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The "Engineer" publishes the most significant results of scientific and applied research carried out in universities of transport profile, as well as other higher educational institutions, research institutes, and centers of the Republic of Uzbekistan and foreign countries.

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Evaluation of key indicators affecting the delivery of containerized cargo in automobile transport

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Abstract: In this article, the key indicators affecting the transportation of containerized cargo in automobile transport are identified using the Ishikawa diagram, and effective methods for assessing their importance levels are studied. The analyses demonstrate that the most important indicators, such as transportation distance, cost, delivery time, and quality of cargo handling, are substantiated. The importance coefficient values of the indicators were determined through expert evaluation and the entropy method. This creates opportunities to increase the efficiency of containerized cargo transportation in automobile transport.

Keywords: road transport, containerized cargo, indicators, importance level, expert evaluation, methods

1. Introduction

Improving the indicators of cargo delivery in automobile transport via containers serves not only to optimize logistics processes but also to increase economic efficiency. This process includes consolidating cargo, introducing modern technologies, ensuring safety, and taking environmental aspects into account [1].

Today, the transport-logistics system is an integral part of any country's economy. In particular, the development of containerized cargo transportation technology ensures the safe, fast, and relatively inexpensive delivery of goods, occupying a significant place in global trade processes. In this regard, the transportation of containerized cargo by automobile transport is recognized as one of the main directions determining the efficiency of modern logistics.

The advantage of automobile transport over other types of transport is its ability to deliver goods from door to door. However, numerous factors affect the process of transporting containerized cargo by road. These include the condition of road infrastructure, the technical specifications of vehicles, transportation distance, traffic congestion on routes, the speed of loading and unloading operations, as well as costs associated with transportation [2].

By identifying the main factors affecting the delivery process of containerized cargo in automobile transport and analyzing them using mathematical-statistical methods, the most critical indicators are determined, thereby providing a scientific basis for organizational and technical decisions in this field. The analytical method helps identify the primary trend by ensuring monotonicity in the development of the processes under study over the considered time period.

Identifying the factors and indicators influencing the transportation of containerized cargo in automobile transport not only improves transportation quality but also enables the establishment of agreements on probable causes that need to be empirically verified.

Based on the review of scientific literature, it was determined that research related to container transportation in automobile transport remains highly relevant. In the study, a multi-criteria hierarchical evaluation system was developed to achieve four strategic objectives for the key indicators affecting containerized cargo transportation in automobile transport (Figure 1).

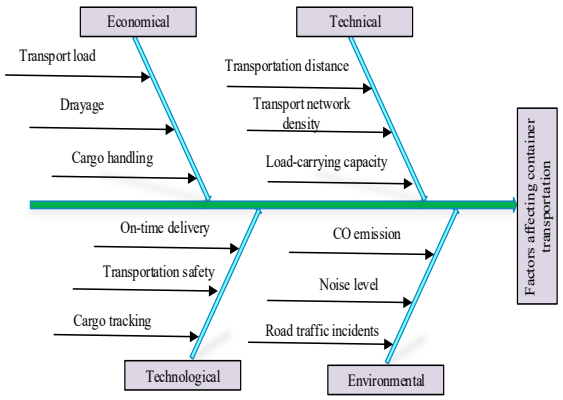

Fig 1. Results of identifying the main factors affecting container transportation in automobile transport based on the Ishikawa diagram

The main factors and indicators affecting container transportation in the logistics supply chain, identified based on the Ishikawa diagram, are presented.

2. Methodology

Many researchers have attempted to identify and evaluate indicators to determine the efficiency of container transportation in automobile transport. For instance, V. A. Shebanov (2008), in his scientific work titled “Logistics of Container Transportation Systems”, identified indicators such as weight, distance, transportation cost, drayage, and loading time for assessing container transportation efficiency. He emphasized the need for a comprehensive analysis of factors influencing transport selection [5].

In addition, Malcolm McLean, in his work “Evaluation of the Efficiency of Transport Logistics Systems”, took into account the interdependence of the container transportation process with transport networks. He proposed selecting key indicators using weight coefficients and mathematically expressing their impact on transport decisions [4].

Currently, the following main methods are widely used to evaluate indicators affecting containerized cargo transportation:

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- Expert evaluation method: The importance of each indicator is determined based on the opinions of experienced specialists.

- Delphi method: A group of experts reaches consensus through anonymous, multi-stage evaluation. This method was first developed by Norman Dalkey and Olaf Helmer in the 1960s at RAND Corporation [3,5].

- AHP – Analytic Hierarchy Process: Indicators are compared in pairs, and weight coefficients are determined. This method was proposed by T. L. Saaty and is applied in many transport systems [6].

In modern logistics systems, containerized cargo transportation technology plays a central role in global trade and transport operations. In particular, the delivery of containerized cargo by automobile transport is closely linked to factors such as economic efficiency, environmental safety, and service quality. Therefore, identifying and evaluating the key indicators affecting this mode of transport holds significant scientific and practical importance in enhancing its competitiveness and substantiating management decisions

Inside the system of built up participation with neighboring nations such as Kazakhstan, Kyrgyzstan, Tajikistan, Turkmenistan, and Afghanistan, assentions have been come to on the development of unused interstates, the opening of courses to outside nations through them, as well as the joint repair and operation of existing streets [4]. As a result, the volume of street cargo transportation and travel cargo transportation has been expanding year by year.

Various evaluation methods exist to identify the factors affecting the transportation of containerized cargo in automobile transport and to determine their relative importance. This section analyzes three main methods: expert evaluation, the entropy method, and AHP (Analytic Hierarchy Process). The capabilities of the expert evaluation method include the following:

- proposing solutions even in the absence of statistical data;

- rapid, flexible, and practical data processing based on experience;

- creating a foundation for new ideas and unconventional approaches.

However, this method also has drawbacks: a high probability of subjectivity, strong dependence of results on the quality and number of experts, and the occasional emergence of conflicting opinions. In such cases, improved expert evaluation methods like the Delphi method are applied.

In conclusion, the expert evaluation method is an effective tool for analyzing complex, multi-factor problems in the transport sector, providing results that are close to reality and reliable. It holds significant importance in determining directions for further improving containerized cargo transportation.

The expert evaluation method is an approach aimed at determining the relative importance of various indicators or criteria based on the opinions of specialists. It is one of the simple yet effective methods widely used in the field of transport logistics. Qualified and experienced experts (i.e., industry professionals such as transport managers, road transport engineers, and logistics analysts) assess the importance level of each criterion using a scoring system. These scores are assigned on a scale ranging from 1 to 5, and sometimes from 1 to 10 [4].

Table 1

Experts' ratings on a 1–10 point scale

Indicator	Expert 1	Expert 2	Expert 3	Expert 4	Expert 5	…	Expert 21	Average
Transportation distance	9	9	9	8	9	…	8	8,7
Transport network density	5	4	5	6	5	…	4	4,7
Load-carrying capacity	5	6	7	5	7	…	5	6
Transport load	8	9	8	9	7	…	9	8,3
Drayage	5	4	4	6	6	…	4	5
Cargo handling	6	5	8	6	7	…	6	6,3
On-time delivery	8	8	8	7	8	…	7	7,7
Transportation safety	7	6	6	6	6	…	7	6,3
Cargo tracking	6	7	8	8	5	…	8	7
CO_2 emission	8	7	5	5	6	…	7	6,6
Noise level	7	7	6	6	6	…	6	6,6
Road traffic incidents	5	7	6	7	5	…	6	6
Total						…		79,2

Formula for calculating average scores:

$$K_j = \frac{1}{n}\sum_{i=1}^{n} k_{ij}, \quad (1)$$

Here, $\mathbf{K_j}$- j- average score for the indicator;

$\mathbf{k_{ij}}$- score given by the i-th expert to the j-th indicator;

n – number of experts.

Formula for calculating importance using the expert evaluation method:

$$w_j = \frac{K_j}{\sum K_j}, \quad (2)$$

K_j=8,7 average score for transportation speed;

$\sum K_j$=79,2 number of experts;

W_j=8,7/79,2= 0,11 is calculated for each indicator.

The expert evaluation method is a technique that utilizes the knowledge and experience of qualified specialists (experts) in a specific field to determine the importance level of a particular indicator or factor. With this method, situations that need to be qualitatively assessed (e.g., transportation safety, drayage quality, cargo handling speed) are expressed in quantitative terms [6].

3. Results and Discussion

In this method, the criteria to be evaluated are first identified, followed by the selection of experienced experts. Questionnaires are presented to the experts, and their opinions and assessments are collected in Table 1. The evaluation can be conducted using a scoring system (e.g., on a scale of 1–10), in the form of rankings (from most important to least important), or based on pairwise comparison. The obtained results are processed, generalized, and conclusions are drawn using mathematical-statistical methods [5, 6].

Table 2
Calculating importance using the expert evaluation method

Indicator	Average score (Kj)	Importance (Wj)
Transportation distance	8,7	**0,110**
Transport network density	4,7	0,0593
Load-carrying capacity	6	0,0758
Transport load	8,3	0,105
Drayage	5	0,0631
Cargo handling	6,3	0,0795
On-time delivery	7,7	0,0972
Transportation safety	6,3	0,0795
Cargo tracking	7	0,0884
CO_2 emission	6,6	0,0833
Noise level	6,6	0,0833
Road traffic incidents	6	0,0758

The factors affecting containerized cargo transportation in automobile transport are listed in Table 2, including “transportation distance”, “transport network density”, “load-carrying capacity”, “transport load”, “on-time delivery”, “drayage”, “cargo handling”, “transportation safety”, “cargo tracking”, “CO_2 emission”, “noise level”, and “road traffic incidents”. These factors are evaluated by experts using a scoring system. Based on the assigned scores, the importance level of each factor is calculated, and the most critical factors are identified.

4. Conclusion

During the evaluation process, each expert assigned scores to the indicators, and the total sum was calculated based on these scores. Subsequently, the weight of each indicator—representing its overall impact strength—was determined as a percentage, expressing its degree of influence on the overall analysis. For example, transportation speed received the highest score (8.7), with a weight of 0.11 (11%). This indicates that the indicator is more significant compared to others.

The results clearly show that the expert evaluation method identified the relative proportions among the factors, determining the extent to which each plays a critical role in the overall system. This approach not only ranks the indicators but also serves as a foundation for prioritizing them in future decision-making processes.

References

[1] United Nations Conference on Trade and Development UNCTAD, 2020. Review of Maritime Transport 2020. United Nations Publication, New York and New York and Geneva Available online: https://unctad.org/system/files/official-document/rmt2020_en.pdf (accessed on 12 November 2020).

[2] O‘zbekiston Respublikasi Prezidentining 2025-yil 27-yanvardagi “O‘zbekiston Respublikasining transport-logistika tizimini yanada rivojlantirish chora-tadbirlari to‘g‘risida”gi PQ-28-son qarori

[3] Anatoliy Egorov, Nadezhda Pilipchuk, Igor Khmelev, Vitaliy Shatokhin va Aleksey Kovkinlar "World experience in the development of container traffic" 2018-03-19.

[4] Malcolm McLean; Pioneered use of Shipping Containers. Los Angeles Times. May 29, 2001. Retrieved 2017-03-09.

[5] Axunov J.A , Chariyev X.Sh., Yusufxonov Z.Y. Konteynerli yuklarni avtomobil transportlarida tashish texnologiyasini takomillashtirish usullari: adabiyotlar tahlili. Farg‘ona Politexnika Instituti. Ilmiy – texnika jurnali, ISSN 2181-7200, Maxsus son № 20, 2024, 33-43 betlar.

[6] Dirk, Steenken., Stefan, Voß., Robert, Stahlbock. (2004). Container terminal operation and operations research — a classification and literature review. OR Spectrum, 26(1):3-49. doi: 10.1007/S00291-003-0157-Z

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