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METHODOLOGICAL FOUNDATIONS FOR ASSESSING THE EFFICIENCY OF MARITIME TRANSPORT ENTERPRISES IN MEETING THE NEEDS OF THE NATIONAL ECONOMY

Halyna Alekseievska[1], Svitlana Ilchenko[2]

Abstract. Maritime transport companies are a strategically important sector for Ukraine, contributing to economic growth by ensuring the efficiency of international trade and foreign economic relations. Assessing the performance of maritime transport is a complex task aimed at optimising efficiency, ensuring competitiveness and addressing environmental and economic sustainability. Evaluation methods range from traditional economic approaches to modern innovative models based on big data and computational technologies. The objective of this research is to develop a methodology for assessing the performance of maritime transport in meeting the needs of the national economy of Ukraine. The paper presents the results of substantiating the scientific principles of diagnosing the performance of maritime transport in meeting the needs of the national economy. A phased methodology for assessing the performance of maritime transport in meeting the needs of the national economy has been developed. It includes main and additional components and indicators, taking into account the peculiarities of the studied maritime transport sector and the specialisation of its units. The evaluation process is proposed to be divided into three different blocks: preparation, calculation and summary. This structured sequence of assessment of maritime transport activities aims to provide an in-depth understanding of its role in meeting the needs of the national economy, to identify strengths and weaknesses, and to formulate effective strategies for future development. This methodology helps to identify the weaknesses of maritime transport that require attention and improvement, as well as the existing potential opportunities and their rational use. This enables effective adjustment of the strategic development of maritime transport to the needs of the national economy. Such a methodological structure for evaluating the performance of maritime transport can contribute to a deeper understanding of its role in meeting the needs of the national economy. The identification of strengths and weaknesses will help to pinpoint key aspects of its effectiveness, while the development of strategies for further development will enable the sector to be efficiently improved for maximum benefit to the national economy.

Key words: maritime transport enterprises, development, methodology, efficiency, needs of the national economy.

JEL Classification: A10, F63, F64

1. Introduction

Maritime transport companies play a key role in Ukraine's economy. Prior to the full-scale invasion in February 2022, maritime transport served as the main means of exporting and importing goods, accounting for a significant portion of the country's gross domestic product. Through its seaports, Ukraine has access to international markets, and the absence of port blockades makes it possible to diversify trade and reduce economic risks.

The maritime industry generates thousands of jobs in shipping, stevedoring, agency, freight forwarding, crewing and other maritime transport companies, contributing to social stability in the country. Maritime transport also stimulates the development of related industries such as shipbuilding, logistics, trade and others.

The development of maritime transport in Ukraine is a factor of economic growth and stability of the national economy. Maritime

[1] Institute of Market Problems and Economic and Ecological Research National Academy of Science;
Odesa I.I. Mechnikov National University, Ukraine *(corresponding author)*
E-mail: g.alex@onu.edu.ua
ORCID: https://orcid.org/0000-0002-6708-0098
[2] Institute of Market Problems and Economic and Ecological Research National Academy of Science, Ukraine
E-mail: ilchenko.svit@gmail.com
ORCID: https://orcid.org/0000-0002-8052-8678

routes serve as the main arteries of international trade, so the efficiency of maritime transport affects Ukraine's ability to compete in the global market. However, despite the importance of maritime transport, there is a lack of clear methodologies for assessing its performance.

The activities of maritime transport companies have been extensively studied in many works. In particular, Stopford M. (2009) in Maritime Economics comprehensively examines all aspects of maritime transport, including its valuation. The Annual Report of the United Nations Conference on Trade and Development (2022) provides a detailed analysis of the global maritime transport market. Talley W. K. (2017), which focuses on port economics, also includes sections on evaluating the effectiveness of ports and maritime transport.

Alan E. Branch (2009) deals with international logistics and the role of maritime transport in global supply chains. Up-to-date information on the state of Ukraine's seaports, statistics and research relevant for assessing maritime transport activities in Ukraine can be found on the website of the Administration of Seaports of Ukraine or in specialised publications such as "Shipping" and "Ports of Ukraine".

There are specialised works dedicated to specific areas of maritime transport activities. For example, the study by Alamoush A. S., Ballini F., Ölçer A. I. (2021) examines maritime transport as an environmentally friendly mode of transport and its impact on the environment in the context of global trade.

A detailed classification and comparative analysis of risk assessment methods for maritime transport companies, with a focus on the global economy and trade, is carried out in the research by Xi Huang et al. (2023). It examines conventional approaches to data analysis in the context of maritime risk. The researchers categorise modern risk assessment methods, taking into account different levels of system complexity. They conclude that risk assessment approaches in this area are becoming increasingly systemic and integrated. Integration with artificial intelligence technologies may be a key direction for future development.

The development of an alternative framework for assessing the performance of freight transport based on the service economy, as presented in the work of Blanquart C., Burmeister A. (2009). The authors conclude that achieving productivity in freight transport is not a one-size-fits-all approach, but involves different service configurations, each with its own productivity logic.

The Review of Maritime Transport (2020) presents an in-depth analysis and update of the evolution of maritime trade, industries, markets and companies, as well as key performance indicators and the legal and regulatory environment. New datasets are proposed to analyse the performance of seaports and the age of the global fleet.

The aim of this study is to develop a methodology for assessing the activities of maritime transport companies in meeting the needs of the national economy. In order to achieve this goal, it is necessary to solve the following tasks:

– To analyse the existing indicators for assessing the performance of maritime transport companies;
– to study the key performance indicators of maritime transport companies;
– to develop an evaluation methodology taking into account the specifics of the country's national economy. These tasks are specified in the paragraphs of the article.

Assessment of the performance of maritime transport enterprises is a complex task aimed at achieving optimal productivity, increasing competitiveness and taking into account aspects of environmental and economic sustainability.

2. Key Performance Indicators for Maritime Transport Enterprises

Efficiency, in a broad sense, refers to any assessment or measure of comparison. A performance indicator can be considered as a quantitative or qualitative characteristic of productivity (Eboli, Mazzulla, 2012). Measuring productivity is crucial because quantifying the actual performance of processes enables future improvements (Štefko, et al., 2016). The primary goal of process improvement is cost reduction (Kot, 2015). Numerous scientific publications deal with performance measurement systems (PMS), frameworks and measurements of individual productivity. Most performance measurement systems are based on financial indicators only, but some include both financial and non-financial indicators (Bendoly, 2007). Several performance measurement systems

are presented in the literature, such as the balanced scorecard (Kaplan, 1996), performance measurement matrices (Keegan, 1989) or efficiency pyramids (Cross, 1992).

In most cases, however, it is not possible to apply standardised or universally accepted performance measurement systems. Therefore, a large number of individual evaluation criteria, recommendations or commonly used KPIs are used across different sectors. In the logistics literature, logistics efficiency indicators are often discussed (Schmitz, 2004).

Traditional methods of measuring efficiency, such as the balanced scorecard, performance measurement matrices, efficiency pyramids or standardised PMSs, may not always be appropriate for all sectors, particularly for transport companies. Establishing distribution and transportation metrics and key performance indicators is a complex task for any transport company.

Improving transport operations is only possible with a high level of transparency and continuous monitoring of productivity in the transport sector. Evaluating efficiency in the maritime transport sector requires special attention, as universal indicator systems often prove inadequate. Maritime transport has unique characteristics, such as its connection to global logistics networks, variability of weather conditions and compliance with international standards and regulations, which make it significantly different from other modes of transport. Therefore, specific indicators for maritime transport take these characteristics into account, focusing on critical aspects such as energy efficiency of vessels, coordination between more efficient modes of transport, port logistics and related services. These specific indicators not only help to assess the current state of operations, but also highlight opportunities for improvement and optimisation.

Choosing the right set of specific indicators for maritime transport companies can have an impact on management efficiency, strategic planning and operational activities. This enables companies not only to respond appropriately to current challenges, but also to anticipate future needs and trends in maritime transport. The most common criteria for choosing a mode of transport include transit time, cost, reliability, potential, availability and safety.

Ross D. F. (2015) states that there are six characteristics of transport modes that determine any decision regarding the choice of transport, namely speed, cost, completeness, reliability, capacity and frequency.

At the enterprise level, modern methods of assessing the interaction between transport and production reflect how effectively transport infrastructure supports production needs and logistics. Here are some of these methods:

1. Cost breakdown analysis. A detailed analysis of the costs associated with transport, storage and inventory management. This analysis can help improve the efficiency of transport services in supporting the production process.
2. Supply chain modelling. These methodologies enable the analysis of the interaction between transport and production at different stages of the supply chain, identifying bottlenecks and opportunities for optimisation.
3. Theory of constraints. An analysis that focuses on finding constraints in a system (often in transport) and optimising them to improve the production process.
4. Key Performance Indicators (KPIs). Identification and tracking of key performance indicators to assess the interaction between transport and production.
5. SWOT-analysis and PEST-analysis. These analytical tools can be adapted to assess the internal and external factors that influence the interaction between transport and production.
6. Cycle time analysis methods. Estimating the time required to move goods between production lines or from a supplier to a manufacturing facility.
7. Transport elasticity analysis. An assessment of how easily transport solutions can be scaled to meet changing production needs.
8. Delivery reliability analysis. Investigation of the ability of the transport system to ensure stable deliveries without failures.

These methods provide important tools for companies seeking to optimise their production processes.

3. Methodology for Assessing the Performance of Maritime Transport Enterprises

Maritime transport companies in Ukraine play a significant role in the country's national economy and must meet the needs of the national economy as a key facilitator of Ukraine's foreign trade. Ukraine has an extensive coastline along

the Black Sea and the Azov Sea, which are currently temporarily occupied by Russia, creating significant opportunities for maritime exports and imports. Ensuring the efficiency of maritime transport guarantees the development of international economic relations and access to global markets.

Several transit corridors for freight transport between Europe and Asia pass through Ukraine. Maritime transport companies play a key role in ensuring transport connectivity between these two parts of the world. Maritime transport is crucial for the supply of resources and energy to Ukraine, with many raw materials and imported goods passing through sea ports. Ensuring the reliability of these supplies is critical to the country's energy and resource security.

It is proposed to divide the evaluation into three blocks: preparation, calculation and summary (Figure 1). Such a sequence of evaluation of maritime activities can help to gain a profound understanding of its role in meeting the needs of the national economy, to identify strengths and weaknesses, and to develop effective strategies for further development. Consider some of the stages in more detail. Preparatory Stage – this stage analyses the role of maritime transport in the national economy. It identifies the strategic challenges facing maritime transport in the context of international economic relations and global transport connectivity. Calculation Stage – this stage involves the assessment of specific indicators of maritime transport activity, such as cargo volumes, transit times, costs, energy efficiency, etc. Aspects of transit corridors and their impact on international economic relations are also considered. Summary Stage – a comprehensive assessment of the results is made, taking into account all aspects of the preparatory and calculation stages. Strengths and weaknesses of maritime transport activities are identified and strategies for further development are formulated.

The objectives and objects of evaluation are interrelated: the objects are selected on the basis of how they can contribute to the achievement of the objectives. They are integrated into a unified process that allows the systematic collection, analysis and interpretation of data to confirm or adjust strategies, plans and actions.

These goals and objectives can serve as a starting point for a more detailed evaluation plan, including data collection, analysis, and formulation of conclusions and recommendations.

Assessment of the performance of maritime transport enterprises in meeting the needs of the national economy is a complex task that requires a multifaceted approach. The assessment can be carried out at different levels: from the resource level (production assets and infrastructure) to the institutional level (compliance of the maritime transport development strategy with the priorities of the national economy).

Using a combination of these approaches, it is possible to achieve a deep understanding of how maritime transport meets the needs of the national economy and what aspects require attention for further optimisation (Table 1).

Each approach has its own advantages and disadvantages, and the choice will depend on the specific objectives of the assessment. By using a combination of these approaches, a more comprehensive and in-depth analysis of maritime transport security can be provided, which in turn can be useful for various stakeholders, from port operators to public authorities.

The provision of the national economy with maritime transport is determined on the basis of various indicators and levels of accessibility and efficiency of maritime transport.

The following levels are suggested:

1. High provision level. The country has a powerful, well-developed maritime transport system that fully meets the needs of the national economy at all levels. It provides access to sea routes for efficient and widespread use of maritime transport.

2. Medium provision level. The country has port infrastructure and a fleet, but they are less developed and limited in scale than the national economy requires, both in terms of quantity and quality. Such an economy may be more dependent on other modes of transport.

3. Low provision level. The country has limited maritime transport resources, may have limited access to the sea or underdeveloped port infrastructure, poor transport organisation and management, and underdeveloped logistics and services.

4. Unsatisfactory provision level. The country has very limited access to the sea and a small fleet.

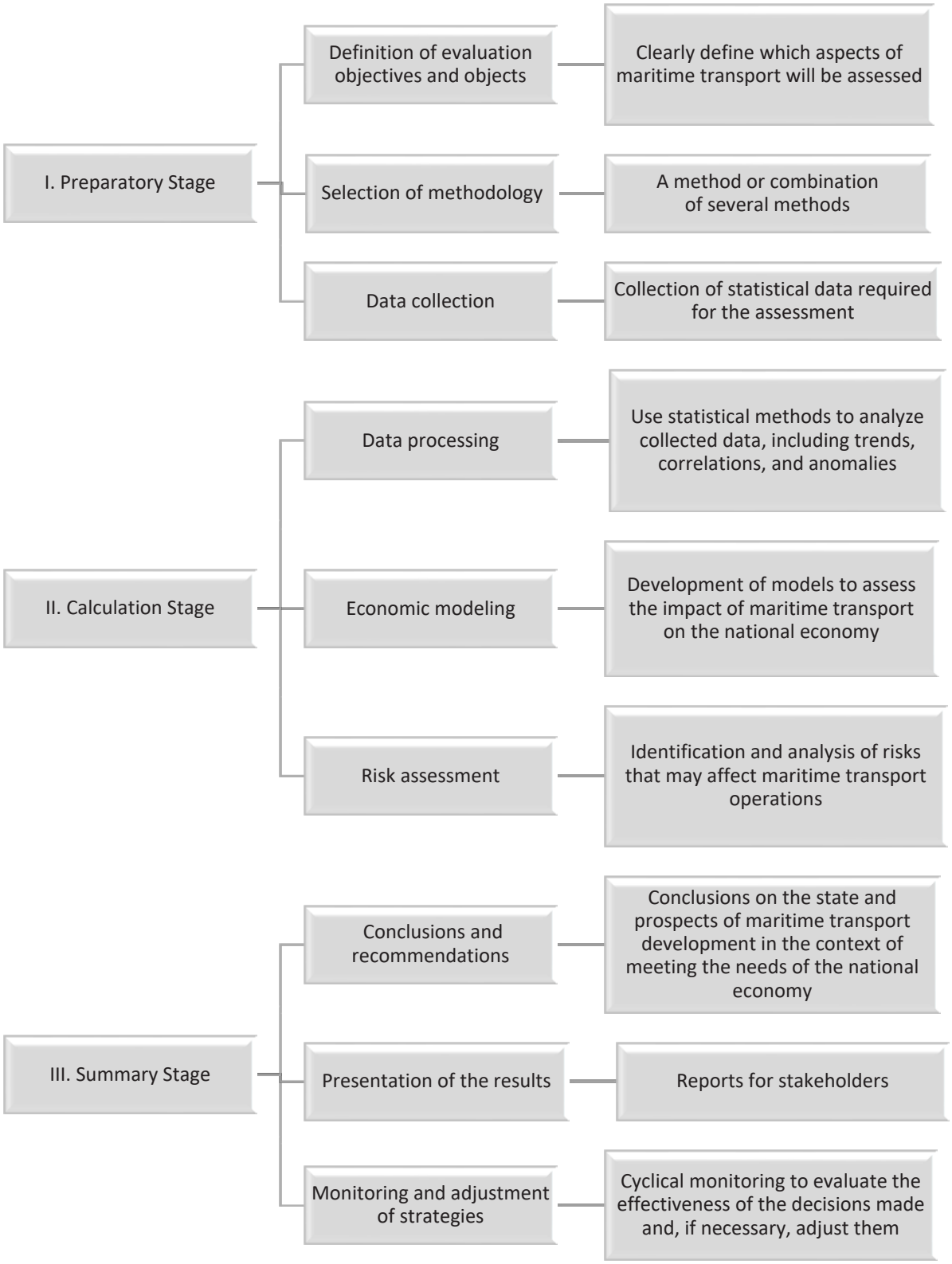

Figure 1. Stages of assessment of maritime transport enterprises' activities in meeting the needs of the national economy

Source: developed by the author

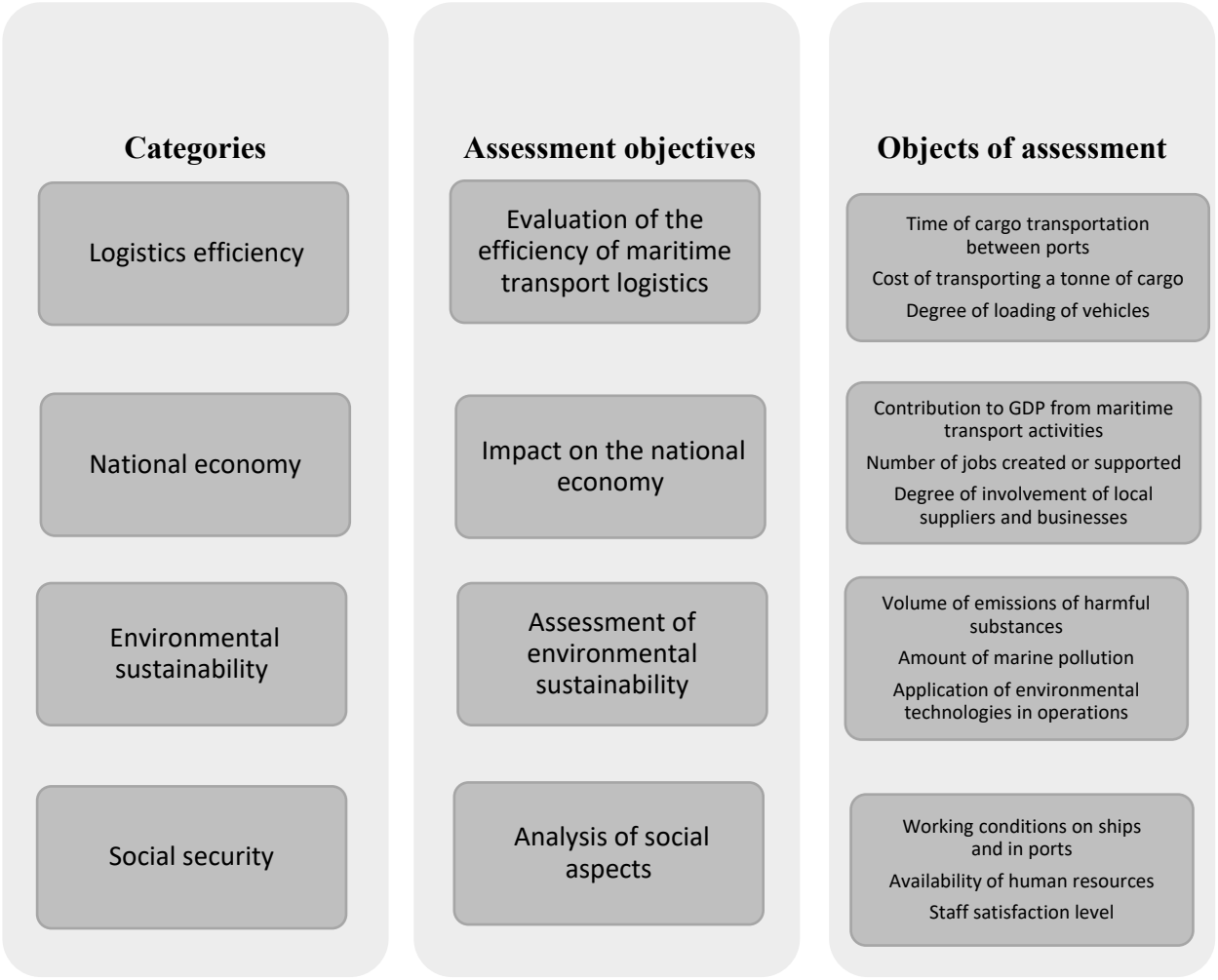

Figure 2. Example of evaluation objectives and objects

Source: developed by the author

Table 1

Comparison of different approaches to evaluation at different levels

Approach	Level of analysis	Key parameters for evaluation	Advantages	Disadvantages	Practical applications
Resource-based approach	Production and technological	Production capacity, vessel availability, technology, access roads	Detail of the resource base, accuracy of assessment	Restrictions on organisational and strategic aspects	Optimisation of port operations
Structural approach	Organisational and economic	Management system, interaction with other sectors, organisational structure	Flexibility in adapting to market conditions	Technological aspects can be ignored	Strategic management
Targeted approach	Strategic and institutional	Alignment with national strategies, impact on economic development, social stability and international commitments	Long-term plan, integrated approach	High level of abstraction, less operational utility	Development of national strategies

Source: developed by the author based on Khaietska O. (2023) and Grimalyk A. (2023)

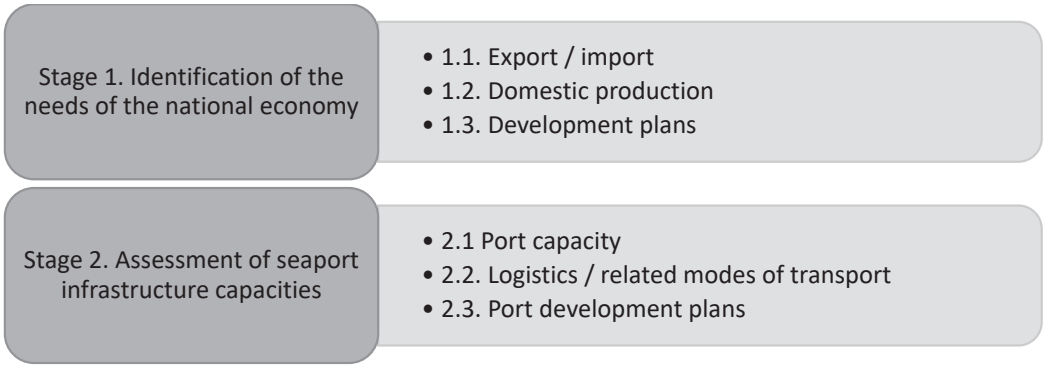

Figure 3. Sequence of information collection

Source: developed by the author

The national economy is heavily dependent on other countries and their services for maritime transport.

The classification of levels of provision is essential for determining the state of maritime transport as a component of the national economy, for developing maritime development strategies and for planning logistics processes to meet the needs of the national economy. Different assessment methods are proposed for different approaches and at different levels.

The methodology also involves comparing the capacity of maritime transport, in particular seaports, with the needs of the national economy. The following sequence of information collection is proposed.

Table 2 provides an indicative guide to the indicators that may be needed to assess the performance of maritime transport enterprises. The detail of the indicators depends on the purpose of the assessment.

Risk assessment is an essential component of a comprehensive approach to evaluating the activities of maritime transport companies. Risk analysis helps to mitigate threats and provides the ability to predict and prevent adverse events that could significantly affect the efficiency and stability of the sector.

Geopolitical factors can have a significant impact on the safety and efficiency of maritime transport. For example, political conflicts or sanctions can restrict access to key routes or ports, leading to an increase in transport costs.

Political instability in a country can result in rapid legislative changes, corruption and direct threats to transport security. This could include everything from political protests to military action in different regions of the country.

Table 2
Recommendations for evaluation indicators

	Indicators for calculation
Stage 1. Identification of the needs of the national economy	
1.1. Estimation of the country's exports and imports	– Gross exports and imports (in monetary terms and tonnes) – Structure of exports and imports by type of goods
1.2. Analysis of domestic production and consumer spending	– Domestic production by sector – Consumer spending on goods and services – Geographical distribution of production and consumption
1.3. Research on development plans and infrastructure projects	– List of key infrastructure projects – Assessment of the need for transport services for each project
Stage 2. Assessment of seaport infrastructure capacities	
2.1. Characteristics of port infrastructure capacity	– Cargo handling by type of cargo – Port throughput capacity
2.2. Analysis of infrastructure (logistics)	– Condition of roads and their capacity – Current state of railways and their capacity
2.3. Development plans for enterprises at seaports	– Companies planning to expand – Assessment of capacity expansion opportunities

Source: developed by the author

Table 3
Recommendations for indicators and risk calculation methods

Factors	Indicators	Calculation methods
Geopolitical	Degree of geopolitical tension Access to key communication routes	Geopolitical risk indices Monitoring changes in route availability
Political	Level of political stability Legal climate	World Bank indices Transparency International
Legislative	Changes in environmental standards Alterations in tax policy	Analysis of legislative acts Overview of new draft laws
Natural	Probability of hurricanes and other natural disasters	Meteorological statistics Geological and meteorological data

Source: developed by the author

Legislative changes may result in new environmental standards, tax rates or shipping regulations that could increase operating costs or require additional investment to modernise the fleet.

Natural disasters (hurricanes or other natural phenomena) can cause serious damage to maritime transport, including damage to infrastructure and loss of cargo. Risk analysis not only identifies threats but also develops strategies to minimise or neutralise them. Risk assessment should be a continuous process that adapts to changing conditions and new information to ensure the stability and efficiency of maritime transport in complex economic and political circumstances.

Once recommendations have been implemented, regular monitoring is required to assess the effectiveness of the decisions taken and to make corrections where necessary. Monitoring and corrections are critical stages in the evaluation of maritime activities in meeting national economic needs. This stage is not just a final note, but an integral part of a systematic process that continues throughout the life of the project or strategy.

Key elements of monitoring and adjustment:

1. Identify key performance indicators (KPIs) as a result of measuring and evaluating activities aimed at implementing the recommendations.
2. Monitoring should not be a one-off activity. It should be conducted on a regular basis according to a set schedule to ensure that the data is up-to-date and that timely responses are made.
3. If the indicators do not meet expectations or norms, analyse the reasons for these deviations.
4. Development of a correction plan based on the analysis of deviations, which may include changes in strategy, tactics or resources.
5. Document all data, findings and recommendations for further analysis and use in future monitoring cycles.
6. Monitoring and adjustments not only depend on assessing the effectiveness of solutions, but also provide opportunities for optimisation, which is crucial for the sustainable success of maritime transport operations.

Such a structure of the methodology for assessing the performance of maritime transport enterprises can help to gain a deeper understanding of its role in meeting the needs of the national economy, identify strengths and weaknesses, and develop effective strategies for further development.

4. Conclusions

In conclusion, the successful development of maritime industries as a vital component of the national economy requires coordinated efforts in the areas of regulation, investment and technology. Particular attention must be paid to the synergy between these three aspects in order to ensure the long-term stability and competitiveness of the country's economy as a whole.

Understanding the relationship between the development of maritime transport enterprises and the national economy is crucial to understanding the critical role of maritime transport in overall economic prosperity. Maritime transport can contribute to GDP growth by increasing exports and imports, reducing logistics costs and improving access to markets. Conversely, inefficiencies in maritime transport can limit economic development through high costs and supply chain disruptions.

Maritime transport companies serve as a catalyst for the development of other infrastructure sectors, such as ports, railways, roads

and logistics centres. This, in turn, can have a positive impact on the investment climate and job creation.

Efficient maritime routes can reduce the cost of imports and increase the competitiveness of exports, as maritime transport is a key element in maintaining a balanced trade exchange.

The efficiency of maritime transport enterprises often correlates with the level of technological development of a country. The introduction of advanced technologies in maritime transport can be an indicator of overall technological competitiveness.

Environmental issues are an integral part of any transport development strategy. Modern maritime transport can also reduce the environmental impact of transport activities, positively contributing to the sustainability and environmental security of the national economy.

Maritime transport enterprises can create a significant number of jobs not only in the sector itself, but also in related industries, such as logistics, shipbuilding, steel production, etc.

Taking all these factors into account, it can be concluded that the development of maritime transport enterprises is closely intertwined with key economic indicators. Analysing this relationship not only provides a better understanding of the mechanisms of economic development, but also allows to optimise maritime transport operations to achieve maximum economic benefits.

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