5 Conclusions

This study examined various aspects of organizing transport services and ensuring the safety of the transport process. First and foremost, choosing the right type of transport proved to be key to the successful delivery of goods, considering various parameters such as the type of cargo, the distance of transport and the delivery time. Route planning played a key role, as route optimization and consideration of road conditions helped to reduce time and financial costs and improve delivery efficiency.

Selecting reliable carriers and ensuring the safety of the cargo also proved to be integral parts of the logistics process. Evaluating carriers' reputations, holding tenders and concluding contracts with clear terms and conditions played an important role in ensuring the safety of the cargo and meeting delivery deadlines. The use of security

measures, such as sealed containers, GPS tracking and insurance, helped to minimize risks and ensure the safety of goods during transport.

Staff training and legal compliance also played a key role in ensuring the safety of the transport process. Regular safety training and compliance with legal regulations and requirements helped to prevent emergencies and ensure the smooth running of logistics operations. Thus, all the above-mentioned aspects contribute to the optimization and safety of the transport process in the organization of transport services.

The analysis of carbon dioxide emissions by mode of transport in Kazakhstan has been a key element of the environmental strategy in the transport sector. Determining the number of employees employed by logistics and transport companies in different regions of the country can be used to assess the needs for human resources and the development of this industry. Statistics on modes of transport in Kazakhstan for 2023 provided valuable information for transport management, route planning and strategic decision-making in the development of transport infrastructure.

Future research could explore the integration of artificial intelligence and machine learning in optimizing transport choices and route planning. While this study primarily focused on transport selection and logistics efficiency, further investigation is needed into the impact of automation and digitalization on transport safety and risk management. Additionally, the role of geopolitical risks, supply chain disruptions, and climate change on transport logistics remains an important area for continued research. Expanding the scope to include cross-border logistics and the effects of global trade policies on transport efficiency could provide a more comprehensive understanding of the evolving logistics landscape.

By implementing these recommendations, practitioners in the transport and logistics industries can enhance operational efficiency, improve cargo security, and contribute to sustainable logistics development. Strengthening collaboration between businesses, policymakers, and researchers will be essential for advancing the logistics sector and addressing emerging challenges in global transport networks.

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