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# IMPROVING QUALITY MANAGEMENT IN THE TRANSPORT LOGISTICS OF UKRAINE'S INLAND WATERWAYS

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## УДОСКОНАЛЕННЯ МЕНЕДЖМЕНТУ ЯКОСТІ В ТРАНСПОРТНІЙ ЛОГІСТИЦІ ВНУТРІШНЬОГО ВОДНОГО ТРАНСПОРТУ УКРАЇНИ

***In the context of developing transport systems, the role of effective quality management in logistics processes is growing. This is particularly relevant for inland water transport, which is recognized in global practice as one of the most efficient and environmentally balanced modes of transportation. The aim of this article is to substantiate the theoretical and methodical foundations and to develop approaches for improving quality management in the transport logistics of Ukraine's inland water transport. The conducted study demonstrates that improving quality management in the transport logistics of Ukraine's inland water transport is a key factor in enhancing the efficiency of the national transport system, optimizing logistics flows, and ensuring the competitiveness of river transport. The article substantiates a comprehensive approach to quality management improvement, which includes: standardization of logistics processes and implementation of international quality management systems; digitalization of transport management, document flow, and real-time monitoring of vessel and cargo movements; integration of inland water transport into multimodal logistics chains; modernization of infrastructure and logistics hubs; strengthening of safety and environmental standards; and harmonization of the legal and regulatory framework with European standards. The proposed mathematical algorithm for improving quality management enables a systematic assessment of the integral quality indicator, determination of the effectiveness of managerial measures, optimization of resource utilization, and informed decision-making regarding the development of river logistics. Its flow-based implementation ensures real-time monitoring and adjustment of processes, increasing the reliability of transport operations and the coordination of logistics activities. The value of this research lies in its comprehensive approach to the assessment and management of transport service quality on Ukraine's inland waterways, combining standardization, digitalization, infrastructure modernization, and integration into the international transport space.***

***В умовах розвитку транспортних систем зростає роль ефективного управління якістю логістичних процесів. Особливої актуальності це набуває для внутрішнього водного транспорту, який у світовій практиці розглядається як один із найбільш ефективних та екологічно збалансованих видів перевезень. Метою статті є обгрунтування теоретико-методичних засад та розроблення напрямів удосконалення менеджменту якості у транспортній логістиці внутрішнього водного транспорту України. Проведене дослідження демонструє, що удосконалення менеджменту якості у транспортній логістиці внутрішнього водного транспорту України є ключовим чинником підвищення ефективності функціонування національної транспортної системи, оптимізації логістичних потоків та забезпечення конкурентоспроможності річкових перевезень. У статті обгрунтовано комплексний підхід до удосконалення менеджменту якості, який передбачає: стандартизацію логістичних процесів та впровадження міжнародних систем управління якістю; цифровізацію управління перевезеннями, документообігом та моніторинг руху суден і вантажів; інтеграцію внутрішнього водного транспорту у мультимодальні логістичні ланцюги; модернізацію інфраструктури та логістичних вузлів; посилення стандартів безпеки та екологічної відповідальності; гармонізацію нормативно-правової бази із європейськими стандартами. Запропонований математичний алгоритм удосконалення менеджменту якості дозволяє системно оцінювати інтегральний показник якості, визначати ефективність управлінських заходів, оптимізувати використання ресурсів та приймати обгрунтовані рішення щодо розвитку логістики внутрішнього водного транспорту. Його потокова реалізація забезпечує контроль і коригування процесів у режимі реального часу, підвищуючи надійність перевезень та узгодженість логістичних операцій. Цінність дослідження полягає у комплексному підході до оцінки та управління якістю транспортних послуг на внутрішніх водних шляхах України, що поєднує стандартизацію, цифровізацію, інфраструктурну модернізацію та інтеграцію у міжнародний транспортний простір.***

*Key words: standardization of logistics processes; quality management systems; transport management; document flow; monitoring of vessel movements; cargo; multimodal logistics chains; infrastructure; logistics hubs; quality; safety standards.*

*Ключові слова: стандартизація логістичних процесів; системи управління якістю; управління перевезеннями; документообіг; моніторинг руху суден; вантажі; мультимодальні логістичні ланцюги; інфраструктура; логістичні вузли; якість; стандарти безпеки.*

## PROBLEM STATEMENT

In the development of transport systems, the role of effective management of logistics process quality is increasing. This is particularly relevant for inland water transport, which in global practice is considered one of the most efficient and environmentally balanced modes of transportation. For example, in terms of energy expenditure for transporting one ton of cargo over a distance of 1 km (MJ/t-km), there is a significant difference between transport modes: inland water transport — 0.3—0.4 MJ/t-km; rail transport — 0.6-0.8 MJ/t-km; road transport — 1.2-1.8 MJ/t-km. Moreover, energy efficiency directly affects the carbon footprint of transport operations. According to data from the European Environment Agency, inland water transport emits 30—35 g $CO_2$/t-km; rail transport — 45—60 g $CO_2$/t-km; road transport — 90—120 g $CO_2$/t-km. The high efficiency of inland water transport is also explained by the significant cargo capacity of barges and the possibility of forming large convoys of vessels. Considering these characteristics, the development of inland waterways in European Union countries is a key component of building a sustainable transport system, as it not only reduces the load on road and rail networks but also lowers greenhouse gas emissions and enhances the efficiency of supply chains.

In Ukraine, inland water transport possesses considerable development potential, owing to the extensive network of river routes, particularly in the basins of the Dnipro, Danube, and Southern Bug rivers. However, the current state of the river transport system is characterized by several systemic challenges, including underdeveloped infrastructure, limited investment resources, technological obsolescence of the fleet, and insufficient integration of logistics processes within the national transport system. Enhancing the efficiency of inland water transport thus depends largely on improving the management of logistics process quality, which contributes to greater reliability of transport operations, optimized resource utilization, and the establishment of competitive advantages in the transport market.

## ANALYSIS OF RESEARCH AND PUBLICATIONS

Contemporary scientific research (notably initiated by B.V. Burkinsky, N.M. Andreeva, V.F. Hryshchenko [1], A.V. Tserkovna, A.M. Rakhimi [8], L.I. Raicheva [7], A.Ya. Kazarezov, Yu.Yu. Verlanov, and O.Yu. Verlanov [3]) pays considerable attention to the development of transport logistics, the management of logistics service quality, the digitalization of transport processes, and the formation of integrated transport and logistics systems. At the same time, the issue of quality management in the field of inland water transport in Ukraine remains insufficiently studied, particularly regarding the integration of modern logistics management principles, international quality standards, and the requirements of sustainable transport system development.

## FORMULATION OF THE ARTICLE'S OBJECTIVES

This article aims to substantiate the theoretical and methodical foundations and propose approaches for enhancing quality management in the transport logistics of Ukraine's inland water transport.

## THE PAPER MAIN BODY

Within the scope of this study, quality management in the transport logistics of inland water transport is considered both in a narrow and a broad sense (referring to a focus on specific operations and services versus the comprehensive management of the entire logistics system [3]).

In the narrow sense, quality management is a systematic process of planning, organizing, controlling, and continuously improving logistics operations for cargo transportation and associated services, aimed at complying with established standards, enhancing the efficiency and reliability of transport operations, and meeting consumer needs.

In the broad sense, quality management involves the integrated management of the entire logistics system of inland water transport, including: the organization of transport flows and routing of shipments; management of port and terminal operations; coordination of interactions among carriers, ports, freight forwarders, and cargo owners; monitoring compliance with safety, environmental, and technological reliability standards; tracking the efficiency of transport infrastructure and fleet utilization; implementation of international quality management standards and digital logistics systems.

This allows us to assert that, in the context of the contemporary development of transport systems, there is a need to improve quality management in the transport logistics of Ukraine's inland water transport due to: the necessity to enhance the effectiveness and coordination of logistics operations; the optimization of transport flows; the assurance of reliability and safety in transport operations; and the adaptation of the national transport system to European management standards (see Table 1).

**Table 1. Factors necessitating the improvement of quality management in the transport logistics of Ukraine's inland water transport**

| Reason for the need to improve quality management | Characteristics of the reason determining the need for quality management improvement | Significance for the development of inland water transport logistics |
|---|---|---|
| The need to increase the effectiveness and coordination of logistics operations | Includes improvement of transport planning processes, reduction of cargo handling time, cost reduction, and increased productivity of logistics operations. | Contributes to increasing the economic efficiency of transportation, reducing operational costs, and enhancing the competitiveness of inland water transport in the transport market. |
| Optimization of transport flows | Involves improving the management of freight flows, coordinating interaction between ports, terminals, and carriers, as well as integrating inland water transport into multimodal logistics chains. | Ensures rational distribution of transport flows, reduces congestion at individual transport hubs, and improves the efficiency of logistics supply chains. |
| Ensuring reliability and safety of transport operations | Associated with the need to comply with technical, technological, and organizational standards for cargo transportation, improve navigation safety, control the quality of logistics operations, and manage risks. | Increases the trust of market participants in river transportation, ensures stability of transport operations, and minimizes the risks of cargo damage, accidents, and delays in logistics processes. |
| Adaptation of the national transport system to EU requirements | Determined by Ukraine's European integration processes and the need to harmonize the regulatory framework, management approaches, and quality standards of transport services in accordance with European practices. | Promotes the integration of Ukraine's inland water transport into the European transport space, the development of international logistics corridors, and the increase of investment attractiveness of the sector. |

Source: created by the authors based on [1—2; 4; 7—8].

It is worth noting that the current state of inland water transport logistics in Ukraine is characterized by several systemic problems that limit the efficiency of the associated logistics processes.

In particular, despite the fact that as early as 2011 a modern River Information System (RIS) was introduced and tested on Ukraine's inland waterways, particularly on the Dnipro River, which provides the collection, processing, and analysis of data from all elements of navigation, the current level of coordination among key participants in the logistics chain (shipping companies, port operators, freight forwarders, and other market participants) remains insufficient.

As a result, most river transport operators report significant problems related to transport planning, cargo handling, and operational productivity in inland water transport logistics (see Table 2).

Based on the data presented, it is evident that problems in Ukraine's inland waterways significantly affect transport planning, cargo handling, and the productivity of logistics operations, resulting in numerous delays at various stages of the logistics process.

On the Dnipro River, vessel waiting times at locks are a common occurrence due to their technical wear and ongoing maintenance works. In 2022, major repairs were carried out on certain navigable locks and the control point of the Kyiv Lock was modernized. However, the scope of these works was limited by funding constraints, administrative challenges, and the onset of the full-scale war, so the situation regarding vessel waiting times remained largely unchanged. A similar situation is observed on the Southern Bug, although the scale of the problems is smaller. The lock infrastructure is limited and often outdated. As of 2025, vessels continued to experience delays at the affected waterways.

Regarding the Danube, problems are more often associated with safety under wartime conditions and technical navigation constraints in certain sections, which depend on water levels and sedimentation. Reduced water levels in summer and autumn limit fairway depth, forcing vessels to reduce draft or even suspend navigation in some areas. High water levels during floods complicate vessel maneuvering and worsen safety conditions, while after heavy floods, riverbeds may become silted, restricting passage for vessels with deep drafts.

Delays on the Dnipro River waterways also occur during cargo handling at river ports, where vessels must wait for available berths or handling equipment. For example, during periods of active grain exports (May-October), barges at the river terminals of Kherson and

**Table 2. Impact of inland waterway problems in Ukraine on transport planning, cargo handling, and logistics operational productivity, 2025**

| Inland waterway | Problems / limitations | Impact on transport planning | Impact on cargo handling | Impact on logistics operational productivity |
|---|---|---|---|---|
| Dnipro | • Worn locks (Kremenchuk, Kaniv)<br>• Limited lock capacity<br>• Major repairs in 2022 constrained by limited funding<br>• Destruction of the Kakhovka lock (2023)*<br>• Lack of official statistics on vessel waiting times | Inability to accurately forecast vessel transit times through locks, which complicates the scheduling of transport operations. | Delays at locks lead to cargo idle time and queues at berths. | Reduced logistics efficiency due to vessel idle time, unpredictable delays, and congestion at storage facilities. |
| Southern Bug | • Limited and outdated lock infrastructure<br>• Insufficient modernization and funding<br>• Seasonal shallowing of the riverbed<br>• Floods and heavy precipitation | Transport planning becomes difficult during the summer–autumn period due to changes in depth and current velocity. | Cargo transportation may be suspended or vessel draft must be reduced, resulting in decreased cargo volumes. | Productivity of logistics operations declines due to irregular navigation, waiting times, and maneuvering under difficult conditions. |
| Danube | • Technical limitations of locks and fairway<br>• Sedimentation in certain river sections<br>• Seasonal fluctuations in water levels<br>• Security challenges under wartime conditions | Transport planning is complicated by seasonal water level fluctuations and draft limitations. | Restrictions on barge draft and possible suspension of navigation lead to delays in cargo handling. | Logistics productivity decreases due to the need to reduce cargo loads and wait for favorable navigation conditions. |

Note

* In June 2023, the dam and hydropower plant of the Kakhovka HPP were destroyed, which disrupted navigation from the dam to the Dnipro delta and the Black Sea, i.e., in the direction of Kherson Oblast and further to the Black and Azov Seas.

Source: Data from the State Service of Maritime and Inland Water Transport of Ukraine.

**Table 3. Current transport flows on Ukraine's inland waterways статей:**

| Inland waterway | Seasonality of cargo flows | Peak load | Off-season load | Impact on infrastructure efficiency |
|---|---|---|---|---|
| Dnipro | Main navigation: May–October | High load on locks and port terminals | Significant reduction in cargo turnover and vessel utilization | Peak loads overload infrastructure, while off-season underutilization reduces capacity efficiency |
| Southern Bug | Main navigation: May–October (depending on water level)* | Moderate load on locks and berths | Very low utilization; navigation limited during low water levels (river depth on some sections decreased from 3 m to 1.65 m since the 1990s) | Infrastructure efficiency is seasonal and uneven; navigation stops during low water periods |
| Danube | Navigation: May–October | High load during peak transportation periods and due to depth limitations | Reduced cargo turnover caused by riverbed shallowing and seasonal water level fluctuations | Infrastructure is partially underutilized in the off-season; draft limitations reduce productivity |

Note
** The dependence on water level is significant, despite dredging works carried out independently by the company "NIBULON" on the river.
Source: created by the authors based on [1; 4—6; 7] and State Service of Maritime and Inland Water Transport of Ukraine.

Mykolaiv arrive at the berths earlier or later than the planned accumulation time of grain batches in 80% of cases. This results in vessel idle time (ranging from 12 to 36 hours in 2025) and generates additional logistics costs for carriers and cargo owners.

The flow of transport on Ukraine's inland waterways is uneven (see Table 3). Inland river cargo flows in Ukraine are highly seasonal-navigation is limited by climatic conditions, including fluctuations in water levels and ice cover, and is concentrated during the main navigation period (typically May-October). In contrast, during the off-season, vessel utilization and cargo turnover on river transport decrease significantly.

The uneven distribution of transport flows during the navigation period, as well as peak load periods on infrastructure-typically from June to September-remains a significant issue (see Table 4). There are also challenges in ensuring the reliability and safety of inland water transport operations. The full-scale Russian invasion in 2022 has considerably complicated the functioning of Ukraine's inland waterways.

The Ukrainian segment of the Danube remained comparatively safe for navigation. In contrast, significant safety issues arose on the Dnipro, caused by the mining of certain river sections and the constant threat of attacks on ports and cargo handling terminals. A substantial portion of the river fleet remaining in Ukraine-controlled waters was effectively unusable by its owners. In addition, part of the river fleet in southern Ukraine was physically lost. This can be explained by the fact that, as of February 2022, most river carriers were preparing to open the navigation season, and a significant number of vessels were located in southern ports, including Mykolaiv and Kherson.

Regarding transport on the Southern Bug, since it is a less utilized transport artery (despite completed dredging works) compared to the Dnipro and the Danube, the reliability and safety of operations on this river remained relatively stable.

**Table 4. Transport reliability and safety on Ukraine's inland waterways, 2022—2025**

| Inland waterway | Major safety threats / issues | Losses of river fleet | Impact on navigation use | Remarks / Features |
|---|---|---|---|---|
| Dnipro | • Mining of certain sections<br>• Threats of attacks on ports and terminals | Part of the fleet remaining in Ukraine-controlled waters (e.g., downstream of the Kakhovka HPP, in Mykolaiv and Ochakiv) is largely unused by its owners. Significant losses reported in southern ports* | Limited fleet utilization under Ukrainian control (after Kakhovka HPP) | Major safety challenges; serious impact on transport efficiency |
| Southern Bug | • Limited navigation safety in case of potential threats<br>• Seasonal restrictions due to low water levels and floods | No significant physical fleet losses recorded | Navigation is seasonal; efficiency is limited; navigation is difficult on the section between Nova Odesa and Mykolaiv | Smaller-scale but systemic problems; less utilized as a transport artery |
| Danube | • Potential safety restrictions in case of riverbed sedimentation or low water levels | No fleet losses | Navigation is relatively safe; 24/7 navigation possible | Safest inland waterway during wartime; seasonality affects cargo volumes |

Note
* One of the most promising river transport operators, Grain Transshipment, lost 31 vessels in 2022, representing approximately 50% of its total fleet. One of Ukraine's largest river carriers, NIBULON, whose fleet numbered 85 vessels before the full-scale war, lost three tugboats and five non-self-propelled vessels. Asket-Shipping, which was just beginning to develop river transport operations, also lost one of its two tugboats [6].
Source: created by the authors based on [1; 4—6; 8].

**Table 5. Adaptation of Ukraine's inland water transport to European management standards**

| Inland waterway | Level of integration into the European transport system | Main challenges in adapting transport operations to EU standards | Overall assessment |
|---|---|---|---|
| Dnipro | Medium | Outdated lock and hydraulic infrastructure; need to modernize vessel traffic management systems; incomplete harmonization of legal and regulatory framework with European standards | Significant transport potential, but requires extensive modernization to meet EU standards |
| Southern Bug | Low | Limited development of navigational infrastructure; insufficient investment; slow implementation of European standards due to low transport volumes | Integration into the European transport system is slow due to limited utilization of the river |
| Danube | High | Partial regulatory and technological differences; further harmonization of management and navigation systems required | The most integrated inland waterway in Ukraine, forming part of international transport corridors |

Source: created by the authors based on [1; 5—6; 8].

Within the scope of this study, the authors also highlight challenges related to the adaptation of the national transport system to European management standards, encompassing a range of institutional, infrastructural, regulatory, and technological issues (see Table 5). For Ukraine, this process is particularly relevant in the context of European integration and the gradual incorporation of its transport network into the broader European transport space.

One of the key challenges is the insufficient harmonization of Ukraine's legal and regulatory framework with European legislation. Although Ukraine is gradually implementing European directives and regulations-particularly concerning transport safety, competition, and environmental standards-progress remains slow and uneven [7]. Regulatory gaps hinder the integration of Ukraine's transport system into the European transport space, including incomplete implementation of EU inland water transport directives, lack of full harmonization of vessel and equipment technical standards, and limited adaptation to environmental requirements.

In view of the above, the improvement of quality management in the transport logistics of Ukraine's inland waterways should be pursued along the following directions [1; 3—4; 7]:

1. Implementation of modern quality management systems in logistics processes through standardization, including the adoption of international standards (ISO 9001, ISO 28000, ISO 14001) and internal quality control procedures at all stages of the logistics chain.

2. Digitalization of transport and logistics management, encompassing the digital management of transport operations, documentation, and monitoring of vessel and cargo movements.

3. Integration of inland water transport into multimodal logistics chains through systems enabling interaction between river, road, rail, and maritime transport.

4. Modernization of infrastructure and logistics hubs of inland waterways, including upgrades to port infrastructure, cargo handling terminals, fleet, and navigation systems.

5. Strengthening safety and environmental standards through modern navigation safety systems, risk management, and compliance with environmental regulations for transport operations.

6. Harmonization of the legal and regulatory framework with European requirements by aligning Ukraine's inland water transport legislation with EU standards.

It should be noted that the comprehensive implementation of these directions is particularly important, as it enables the improvement of transport service quality and the enhancement of the competitiveness of Ukraine's inland water transport system (see Fig. 1).

Accordingly, the mathematical algorithm for improving quality management in the transport logistics of Ukraine's inland water transport can be expressed by the following relationship:


**Figure 1. Improvement of quality management in the transport logistics of Ukraine's inland water transport**

Note

*Regarding quality, this will contribute to improving the timeliness of managerial decisions and optimizing transport flows.

**Regarding quality, this will allow an increase in the throughput capacity of river transport corridors.

***Regarding quality, this will enhance transport efficiency, reduce logistics costs, and ensure more flexible management of cargo flows.

Source: created by the authors based on [1; 3—4; 7].

Q=f(Q1,Q2,Q3,Q4,Q5,Q6) (1),
where:

— Q — integral indicator of quality management in transport logistics;

— Q1 — level of standardization of logistics processes;

— Q2 — level of digitalization of transport and logistics processes;

— Q3 — level of integration of inland water transport into multimodal logistics chains;

— Q4 — level of modernization of infrastructure and logistics hubs;

— Q5 — level of transport safety and environmental responsibility;

— Q6 — level of harmonization of the legal and regulatory framework with European standards.

Direction: Implementation of modern quality management systems in logistics processes

The integral indicator can also be defined as a weighted sum:

$$Q=\sum_{i=1}^{6} w_i Q_i \quad (2);$$

where:

wi — weight coefficient reflecting the importance of the corresponding direction;

$\sum_{i=1}^{6} w_i = 1$ — normalization condition for the weight coefficients;

Qi — value of the quality indicator for the i-th direction of improvement in transport logistics management.

It should be noted that the outlined mathematical algorithm for improving quality management allows for a systematic assessment of the integral quality indicator, determination of the effectiveness of management measures, optimization of resource utilization, and making informed decisions regarding the development of river logistics. The value of the proposed algorithm lies in its real-time (streamlined) implementation (see Table 6), which ensures control and adjustment of processes in real time, thereby enhancing transport reliability and coordination of logistics operations.

It should be noted that the term "streaming implementation" refers to the continuous and sequential execution of the logistics quality management algorithm, where all stages-assessment, planning of measures, monitoring, and adjustment-are performed as an ongoing flow of operations rather than as a one-time process [2]. In the context of inland water transport logistics, this means that the algorithm operates in real time, and the processes of controlling and adjusting operational quality occur dynamically: if certain measures do not achieve the expected quality increase (ΔQi), the system immediately proposes adjustments to the measures or a reallocation of resources. At the same time, a close connection with digital systems is ensured, and it is precisely the digitalization of processes-such as vessel monitoring, electronic document flow, and transport management systems-that makes streaming implementation possible. This approach allows for rapid response to changes in river traffic, ports, or navigation conditions, thereby enhancing the reliability of transport operations and the coordination among participants in the logistics chain.

**Table 6. Step-by-step specification for applying the mathematical algorithm for improving quality management in the transport logistics of Ukraine's inland water transport**

| Algorithm step | Step content | Mathematical representation |
|---|---|---|
| Assessment of the baseline quality level | Determination of the initial state of quality management in inland water transport logistics based on the integral quality indicator. | $Q^0=\sum_{i=1}^{6} w_i Q_i^0$, where $Q^0$ — initial integral quality level; wi — weight coefficient of significance of the i-th improvement direction; $Q_i^0$ — initial quality indicator value for the i-th direction; i=1…6 - number of improvement directions. |
| Formation of management measures | Development of a set of measures to improve logistics process quality for each improvement direction. | $M_i = m_{i1}, m_{i2}, \ldots, m_{i,}$, where Mi — set of management measures aimed at improving the quality indicator for the i-th direction; mi1,mi2,…,min — individual measures within the i-th direction; i=1…6. |
| Evaluation of the effect of measures | Determination of changes in quality indicators as a result of implemented management measures. | $Q_i^{t+1} = Q_i^t + \Delta Q_i$, where ΔQi — increase in quality level due to implemented measures; $Q_i^t$ — quality indicator value at time t; $Q_i^{t+1}$ — quality indicator before implementation. |
| Calculation of the updated integral indicator | Calculation of the updated integral quality management indicator. | $Q^{t+1}=\sum_{i=1}^{6} w_i Q_i^{t+1}$ where wi — weight coefficient of significance of the i-th direction. |
| Verification of target level achievement | Comparison of the obtained quality level with the target; decision on completion or adjustment of the algorithm. | Completion condition: $Q^{t+1} \geq Q^{*}$ Adjustment condition: $Q^{t+1} < Q^{*}$ where Q* — target quality level of transport logistics management. |
| Optimization objective function | Maximization of the integral quality indicator under resource constraints. | Objective function - $\max Q=\sum_{i=1}^{6} w_i Q_i$, Resource constraints - $\sum_{i=1}^{6} C_i \leq B$ where Ci — costs of implementing measures; B — available modernization budget. |

Source: created by the authors.

## CONCLUSIONS

The conducted study demonstrates that improving quality management in the transport logistics of Ukraine's inland waterways is a key factor in enhancing the efficiency of the national transport system, optimizing logistic flows, and ensuring the competitiveness of river transport.

The article substantiates a comprehensive approach to quality management improvement, which includes:

1. Standardization of logistic processes and implementation of international quality management systems.

2. Digitalization of transport management, document flow, and real-time monitoring of vessels and cargo.

3. Integration of inland water transport into multimodal logistic chains, enhancing synergy between river, road, rail, and maritime transport.

4. Modernization of infrastructure and logistic hubs, increasing the capacity of river corridors, and reducing logistic costs.

5. Strengthening safety and environmental responsibility standards, improving trust in transport operations, and reducing risks to cargo.

6. Harmonization of the regulatory framework with European standards.

The proposed mathematical algorithm for quality management improvement enables a systematic assessment of the integral quality indicator, evaluation of the effectiveness of management measures, optimization of resource utilization, and informed decision-making regarding the development of river logistics. Its streaming implementation ensures real-time monitoring and adjustment of processes, thereby enhancing transport reliability and coordination of logistic operations.

The study's value lies in its comprehensive approach to assessing and managing the quality of transport services on Ukraine's inland waterways, combining standardization, digitalization, infrastructure modernization, and integration into the international transport space. The implementation of the proposed measures can increase the economic efficiency of river transport, reduce operational costs, minimize risks, and ensure compliance with modern European standards for transport logistics management.

Prospects for further research include: the development of cargo flow forecasting and route optimization models based on artificial intelligence and big data analytics, as well as the development of a KPI system for monitoring the quality and safety of transport operations on Ukraine's inland waterways.

Література:

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