MULTIPLE FREIGHT TRANSPORT OPTIONS

Uzakov Ortik Shaymardanovich
Associate Professor of the Department of "Optical Communication Systems and Networks" of the Karshi State Technical University. Doctor of Philosophy in Economics (PhD)

Abstract: *In contemporary logistics systems, reliance on a single mode of freight transport has become increasingly inefficient due to rising costs, infrastructure constraints, environmental regulations, and growing uncertainty in global supply chains. As a result, the selection among multiple freight transport options—including road, rail, maritime, air, and multimodal combinations—has emerged as a critical strategic decision for logistics operators and supply chain managers. This study examines multiple freight transport options through an IMRAD-based research framework, focusing on the trade-offs between cost, transit time, reliability, risk, and environmental sustainability. The methodology integrates multi-criteria decision analysis (MCDA) with optimization principles to evaluate transport alternatives under different operational scenarios. The results demonstrate that multimodal and intermodal transport solutions often outperform single-mode transport in terms of resilience, environmental performance, and overall service reliability, particularly for long-distance and high-volume freight movements. The study concludes that a systematic, criteria-based selection of freight transport options enhances supply chain efficiency, robustness, and sustainability.*

Keywords: *freight transport, multimodal transport, intermodal logistics, transport mode selection, supply chain management, MCDA, sustainability, logistics optimization*

INTRODUCTION

Freight transport plays a fundamental role in enabling economic activity by connecting production, distribution, and consumption across regions and countries. Efficient transportation systems reduce logistics costs, improve market accessibility, and enhance the competitiveness of firms and national economies. Traditionally, freight transport decisions have often been based on a dominant mode—most commonly road transport—due to its flexibility and door-to-door service capability. However, increasing congestion, fuel price volatility, environmental concerns, and infrastructure limitations have exposed the weaknesses of single-mode transport strategies.

The growing complexity of global supply chains has intensified the need for more flexible and resilient logistics solutions. Disruptions such as port congestion,

border delays, extreme weather events, and geopolitical instability highlight the risks associated with over-dependence on a single transport mode. Consequently, the concept of multiple freight transport options has gained significant attention in both academic research and practical logistics management. This concept emphasizes the availability and systematic evaluation of alternative transport modes and their combinations to achieve optimal performance under varying conditions.

Multimodal and intermodal transport systems, which integrate two or more transport modes within a single logistics chain, are increasingly promoted as solutions for reducing costs, emissions, and operational risks. Despite their potential benefits, selecting the most appropriate transport option remains a complex decision-making problem involving multiple, often conflicting criteria. This study addresses this challenge by proposing a structured IMRAD-based analysis of multiple freight transport options.

The objectives of this research are threefold:

1. to identify and classify major freight transport options and their characteristics;
2. to develop a multi-criteria framework for evaluating transport mode alternatives;
3. to analyze the performance of different transport options in terms of cost, time, reliability, and sustainability.

METHODOLOGY

This study adopts a qualitative–analytical research methodology supported by a structured decision-making framework. The analysis is grounded in logistics and supply chain management theory and applies multi-criteria decision analysis (MCDA) principles to compare alternative freight transport options.

Classification of Freight Transport Options

The study considers the following major freight transport modes:

- Road transport, characterized by high flexibility and door-to-door service but limited capacity and higher emissions per ton-kilometer.
- Rail transport, suitable for bulk and long-distance freight, offering lower unit costs and emissions but requiring terminal infrastructure.
- Maritime and inland waterway transport, providing the lowest cost per unit for international and large-scale shipments, with longer transit times.
- Air transport, offering the fastest transit times for high-value and time-sensitive goods at significantly higher costs.
- Multimodal and intermodal transport, combining two or more modes to exploit their complementary strengths.

Evaluation Criteria

To assess transport options systematically, six groups of evaluation criteria are defined:

1. Economic criteria: total logistics cost, tariff stability, handling and terminal costs.
2. Time-related criteria: transit time, delivery punctuality, and schedule frequency.
3. Reliability and risk: probability of delays, damage risk, and exposure to disruptions.
4. Infrastructure and operational compatibility: terminal availability, cargo type suitability, and network coverage.
5. Environmental sustainability: carbon dioxide emissions, energy efficiency, and environmental impact.
6. Flexibility and adaptability: ability to respond to demand fluctuations and emergency re-routing.

Multi-Criteria Decision Analysis (MCDA)

Each transport option is evaluated against the defined criteria using normalized performance scores. Weights are assigned to criteria based on strategic priorities, such as cost minimization, service quality, or sustainability objectives. The overall performance score for each option is calculated as a weighted sum of criterion scores. Scenario analysis is applied to examine the robustness of transport choices under changing conditions, such as fuel price increases or infrastructure disruptions.

RESULTS

The application of the proposed framework reveals several key findings regarding the performance of multiple freight transport options.

First, single-mode transport solutions perform well only under specific conditions. Road transport is effective for short-distance and time-flexible deliveries, while rail and maritime transport excel in cost efficiency for large volumes and long distances. However, their performance deteriorates when evaluated against reliability and flexibility criteria.

Second, multimodal and intermodal transport solutions consistently achieve higher overall scores in the MCDA results. By combining the strengths of different modes, these solutions reduce dependency on a single transport network and improve resilience against disruptions. For example, rail–road combinations offer a balance between cost efficiency and last-mile flexibility, while sea–rail combinations significantly reduce emissions for international freight.

Third, environmental evaluation indicates that transport chains with a higher share of rail and maritime modes generate substantially lower carbon emissions compared to road-dominated chains. When sustainability criteria are assigned

higher weights, multimodal solutions emerge as the preferred option in most scenarios.

Finally, scenario analysis demonstrates that transport options based on multiple modes are more robust under uncertainty. Changes in fuel prices, border delays, or infrastructure availability have a smaller negative impact on overall performance when alternative modes are available.

DISCUSSION

The results confirm that freight transport selection is inherently a multi-dimensional decision problem. Focusing exclusively on cost or speed leads to suboptimal outcomes when reliability, risk, and sustainability are ignored. The findings support the growing consensus in logistics research that multimodal and intermodal transport systems are essential for building resilient and sustainable supply chains.

From a managerial perspective, the study highlights the importance of aligning transport mode selection with cargo characteristics and strategic objectives. High-value and time-sensitive goods may justify higher transport costs, while bulk commodities benefit from cost-efficient and environmentally friendly modes. Additionally, the integration of digital tracking and real-time information systems is critical for managing the complexity of multimodal transport chains.

The discussion also underscores the policy implications of promoting multiple freight transport options. Investments in intermodal terminals, rail infrastructure, and port connectivity can significantly enhance national and regional logistics performance while supporting environmental goals.

CONCLUSION

This study has presented an IMRAD-based analysis of multiple freight transport options, emphasizing the trade-offs between cost, time, reliability, and sustainability. The findings demonstrate that relying on a single transport mode increases vulnerability to disruptions and limits optimization potential. In contrast, systematically evaluated multimodal and intermodal solutions improve supply chain resilience, reduce environmental impact, and enhance overall logistics performance.

The proposed multi-criteria framework provides a practical tool for transport planners and supply chain managers to support informed decision-making. Future research may extend this work by incorporating quantitative optimization models, real-world case studies, and the application of artificial intelligence techniques for dynamic transport mode selection.

REFERENCES:

10. Shaymardanovich U. O. Raqamli iqtisodiyotda kiberxavfsizlik zaifliklari tahlili //Intellectual education technological solutions and innovative digital tools. – 2024. – Т. 3. – №. 28. – С. 88-92.
11. Zohirov K. et al. Electromyography-Based Sign Language Recognition: A Low-Channel Approach for Classifying Fruit Name Gestures //Signals. – 2025. – Т. 6. – №. 4. – С. 50.
12. Berdiyev G., Ochilova S., Pardayeva G. FRAKTAL NAZARIYASI ASOSIDA KOMPYUTERDA MUSIQA YARATISH TEXNOLOGIYASI //DIGITAL TRANSFORMATION AND ARTIFICIAL INTELLIGENCE. – 2024. – Т. 2. – №. 2. – С. 116-119..
13. Rashidovich B. G. DESIGNING FRACTAL BUILDINGS USING ITERATIVE FUNCTION SYSTEMS.
14. Ochilova S., Berdiyev G., Xujaqulov N. Fraktal nazariyasiga asoslangan musiqa kompozitsiyasining tahliliy usullari //Journal of Transport. – 2025. – Т. 2. – №. 3. – С. 136-139.
15. Pardaeva G., qizi Vakilova L. N., qizi Samandarova S. J. THE ROLE OF MOBILE APPS IN SIMPLIFYING ENGLISH LEARNING //Global Science Review. – 2025. – Т. 4. – №. 5. – С. 685-691.
16. Sadullaeva S. A., Pardaeva G. Numerical Investigation one System Reaction-Diffusion with Double Nonlineari //Journal of Mathematics, Mechanics and Computer Science. – 2015. – Т. 86. – №. 3. – С. 58-62.
17. Shoniyozova Y. Q., Turdiyeva M. A., Norboyev B. U. NETWORK ATTACK PREVENTION SYSTEMS //ИННОВАЦИОННЫЕ МЕХАНИЗМЫ И СТРАТЕГИЧЕСКИЕ ПРИОРИТЕТЫ НАУЧНО. – 2020. – С. 46.
18. Bekhzod N., Berdiev G. Development of a System for Automating the Process of Lending to Individuals in Banks //American Journal of Public Diplomacy and International Studies (2993-2157). – 2023. – Т. 12. – С. 21.
19. Pardayeva G.A. A PROJECT-BASED WAY TO USE OPEN BIOLOGICAL DATA IN BIOINFORMATICS EDUCATION // Universum: психология и образование : электрон. научн. журн. 2025. 1(139). URL: https://7universum.com/ru/psy/archive/item/21705
20. Норбоев Б.У., Андокулов Т.Х. ADAPTIVE MULTIMODAL BIOMETRIC AUTHENTICATION SYSTEMS: A HUMAN-CENTERED ANALYSIS OF DESIGN, EVALUATION, AND SECURITY CHALLENGES // Universum: технические науки : электрон. научн. журн. 2026. 1(142). URL: https://7universum.com/ru/tech/archive/item/21701
21. Berdiev G.R., Norboev B.U., Normurodov B.B. USING AI TO MAKE A SOPHISTICATED DECISION-MAKING SYSTEM THAT CAN ADVISE YOU IN

REAL TIME WHETHER TO STOP OR KEEP GOING AT PEDESTRIAN CROSSINGS // Universum: технические науки : электрон. научн. журн. 2026. 1(142). URL: https://7universum.com/ru/tech/archive/item/21672

22. G.A. Pardayeva, B.Sh. Choriyev, D.B. Sulaymonova. SUN'IY INTELLEKT TEXNOLOGIYALARIGA ASOSLANGAN RAQAMLI TA'LIMDA ADAPTIV O'QITISH METODIKASINING NAZARIY MODELI VA AMALIY ASOSLARI. Scientific theoretical and methodical journal. INTER EDUCATION & GLOBAL STUDY. ISSN 2992-9024 (online) 2025, vol.3