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MANAGEMENT OF THE ECONOMIC ACTIVITIES OF SHIPPING COMPANIES

Textbook

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This textbook provides a comprehensive analysis of the management and development of commercial shipping, covering both global trends and the specifics of Ukraine. The authors thoroughly examine key aspects of maritime transport economics, fleet management, strategic planning, and the competitive advantages of shipping companies. Special attention is given to financial mechanisms, revenue and cost analysis, resource management, cargo transportation planning, and the issues of sustainable industry development.

The textbook is written in an academic and professional style, with an abundance of complex economic terms and formulas, making it suitable for specialists, educators, and students studying maritime transport economics and shipping company management. It will also be useful for both domestic and international researchers, entrepreneurs, and managers in the maritime transport sector.

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INTRODUCTION

The methodological and practical aspects of managing the results of maritime transport enterprises' development are determined by the goals of economic sustainability of the fleet in the global freight market and achieving optimal relationships with other links in the production infrastructure. Improving the management of operational and investment activities becomes a central task in optimizing the economic development of shipping companies. The strategy of maximizing results is influenced by issues related to improving the welfare of company employees, expanding the scale of economic activities, resource limitations, and transitioning enterprises to the conditions of real competition in global shipping.

Improving the methods of measuring results and costs in maritime transport enterprises stems from the need to increase the contribution to achieving the final socio-economic goal. The focus on intensive methods of economic activity, driven by the factor of time, and the reorientation of investment activities toward maximizing final results, predetermine the feasibility of strengthening the normative and methodological support for the mechanism of making optimal economic decisions.

Under the influence of socio-economic factors and the conditions of economic activity, the requirements for scientifically grounded management decisions based on entrepreneurial efficiency criteria are becoming more stringent. As a result, issues arise in the economic, organizational, and technical aspects, requiring the improvement of strategic planning, performance evaluation, and the level of economic resource utilization.

Strategic approaches to operating efficiency in the freight market, developed by the maritime community in the form of customs, define the principles for optimizing economic decisions regarding the development of industry and territorial subsystems. Attention should be focused on issues related to the use of production potential.

It is also important to maintain a balance between adjacent types of transport and cargo-generating sectors in relation to the commercial fleet. The issues of increasing the efficiency of maritime transport determine the relevance of improving the methodology for managing and planning the results and costs of individual transport enterprises within a unified system for delivering goods to their markets.

To address national objectives and ensure the system's alignment with competitive conditions and the external constraints of order, it is essential to identify the key link that predetermines the optimal results of the transport complex's functioning. When implementing the theory of permanent income, targeted planning becomes crucial for the shipowner. The starting premises and criteria for decision-making should focus on the socio-economic stability of the company.

The concept of shipping results management assumes the presence of a perfect mechanism for operating in the market pricing conditions. Based on efficiency, decisions are made regarding the prioritization of shipping development forms, and processes related to operation and investment are examined, all aimed at enhancing the technical and economic level of the shipping company.

The training manual covers theoretical and practical issues related to the organization of effective fleet operations based on the improvement of the economic mechanism for the development of national shipping according to the criteria of market adequacy. The multifaceted nature of these problems has led to the identification of priority tasks: managing the efficiency of transport potential, substantiating economic processes, ensuring balanced development, and methods for determining the efficiency of using the transport fleet.

Improving the management mechanism of shipping companies within the global freight market system and development management, as well as enhancing the economic responsibility of shipowners for optimal results, are predetermined by the economic goals of entrepreneurial activity. The uneven growth of global production, the acceleration of scientific and technological progress, and the increasing complexity and expansion of internal and external economic relations contribute to the growing role of the maritime fleet in ensuring the efficiency of public production and work quality.

The effectiveness of shipping companies' entrepreneurial activity depends on the rationality of managing the development of maritime transport enterprises. In this context, the choice of a system for assessing and controlling the state of the fleet and the service sector enterprises of the transport services market becomes highly relevant. The principles of improving business activities concerning global economic ties and the development conditions of the freight market should be oriented towards the rational use of the capital of commercial shipping. These tasks can be solved based on performance indicators of maritime transport enterprises.

Justification of business decisions requires thorough economic calculations at all levels of maritime business management. The relevance of a comprehensive approach, based on economic analysis and the calculation of interconnected indicators, is increasing. The degree of justification for planned and business decisions and management effectiveness largely depends on the regulatory and methodological support.

The system of performance indicators should coordinate the interests of shipowners concerning the laws of supply and demand, the requirements of cargo owners, and stimulate the rational use of resources and cost reduction within an integrated system of transport services for global economic ties.

Taking into account the general principles of market equilibrium, prospective solutions for the effective functioning of the merchant fleet are considered. Special attention is given to methods for assessing the efficiency of fleet operations and the resources used. In developing transport subsystems, it is impossible to fully reflect the entire set of results from the use of production factors with a limited system of indicators.

A mechanism aimed at reflecting the actual results of optimizing the quality of production processes allows for the justification of business and project decisions, as well as the effectiveness of investment processes. The introductory section outlines specific approaches to managing competitive sustainability under conditions of financial resource limitations. Particular attention is paid to the intensification of production processes.

The systematization of principles and strategies for the sustainable functioning of maritime shipping companies is presented. The directions for the development of national shipping based on a set of economic indicators are discussed.

The tasks of improving the efficiency of maritime transport are part of the problem of implementing the socio-economic policy of the state and individual entrepreneurial structures. The most important areas for improving the efficiency of maritime transport and enhancing its quality of work are determined by the current and expected state of the freight market and the competition for mastering freight flows. Leading shipowners focus on accelerating the implementation of key forms of scientific and technological progress, introducing cost-effective types of vessels, and adopting advanced technological processes. For underdeveloped shipping companies, the most important task is to preserve and strengthen their position in the freight market and the economic system of the country.

The features of managing the operation of the merchant fleet are predetermined by the state of the freight market, which is influenced by the balance of demand for tonnage to carry goods along major routes or specialized market segments of maritime trade.

Maritime transport has significant advantages over other modes of transport. The actual (gross) delivery speed of goods by the merchant fleet is twice the speed of transporting goods by rail. The cost of transporting a unit of cargo by sea is 25.3% lower than by rail and 20.5 times lower than by road transport. The productivity of one worker in maritime transport (measured in ton-kilometers) is 4.9 times higher than on rail transport.

The metal consumption of maritime transport is 5-7 times lower than that of rail transport per ton of cargo. The energy intensity of transportation work by the merchant fleet is also significantly lower.

Second Edition, Revised and Expanded

The second edition of this textbook features updated and fresh statistical data, ensuring relevance to current industry trends. Additionally, a new Chapter 14 on Safety has been introduced, providing an in-depth analysis of modern safety standards and best practices in maritime transport.

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Chapter 1.

OBJECTIVES AND MANAGEMENT OF THE DEVELOPMENT OF COMMERCIAL SHIPPING

1.1. Economic Conditions for the Development of Commercial Shipping

Commercial shipping is the foundation of the sustainability and efficiency of international economic relations. The growth of the world economy and the strengthening of integration processes influence the formation of cargo flows. The increase in wealth in developed countries and the desire to maintain health predetermine the rise in demand for sea travel and the development of the cruise fleet.

The relationship between demand (the dynamics of freight and passenger traffic) and supply (the amount of deadweight and passenger capacity) under otherwise equal conditions, according to the principles of economic theory, establishes a balanced level of tariff rates. Therefore, the methods for assessing the conditions of the freight market become fundamentally important.

The directions for the development of the merchant fleet are determined by long-term expectations and forecasts for the development of the mega-economy, national economy, and entrepreneurial activity. The need to replenish a shipping company's fleet with the necessary type of vessel is determined by calculations based on projected workloads and the indicators of capacity utilization. A key criterion is the productivity of a ton of deadweight capacity of the vessel per day of operation. It should be noted that in competitive segments of the maritime trade market, the pricing parameters for shipping companies tend to be independent.

The functional activities of shipping companies in the marine trade market, dominated by competitive strategies, are based on the principles of self-regulation. This self-organizing property of shipowning or operating companies allows them to address effective positioning tasks in the face of the complexity of current planning and volatility in the freight market.

In the cost and expenses of the transportation process, two main components are distinguished. One includes the market value of ships, while the other encompasses labor and the use of material resources directly expended in the process of servicing cargo flows. The capital cost of ships is transferred to the cost of the transported cargo within the framework of the existing tariff rates in the marine trade market. The divergence between the conditions for the formation of these different cost flows predetermines the economic risks for shipowners.

The dynamic equilibrium of the maritime trade market and the development of shipping companies is predetermined by the constant automatic renewal based on feedback regarding the alignment of demand (magnitude of cargo flows) and supply (parameters of the trading fleet). Development, that is, transition to the next level of characteristics, relies on the continuous improvement of ship design and management in commercial shipping.

The principle importance in managing the effective operations of shipping companies lies in the balancing of the system. The mechanism for managing the balance in the development of commercial shipping includes organizational forms for managing potential, a system of economic incentives and levers, as well as ways to optimize the turnover of material resources within the legal framework of economic activities. Among the goals of achieving balance, managing competitive stability in the structure of temporal transformations is highlighted (see Fig. 1.1).

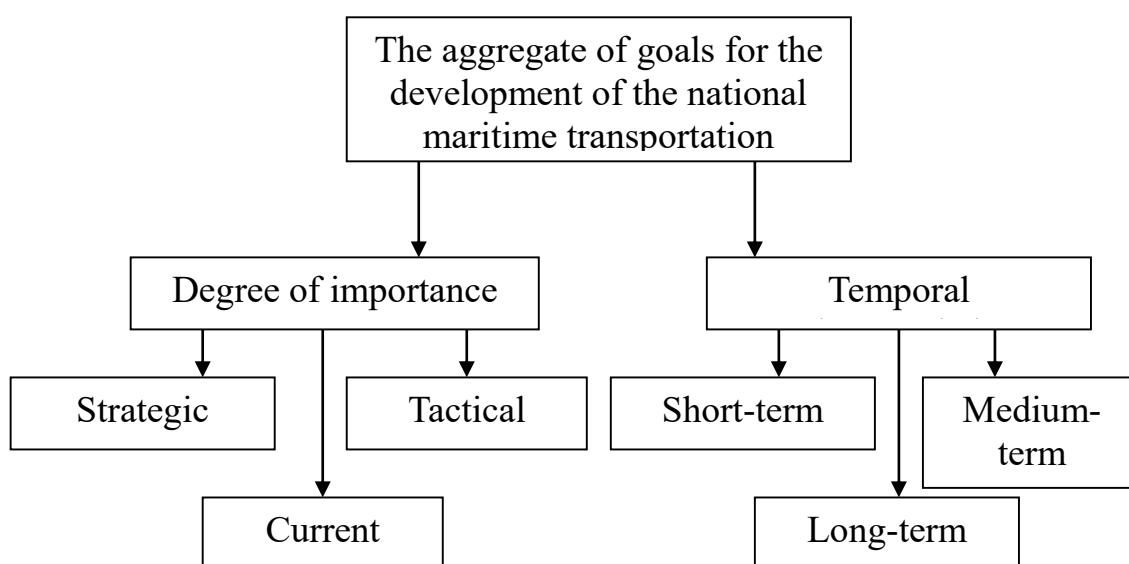


Figure 1.1. Periodization of the Goals for the Development of National Trade Shipping

In any case, all commercial activities are aimed at generating net income for the owners of economic potential – profit. Therefore, all subsystems pay attention to the trends and patterns in the formation of the main components of profit – revenue rate and cost price. At the same time, the processes of forming the production potential of the enterprise are interconnected.

A firm, as an economic category, is an economic business unit that possesses ownership rights and engages in full-scale production and investment activities. The firm makes independent decisions and actively employs production factors to carry out the core processes of manufacturing and selling products and providing services.

A shipping company, as a specific type of firm, represents a unique kind of commercial enterprise in the form of a separate production unit (entity) that possesses resources and provides services for the transportation of goods and passengers. In this process, the characteristics of the activities of operator shipping companies are highlighted.



Figure 2. Container Ship BMI EAGLE

LOA – 113,8 m, beam – 16,2 m. Gross tonnage – 4631 GT. DWT - 6,231 tons.
TEU – 465. Average speed / Max Speed - 10.3 / 13.1 knots. Year of Build – 1999.
Mv BMI EAGLE operated on the routing Constanta-Reni in 2023 year

In Ukraine, the terms "enterprise" and "firm" are commonly considered synonyms. However, this does not always reflect reality. In foreign economic practice, these concepts are differentiated, primarily because an enterprise is not necessarily the owner of a fleet.

There are distinctions in the relationships between an enterprise and a firm:

- A firm shapes a rational type of enterprise that corresponds to external conditions. An enterprise – a shipping company – can accumulate capital and invest it in subsidiary structures.

- Any firm is formed through the integration (merger) of enterprises in the form of mergers, acquisitions, or stock buyouts. The most well-known firm in this regard is AP Moller Maersk – Sea Land.

The criteria for the functioning of enterprises and firms in commercial shipping is the maximization of profit under the existing conditions of its formation, distribution, and use.

A particular role in the decision-making system in commercial shipping is played by the consideration of prevailing economic situations. Any situation in the

maritime trade market reflects the qualitative certainty of real relationships. Their specificity is characterized by content and a certain duration over time. Nevertheless, each situation in commercial navigation has its own features that need to be taken into account in operational planning.

The economic situation for individual shipping companies should be viewed as the static and dynamic aspects of a complex set of production relations that require specific organizational decisions. It consists of elements and linkages within the transport process that predetermine the directions for resource concentration.

The movement of key economic indicators is reflected by special indexes. These indexes represent the state of both macroeconomic processes and specific characteristics of various components of the global market, particularly freight indexes.

Specific situations in trade shipping necessitate the consideration of the nature of the manifestation of primary positioning laws. The comparative efficiency of different types of specialized fleet vessels, depending on the state of the maritime professions market, can be determined based on the specific labor intensity of performing transport work.

$$\beta_{cr} = \frac{L_s(1+\kappa_m)}{\varepsilon V} \quad 1.1$$

where:

L_s – crew size according to the staffing schedule;

κ_m – a coefficient accounting for the management characteristics of the operational activities of this fleet group;

ε – a coefficient for the utilization of the fleet's carrying capacity;

V – the operational speed achieved in the segment of operational activities.

In an active freight market, the fleet has sufficient loading for profitable operation. A passive state of the freight market results in incomplete utilization of the fleet's carrying capacity and leads to inefficient operational activities.

The positioning of seaports within transit cargo flows significantly impacts the volume of maritime transport turnover. The average transport distance on the East-West route depends on the competitiveness of the ports in the Black Sea or Baltic basins. In this context, the capacity of the ports that ensure the country's foreign economic relations becomes particularly important.

Vessels sail under a flag based on an official permit from the organization that issues the flag patent. The port captain, to whom the vessel is registered, issues the permit at the written request of the shipowner.

Commercial shipping in Ukrainian conditions is regulated by the CMM and the Customs Code, which provides the rules for the passage of vehicles across the state border. Customs clearance of transport and goods (cargoes) becomes of utmost importance.

Maritime transport enterprises, apart from their sectoral functional designation, are effectively participants in international trade, providing export transportation services, and simultaneously creating conditions for the sustainability of international labor division. The most important regulator of foreign trade is customs duty. To avoid losses in transport potential, an international convention has been developed for cargo control at borders. It provides for inspections at internal customs points. Transit cargo is not subject to inspection. However, in Ukraine, this principle has been systematically violated for a long period, which has led to problems in the effective functioning of the national maritime transport industry.

Among the conditions for the development of commercial shipping, achieving freedom in operational activities based on international regulations and contractual relations between states becomes fundamental.

Among the local strategies for limiting shipping, regulatory principles of the states in whose zones maritime communications are located stand out. For instance, the Turkish authorities introduced regulations for navigation through the Bosphorus and Dardanelles Straits in 1994 to enhance safety.

The navigational, technical, and administrative restrictions outlined in these regulations effectively violate the freedom of navigation and the Montreux Convention of 1936, which governed the passage of vessels through the straits. Subsequently, a system for the safe passage of ships was established in the Bosphorus, utilizing modern tracking equipment and emergency warning systems.

1.2 Main aims of commercial shipping development

The basis of any rational activity of a person and separate enterprises is the formation of a new product or services, which in the process of realisation create an added value in relation to the spent efforts and energy resources. In this aspect economic management in merchant shipping should be understood as a system of purposeful influence on production teams through the system of motivation of efforts to achieve effective final results of the company.

Traditionally, the most important result in any economic system is the added value, which includes the profit of the enterprise and the value of paid labour actively involved in production activities. It should be taken into account that any value indicator, which is ultimately aimed at fleet activity, depends on the level of prices and

tariff rates. The cost of the transportation process includes a part of the cost of transport vessels and the value of labour remuneration of the shipping company's employees.

Furthermore, the shipping company, as well as any manufacturing enterprise in the course of its activities, should ensure reimbursement of the spent funds used to pay for purchased material resources in accordance with the current market prices. These two conditions determine the objectives of income ('profit') growth from the sale of products and services. Profit is mainly intended to stimulate the development of the enterprise's production potential.

Therefore, the profitability value plays a significant role in the basis of evaluation of the functional activity of shipping and operating companies. Profit is the main economic lever of the economic mechanism, the most important source of development and formation of budgetary funds. Profit should grow due to increase of economic, organisational and technical level of the transportation process, labour productivity and reduction of the cost of a unit of transport work.

In merchant shipping there are traditional ways of realisation of ownership relations and capital concentration:

- horizontal integration, i.e. the association of enterprises that perform similar work and services. Consequently, the firm's share in the market of a given type of product increases. This applies to specialised shipping companies;
- vertical integration, i.e. uniting production facilities that are at different stages of the technological process. As an example, we can consider container companies with cargo terminals and land transport highways;
- conglomerate, the so-called diversification of capital on the basis of productions that are not technologically related to each other. Such a firm is Nibulon, which grows cereals and exports them with its own fleet. It also has its own shipbuilding and ship repair facility.

In the system of management of functional activities of shipping companies, direct and out-of-system results are distinguished. It is the out-of-system results that form the perceived value of enterprises, so it is important to ensure the conditions for their optimisation. Then the priority of new construction in relation to the conditions of formation of off-system results can be controlled on the basis of the following principle:

$$\sum_{t=1}^{T_l} \left(\Delta q_n \Delta c_{si} + \frac{\Delta q p_c \eta t_l}{365} \right) \alpha_{ii} \geq \Delta q k_{un} \quad 1.2$$

where:

Δc_{sl} – increase in the cost of production, delivery and sales of products that form new freight flows (Δq_n) and require increasing transport potential in terms of time and distance;

p_c – price of one tonne of goods in the process of movement;

Δq – increment in the volume of cargo transportation, the acceleration of delivery of which provides additional efficiency for the cargo owner in the form of working capital savings;

η_t – reduction of cargo delivery time, which reduces the working capital requirement;

k_{un} – specific capital intensity of transport work, reflecting the current cost of development of the merchant fleet of the corresponding specialisation.

Two basic conditions for the economic competitiveness of a fleet should be considered:

- technical and economic advantages relative to average conditions;



Figure 3. General Cargo Ship Commander

LOA – 92,8 m, beam – 17,7 m. Gross tonnage – 2992 GT. DWT - 5,833 tons. TEU – 320. Average speed / Max Speed - 8.4 / 19 knots. Year of Build – 1993.

Mv Commander is currently calling the ports of Big Odesa.

Two basic conditions for the economic competitiveness of a fleet should be considered:

- technical and economic advantages relative to average conditions;

the use of the principles of reduction of current costs and tax charges on the basis of a special registration system. It is based on the use of registers, so-called flags of convenience and a second (international) register of the national flag. Registration fees and tax deductions are minimised.

The global trend of increasing the economic priority of a particular flag is also to increase the benefits of crew hiring rules. In any case, it is important to ensure the availability of financial credit.

At the same time, this process complicates the achievement of the main qualitative characteristic of the state of the industry - its system equilibrium. Management of the balance state of all units of the system depends on the degree to which plans take into account global economic processes. The difficulty of reflecting the totality of needs forms the risks of innovative development and selection of the level of planned reserves.

The maritime transport fleet is considered as an important tool for ensuring national interests, especially in the sphere of foreign economic relations. Therefore, normal maritime states strive to support shipping companies in case of non-standard situations that violate the principles of open competition. For this aim, tax policy, subsidising and lending instruments are actively used. The methods and level of support for maritime transport enterprises vary over time and depending on the factors of development of the global and national economies.

The global maritime commercial market is characterised by economies of scale in cargo flows. This is what determines the structuring within the subdivisions of the global maritime transport industry. In these conditions, unification and standardisation of rules of conduct in the system of actual unification of customers of transport services is required. The internationalisation of merchant shipping is based on the openness of the main segments of the maritime commercial market, independent of the flag of registration of the SC fleet. The main condition for differentiation is the nature of adequacy of the fleet's TEU to the normalised conditions of balanced carrying capacity and cargo traffic.

The system of goals of functioning of the main units of the maritime transport industry includes a set of tasks of shipping company management. They actually reveal the meaning of functioning and development of shipping companies. These are, first of all, the results of operational and investment activities at the final output. A special group of tasks at the input of the subsystem includes plans of formation and utilisation of the company's resources.

Production tasks, i.e. ensuring the efficiency of the shipping process, form the most stable group of management activities. This task is generally faced by all participants of the production process - owners, management and employees. In merchant shipping a number of tasks are characterised by quantitative uncertainty. This concerns the future cargo flow and the behaviour of competing companies. Therefore, the reality of a multi-variant approach must be accepted. In addition, a number of operational plan tasks may arise spontaneously due to the presence of risks and threats.

Shipowners and operators independently choose a variety of ways, means to achieve the expected result and, to a certain extent, strive to fulfil their economic objectives.

1.3. Criteria for the Adequacy of a Vessel to the Conditions of the Transport Services Market

Shareholders and managers in the shipping business must base their decisions on three key conditions: a deep understanding of professional activities, a creative approach to solving the full range of tasks, and a search for solutions to maintain the stability of the maritime trade market segment. At the core of such decision-making lies the selection of a company's specialization, based on choosing the direction of operational activities and the type of vessel.

An essential element of fleet management is information. The efficiency of management depends on the availability of data that ensures connections between system elements. One of the key management tasks is to structure the flow of information so that it quantitatively and qualitatively meets the efficiency criteria for maximizing the shipping company's resource returns.

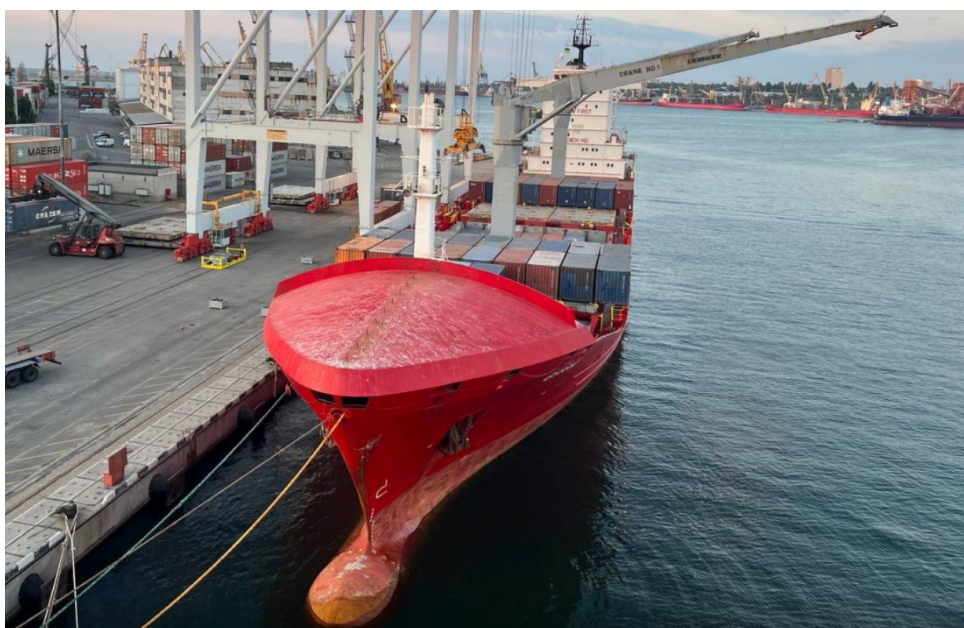


Figure 4. Container Ship Salgueiro

LOA – 147,8 m, beam – 23,4 m. Gross tonnage – 9956 GT. TEU – 1100. Average speed / Max Speed - 9 / 13.8 knots. Year of Build – 2005.

Mv Salgueiro was made the regular calls from Greece to the port of Chornomorsk in 2024

Achieving the main economic objectives requires effective competitive positioning within the relevant maritime trade market segment. This is facilitated by high technical and economic performance of the vessels and efficient organization of operations. A crucial criterion is commercial efficiency in operational activities. In this regard, the choice of a vessel's flag of registry in a relevant register plays a significant role. There are national registries, flags of convenience, and competitive secondary

(international) registries. The latter two feature preferential tax regimes.

When establishing a secondary registry, the level of registration fees and charges is determined based on the rates in flag-of-convenience countries, considering qualification indicators used to form the composition and level of payments.

To determine whether a vessel's parameters are suitable for efficient operation in a maritime trade market segment, a key indicator is calculated, reflecting the ratio of freight revenue to the vessel's economic potential.

This calculation is based on data that characterizes both current freight market conditions and the economic parameters of the vessel. To assess competitiveness and optimization reserves, the value of transportation for cargo owners is considered by calculating the impact of tied-up working capital over the transportation period:

$$\frac{R_u}{t_r D_w} \cdot \frac{R_u}{c_s + \frac{1}{T_r} (\hat{E}_{us} + \hat{E}_{ug})} = \max \quad 1.3$$

where:

R_u – net foreign currency revenue over the calculated operational period;

t_r – duration of the voyage;

c_s – annual operating costs of the vessel;

T_r – standard capital payback period under fleet sustainability and financial market conditions;

E_{us} – market (balance sheet) value of the vessel;

E_{ug} – the amount of working capital tied up by cargo owners during transportation. This factor reflects the competitiveness of a given freight delivery option.

Considering all cost factors, the optimal operating speed is usually higher than when considering only current expenses. This principle is widely implemented in container ships.

The primary criterion for a well-balanced specialized maritime trade market segment should be a sustainable increase in the quality of operational performance. A sharp drop in fleet utilization, as seen during the 2009 financial crisis and the

subsequent global economic stagnation (2011–2013), led to an excessive number of idle vessels.

Economic constraints must be factored into fleet capacity decisions, ensuring rational technical characteristics and high-quality cargo service. Fleet sustainability within a normalized life cycle depends on medium-term strategic priorities for shipping companies in the maritime trade market structure.

Navigational hazard zones must also be considered. For example, the Bosphorus and Dardanelles handle over 46,000 vessel transits annually, in addition to 1,400 daily local ferry operations.

External market conditions can either promote fleet efficiency or negatively impact capital returns. Favorable conditions signal potential increased resource utilization and improved financial performance, whereas negative conditions may necessitate investment cuts or withdrawal from specific operational segments.

Unfortunately, shipping companies, as complex economic entities, can become complacent when market conditions remain stable for prolonged periods. From 2003 to 2007, many firms overestimated market growth, leading to excessive new ship orders. This ultimately resulted in a freight market collapse due to oversupply.

Methods relying on uniform economic assumptions pose risks, as periodic turbulence in maritime trade markets alters the parameters driving future growth dynamics.

1.4. Classification of Indicators for Evaluating the Effectiveness of Management Development

The results of functional activities are reflected in the overall economic outcomes – the efficiency of fleet operation and resource productivity. The organizational and economic aspect of shipping companies' operations is based on a systemic unity of capital asset value, workforce size, current cost levels, and time parameters that characterize the company's condition and the competitiveness of its potential realization.

All economic relations in the maritime trade market have a value-based nature, despite the initial consideration of the tangible form of resources and means of labor. Fleet management should be considered a specific part of the functional activities of shipping companies, involving the collection, accumulation, processing of information, and justification of decisions aimed at achieving predetermined results.

To justify the parameters of functioning and development, to objectively assess the efficiency of balanced development of SC, and to evaluate the effectiveness of increasing fleet carrying capacity, the traditional profitability indicator is used. It corresponds to the criterion of maximizing the return on key production factors –

capital and labor. The chosen indicator should reflect the results of resource utilization, reveal the dynamics of production outcomes, potential, and financial stability.

The system of planned and evaluative indicators should reflect the specifics of the functional activities of shipping companies to encourage rational positioning in the chosen sector of the freight market. These tasks determine the mechanism for developing performance and status indicators of SC. The indicators should reflect the requirements of unified positioning in the global maritime trade market and the objectivity of business performance assessment.

The determination of an SC's efficiency is based on indicators that reflect production, technical, economic, and social results through quantitative and qualitative characteristics. The problem remains the measurement of resource utilization intensity, the rationality of increasing the company's capital value, and the improvement of organization and technology. Considering the production and economic goals of maritime transport enterprises, the following classification of indicators can be used:

- reflecting the scale of production resources and the technical and economic characteristics of maritime transport assets;
- reflecting the scale of participation in the transport services market, the achievement of goals, and the balance of supply and demand (transport volume, net revenue, ratio of results to costs);
- improving the utilization of the potential and resources of shipping companies (reducing downtime, minimizing ballast voyages, ensuring timely cash flow);
- operational efficiency (reducing transportation costs, increasing labor productivity, and improving profitability);
- improving work quality (reducing cargo delivery times, enhancing the safety of shipments, and decreasing accident rates and commercial losses).

This classification of indicators is united by the criterion of economic efficiency and is differentiated by specific specialized groups of the fleet.

The dynamism of a balanced system of indicators is determined by the external conditions for fleet development and the changing priorities in establishing a competitive technical and economic level of the SC. The system of specific indicators for the commercial fleet consists of those that most fully reflect the functional, parametric, and technical-economic characteristics. The uniqueness of the results of the SC and individual vessels is characterized by indicators of resource utilization over time and by productivity.

Quantitative indicators include:

- a) the amount of cargo by this option and by types of transportation, cargo turnover;

b) the quantity and structure of the fleet by types and by transportation technology.

Qualitative indicators include those that reflect the intensity of using production potential: vessel and container loading indicators; fleet utilization based on carrying capacity; intensity of cargo handling at terminals; average financial indicators per unit of carrying capacity or transport volume.

The development of the maritime trade market is accompanied by changes in structure, operating rules, levels of deadweight concentration, the emergence of new types of vessels, and an improvement in their technical and economic levels. This also determines the qualitative aspects of the freight market. Along with this, the requirements for fleet efficiency change, especially regarding energy consumption per unit of transport output. Therefore, when formulating the development strategy of a shipping company, the analysis of fuel consumption is conducted based on norms per vessel per day or per unit of power.

$$\beta_{en} = \frac{24 \cdot q'_m + 24 \cdot q'_{st} \cdot c_c}{\varepsilon V} \quad 1.4$$

where:

q' – fuel consumption rate in kWh;

c_c – the coefficient accounting for the influence of onboard cargo handling equipment on fuel consumption during their use;

ε – coefficient of cargo capacity utilization of the vessel;

V – operational speed of the vessel in knots.

The targeted approach to forming results and measuring their indicators is highlighted (Fig. 1.2).

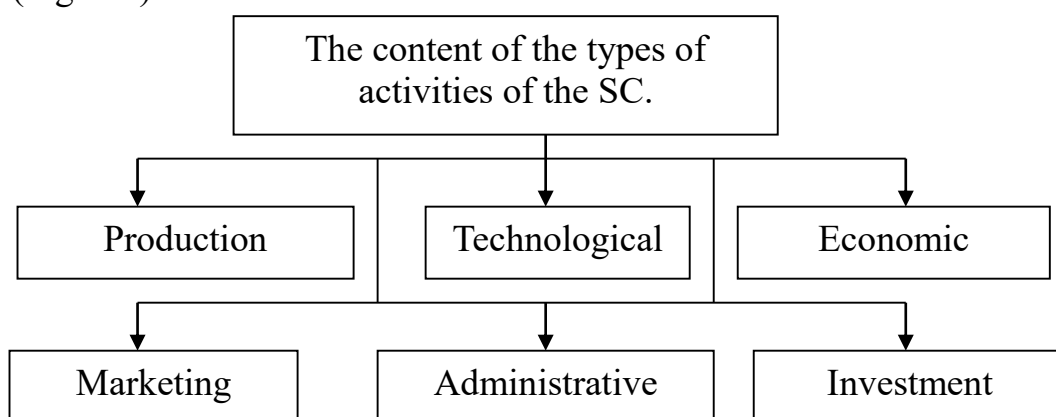


Fig. 1.2 System of substantive development goals for the SC.

The most important aspect of achieving freight independence in foreign trade relations is the emphasis on organizational factors and the selection of rational ways to gradually increase transport capacity. Competitive effectiveness of development projects serves as the criterion. The strategy for forming shipping potential includes

the selection of investment instruments and the expansion of the fleet based on vessels that ensure the company's stability through net cash flow.

The activities of a shipping company should be considered effective when the profit generated is sufficient for reproduction using new innovative technologies. It is also necessary to take into account the dependence of profitability, as a key indicator of efficiency, not only on the level of the fleet and management but also on external factors, such as shifts in cargo flows and the level of tariff rates.

When choosing an economic development model for a shipping company and focusing on the degree of balance in the maritime trade market, several conditions for forming positioning segment parameters should be considered:

- assessment of the stability of growth rates considering the multitude of operators offering similar technologies;
- determination of the limit of possible market carrying capacity development based on the state of investment flows;
- prioritization of development considering the ultimate goal of forming the company's capital value;
- justification of the necessary amount of resources to ensure stability, taking into account the actual volatility of the freight market.
- calculation of the level limits of the main characteristics of the shipping company's fleet that ensure an anti-crisis state by minimizing the impact of the overall risks.

The costs of the national economy involved in international division of labor depend on the efficiency of maritime transport operations. Therefore, the measurement of output or the volume of transport work should be balanced with the interests of cargo owners (Table 1.1). Unfortunately, the cargo turnover of transport does not reflect the rationality of transport-economic relations. The accounting of transport work in conditional-natural indicators - ton-miles – represents a gross form of measuring the result. In some cases, it does not take into account either the labor intensity or the capital intensity of the transportation process.

Table 1.1. Indicators of Output (Work) of Maritime Transport Divisions

Divisions of Maritime Transport	Indicators and measures of resource (potential) utilization results of enterprises
Transport and technological systems for cargo transportation	Cargo transportation, t Fleet cargo turnover, ton-miles Revenue from cargo transportation, monetary units Net foreign currency earnings, USD

Transport and technological systems for passenger service	Passenger transportation, persons Passenger turnover, passenger-miles Revenue from transportation, monetary units Net foreign currency earnings, USD
Technological transshipment complexes of ports	Cargo handling, t Transshipment cargo turnover, ton-operations Revenue from stevedoring and other operations, monetary units
Technical fleet	Volume of excavated and removed soil, m Channel parameters, m ³ , m Revenue from core activities
Emergency and rescue fleet	Number of operations, Fleet capacity, Revenue from emergency and rescue and underwater technical works.
Service and auxiliary fleet	Number of towage and mooring operations, Tugboat fleet capacity, Revenue from functional activities
System of maintenance and repair of the fleet	Volume of services, Total equivalent tonnage of repaired vessels

In general terms, the management system of commercial shipping consists of two subsystems: the object of management – in this case, the shipping company, individual vessels, and the process of transporting goods and passengers. The management system organizes and implements the management actions themselves. The relationships between the object of management and the management system (managerial divisions) are based on production goals, as well as communicative and informational connections.

The management system in commercial shipping – organized complex of specialists, methods, and management tools. Changes in cargo transportation technology require special consideration of the results of transport work, which is characteristic of the container fleet and steamships. The consumer utility of transport operations is determined not only by the quantity but also by the delivery time of cargo.

Conditional-natural measures of transport work volume are used for planning costs and resource intensity under the given transportation flow processing technology.

The contradiction between volume and resulting indicators arises with the improvement of the quality of the transportation process, technological efficiency, and reliability, as well as the adoption of high-performance vessels that require additional capital resources but provide synergy for cargo owners. General system indicators reflect the interrelationship of economic interests and costs through vertical connections in result formation. Summary indicators reveal the most significant and fundamental production-economic relationships and allow for the evaluation of the effectiveness of investment and management decisions.

1.5 Complexity and balance of the maritime trade market condition

The high mobility of elements and connections within the maritime trade market requires the management system to be capable of continuously monitoring situations and reallocating resources to optimize their utilization.

The fleet management system involves the development of specific objectives that reflect both long-term and current tasks, as well as the external conditions for their achievement. Moreover, management should focus on creating material and organizational conditions for the efficient use of the shipping company's production potential.

The systemic significance of the stable functioning of the global maritime trade market, from the perspective of international economic relations, predetermines a key requirement for individual shipping enterprises—their orientation toward balanced relationships with cargo owners and functional interaction entities.

Therefore, the management system for the stability of the shipping business includes extrinsic coordination of processes that ensure maritime safety. At the same time, each participant remains focused on competitive advantages and, based on this, on achieving operational efficiency and development. The volume of transport operations should ensure the regulatory utilization of the fleet's carrying capacity.

An established system of regulations for utilizing a shipping company's potential is a crucial factor in controlling the impact of external conditions on capital returns and other company resources. Ownership structures gain the ability to more accurately select fleet characteristics on both the shipbuilding and secondary markets. It is essential to monitor changes in key indicators through analytical assessment to minimize the risk of financial difficulties for the company.

The regulations reflecting the utilization of the fleet include:

- the productivity of a ship's cargo-carrying capacity per ton;

- the intensity of vessel handling at the terminal;
- the profitability level of a vessel's operation within the accounting period;
- the ratio of sailing time to idle time.

Traditional offshore technologies in the global maritime trade market have proven to be an effective tool for regulating the pricing of export-import contracts and stabilizing payments. They also provide favorable conditions for the self-financing of commercial shipping and the settlement of foreign currency contracts.

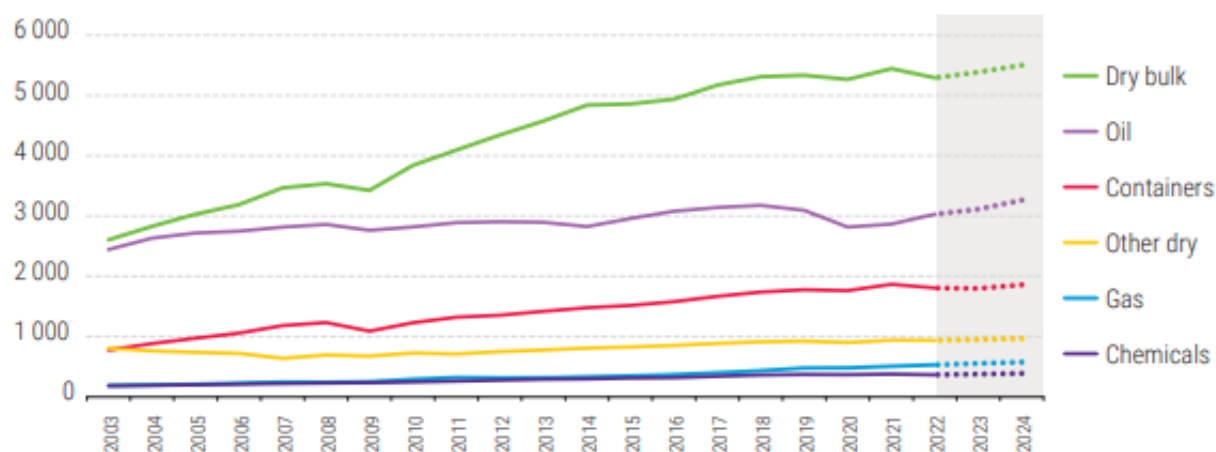
Numerous change management theories focus on a company's response to external transformations in its functional environment. Furthermore, a key aspect of these theories is the method of implementing change projects concerning cargo flow structures and deadweight capacity. Transformations are initiated both by the management system and by global conditions.

The foundational elements of a shipping company include functional activity objectives and a commitment to optimizing the results of efficiently utilizing its potential. In addition to these, the most essential elements are:

- Economic levers – sources and resource funds that ensure the reliability of the functional operation of capital assets and employees;
- A set of material, production, and economic instruments – the basis for forming the organizational, economic, and legal framework that defines specific situations (norms, standards, regulations, methods);
- Psychophysical capabilities of managers and seafarers;
- Needs and material interests.

In general, the operational activities of shipping companies depend on the state of the global maritime trade market. Among the systemic patterns that shape the main parameters of maritime trade market segments, complexity and balance stand out as key factors. The conditions and challenges of shipowners' operational activities are shaped based on these characteristics. Complexity parameters include the diversity of cargo flows and the full adequacy of the available commercial fleet. Balance, as a fundamental characteristic, is defined as the complete alignment of supply and demand for all types of transportation in terms of both quantitative and qualitative indicators.

Only under these constraints can fair competition be established, leading to a just system of freight and tariff rates. Systemic and non-systemic factors influencing the cyclical nature of the freight market determine deviations in the complexity and balance of the global maritime transport industry (Table 1.2, Figures 1.3, 1.5).



Source: UNCTAD secretariat, based on Clarksons Research, Shipping Intelligence Network time series (July 2023).

Notes: 2023 and 2024 are forecast. "Dry bulk" includes major bulks (iron ore, coal and grain) and minor bulks (metals, minerals, agribulks and softs); "Oil" encompasses crude oil and refined oil products; "Other dry" is an estimation of all other dry trade that is not included in major/minor bulks, for instance, cars and other vehicles, ro-ro and project cargoes, as well as reefer cargoes that don't go in containers and breakbulk cargoes that are not in the minor bulk category; "gas" includes LPG, LNG and ammonia.

Year	Dry Bulk (Млн тонн)	Oil (Млн тонн)	Containers (Млн тонн)	Other Dry (Млн тонн)	Gas (Млн тонн)	Chemicals (Млн тонн)
2003	~2,500	~1,700	~600	~500	~200	~100
2005	~3,000	~1,900	~800	~600	~250	~150
2007	~3,300	~2,000	~1,000	~700	~300	~200
2010	~3,800	~2,200	~1,200	~800	~350	~250
2012	~4,200	~2,300	~1,400	~900	~400	~300
2015	~4,500	~2,200	~1,500	~900	~450	~350
2017	~4,800	~2,100	~1,600	~850	~500	~400
2019	~4,700	~2,000	~1,500	~850	~550	~450
2021	~4,900	~2,000	~1,500	~900	~600	~500
2022	~5,000	~2,100	~1,600	~950	~650	~550
2023*	~5,100	~2,100	~1,700	~1,000	~700	~600
2024*	~5,300	~2,200	~1,800	~1,050	~750	~650

* The data for 2023-2024 are projected.

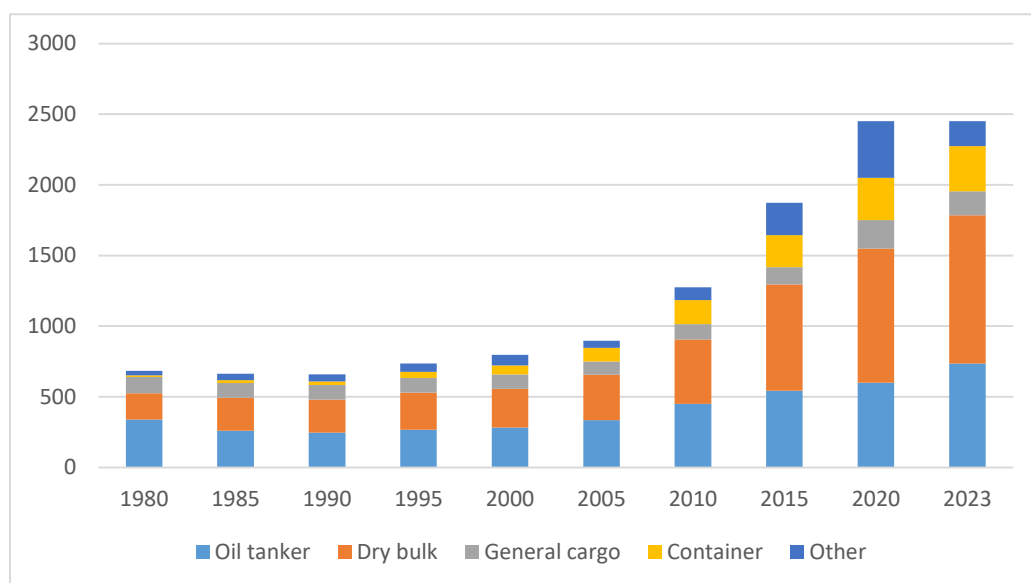
Table 1.2. Dynamics of Cargo Transport for Major Commodity Groups in Global Maritime Trade (million tons)

As seen in Table 1.2, global statistics use a generalized classification of cargo based on the labor intensity of transportation technology and loading/unloading operations. With the growth of foreign trade volumes, in line with the principles of globalization in economic relations, the cargo flow of maritime trade continues to expand. At the same time, the proportion of energy resources and raw materials in the total flow remains stable. The increasing transportability of finished goods determines the growth pattern of this extensive group of commodities. The internal structuring of cargo categories and the growing role of container technologies drive the specialization of the fleet within cargo types (Figure 1.3).

In a broad sense, the demand for cargo transportation is determined by the level of economic development and the division of labor. Transport, which facilitates the continuation of the production process, must evolve in accordance with the growth of the national economy and the ability to engage in transit cargo flows. Thus, the most critical factor influencing transport volumes is the **level of economic development**, as it determines both production volumes and the demand for transport services.

The analysis of cargo traffic dynamics for the period 2003–2021 demonstrates a steady increase in transportation volumes. The most significant growth is observed in the *dry bulk* segment, which has more than doubled since 2003, reaching peak values of over 5,500 million tons in 2019–2021. Container traffic also showed stable growth until 2019, after which there was a slight decline, followed by recovery. Oil transportation remained relatively stable, although it experienced a slight decrease after 2018. Gas and chemical cargo flows demonstrate gradual but stable growth.

It is expected that in 2022–2024, the dynamics of transportation for major commodity groups will remain positive, with a further strengthening of containerization, an increase in gas transportation, and stable indicators for oil and chemical cargo transport.



Type of vessels	1980	1985	1990	1995	2000	2005	2010	2015	2020	2023
Oil tanker	339	261	246	268	282	336	450	543	600	735
Dry bulk	186	232	235	262	276	321	457	752	950	1 050
General cargo	116	106	103	104	101	92	108	122	200	170
Container	11	20	26	44	64	98	169	228	300	320
Other	31	45	49	58	75	49	92	228	400	175

Figure 1.3. Deadweight Structure of the Commercial Fleet by Main Specialization Groups, million tons

The dynamics of deadweight and structural shifts reflect not only the factors of global trade development but also the peculiarities of fleet composition formation under the influence of innovative factors, which contribute to reducing energy and resource consumption in production, as well as increasing the productivity of the commercial fleet.

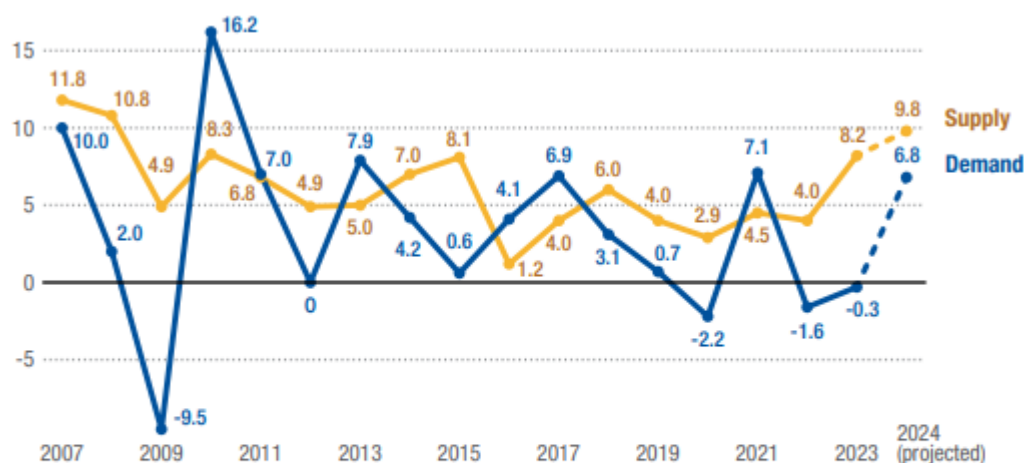
The total deadweight of the commercial fleet increased from 683 million tons in 1980 to 2,430 million tons in 2023, which is more than 3.5 times.

The deadweight of the tanker fleet increased 2.2 times (from 339 to 735 million tons), while the deadweight of the bulk carrier fleet grew 5.6 times (from 186 to 1,050 million tons).

The vessel's speed and design take into account the type of cargo transported and the impact of delivery technology on the amount of working capital immobilized during transportation. The flag: Singapore indicates the operator's stable functional and financial position.

The diversity of the commercial fleet and the presence of technological advantages do not eliminate operational risks. The periodic imbalance between cargo flow volumes and fleet deadweight results from both cyclical factors in global economic development and the competitive positioning of individual shipping companies (Figure 1.5).

Achieving a balanced ratio between cargo flows and transport capacity is challenging because shipping company owners tend to focus on overall supply and demand trends in the global economy while underestimating the strategies of other operators. In this regard, the choice of forecasting methods for cargo flow volumes and the techno-economic development of fleets and ports becomes critically important.



Source: UNCTAD calculations. Demand is based on data from MDS Transmodal, World Cargo Database from chapter I (TEU), and supply is based on data from Clarksons Research, Container Intelligence Monthly, various issues.

Note: Supply data refer to total capacity of the container-carrying fleet (TEU), including multipurpose and other vessels with some container-carrying capacity.

Year	Demand	Supply
2007	10,0	11,8
2008	2,0	4,9
2009	-9,5	1,3
2010	16,2	8,6
2011	8,3	7,0
2012	4,9	7,0
2013	4,9	7,1
2014	3,0	6,0
2015	2,1	4,1
2016	4,0	3,1
2017	6,9	4,0
2018	4,0	3,7
2019	3,1	3,0
2020	-2,2	1,7
2021	7,1	3,7
2022	-1,6	4,0
2023	-0,3	8,2
2024 (forecast)	6,8	9,8

Figure 1.5. Changes in Market Balance in the Container Shipping Segment

The relationship between cargo flow volumes (demand) and available tonnage (supply) in the container shipping segment (Figure 1.5) reflects the influence of external factors that complicate the assessment of the real economic situation.

On the other hand, ship-owning structures, driven by leadership strategies, tend to create excessive fleet capacity during certain periods, which subsequently leads to a collapse in freight rates.

The focus of economic levers and incentives on improving the qualitative aspects of shipping companies' operational efficiency, along with increased accountability for fulfilling contractual obligations, highlights the growing importance of regulatory planning methods and the development of subsystems.

The 2009 market imbalance was caused by a sharp decline in global trade, which had not been accounted for in new orders for high-capacity container ships.

1.6. Regularities of maritime transport development

The tasks of increasing the volume and efficiency of macroeconomic activity determine the need for adequate formation of the country's transport potential and improving the quality of its work.

The main regularity of the effective state and development of the transport system is the full and timely satisfaction of the needs of the production complex, population and world economic relations in transportation. The time of delivery of goods should meet the needs of continuity of production and consumption and the minimum working capital of transport and cargo owners. This determines the requirements for the technical and economic level of the fleet and ports, carrying capacity and the nature of the use of transport capacity. Transportation should ensure continuous improvement of transport and economic relations of the regions.

The nature of development and use of production assets of transport (ships), as well as the socio-economic nature of shipping companies is predetermined by the mode of production and the principles of a particular economic system. At the same time, global world economic processes have a significant impact, as means of transportation, irrespective of their ownership, participate in the world market of transportation services.

The fact that in certain historical conditions sea transport was the main means of delivery of goods to markets played a determining role in the development of capitalist and market relations in maritime shipping. This is, first of all, the free use of sea routes for trade transportation, the great geographical discoveries and colonization of the world, the development of global economic relations. The achievement of economic goals of production could be ensured at a high level of development of transportation, especially the merchant fleet.

Inherent contradictions of market economic systems formed one of the regularities of maritime transport development - cyclicity of production potential utilization.

Transportation is an integral part of the productive forces of this or that economic system. Therefore, production relations in transportation reflect the regularities of development of society and the state as a whole. This, naturally, is reflected in the nature and direction of socio-economic development of shipping companies.

Modern maritime transport is based on the equivalence of various forms of means of production and is aimed at maximizing profitability with intensive use of ships. The tasks of transportation enterprises are conditioned by the basic laws of market relations. However, a rational approach to the law of competition in the conditions of cyclic freight market is necessary. Competitive struggle of separate

shipowners and modes of transportation causes irrational use of outsiders' vehicles. Periodic imbalance of transportation services market and transportation capacities is observed. At the end of the 70's the surplus of tanker tonnage reached 100 million deadweight tons. The same situation remains in some years of the 21st century.

In these conditions it is important to find adequate levers to stabilize the position of transport enterprises, especially in the system of multifactor threats. Shipowners widely use a peculiar mechanism of optimization of operating costs - fleet transfer "under false flags".

From time to time, depending on the state of the economy and the cycle of the transport services market, a number of market economies denationalize transport by building transport through budget financing or nationalizing it by buying it back from private owners. In this way, temporary problems of rationalization of the use of production resources are solved. A part of sea transport is at anchorage in case of inadequate state of the freight market.

In any case, the laws of stabilization of the economic situation of the country predetermine the attitude to transport as:

- a) an organic constituent part of the country's economy and an instrument of its integration into world economic relations;

- b) a structure subject to the influence of system-wide economic laws of development;

- c) a production and economic system with the potential to expand and improve production on the basis of the most important directions of scientific and technical progress and oriented to meet the needs formed by the market of transportation services;

- d) the most important subdivision of the production infrastructure, oriented in its activities on the programs of production development and commodity exchange;

- e) a constantly developing subsystem based on the principles of competitiveness, providing full satisfaction of demand for transportation and optimal economic results of operation in the freight market.

Depending on natural conditions and the structure of cargo flows, inland waterways (rivers, lakes, canals) occupy an important place in the transportation system. Development of inland waterways is associated with hydraulic engineering works and creation of fundamentally new vessels.

Coordination of the development of various types of transport from the standpoint of national transport security and the formation of a national transport system based on new transport modes are key factors. Additionally, the rationalization of cargo flow distribution by transport type and the specific location of different

transport modes influence the role of each transport type in the transportation of goods and passengers. Structural shifts in transportation work are constantly taking place.

With the development of intermodal transportation and logistics, IMS and ITC the interaction between maritime and land modes of transport in providing internal and external transportation is intensifying.

The main task of maritime transport is the fullest development of cargo flows of foreign trade, transportation of cargoes of third countries, mitigation of seasonal unevenness of cargo flows of railway transport, economically justified participation in mixed river-sea transportation with the extension of the navigation period on the rivers.

Expansion of river transport use is associated with reconstruction of waterways, creation of inter-basin connections (Rhine-Danube-Main, Volgo-Balt) and integrated development of all components. The development of natural routes requires relatively small initial costs. These costs for the organization of navigation with the throughput capacity of 80 -100 million tons per year are 10 times less than the corresponding costs for the creation of railroads with rolling stock and 3-4 times less than for roads.

Optimization of the formation of the country's transport network makes it possible to develop mixed rail-water and water-automobile transportation of goods. The development of logistic commodity-conducting systems becomes the main thing.

All modes of transportation form a unified production infrastructure of the country. It is necessary to scientifically substantiate the choice of the system and harmonization of economic interests of individual types of transport in providing national needs.

It is necessary to take into account the close relationship between the volume of transportation work and the parameters of output and export of all types of products. The cyclical nature of economic development, despite the forecasting and planning of economic activity, determines the objective need for reserves of transportation capacities.

The laws of economic development according to the criterion of reducing resource intensity and marginal level of costs predetermine the process of rationalization of the location of productive forces and maritime transport enterprises.

The general laws of economic development on transport limitations are reduced to:

- rationalization of transport location, internationalization of use of its capacities on the basis of IMS and ITC;
- rationalization of transportation distribution by modes of transport on the basis of competitiveness in terms of quality and price indicators;

- striving for the most complete utilization of transport means by each owner according to the criteria of marginal profitability;
- creation of conditions for relative reduction of transportation costs for moving products.

However, it should be borne in mind that the possibility is not yet a reality. It is necessary to realize this possibility clearly.

Besides commercial functions of merchant shipping, it is necessary to take into account the function of transport in strengthening the system country, which predetermines the tasks of state support of the fleet, ports and shipbuilding enterprises.

Maritime transportation plays a crucial role in the development of the country's economy. Therefore, in all economic processes the development of fleet and ports should be given the necessary attention. A special stage in the development of maritime transport enterprises is represented by the periods of the country's active access to foreign markets.

Taking into account the spatial gap between the sphere of production and the sphere of consumption, as well as the comprehensive nature of interregional exchange, we can assert the most important role of maritime shipping companies in accelerating the rate of circulation of industrial products, in ensuring the pace of effective expanded reproduction.

Technical improvement of fleets, terminals and land vehicles is an important means of reducing the circulation time of goods in transport. This concept is gradually being implemented in all modes of transport in the leading countries of the world.

The amount of cargo in the process of transportation depends both on the location of productive forces and production volumes, and on the speed of cargo delivery. Cargo, which is in the process of delivery, economically represents a form of working capital of enterprises - consignors or consignees. The amount of these working capital temporarily withdrawn from the production process can be calculated according to the formula:

$$M_K = \frac{\sum Q p_{cf} t_t}{365} \quad 1.5$$

where:

$\sum Q$ - the amount of cargo transported during the year;

p_{cf} - average cost (price) of one ton of cargo;

t_t - average delivery time, days.

Acceleration of cargo delivery leads to a significant reduction of working capital in cargo-forming divisions. The amount of working capital release can be calculated according to the formula:

$$\Delta O_t = \frac{\sum Q f_p(t_{d1}-t_{d2})}{365} \quad 1.6$$

where:

t_{d1}, t_{d2} – is the time of cargo delivery with a longer transportation process (traditional transportation technologies) and under the option of accelerated delivery, respectively.

Reserves for increasing the efficiency of the functional activity of goods owners due to the reduction of cargo delivery time are significant, determined by the scale of commodity turnover and the price of 1 ton of cargo transported on the main directions.

In 2024, the total gross domestic product of the global economy was approximately \$110 trillion. Maritime transport handled about 11 billion tons of cargo during the year. The average price per metric ton of cargo exceeded \$2000, and the average delivery time was more than 15 days. Therefore, accelerating delivery by just 1% can release working capital amounting to hundreds of millions of United States dollars. This is why the transportation capacity of the container fleet is increasing at an accelerated pace.

1.7. Principles of ship registration

In the system of managing the development and operation of the fleet, economic incentives for decision-making play a fundamental role. In this regard, the most important procedure is the one that ensures proof of ownership of the relevant capital assets. This is especially important in global commercial shipping. Maritime vessels operate in various sectors of the world ocean and within the economic zones of foreign states.

An incentive is the ultimate goal of forming and utilizing maritime transport potential. It is what the owner of the enterprise (the principal), its management, and employees purposefully strive for within the calculated time period.

The main economic incentives for implementing this strategy include job creation, profit, wages, pricing, norms, and standards. Profit maximization among these incentives drives the search for cost rationalization. A particularly crucial factor in maritime transport is the choice of the vessel's registration form or the flag of the state.

The significant differentiation in the techno-economic level of merchant fleet vessels across different companies, the regulatory frameworks imposed by tax administrations, and the principles of vessel registration in various registries determine

the actions of shipowners in ensuring the economic efficiency of vessel operations. This process is primarily aimed at enabling the accumulation of investment resources for the next stage of fleet renewal.

Reflagging, as a means of selecting the place and method of registering merchant fleet vessels, is fundamentally based on socio-economic, organizational, and political considerations and factors. The initial inertia in the perception of this strategy was due to the early focus on selecting a registry based on the principles of cost minimization and profit maximization. However, over time, with the increasing emphasis on maritime safety and the tightening of standards for working conditions, wages, and rest periods by the IMO, the institution of alternative national fleet registration has become a widely recognized tool for maintaining competitiveness in the volatile maritime trade market.

The crews of vessels, regardless of the flag of registration, have the right to wages in accordance with current international standards under modern maritime regulations based on IMO Conventions and ITF provisions.

At the same time, to ensure proper working conditions, fair wages, and adequate rest for seafarers – who contribute to the efficient and safe operation of the fleet – standardization is being developed based on ITF policy. According to the “Baltic Standard”, the terms of a collective agreement for a vessel of any type under any flag must be coordinated with seafarers' unions operating in the ports of call. The standards of the country with the higher wage levels and collective agreement conditions serve as the benchmark.

Three groups of merchant fleet registries should be distinguished:

- national flag registries;
- flag of necessity or convenience;
- second (international) registries.

This process is closely related to the classification of maritime registries based on their level of risk, which, historically, has also defined the extent to which normal working conditions for vessel crews are ensured. The ITF Fair Practices Committee, considering socio-economic constraints, develops and conducts campaigns against flags of convenience.

To ensure maritime safety and proper living and resting conditions for crews, inspections are introduced for vessels that have been laid up for an extended period. This process can take from 3 to 6 months.

Considering the specifics of national maritime policy and the priority of the national flag registry, vessel registration practices are continuously improved based on cost optimization criteria. Normal maritime nations strive to establish competitive conditions for maintaining national registries. In this regard, for example, the Turkish

second registry, considering certain characteristics, essentially aligns with flags of convenience. Therefore, collective agreements with shipowners must also account for potential risks related to wage conditions.

Figure (fig. 1.6) illustrates world fleet ownership by capacity in dead weight tons and flag of registration, as of 1 January 2024.

Country or territory of ownership	Number of vessels			Deadweight tons				
	National flag	Foreign flag	Total	National flag	Foreign flag	Total	Foreign flag as a percentage of total	Total as a percentage of world dead weight
Greece	580	4 406	4 992	49 985 667	344 971 148	394 977 181	87.3	16.9
China	6 600	2 772	9 418	130 737 555	178 336 427	309 870 897	57.6	13.3
Japan	959	3 142	4 104	38 689 931	203 666 970	242 366 672	84.0	10.4
Singapore	1 350	1 445	2 824	67 827 285	78 156 951	146 047 319	53.5	6.3
Hong Kong, China	869	1 104	2 000	76 961 461	57 939 090	135 586 887	42.7	5.8
Republic of Korea	826	852	1 688	19 896 324	77 045 438	97 020 891	79.4	4.2
Germany	172	1 918	2 091	7 492 926	66 931 088	74 427 230	89.9	3.2
Taiwan Province of China	144	890	1 043	5 826 691	54 846 644	60 735 889	90.3	2.6
United Kingdom including Isle of Man	334	928	1 267	9 070 489	47 538 877	56 980 416	83.4	2.4
Norway	936	898	1 836	17 331 399	36 441 844	53 903 936	67.6	2.3
United Arab Emirates	130	1 291	1 427	596 404	50 624 996	51 247 355	98.8	2.2
United States including Puerto Rico	770	1 010	1 788	10 477 424	39 245 905	50 416 065	77.8	2.2
Türkiye	401	1 619	2 030	6 623 393	40 174 680	46 849 025	85.8	2.0
Switzerland	14	647	661	835 748	40 293 135	41 128 883	98.0	1.8
India	926	345	1 275	17 670 993	23 006 477	40 697 051	56.5	1.7
Indonesia	2 398	132	2 540	28 277 194	3 430 913	31 980 209	10.7	1.4
Cyprus	113	311	424	3 939 325	25 272 183	29 211 508	86.5	1.3
Belgium	81	211	292	7 038 164	17 182 252	24 220 416	70.9	1.0
France	144	309	453	4 145 965	14 162 666	18 308 631	77.4	0.8
Saudi Arabia	176	122	300	14 023 679	2 555 698	16 583 171	15.4	0.7
Brazil	297	86	384	4 687 509	9 423 957	14 116 966	66.8	0.6
Canada	216	158	375	2 645 448	7 351 057	9 996 989	73.5	0.4

Source: UNCTAD calculations, based on data provided by Clarksons Research Services.

Figure 1.6. Differentiation of the fleet by registries

The National Registry must create competitive conditions for the development of the Ukrainian-flagged fleet compared to alternative vessel registration forms. The key objective is to establish favourable principles that encourage ship registration under the Ukrainian flag. This will enable Ukraine to fully realize its potential as a maritime nation. The need for domestic shipbuilding development becomes justified, the number of effective jobs expands, and a positive freight flow is formed.

The lack of favourable conditions to incentivize shipowners to register vessels under the Ukrainian flag prevents the country from realizing the potential of its maritime transport sector and revitalizing national shipbuilding. A legislative act is crucial, one that consolidates and adapts global standard fleet registration procedures. These must be based on internationally competitive tax rates, both for the registration process and the operational activities of companies. A particularly vital role is played by procedures involving banks in ship purchase and sale transactions as well as investment in ship construction.

The key legislative framework should be the Law “On the International Register of Maritime and Inland Waterway Vessels of Ukraine”. This law must be based on the strengths of similar registries in Panama, Germany, and Russia.

1.8. Administration and Organizational Structures in the System of Commercial Shipping

The maritime transport industry is one of the most globalized sectors. Therefore, in addition to purely entrepreneurial tasks, the management of functional activities, resource formation, and utilization is based on a set of principles and standards developed by international maritime organizations.

The regulation covers shipbuilding and navigation standards in terms of safety parameters and working conditions for seafarers. One of the most strictly regulated areas is the seafarers' labor market segment.

In Ukraine, the foundation of state administration in the commercial shipping system is the "Department of State Policy in the Field of Maritime and Inland Water Transport" under the Ministry of Infrastructure. Unfortunately, despite the systemic importance of maritime transport and the relative stability of industry characteristics, its management system is subject to frequent changes, which does not contribute to the sustainability of business activities with elements of state support. Nevertheless, the fundamental goal of developing the national shipping complex remains.

Regulatory administration groups, which serve as a management link between the industry's top leadership and the production units of the maritime economy complex, include the International Maritime Organization (IMO), the International Transport Workers' Federation (ITF), and specialized UN bodies.

For shipowning and operating structures, the principles of the Paris Memorandum of Understanding (Paris MoU) on fleet condition assessment are particularly significant. Periodically, lists categorizing fleets into "white," "gray," and "black" based on their flag state are compiled. This classification predetermines subsequent operational and chartering conditions.

In the framework of IMO, the following conventions have been developed:

- International Convention for the Safety of Life at Sea (SOLAS, 1974);
- International Convention on Load Lines (1966);
- International Convention on Tonnage Measurement of Ships (1969);
- Convention on the International Regulations for Preventing Collisions at Sea (COLREGs, 1972);
- International Convention for Safe Containers (CSC, 1972);
- Convention on the International Maritime Satellite Organization (INMARSAT, 1976);
- International Convention on Maritime Search and Rescue (SAR, 1979);
- Nairobi International Convention on the Removal of Wrecks (2007);
- International Convention on the Removal of Sunken Vessels (2007).

Under the general conditions of the ITF, compensation for loss of working capacity is set at:

- \$75,000 for rank-and-file crew members;
- \$100,000 for mid-level officers;
- \$125,000 for senior command staff.

Additionally, the maximum share of the total salary package allocated for social needs and education is 15%. A well-defined system for resolving labor disputes on board is crucial.

A Seafarers' Welfare Fund is established to support social and domestic activities on board, maintain crew communication with their families, and assist seafarers' families.

Germany, as one of the leading maritime nations, is becoming a new center for ship arrests due to amendments to its maritime legislation aimed at facilitating this process.

The German judicial system permits ship arrests. Currently, the conditions for such arrests have been simplified. In court, it is sufficient to prove that the claim against the shipowner is valid based on documentation and that the case falls under the jurisdiction of the respective court.

If both conditions are met, ship arrest becomes inevitable.

A crucial role in shipping safety administration is played by the Paris Memorandum of Understanding (MoU) on Port State Control. Ships that have been issued repair requirements and enter EU ports without complying with these requirements are subject to arrest under port state control measures.

1.9. Features of the construction of organizational structures of shipping companies

Modern SC are characterized by a complex system of internal connections between various departments in terms of production, financial, technological, organizational, and other types of relationships.

In every large SC, the performance of certain functions is carried out by the relevant structural divisions, which are typically classified into main (production or operational) and auxiliary (or staff) units.

As the volume of transportation increases, the number of operational and auxiliary divisions also grows, while changes in the freight market conditions lead to shifts in the significance of certain services. The need for continuous fleet renewal and transportation technology upgrades, driven by competition in the context of innovation and globalization, has made the efficiency of SCs directly dependent on marketing structures and technical management (figure 1.7).

The role of multimodal systems and activity diversification is increasing. The rise in capital investments enhances the importance of the financial department. In many companies, these divisions have become key players.

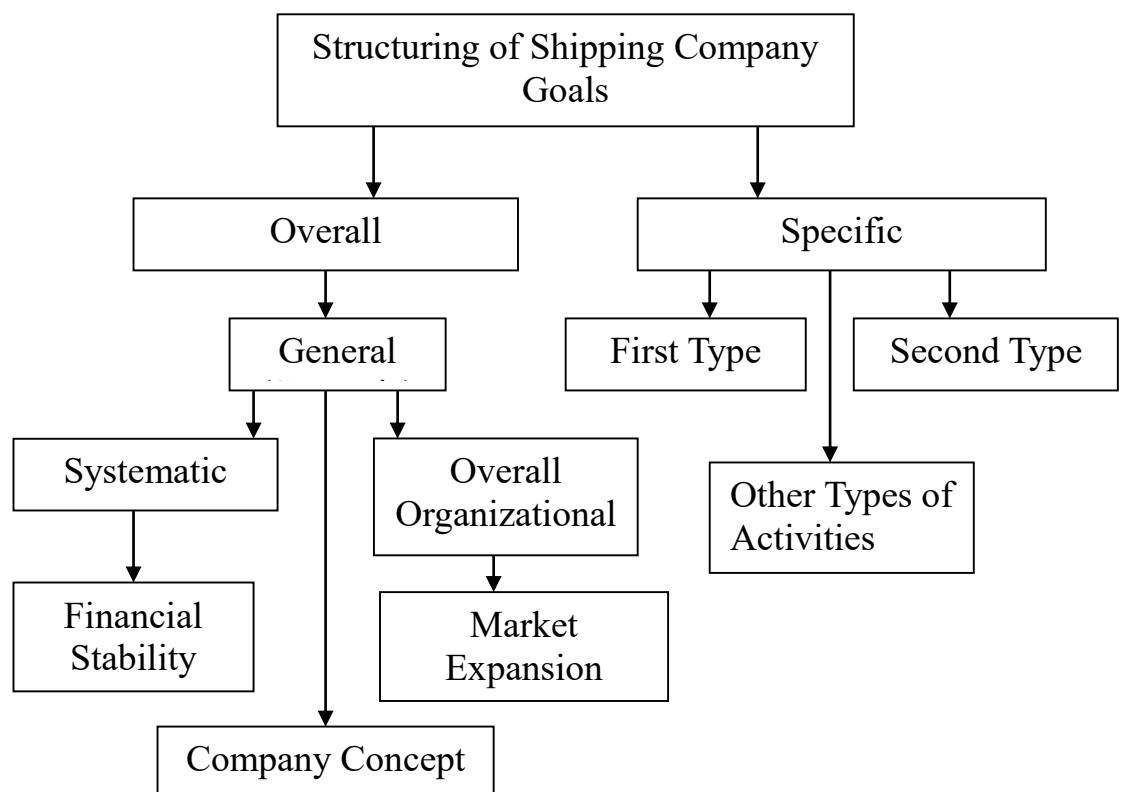


Figure 1.7. Identification of SC Development Goals Based on Positioning Conditions

Production divisions oversee the activities of their assigned groups of vessels and subsidiary companies. In large SC, specialized fleet groups are transformed into managerial subsidiaries.

Auxiliary (staff) services function as advisory bodies. They are responsible for coordination and control, planning, and providing recommendations to senior management. Auxiliary functions are grouped according to their nature into specific departments, such as planning, marketing, procurement, legal, and others.

In the organizational structure of modern SC, the main production units are represented by divisions, which consist of several departments. In large SC, divisions are further combined into specialized units (figure 1.8).

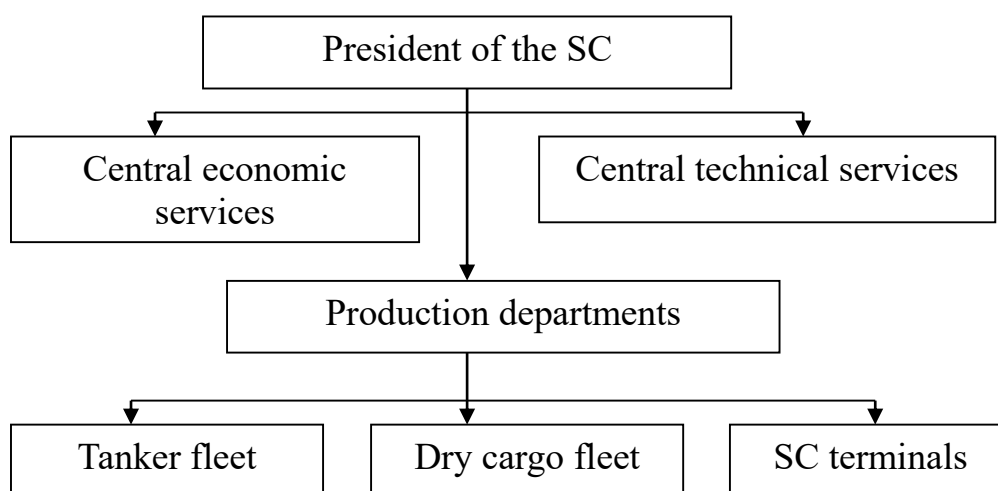


Figure 1.8. Organizational structure by product type

A weak point of a product-based structure is the difficulty in accounting for demand variations across different segments of the maritime trade market. To mitigate this issue, large shipping companies combine product-based and regional principles in their functional organization. Maritime ranges are designated with more efficient shipping methods.

Market-driven factors influencing the development of the maritime trade market include a system of measures aimed at maximizing fleet utilization efficiency throughout the key phases of the economic cycle. These measures encompass corporate interest protection, freight policy, forms of cooperation and division of market influence, fleet's technical and economic level, and innovation management.

The construction of an organizational structure based on the functional principle prioritizes specialization. Each division performs a specific function within the SC as a whole and reports directly to its management (figure 1.9).

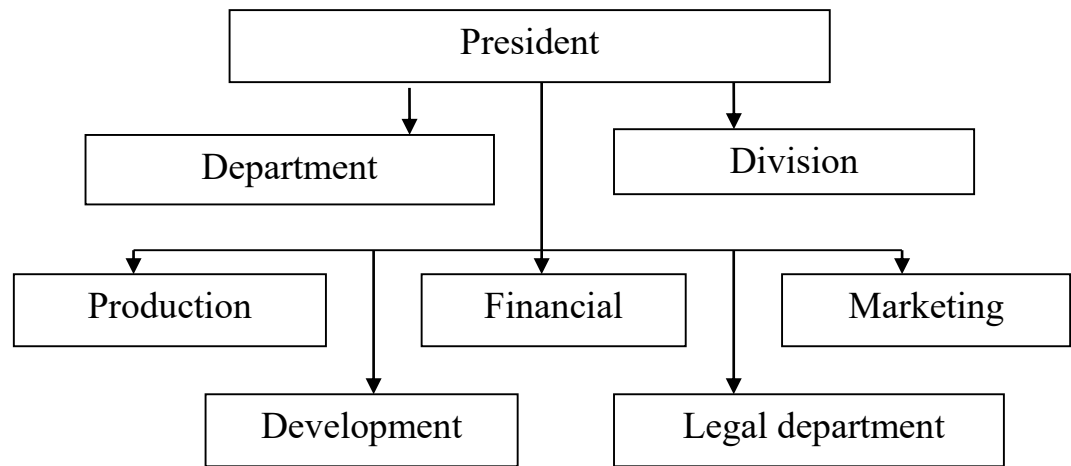


Figure 1.9. Organizational structure by production type

The functional organizational structure is used by narrowly specialized SC that serve a homogeneous segment of the maritime trade market. For diversified and geographically dispersed operators, the functional organizational structure creates several problems in coordinating the activities of functional divisions.

Sometimes, the construction of organizational structures is based on the market principle, which often aligns with the approach to regionalization. In their operations, SC distinguish between internal and external transportation. An organizational structure based on the principle of the transportation process technology is also used.

It is also necessary to consider the factor of modern piracy at sea, which is primarily driven by violence for profit. This, to some extent, if not destabilizing shipping, introduces an additional degree of risk to the lives of crew members and predetermines the emergence of excessive costs for shipowners.

The globalization of the maritime transportation industry increases the importance of administration by international maritime organizations in the system of maritime safety and fair relations between capital owners (shipowners) and seafarers. Among such regulators, the Fair Practice Committee (FPC) and the Shipping Section Committee (SSC) occupy a special place. The FPC includes representatives of seafarers and dockers worldwide. The main focus is on strengthening the IMO's policy against flag-of-convenience (FOC) ships that do not comply with minimum standards for the payment and working conditions of seafarers.

1.10. Tax Policy of Maritime Nations

In the standard economic policy of the state and the system of market relations, the principle of maximizing entrepreneurial results and the fair formation of the state budget is implemented. The latter is based on customs and tax policy. Elements of tax

policy that stimulate the development of the national merchant marine fleet include a series of special government decisions aimed at reducing costs and boosting investment activity in maritime transport enterprises. Taking into account that depreciation deductions significantly impact current expenses and the investment accumulation system, the principle of differentiation is applied based on the goals and objectives of maintaining the national flag fleet.

Among the strategies for taxation and regulatory measures aimed at developing the national flag fleet, the following stand out:

- Justification of a fair tax rate on the economic results of commercial entities;
- Tax crediting;
- Accelerated depreciation;
- Creation of a reserve fund;
- Implementation of the tax credit principle.

Accelerated depreciation involves writing off a larger portion of a vessel's cost in the initial years of its operation. This creates the opportunity to reduce the standard service life of the tonnage. To achieve this, a degressive or mixed method of calculating the vessel's book value is applied. In the degressive method, either a fixed increased depreciation rate is set. It is applied in the first year to the initial cost of the vessel and in subsequent years to its remaining book value (declining balance method). Alternatively, a decreasing rate is used, based on the vessel's initial cost.

The mixed method combines both linear and degressive depreciation approaches. Most maritime nations allow shipowning entities to freely choose their preferred method of capital depreciation.

Under the linear depreciation method, different standard service lives for tonnage are established depending on economic conditions:

- Ukraine – 17 years;
- USA – 8 years;
- Japan – 14 years;
- France – 8 years;
- Italy – 10 years.

Under the degressive depreciation method, rates vary from 13.79% in the USA to 31.25% in France. In the latter case, the chosen rate must not exceed the linear depreciation rate by more than 2.5 times.

In France, the accelerated depreciation principle under the mixed method allows for writing off 40% of a new vessel's cost in the first year. In Italy, up to 40% of a vessel's cost can be written off within the first three years, but no more than 15%

in any single year. This approach ensures resource accumulation for the next fleet renewal phase.

In Japan, for vessels with a capacity of at least 2,000 GRT, an additional 12% of the vessel's initial cost can be written off in the first financial year, beyond the standard depreciation rate. This contributes to the country's traditionally low-average-age merchant fleet.

In the USA, when calculating depreciation, in addition to the linear method, one can use the principle of double depreciation or the sum-of-the-years-digits method. In the latter, the depreciation rate is determined by the ratio of the number of years remaining until the expiration of the standard service life of the vessel to the sum of numbers from one to the value of the standard service life.

In addition to depreciation policy, other principles are used to stimulate the innovative development of national maritime transport.

Reserve Funds. In Japan, the USA, and France, shipowners establish dedicated reserve funds for fleet replenishment, maintenance, and modernization. In the USA, the capital construction fund program is regulated by the Merchant Marine Act. The primary goal of these reserve funds is to provide financial assistance to American shipowners by deferring tax payments. Shipowners can exempt their revenue from taxation if the proceeds are used for vessel acquisition. However, this benefit is subject to the condition that the funds must be used within the national shipbuilding industry, and the vessels must be registered under the national flag.

Tax crediting is available only to shipowners. A shipowner is allowed to deposit revenue from the operation of vessels registered under the American flag into a reserve fund, as well as income from investing those funds.

In France, tax-free reserves can be created to cover shipowners' expenses resulting from rising wages or the need for vessel modernization.

Italy follows the principle of allocating revenue from the sale of a vessel to a special fund for reinvestment in fleet renewal. This fund is not subject to tax regulation.

A significant challenge in merchant shipping is the risk of periods of unprofitable operations. To address this, the legislation of several maritime nations includes special support mechanisms for the fleet during such times. In the USA, Japan, and Italy, shipping companies are allowed to carry forward or carry back losses to other fiscal years. This flexibility in capital accumulation helps stabilize shipowners' financial positions.

Additionally, the maritime transport sector benefits from various tax incentives to create additional financial opportunities for development. These include exemptions from value-added tax (Italy and France), as well as exemptions from customs duties on materials intended for shipbuilding. All these measures enhance the competitiveness of

the national fleet and contribute to improving the security of foreign trade transportation.

1.11. Specifics of the development of maritime transport

The maritime transport, despite its main peculiarities, is an integral part of the country's transport industry. It develops in accordance with the main principles of transport process formation. However, it is important to consider the key limitations of maritime transport capacity.

The growth rates of maritime freight transport depend on the nature of the use of sea routes, the role of foreign trade links and investment opportunities for financing development. In addition, the rates of development of maritime transport in relation to other components of the production infrastructure are influenced by the advantages of maritime transport. The economic advantages of maritime transport are fully realized when it comes to transport over long distances.

Except for canals, sea routes do not normally require capital investment. An important advantage is that maritime communications are not limited by the immutability of the geographical location of the routes. Therefore, unlike other modes of transport, there is no problem of minimizing transport distances. The cost-effectiveness of maritime transport is determined by the horizontal and linear nature of the transport routes. This results in minimal energy consumption for cargo transport.

The main disadvantage of maritime transport is the need for costly port infrastructure and the long duration of vessel handling in ports, as well as the vulnerability to hydrometeorological and climatic factors affecting the operation of the fleet and ports. Serving only the peripheral regions with maritime transport requires the development of a special system for coordinating mixed services.

Maritime transport occupies a special place in the transport system because it is the main mode of transport for the country's foreign economic relations. Maritime transport accounts for about half of foreign trade shipments and 80% of foreign trade cargo turnover. It plays a crucial role in the economic cooperation of the country's foreign economic residents with most countries around the world.

The growth of global production and international division of labor are the main factors determining the significance, development, and placement of global shipping. The activities of maritime transport enterprises are closely linked to the international economic, political, and military situation.

In the final years of the Soviet Union, maritime transport with a deadweight of 22 million tons provided annual foreign currency revenue of 3.4 billion USD. This

means that one ton of deadweight generates an income of 159 USD for the owner over the course of the year.

Sea transport is the cheapest mode of transport. Furthermore, vessels have a high carrying capacity. The size of sea routes does not typically constrain the cargo capacity of ships, except in certain ports and approach channels.

Due to these factors, the cost of maritime transport is 40–44% lower than rail transport and 35–37% lower than river transport. The average speed of a freight train in Ukraine is 300–350 km per day, while maritime transport exceeds 400 km.

With a normal participation of a country in the world division of labour, there is an increase in foreign trade in the world as a whole and between individual countries. Therefore, the increase in the carrying capacity of the fleet should correspond to the volume of foreign trade turnover. In this case, the fleet can develop faster in relation to the national needs of foreign trade flows, which ensures participation in the export of transport services.

Chartering foreign tonnage is still an option, even if there is sufficient domestic tonnage. However, the cost of using foreign tonnage must be covered by the income from FFC traffic. Generally, the national fleet should play a dominant role in transporting cargoes under conditions where carriage by its own vessels is specified.

The average range of maritime cargo transport is determined by the location of the main foreign trade partners. As a matter of fact, the share of foreign trade cargoes carried by sea is determined by the cost of delivery and the complexity of development of various transport subsystems.

At the same time, there is no direct proportionality between the growth rates of production and the volume of goods transported (Figure 1.10). Generally, production growth rates are higher than transport growth rates.

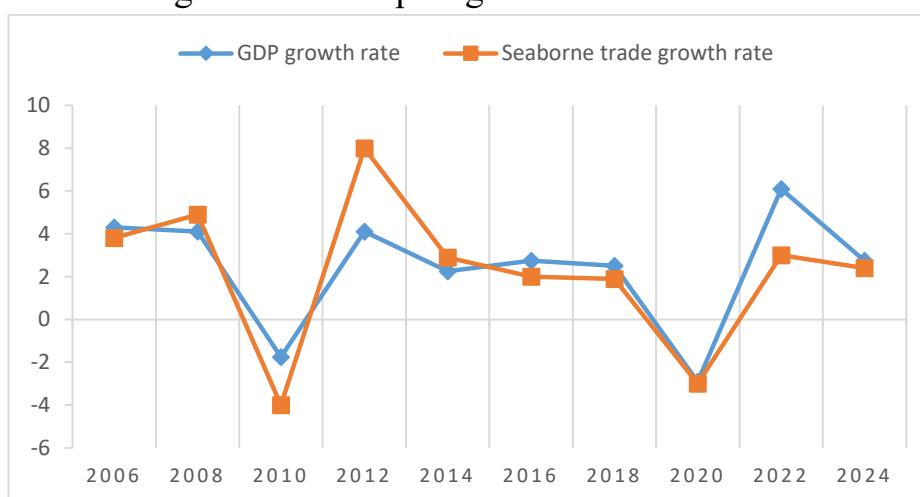


Figure 1.10. Peculiarities of the dynamics of interrelated indicators of world economic developmentSource: UNCTAD calculations

International maritime trade and world gross domestic product evolve in tandem but at a diverging pace. In 2022, maritime trade volumes grew by 2.9 per cent, and GDP output grew by 6 per cent.

Such a difference in rates can be explained by several objective factors, the most important of which is the improvement in the level of development of individual regions and the increase in the transportability of products. Developed countries are improving the efficiency of their fuel balance. The extraction of mineral and construction materials close to construction sites is developing.

The growth of the food base in industrial centres influences the reduction in the relative need for merchant fleet development. During a significant part of its life cycle, a maritime transport company operates in a challenging freight market. To stay afloat, it must offer transport services using new carrying capacity at the lowest average cost, aligned with freight or tariff rates that balance deadweight and cargo flow capacity.

A maritime nation should rely on its own merchant fleet to ensure foreign trade independence and enhance the foreign exchange efficiency of export. A well-developed maritime nation should implement an active maritime policy. Its key aspects include:

- broad participation of the national fleet in all forms of transport support for the national economy and the export of transport services.
- full satisfaction of the transport needs of national producers and transit services.
- expanding the share of the merchant fleet in international transport.
- providing support to socio-economic partners who lack the carrying capacity of national flag vessels to ensure enough cargo traffic.

The necessary carrying capacity of the merchant fleet guarantees the security of state and commercial interests of entering the world economic relations.

Control questions

1. Justification of the place of merchant shipping in the structure of the maritime economic complex of the Ukraine.
2. The main aspects of the state policy on maritime transport.
3. The set of conditions for sustainable development of merchant shipping.
4. Peculiarities of demand formation in the maritime transport market.
5. Dynamics of equilibrium in the maritime trade market.
6. Principles of supply formation in the system of the maritime industry.
7. Objectives of development of merchant shipping.
8. Economic nature of shipping companies.
9. The dynamics of the objectives of maintaining carrying capacity.
10. Principles of registration of ships under the flag of the State.
11. Customs regulation of merchant shipping.
12. Criteria for the selection of ships according to the conditions of the market segment of maritime trade.
13. The system of indicators for assessing the efficiency of the transport fleet.
14. The structure of works (services) of the main divisions of the maritime transport industry.
15. The main characteristics of the state of the maritime trade market.
16. Fleet utilization norms.
17. International regulation of merchant shipping.
18. Principles of SC organisational structures.
19. Features of the modern period of development of merchant shipping.
20. Principles of the active policy of the shipping industry to stimulate the development of the merchant fleet

Chapter 2

TECHNICAL AND TECHNOLOGICAL CHARACTERISTICS OF SHIPPING COMPANIES' FLEETS

2.1. Linear Characteristics of Vessels

The current state of the global maritime trade market is significantly influenced by the development trends of the merchant fleets operated by the world's leading shipping companies. Historically, the policies of industrially developed nations have played a crucial role in driving innovation in commercial shipping. Fluctuations in the freight market impact the economic performance of shipping companies and the current account balance of a country. Consequently, studying the development trends of the merchant fleet and analyzing the main characteristics of transport vessels is essential.

Among the various indicators characterizing the state of a shipping company, specific indicators hold particular importance. These indicators reflect distinct features and aspects of the utilization of transport assets and resources. They are categorized into subgroups, including:

1. Resource availability
2. Technical condition
3. Qualitative characteristics and renewal level
4. Reliability
5. Utilization by parameters

When developing a system for monitoring the condition of a shipping company and evaluating its operational performance, it is crucial to ensure the optimal selection of indicators. Redundant and contradictory indicators should be avoided. Instead, the selected indicators should accurately reflect the maturity of the assessment and planning system, taking into account industry-specific characteristics and adhering to the balanced scorecard principle. Standard linear vessel characteristics are fundamental for analyzing the state and managing the development of the merchant fleet.

Standard Linear Vessel Characteristics:

1. Maximum vessel length
2. Vessel length between perpendiculars (measured along the waterline)
3. Maximum vessel width
4. Maximum vessel height (from the keel to the topmost point of the masthead – the truck)

5. Freeboard height
6. Vessel side height (between the keel and the upper deck)
7. Vessel draft (the distance between the keel and the waterline at the summer load line)

Variations in these characteristics directly influence the dynamics and structure of operating costs for shipping companies and play a key role in determining freight rates.

The reliability and safety requirements of the merchant fleet necessitate specific structural features and optimized utilization of material resources. The specific metal consumption required for constructing a given vessel type is calculated using the following formula:

$$m_{us} = \frac{M}{T_e k_{wp} D_w} \quad 2.1$$

where:

M – weight of the metal structures for the given vessel type

T_e – operational period duration based on reliability factors

k – coefficient reflecting the efficiency of utilizing the base material set in shipbuilding

D_w – deadweight of the calculated vessel type

The development of the global merchant fleet is closely linked to the international division of labor, globalization trends, and the uneven economic development of different regions. Several key factors drive the evolving needs of the maritime transport industry, including:

1. Global population growth
2. Advances in science and technology
3. The necessity of extracting and transporting resources from hard-to-reach locations

As a result, merchant vessels exhibit a broad range of size classifications to accommodate the diverse demands of the industry.

The established system of linear vessel characteristics provides the foundational principles for vessel classification and grouping based on deadweight. Additionally, the chief officer oversees cargo loading and unloading operations by monitoring the vessel's draft.

2.2 Weight Characteristics of a Vessel

The defining and evaluative indicators must be closely linked to the goal of high productivity and the objectives of ensuring operational reliability and intensifying functional activities based on the criteria of commercial efficiency and synergy. Under any conditions of commercial navigation, the parameters of the production potential of a shipping company depend on the following vessel characteristics:

1. Displacement of the vessel at full load

$$D_W = D_k + D_m + D_{ec} + D_z + D_{cl} \rightarrow \text{const} \quad 2.2$$

where:

D_k – mass of the equipped hull

D_m – mass of the SEI and auxiliary power plant;

D_{ec} – weight of the crew;

D_z – the amount of necessary supplies for the vessel's voyage;

D_{cl} – net cargo capacity.

2. Lightweight of the vessel

$$D_0 = D_k + D_m + D_{ec} \rightarrow \text{const} \quad 2.3$$

3. Gross cargo capacity of the vessel – deadweight

$$D_B = D_z + D_{cl} \rightarrow \text{const} \quad 2.4$$

$$D_B = D_w - D_0 \quad 2.5$$

4. Net cargo capacity of the vessel

$$D_{cl} = D_B - D_z \rightarrow \text{variable} \quad 2.6$$

The amount of supplies necessary for a vessel's voyage is determined considering conditions and limitations:

$$D_Z = D_{xz} + D_{ctz} \quad 2.7$$

where:

D_{xz} – required amount of resource supplies ensuring the normal operation of

the vessel in motion;

D_{ctz} – standard vessel requirement for material reserves during the port stay.

$$D_{xz} = \sum g_{xi} t_x \kappa_s \quad 2.8$$

g_{xi} – daily standard consumption of fuel, water, provisions, and other resources (t/day);

t_x – vessel travel time per voyage;

κ_s – reserve accounting for the need for storm reserves. Its value depends on the season and navigation range, ranging from 1.05 to 1.3.

$$D_{ctz} = \sum g_{ctz} t_{ct} \quad 2.9$$

The complex set of reasons for forming these parameters is driven by significant changes in the freight market. These include principles of competitive positioning, the regulatory framework of international maritime organizations, and the development of innovative technologies.

The continuous growth in the average cargo capacity of vessels in the global fleet and the change in this indicator's ratio across specialized vessel groups influence the state of the global maritime trade market.

When assessing the utilization of the fleet's economic potential, the issue of accounting for the impact of various factors on the dynamics of final results becomes paramount. The complexity of evaluating development strategies based on fleet efficiency levels is due to the multidirectional changes in indicators reflecting resource productivity. It is essential to monitor changes in results and costs under the influence of the fleet's size characteristics.

The relative efficiency of large-tonnage vessels is determined by lower average resource costs required to ensure the transportation process. These vessels have lower capital intensity per unit of cargo capacity, lower labor costs per unit of transport capacity, and lower energy consumption in motion. However, using large-tonnage vessels requires concentrated cargo flows and significant investments in access channels and ensuring appropriate port water depths. This, in turn, is constrained by the need for substantial investment volumes.

2.3. Volumetric Characteristics of Merchant Fleet Vessels

Sectoral and entrepreneurial objectives determine the tasks for stimulating the performance of a shipping company under conditions of full utilization of its

production potential. Achieving optimal entrepreneurial results forms the basis for establishing a system of criteria and indicators for evaluating the condition of a shipping company. Therefore, the following characteristics are distinguished:

1. Vessel Cargo Capacity - $W \text{ m}^3$.

This is the total volume of all cargo spaces.

They are distinguished as:

hold cargo capacity - W_k ;

bulk cargo capacity - W_n .

2. Specific Cargo Capacity of the Vessel

$$\omega = \frac{W}{D_{cl}}, m^3/T \quad 2.10$$

The specific loading volume of 1 ton of cargo in the hold is $U \text{ m}^3/\text{t}$.

For heavy cargoes, if $\omega \geq U$, the amount of cargo that the vessel can accommodate equals its carrying capacity $Q = D_{cl}$.

If, $U \geq \omega$, then the amount of cargo that the vessel can carry is $Q = W/U$.

3. Net Register Tonnage (NRT) - measured in register tons, this is the computed volume of the vessel's spaces used for the carriage of cargo and passengers - that is, the commercially exploitable volume of the vessel.

4. Gross Register Tonnage (GRT) - this is the gross register capacity of the vessel below the main deck and superstructure, excluding auxiliary spaces as specified by the vessel measurement rules.

It is necessary to take into account the influence of the fleet's volumetric characteristics on the transit time of cargo along the route. One factor that slows the formation and realization of the vessels' volumetric parameters is the lag in the development of certain maritime ports.

Among the factors stimulating the growth of volumetric characteristics, especially in the container fleet, are the dynamics of cargo flows and the requirements for achieving economies of scale. The latter has become a priority in optimizing the economic performance of the transportation process.

Despite restrictions due to channel passage conditions and the depths of most commercial ports, a segment of large-tonnage vessels has emerged, ensuring efficient handling of cargo flows and the generation of commercial results for the enterprise. The average carrying capacity of the main groups of the merchant fleet is gradually increasing.

In the State Register of Ukraine, 1325 vessels were registered under the national flag in 2014.

Unfortunately, there is no accurate data on the number of vessels under the Ukrainian flag for 2025 in available sources. However, it is known that as of January 1, 2021, the deadweight of the fleet registered under the Ukrainian flag decreased almost 16-fold compared to 1993 and amounted to 391 thousand tons, which represents 0.02% of the world's merchant fleet.

In August 2021, the Ministry of Infrastructure of Ukraine reported that 1404 vessels were under Ukraine's supervision, of which 1365 were registered under the Ukrainian flag.

Given its size relative to the country's foreign trade volumes and its characteristics, this fleet cannot provide employment for all seafarers. Most of the vessels are small and are unable to participate in cargo transportation on the main shipping routes.

2.4. Speed Characteristics of a Vessel

Fleet management and the implementation of its functional and qualitative parameters can be achieved through a scientifically grounded selection of cargo delivery speed. The choice of speed significantly influences both costs and the production-economic results of the shipping company (SC). The product of maritime transport is a special form of commodity that is created and realized in two categories—time and space. Therefore, considering market laws, the efficiency of the main directions of fleet development should be based on optimizing cost indicators. These depend both on external operating conditions and the justification of speed characteristics.

There are three types of transport vessel speeds:

1. Trial Speed – V_{sd}

This is the maximum speed achieved under a forced operating mode of the ship's main engine (SME). It is measured over a measured mile under specific hydro-meteorological conditions. In modern vessel specifications, it is referred to as the recorded speed.

2. Technical Speed – V_t

This is the design (passport) speed that a vessel can maintain over an extended period. It is confirmed or adjusted during re-inspection of the SME's technical condition. The selection of operational speed is based on optimizing the ratio between the growth rate of foreign exchange earnings and the growth rate of total costs.

Technical speed is further divided into speed when loaded and speed in ballast conditions.

3. Operational Speed

This reflects real maritime navigation conditions on the vessel's working route.

$$V_E = L/t_v \quad 2.11$$

where:

L – distance traveled by the vessel during a voyage;

t_v – voyage time.

Operational speed depends on the technical speed and the conditions in which it is realized (ocean currents, wind characteristics, shallow waters, and other route-specific features).

When selecting vessels based on speed for operational activities in the maritime trade market, it is essential to consider the pattern that revenue per ton-day increases with speed, whereas the foreign exchange efficiency indicator decreases.

The rising cost of acquiring marine fuel, on the one hand, leads to an increase in cargo transportation costs, and on the other, affects the structure of the fleet by tonnage groups. The transportation of high-value cargo in containers necessitates high speeds and significant energy expenditures for container ships.

The Francisco passenger ferry, built at the Australian shipyard Incat for the South American Buenos Aires – Montevideo route, has a capacity of 1000 passengers and 150 vehicles and operates at an operational speed of 50 knots at full power. The shipyard describes this vessel type as a Wave Piercing Catamaran, meaning "wave-piercing." It is one of the fastest modern commercial vessels—specifically a ferry.

Duke University in North Carolina has proposed a material that can radically reduce water resistance during a vessel's movement. As a result, fuel consumption per unit of distance traveled decreases while maintaining or even increasing vessel speed. The project is based on the principle that water surrounding the ship moves along with it. Friction occurs between different water layers rather than between the hull and the water. This effect is achieved using a special porous coating on the ship's hull.

2.5. Forms and Efficiency of Specialization in Maritime Vessels

The production-economic goals and conditions for the development of any commercial subsystems are traditionally implemented based on specialization and concentration. The specialization of the merchant fleet represents forms of vessel adaptation to specific permanent conditions for performing the transportation process.

In the maritime trade market system, three main areas of specialization for transport vessels are distinguished:

1. By navigation regions,
2. By type of transported cargo,
3. By transportation method (technology).

The specialization of maritime transport vessels enables faster cargo delivery, increased efficiency in the use of economic resources, reduced docking time for cargo operations, enhanced competitiveness of shipping companies, and optimized transportation costs.

Specialization is closely linked to fleet standardization, which involves the construction and commissioning of a series of identical vessels. This significantly reduces the cost of building a series of identical vessels compared to the cost of an equivalent volume of tonnage consisting of diverse vessel types. Standardization is the foundation for improving the technology of handling and servicing ships, thereby increasing the efficiency of the merchant fleet.

Fleet specialization has broad implications. Initially, universal fleets gave way to bulk carriers and container ships, which significantly increased tonnage productivity. Most of the bulk cargo is transported on single-deck, specially designed ships—bulk carriers—with a carrying capacity of over 6,000 tons.

Specialized vessels account for more than 60% of the world's shipping tonnage. Since 1975, the construction of classical universal vessels has virtually ceased. However, given the batch nature of certain types of cargo across different navigation regions, the strategy of developing and utilizing a combined fleet adapted for transporting diverse cargoes has gained traction. Thus, the principle of specialization is acquiring new implementation forms.

Dry cargo ships are adapted for transporting large cargo units with nearly full deck exposure and powerful loading equipment.

In 1966, the dry cargo ship "Fairland" became the first in the world to deliver 300 large containers to Bremen instead of a large number of small, diverse containers. These containers were processed 20 times faster than with traditional methods, saving the shipping company 250,000 marks. This gave rise to specialization based on container ships, designed to transport cargo in large-tonnage containers with a gross capacity of 20 to 40 tons. The transport performance unit for this group of vessels became TEU (Twenty-foot Equivalent Unit).

Over the past 25 years, the main reserve for improving delivery efficiency and reducing overall transport costs for general cargo has been the development of container transport. The domestic fleet began replenishing with container ships in 1972 and roll-on/roll-off ships in 1974.

A container ship with a capacity of 1,800–2,000 twenty-foot containers and a deadweight of 35,000 tons at a cruising speed of 16 knots replaces ten conventional dry cargo liners.

The net foreign currency revenue of container ships is 6–10 times higher than the average for dry cargo fleet operations per tonnage-day of exploitation. Experience shows that container manufacturing costs are recouped within the first two to three years of operation.

A 20-foot container initially cost around \$3,000, the same as 1,000 pallets, each holding 1 ton of cargo. In a year, 1,000 pallets can transport as much cargo as nine containers. However, there is a sharp difference in cargo preservation and packaging costs.

Packaging based on large cargo units reduces damage and theft losses by 40%. Cargo handling time and labour intensity decrease by a factor of 3–5.

Thanks to scientific and technological progress, the transport fleet has seen a leap in TEU vessel growth. Classical dry cargo vessels have been replaced by specialized and combined high-performance ships.

For many traditional types of equipment, including the maritime fleet, a diminishing return curve is characteristic due to the achievement of the primary advantages of classical designs. This is a specific manifestation of the law of diminishing marginal returns on economic potential.

Thus, Edison noted in his diary: "One must never forget the economic aspect of the issue even for a minute." The development of new models of metal-cutting machines now requires payback periods 5–8 times longer than during the pre-war period. Despite a 7–10% increase in productivity, the cost of this equipment has risen by 1.5 times.

The cost per ton-mile on hovercraft is about 25 cents, on bulk carriers 0.1 cents, and on universal vessels 3–5 cents (for short-haul transport).

The high level of scientific and technological progress in the dry cargo fleet is driven by the high value of general cargo. Their total value is 3–4 times higher than that of liquid and bulk cargo. The average cost per ton of liquid cargo is \$875, bulk cargo \$279, and general cargo \$2526.

For coastal shipping, an economical fleet has not been developed. Consequently, given the current orientation of seaports toward foreign trade cargo flows, coastal transport costs are higher than rail transport and several times higher than international maritime transport. This is due to high initial and final operation costs (43% of expenses). However, in Western Europe, the strategy of shifting part of land-based cargo flows to short-sea shipping systems is preferred, based on specialization and cargo flow concentration.

In any case, the primary path for maritime transport development lies in prioritizing innovative technologies. For example, comprehensive containerization of cargo delivery allows for the release of 1,500–2,000 workers per million tons of cargo, cost savings of up to \$8 million, a 50–70% increase in ship cargo capacity, and a fivefold increase in berth throughput capacity.

One of the key developments in transport technology systems (TTS) based on large cargo units with strong, stable cargo flows is the creation of lighter and barge carrier systems. For example, delivering cargo from the Czech Republic to Bombay via the Danube-sea lighter carrier system took 15 days, compared to 50 days using traditional shipping methods, excluding port downtime. From Galati, it took 11 days instead of 30, and from Csepel 14 days instead of 40.

Economic calculations confirm that for long distances (over 3,700 km), it is more cost-effective to transport gas in liquefied form by sea in tankers rather than through pipelines.

However, a high-performance fleet requires an advanced level of management for its operation.

2.6. Types of maritime transport vessels and their technical performance

The structural features of transport fleet vessels are determined by the characteristics of technological processes and must meet the requirements of cargo flows.

The merchant fleet is traditionally characterized by two main groups of indicators: the number of vessels in operational condition and their tonnage, which is determined either by cargo capacity or deadweight. Statistics on the number of vessels vary significantly depending on the approach to the form of accounting for the minimum unit of cargo capacity. According to the Code of Merchant Shipping, the main groups of the transport fleet are:

1. Merchant vessels intended for the transportation of cargo, passengers, mail, and the results of fishing activities.
2. Vessels performing special work and services. These include sanitary, security, fire-fighting, rescue, and quarantine vessels.
3. Research vessels and vessels for cultural purposes.
4. Sports vessels.
5. Special-purpose vessels (offshore resource extraction platforms, dynamic positioning vessels).

Several characteristics of the classification of merchant vessels are distinguished:

1. By specialization and purpose:

- a) Dry cargo ships – for general cargo, bulk cargo, and loose cargo. The group of bulk cargo includes minerals, and loose cargo consists of plant-based products.
- b) Tanker vessels – for oil, petroleum products, wine, vegetable oils.
- c) Passenger vessels – if the vessel has more than 12 passenger seats.
- d) Technical vessels – ships engaged in hydraulic engineering works.
- e) Tugs and pushboats.
- f) Service auxiliary vessels – pilot boats, dispatch boats, etc.
- g) Offshore technology vessels.

Some of these ship groups are further subdivided by internal specialization into the following subgroups:

- Universal vessels
- Multipurpose vessels
- Specialized vessels

2. By ownership.

3. By area of operation:

- Unlimited (ocean) navigation.
- Restricted area navigation.
- Mixed navigation (river-sea).
- Local or coastal navigation.

4. By loading-unloading method:

- Horizontal method – ro-ro (roll-on/roll-off).
- Vertical method – lo-lo (lift-on/lift-off).
- Combined loading method.
- Pipeline method.

5. By type of ship's power plant (СЭУ):

- Steamships.
- Motor ships.
- Turbines ships (gas and steam turbine ships).
- Diesel-electric ships.
- Nuclear-powered ships.

6. By location of engine-room and boiler room:

- Midships.
- Shifted aft.
- Aft.

7. A widespread classification of ships is also based on technical-limiting characteristics:

- By construction material.

- By number of decks.
- By height of freeboard, etc.

Data about individual elements of the ship are called its technical-operational characteristics.

All technical-operational characteristics of vessels are divided into five groups:

1. Linear characteristics.
2. Weight characteristics.
3. Volume characteristics.
4. Speed characteristics.
5. Adaptability of vessels to cargo operations.

It should be noted that the optimization of certain economic tasks for fleet development and utilization may be based on local criteria. These should reflect the practical value of business decisions concerning the optimization of the fleet's carrying capacity potential. The optimization criterion for operational results or the development of maritime transport sectors may differ from the economic efficiency criterion due to the scarcity of certain resources.

The objectivity of rational resource use and optimization of production costs dictates the necessity of using efficiency criteria aimed at satisfying normalized needs, which are determined by the condition of the goods and freight markets. The development of maritime transport subsystems was regulated during the active phase of the business cycle. Management processes are distinguished according to the global efficiency criterion and the capital investment efficiency criterion.

By the time of a recession, there is a decrease in the economic efficiency of the transport fleet. The cost of cargo transportation by sea gradually increases under the influence of many external factors.

The level of application of advanced technologies can be more accurately assessed by the ratio of income generated by progressive transport vehicles to the total income from operator activity in the transport services market. Additionally, the nature of changes in resource intensity for performing main transport operations should be taken into account.

In an open competition system in the global maritime industry, the effective position of the shipowner, all other things being equal, depends on the advantages of the merchant fleet vessels and the sophistication of the decision-making and management system. In merchant shipping, the principle is real – every new vessel must meet the highest standards of transportation quality and safety. This approach is embedded in the conditions for the development of the maritime trade market and achieving operational stability. Special attention is given to the regulatory approaches

of international maritime organizations that introduce stricter safety standards and crew working and rest conditions aboard ships.

Based on these principles, statistics on the age characteristics of the merchant fleet are kept (Table 2.1).

Table 2.1. Peculiarities of the age characteristics of the main types of vessels

Age	0-	5-	10-	15-	20
Type of Vessel	4 years	9 years	14 years	19 years	and more years
Bulk Carriers (number)	25,1	14,6	13,2	11,6	35,5
Deadweight	32,0	17,4	14,0	13,1	23,5
Average ship size (dwt)	75607	70918	63151	67114	39294
Container Ships, number of vessels	28,2	24,4	19,7	14,8	12,9
Deadweight	35,5	28,8	17,2	10,4	7,9
Average dwt	47513	44240	32741	25509	23117
General Cargo Vessels	10,4	9,0	8,4	11,0	61,1
Deadweight	18,9	11,4	12,8	9,8	47,8
Average deadweight, tons	9221	6399	7601	4453	3953
Oil Tankers	25,1	18,5	10,1	11,7	34,6
Deadweight	33,6	29,2	16,4	11,6	9,1
Average dwt	57414	64739	69451	42595	11322
Other Types	10,0	9,4	9,2	8,4	63,1
Deadweight	29,0	15,5	10,7	9,1	35,7
Average dwt, tons	4891	2769	1957	1633	979

Economically justified fleet expansion for a shipping company, including vessel sizes and specialized modifications, allows for managing the utilization of vessel capacity and the quality of the transportation process. The expansion of the national

flag fleet's range should be coupled with the acquisition of vessels that provide competitive advantages in the chosen segment of the maritime trade market.

A key factor is accelerating the adoption of new vessels that meet the criteria for commercial efficiency while considering conventional restrictions and maritime safety standards.

However, this process is capital-intensive, as the transition to the Global Maritime Distress and Safety System (GMDSS) to ensure maritime safety required an additional investment of \$70,000 per vessel.

The vessels are equipped with powerful communication systems. The primary system is the AIS (Automatic Identification System), which provides information about approaching vessels, how to maneuver around them, at what distance, and in what time frame. The vessel also has a satellite communication system. All of these contribute to the safety of navigation.

The crisis state of Ukraine's maritime transport complex is evidenced by the high share of foreign tonnage in the cargo turnover of seaports. In the pre-war years, the foreign cargo fleet carried 97% of export and 98% of transit cargo. Even in the ferry cargo segment, the share of domestic tonnage is only 10%.

When analyzing the factors and their influence on the design parameters for the development of maritime transport industry facilities, it is necessary to consider the structural shifts in the macroeconomy. The impact of these shifts, in the context of persistently low GDP growth, determines not only the average level and growth of economic productivity but also the nature of their influence on the dynamics of cargo flows.

Control Questions

1. What are the factors that determine the technical characteristics of the fleet of shipping companies?
2. What do the linear characteristics of a shipping company's fleet reflect?
3. What do the primary weight characteristics of vessels include?
4. What are the specific features of using the volume characteristics of vessels?
5. What is the essence and direction of fleet specialization in a shipping company?
6. What is the role of containerization in commercial shipping?
7. What are the limits of implementing the specialization strategy in commercial shipping?
8. What are the main forms and directions of implementing the economies of scale strategy in commercial shipping?

Chapter 3.

TECHNICAL AND ECONOMIC CHARACTERISTICS OF THE MERCHANT FLEET

3.1. General Characteristics of the Production Process in Maritime Transport

The management of the operational activities of the fleet and the development of shipping companies constitute a specific form of industrial relations and strategic initiatives aimed at achieving optimal operational efficiency and economic performance. The complexity of this process necessitates a precise reflection of the specific nature of the production activities within the management framework, as well as a high level of expertise among personnel responsible for overseeing transportation operations and fleet development. These professionals must possess comprehensive knowledge of information flows that provide insights into both the external operational environment of the fleet and the internal indicators reflecting the company's performance and sustainability.

The management mechanism in commercial shipping utilizes indicators that reflect the intensification of the formation of production and economic results and the optimization of resource involvement in the economic process based on incentives. Incentives in commercial shipping are differentiated according to objectives, in accordance with which tasks and the organizational structure of the company are formed at each level of transportation process management.

Production activities in maritime transport take the form of the transportation process as a set of actions aimed at utilizing the potential of interconnected fixed and current production assets, as well as labor. The result of such interaction is a change in the spatial state of the transportation object. Moreover, the most important characteristic of the process of cargo and passenger movement is the delivery time.

Each type of specialized technical equipment in maritime transport, when implementing the transportation process, is distinguished by a certain specificity of transportation technological processes.

A technological process is defined as a part of the transportation process, the content of which consists of a set of actions related to changing one of the states of transportation objects (loading – transition – unloading – technical operations). The optimal functioning of the potential of shipping companies is characterized by the organic consideration of the overall systemic interests and objectives of the enterprise.

In the management system of positioning interests in the maritime transportation market, the leading link is the interests of cargo owners.

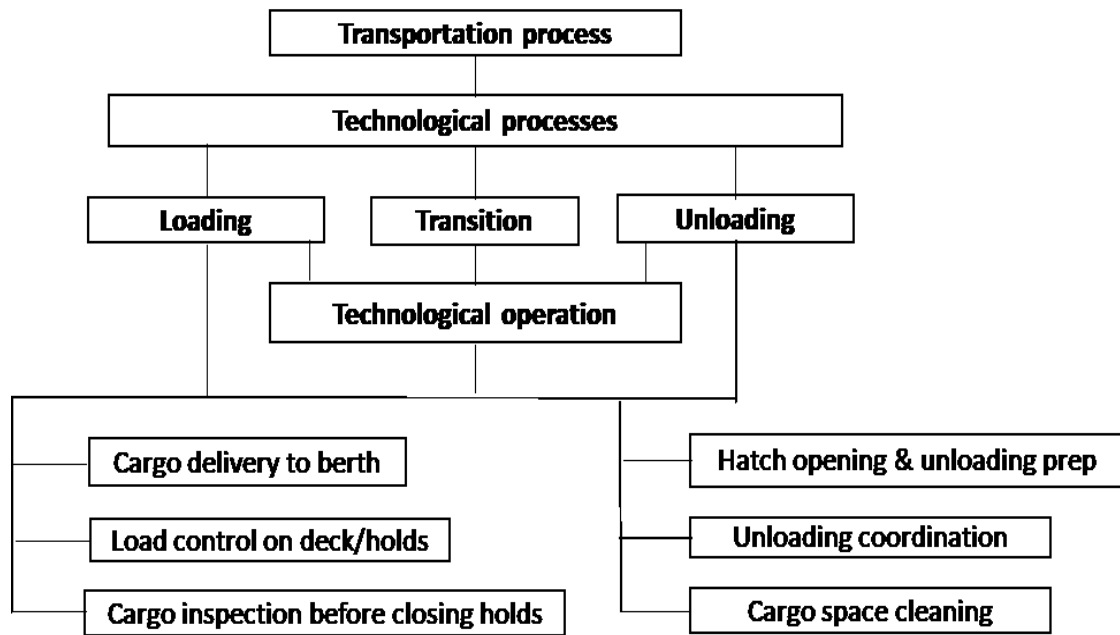


Figure 3.1. Structure of the technological process of maritime cargo delivery

A **technological operation** is defined as a part of the technological process that covers specific aspects of vessel utilization for cargo delivery.

All technological processes and operations are classified based on key criteria, the consideration of which ensures effective management and cost-efficiency in the functional activities of a shipping company:

1. By the nature of the cargo delivery process formation:

Navigation and maneuvering operations

Stationary operations (primary and auxiliary)

2. By significance in influencing final results:

Primary – pure sailing time, time under cargo operations

Auxiliary – maneuvering, bunkering, documentation processing, etc.

3. By location of execution:

– In transit

– In ports

The product of maritime transport is the completed movement of cargo masses and passengers. It is formed in the process of the vessel's functional activity. The basis of such activity organization is the voyage. Thus, the main production process of a maritime transport vessel is the voyage.

A voyage of a transport vessel is a completed technological cycle of cargo or passenger movement between designated ports of departure and destination.

The voyage of a transport vessel consists of sequentially or parallelly performed operations, which, by their nature, are divided into two types – navigational and stationary. The operational activity of a vessel represents an object of organization, standardization, planning, and analysis.

The main characteristics of a voyage are:

- Duration in time
- Start
- End

Moreover, depending on their impact on the transport and economic parameters of the shipowner, it is important to distinguish between:

- Main operations – cargo loading, vessel transition with cargo, cargo unloading.
- Auxiliary operations – these are not directly related to the main operations and may not take place in every voyage.

The nature and scope of auxiliary operations depend on the purpose and specialization of the vessel, the type of cargo transported, and the characteristics of the port.

Common auxiliary operations for transport vessels include:

- Maneuvers in ports – mooring, re-mooring, unmooring.
- Shifting from berth to berth.
- Passing through canals and narrow waterways.
- Cleaning of cargo compartments.
- Installation of shiftings – additional longitudinal and transverse bulkheads in the cargo holds of vessels.
- Inspection of holds by commissions.
- Opening and closing of holds.
- Arrival and departure formalities (border control, customs, and other formalities).
- Processing of cargo documents.
- Fumigation, degassing, deratization, and other similar operations.
- Elimination of the vessel's magnetic compass deviation.

The execution of these auxiliary operations is regulated by relevant normative documents.

Thus, the voyage duration is calculated considering the standardization of all main operations.

$$t_v = t_s + t_b \quad 3.1$$

The **voyage sailing time** depends on the general characteristics of the navigation area and the implementation of the vessel's technical speed.

$$t_s = \frac{L - L_k}{V_T} + \frac{L_K}{V_K} + t_{xbcn}$$

$$t_s = t_{ns} + t_{xk} + t_{xbcn}$$

3.2

where:

t_{ns} – net sailing time of the vessel;

L – distance traveled by the vessel, determined from the nautical distance table or its electronic version;

L_K – length of main waterways;

V_T – technical speed, determined by the vessel's technical specifications;

t_{xk} – time for passing main waterways;

t_{xbc} – auxiliary sailing time.

The voyage port time is determined by the standards for loading and unloading operations.

$$t_b = t_{b1} + t_{b2} + t_{b3} + t_{bb} \quad 3.3$$

$$t_{b1} = \frac{\sum Q_i}{M_c} t / \text{ship} - \text{day} \quad 3.4$$

$\sum Q$ – total amount of cargo loaded or unloaded at the domestic port;

M_c – weighted average cargo handling rate.

The gross port time, as known, reflects the accounting of the total duration of all operations related to the vessel's stay in port.

$$t_{bb} = \frac{\sum Q}{M_b} \quad 3.5$$

M_b – gross intensity of cargo operations is determined by port customs.

The sequential combination of all necessary operations during the voyage, which involves their consecutive or parallel execution, reflects the operational structure of the voyage. It expresses the technological interconnection of performing a set of main and auxiliary operations.

To determine the structure and duration of a voyage, it is necessary to know the start and end moments of the voyage. This process is fairly well standardized.

The starting moment of the voyage is considered to be:

1. For cargo ships operating on non-liner routes – the moment of completion of unloading and the formalization of documents for the previous voyage.

2. For liner ships – the moment the vessel is positioned for loading at the base port of departure.

The end of the voyage is considered to be:

1. For cargo ships – the completion of cargo unloading and the formalization of cargo documents for the completed voyage.

2. For liner ships – the completion of unloading in the initial (base) port of the line.

For the realistic planning of voyage duration and optimal vessel loading parameters to achieve normalized fleet operational efficiency, a system of technical standards is applied, which includes:

- Standards for vessel loading and sailing speed;
- Speed regulation is managed by the mechanical and ship service (technical management). For each vessel type, a technical speed is set for both laden and ballast conditions.

- Loading standard is determined as the minimum value among deadweight capacity, cargo volume capacity, and contractual load:

$$Q_H = \min \{Q_{DN}; Q_W; Q_{KT}\} \quad 3.6$$

- Standards for ship stores and their consumption rate;
- Standard time for auxiliary operations.

The implementation of key directions in scientific and technological progress serves as the foundation of the economic policy of any shipping company, whose activities are aimed at ensuring sustainable competitiveness in the operator segment.

In accordance with economic decisions regarding the development of transport potential, management must be aligned with achieving a normal level of profitability and the well-being of transport company employees.

The intensity of operational activity in the chosen sector of the freight market, under strong competitive pressure, necessitates the optimization of both the technical and economic level of the fleet and the method of cargo transportation, considering logistics and multimodal technologies.

Transport work is generated by the movement of cargo in space and time. Therefore, ballast voyages are incorporated into the cargo voyage, which necessitates such repositioning.

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To ensure the value of a shipping company for cargo owners, it is essential to adhere to the principles of voyage organization, which include:

1. On-time delivery
2. Maximum utilization of cargo capacity
3. Minimal costs
4. Maximum revenue
5. No commercial defects
6. Alignment with cargo owners' requirements
7. Safety

Additionally, it is crucial to consider that the state of any maritime trade market segment is influenced by external conditions, including: political stability in the country or region, phase of the economic cycle, changes in the distribution of productive forces due to globalization and internationalization.

3.2. Specialization of Commercial Fleet Vessels

The systemic principle of developing any economic subsystem is the specialization of the organization and technical means. This is the most important condition for increasing productivity and optimizing costs relative to competitive structures. The set of indicators of any business units is determined by the tasks of optimizing final results. Evaluation indicators should integrate the interests of shipowners, cargo owners, and the macroeconomic environment.

New technological characteristics of cargo transportability, such as containers, packages, roll trailers, and aggregated cargo units, as well as traditional forms, determine the formation of fleet typification. At the same time, the structural and technical characteristics of vessels shape not only the transportation technology but also the tactics of organizing the transportation process.

The adaptability of vessels for efficient cargo handling operations is characterized by the following technical and operational features:

1. Number of cargo holds, tween decks, and deep tanks.

The number of cargo holds determines the possible number of technological processing lines for the vessel in the port, which in turn affects the intensity of loading and unloading operations and the duration of the vessel's stay at the berth.

2. Class of hatch covers.
3. Availability and class of cargo handling equipment.
4. Height of the vessel's double bottom (maximum for coal and ore carriers).

This parameter determines the maximum allowable deck load and imposes restrictions related to navigational safety.

The diversity of transport characteristics of cargo, along with their physical and chemical properties, dictates the need for a large number of vessel types capable of transporting goods with maximum efficiency.

The global merchant fleet consists of the following types of vessels:

1. Vessels for general cargo transportation:

- universal vessels;
- multipurpose vessels;
- specialized vessels;

2. Container ships.

3. Vessels for bulk and dry bulk cargo transportation:

- coal and ore carriers;
- bulk carriers;
- OBO (Ore-Bulk-Oil) carriers;

4. Non-self-propelled vessels:

- Lighters;
- barges;

5. Timber carriers

6. Vessels for liquid cargo transportation:

- broadly specialized tankers;
- narrowly specialized tankers;
- combined carriers;

7. Vessels for uninterrupted transport operations:

- river-sea mixed navigation vessels;
- lighter carriers;
- ferries;

8. Passenger vessels:

- displacement vessels;
- hydrofoil vessels;
- air-cushion vessels.

The key factors determining the fleet's alignment with major trends in global shipping development and the state of the freight market, based on competitiveness criteria, include:

- active integration into global economic relations;
- relative stability in the volume, structure, and direction of national, foreign trade, and transit cargo flows;
- optimization of the balance between investment efficiency, operational activities, and service levels for operators and cargo owners;
- clear orientation of national shipping policies toward supporting domestic maritime transport enterprises during their formation, diversification, and adaptation to changing operational conditions;
- availability of funding sources for the most advanced yet capital-intensive areas of fleet and port development;
- extensive use of commercial management approaches to optimize the technical and economic performance of national maritime transport enterprises.

Under the conditions of a fiscal economic mechanism, the underdevelopment of institutional freight activities in the country and the loss of its own cargo base, when national exporters are artificially placed in an economically disadvantageous position for shipping goods under CIF terms and do not generate significant demand for maritime transportation services, the development of national shipping was not possible. Direct losses to the national economy from this, over the period of Ukraine's independence, amount to tens of billions of USD. Moreover, considering the outflow of qualified personnel in the shipping and shipbuilding industries, these losses are essentially ten times greater. The global merchant fleet, despite periodic crises, continues to develop steadily (Table 3.1). The positioning of individual shipping companies is also influenced by the cost of fuel and energy resources.

*Table 3.1. Structure of the Global Fleet by Major Vessel Types
(thousand dead weight tons and percentage share)*

<i>Fleet composition by vessel type</i>	<i>Years</i>				<i>Percentage change</i>
	<i>2010</i>	<i>2015</i>	<i>2020</i>	<i>2024</i>	
<i>Oil tankers</i>	450.1 35.3	489.4 28.0	601.3 29.0	665.4 28.3	215.3 -7
<i>Bulk carriers</i>	458.6 35.6	760.5 43.5	879.7 42.7	1004.2 42.7	545,6 7.1
<i>General cargo</i>	108.2 8.5	76.7 4.4	76.9 3.7	84.0 3.6	24.2 -4.9
<i>Container ships</i>	169.2	227.7	274.9	329.4	160.2

	<i>13,3</i>	<i>13.0</i>	<i>13.4</i>	<i>14.0</i>	<i>0.7</i>
<i>Other types of ships</i>	<i>92.1</i> <i>7.2</i>	<i>194.9</i> <i>11.1</i>	<i>238.7</i> <i>11.5</i>	<i>270.6</i> <i>11.5</i>	<i>178.5</i> <i>4.3</i>
<i>Liquefied gas carriers</i>	<i>40.1</i> <i>3,2</i>	<i>49.7</i> <i>2.8</i>	<i>73.6</i> <i>3.6</i>	<i>93.8</i> <i>4.0</i>	<i>53.7</i> <i>0.8</i>
<i>Chemical tankers</i>	<i>10.4</i> <i>0,6</i>	<i>42.2</i> <i>2.4</i>	<i>47.8</i> <i>2.2</i>	<i>52.5</i> <i>2.2</i>	<i>42.1</i> <i>1.6</i>
<i>Offshore supply</i>	<i>24.1</i> <i>1,6</i>	<i>74.2</i> <i>4.2</i>	<i>80.1</i> <i>3.9</i>	<i>89.0</i> <i>3.8</i>	<i>64.9</i> <i>2.2</i>
<i>Ferries and passenger ships</i>	<i>6.2</i> <i>0,5</i>	<i>6.3</i> <i>0.3</i>	<i>7.9</i> <i>0.4</i>	<i>8.7</i> <i>3.6</i>	<i>2.5</i> <i>3.1</i>
<i>Other/n.a.</i>	<i>13.2</i> <i>1,0</i>	<i>23.1</i> <i>1.3</i>	<i>25.5</i> <i>1.2</i>	<i>26.3</i> <i>1.1</i>	<i>13.1</i> <i>0.1</i>
<i>World total</i>	<i>1276.1</i> <i>100</i>	<i>1749.2</i> <i>100</i>	<i>2306.4</i> <i>100</i>	<i>2353.8</i> <i>100</i>	<i>1077.1</i> <i>0</i>

Source: UNCTAD Secretariat calculations based on data from “IHS Fairplay”.

The analysis of the global fleet composition by vessel type (2010–2024) shows:

1. Increase in tonnage of bulk carriers and container ships, indicating growing demand for bulk and containerized cargo transportation.
2. Decrease in the share of oil tankers, reflecting changes in energy demand.
3. Decline in the number of general cargo ships, due to the shift towards container transportation.
4. Growth in the fleet of gas carriers and chemical tankers, driven by demand for the transportation of gas and chemical products.
5. Development of the offshore fleet due to the increase in offshore oil and gas platforms.

For cruise liners, unlike other types of commercial vessels, maximum sizes have not yet been established. There was also a trend towards increasing size for container ships. For example, China Shipping Container Lines builds container ships with a capacity of 18,400 TEU. The length of the vessel is 400 meters, and the width is 58.6 meters. One of the leaders in container technology, the shipping company Maersk, ordered 20 container ships in 2013, each with a capacity of 18,000 TEU.

However, shipbuilding trends have changed since then. As of January 2025, the industry is shifting away from ultra-large container ships in favor of more compact vessels. This shift is driven by changes in global trade routes, the redistribution of manufacturing capacities from China to other Asian countries, and new environmental

regulations. As a result, shipowners now prefer container ships with a capacity of 12,000 to 16,999 TEU, which offer greater flexibility and economic efficiency.

Ferry crossings in the Black Sea are widely used by Turkish businesses for cargo deliveries to Ukraine and for transit shipments to Russia, Belarus, the Baltic states, and Kazakhstan. Each year, 80,000 TIR trucks are sent from Turkey to Western Europe.

To maintain a stable contribution to the foreign exchange balance by expanding the export of transport services, it is essential to determine the key operational characteristics of the commercial fleet based on the competitiveness of different vessel types. This approach ensures the prioritization of vessel chartering in the most active segments of the maritime trade market.

The leading indicator of a vessel's positioning efficiency in the freight market, regardless of its type or the region of operation, is its profit margin.

3.3. Parametric Characteristics of Freight Transport by Sea

Transport enterprises, particularly maritime shipping companies and commercial ports, ensure the continuity of trade turnover and the functioning of all sectors of the national economy and global economic relations. Therefore, transport serves as a fundamental and necessary condition for the effective implementation of any production process.

Based on this foundation, the strategy for the development and management of the functional activities of individual transport enterprises is formed, ensuring the quality of interconnected technological processes. These processes reflect the standards for carrying out various activities related to cargo loading, transportation, and delivery.

To determine the parameters of the transport process, it is essential to clearly understand the principle of utilizing the production potential of the transport industry within the overall national economic system.

The following stages are distinguished in the process of achieving a balanced state for a shipping company:

- Determining the scale and operating conditions of this specialized fleet group;
- Selecting alternative solutions that can meet the demands of this segment of the maritime trade market;
- Calculating indicators of comparative efficiency, as well as the necessary resources and their sources of coverage;
- Analyzing options and choosing the most rational solution;
- Assessing the reliability of the chosen priority solution and developing a program for utilizing transport potential.

The production process in transport is a set of actions based on the use of interconnected capital assets (means of production) and human labor. In other words, the transport process is built on the interaction of labor resources and technical transport assets. As a result, the spatial position of cargo or passengers changes, which is the ultimate goal of maritime transport development.

Maritime transport technology refers to the set of means and methods used to carry out the key components of the transportation process, with the goal of ensuring efficient and safe cargo transportation by sea.

The technology of maritime freight transport is developed in accordance with the following key objectives:

- efficient utilization of transport assets;
- implementation of reliable navigation safety measures;
- preservation of the transported cargo.

Maritime transport technology is based on the quantitative and qualitative parameters of the actual composition of the commercial fleet. The number of vessels and their main characteristics are recorded in national registries, the Lloyd's Register, and real flag state registries.

Two methods are used to account for the transport potential of the national fleet:

1. *Deadweight tonnage (DWT)*, measured in metric tons.
2. *Gross tonnage (GT)*, measured in register tons, where 1 register ton equals 2.83 m³.

The efficiency of maritime freight transport technology is characterized by the intensity of freight flow management and the cost-effectiveness of fleet operations relative to the prevailing tariff rates.

The actual cost savings in operational expenses, achieved through reduced delivery costs based on different transport technology options, can be calculated under specific conditions:

$$\Delta R_v = \sum (C_{s1} - C_{sn}) q_1 \quad 3.7$$

The expected efficiency of optimizing freight transport costs compared to the baseline level can be determined by comparing results under the following condition:

$$\Delta P_{rc} = \sum q_n (C_{so} - C_{sb}) \quad 3.8$$

where:

C_{sb} , C_{s1} , C_{sn} – represent the unit cost of transport production in the baseline, reporting, and planned periods, respectively.

q_1 , q_n – denote the volume of transport work actually achieved in the reporting period and the planned calculations of the company.

The quality of transport services and, consequently, the chosen technology – is defined by UNI 9910 as: «Service quality is the overall effect of service delivery, which determines the degree of customer satisfaction».

When justifying the types of cargo fleet vessels that ensure precise technological processes, the key technical and economic parameters, the level of specialization, and the technological advancement of the vessels are determined. The selection of ship types and fleet composition for specific transport routes is based on the deployment of both new and existing vessels. At the same time, it is essential to maintain the competitiveness of the domestic fleet in the global freight market.

The freight market turnover, during periods of active global maritime trade, exceeds \$400 billion. For several maritime nations, the export of transport services has become a major source of foreign currency earnings. The influence of shipping on the optimization of the current account balance drives the strategy for expanding transport service exports, leveraging efficient technology and enhancing the fleet's transport capacity.

Table 3.2. Dynamics of Freight Turnover and Cargo Volume of Maritime Transport

Year	Freight Turnover, bln t/km	Cargo Volume, mln/t
1950	3 570	550
1960	7 500	1 110
1970	18 145	2 480
1975	23 300	3 050
1980	32 160	3 650
1985	27 500	3 190
1990	28 100	4 000
1995	29 015	4 650
2000	31 000	5 100
2001	31 657	5 227
2002	32 418	5 415
2005	35 550	7 109
2007	40 000	8 034
2009	39 500	7 858
2010	41 200	8 409
2011	43 150	8 784
2012	45 800	9 197
2013	49 500	9 514

2014	51 300	9 842
2015	52 800	9 900
2016	54 000	10 100
2017	55 500	10 400
2018	57 000	10 700
2019	58 500	11 000
2020	57 200	10 800
2021	59 000	11 200
2022	58 800	11 000
2023	60 200	11 300
2024	61 500	11 600
2025	62 800	11 900

Source: Review of Maritime Transport

Analysis of Cargo Turnover and Maritime Transport Volume (1950–2025)

General Trends (1950–2025):

- Maritime cargo turnover has *increased nearly 18 times* – from 3,570 billion t.km in 1950 to a projected 62,800 billion t.km in 2025.
- Cargo volume has *grown 22 times* – from 550 million tons in 1950 to a projected 11,900 million tons in 2025.

This indicates *steady growth in international trade*, improvements in logistics, and increased vessel capacities.

- **2020 (COVID-19 impact):** Cargo turnover decreased from 58,500 to 57,200 billion t.km, and transport volume fell from 11,000 to 10,800 million tons.

Reasons: lockdowns, global trade slowdown, reduced demand for oil.

Comparison between 2007 (40,000 billion t/km) and 2009 (39,500 billion t/km) shows a decline in freight turnover. Thus, freight turnover decreased by approximately *1.013 times (or 1.3%)*.

- The volume of transported cargo also decreased from 8,034 million tons (2007) to 7,858 million tons (2009), meaning the cargo volume declined by approximately *1.022 times (or 2.2%)*.

This indicates an overall reduction in freight transportation volumes.

- **By 2025**, *maritime transport may reach 12 billion tons*, but future dynamics will depend on regulatory changes and global economic conditions.

As challenges in improving technologies and the management mechanism for the efficiency of maritime transport development, a set of constraints and conditions is

considered that deviate competitive economic efficiency from the normalized cost level. The goal is to select and assess the optimality of cargo delivery technologies.

The group of issues influencing the economic mechanism's impact on the marginal cost level includes:

- Methodological uncertainty in decision-making;
- Limited access to resources;
- The complexity of comprehensive planning, considering the unpredictable behavior of competitors.

Despite the large number of shipping companies, Ukraine's modern merchant fleet, due to its operational and technical condition, is unable to function effectively in an open competition mode within the freight market. Most vessels, except for a few operated by certain shipping companies, are classified internationally as substandard. At the same time, to expand the cargo base under international restrictions and quota-based regulations, special conditions must be created to restore the position of the merchant fleet in foreign trade shipping, including:

- Choosing a national carrier;
- Signing trade contracts specifying that a portion of cargo is transported by the national fleet;
- Forming companies that integrate production processes with cargo transportation;
- Creating conditions and guarantees to attract small investors' funds for forming share capital;
- Utilizing IMO regulations and the European Union memorandum on port state control.

The state of any maritime transport system is characterized by a combination of quantitative and qualitative indicators, represented through a system of relevant metrics.

In terms of cost-effectiveness, inland water transport is comparable to maritime transport. For example, with five liters of fuel:

- A truck can travel 100 km;
- A train can travel 335 km;
- A river vessel can travel 550 km while carrying over 1,000 tons of cargo, equivalent to 30 railcars.

In Lille, France, inland waterways are even used for waste transportation, eliminating the need for 15,000 trucks. Unfortunately, the Lower Danube is utilized at only 10% of its capacity, while the Dnieper River is used even less.

Therefore, a key priority is developing a strategy for transitioning to the principles and technology of cost-efficient shipping.

3.4. Organizational and economic foundations of the transport process

The implementation of the management process in commercial shipping requires the existence of models that describe the patterns of cargo and vessel flow formation, including:

- informational ensuring;
- regularities in the behavior of all participants in the logistics chain;
- knowledge of the levers influencing the resource system.

The economic independence and autonomy of shipping companies determine the possibility of self-regulation in business activities as a condition for the effectiveness of managing the transportation process, given the constraints of service alternatives offered by other companies.

The principles of international, regional, corporate, and national regulation of organizational and economic relations in maritime transport shipping define the necessary combination of state and industry regulatory mechanisms for optimizing the use of maritime space. At the same time, it is essential to consider the standard principles of competition and protectionism as key conditions for the development of the national commercial and specialized fleets. An active maritime state policy should be based on the criterion of sufficient development of transport, naval, and specialized fleets, as well as coastal infrastructure.

The level of development of Ukraine's maritime transport complex ultimately determines the freight independence of foreign trade operations and the stable condition of the country's balance of payments. Therefore, the minimum level of development of the national merchant fleet should be considered its transport capacity's compliance with the parameters of foreign trade flows and the regulatory quotas of international maritime organizations. Reaching this level allows a country to be considered a maritime power. The implementation of a strategy for participation in and expansion of transport service exports contributes to the economic sustainability of national shipowners. This is due to the fact that maintaining a position in the open sectors of the global freight market is only possible based on a fleet's high competitiveness.

Maritime cargo transportation and other types of work performed by the transport fleet are classified according to the following general criteria to optimize the organization of core processes and management outcomes:

1. By type of navigation:

a – cabotage – transportation is carried out between ports of the same country. Cabotage can be small (transportation between ports within the same basin) and large – transportation between ports of different basins separated by international waters.

b – foreign (international) shipping – the implementation of foreign trade transportation and the export of transport services.

A feature of foreign shipping is its focus on the delivery of cargo for foreign charterers (FFC), as well as the independent operation of the fleet between foreign ports (BFP). These two types of transportation result from the internationalization of transport services in global and regional economic relations.

2. By forms of shipping organization.

The operation of the fleet, based on the forms of transport process management, takes into account the intensity and regularity of shipping on specific routes.

a – Voyage (tramp) form of shipping organization. In this case, vessel operations are not tied to fixed routes, schedules, or ports of call. Transportation, and consequently voyages, arise as needed.

b – Liner form of shipping management and organization. In this case, the operation of transport vessels takes place between fixed ports of call according to a pre-announced schedule.

c – Sequential voyages, where the directions of operation remain constant for an extended period.

This form of shipping organization is characteristic of bulk, dry bulk, and oil tanker cargoes, especially when the fleet belongs to specific corporations.

3. By types of communication.

a - By location of operations, shipping is classified as port-adjacent, local, regional (basin-wide), and interregional (inter-basin) transportation.

b - By connection with other modes of transport.

Shipping is classified as maritime, combined, intermodal, and transshipment-free (when transporting ULD, not the cargo itself, is transferred).

The mentioned classification categories of the transportation process and fleet operations determine the specific features of management organization. Due to the multidimensional nature of these forms, the development of specialized solutions for fleet utilization becomes relevant:

1. The structure of management of core operational activities, including the transport process and fleet operations.

2. Issues related to the maintenance and improvement of various forms of commercial shipping and maritime communities.
3. Methods of technical regulation of the fleet's functional activities and the improvement of technical support systems for maintaining stable market positioning.
4. Training of specialists based on principles of competence and competitiveness of human capital for work in shipping companies.

Each of these stages has its own independent significance and foundation, forming the prerequisites for solving tasks related to the management of the transportation process and fleet operations, as well as the organization of activities of core and auxiliary subsystems.

The main patterns of managing the efficiency of shipping activities are:

1. Proportional and optimal state of management systems.

This means achieving a balance between the fleet's transport capacity, port throughput, and the potential of service enterprises. The key goal is to establish such proportions of production potential that minimize unproductive downtime.

2. Rhythmic operation of all elements of the transport system, ensuring the normal functioning of the logistics production complex.
3. Operational efficiency under market cyclicity and compliance with convention-based regulations governing navigation safety.

When choosing a development strategy for shipping companies, it is essential to consider not only the ultimate economic goals, growth potential, and stability in the freight market but also the availability of investment resources. While the primary focus of business activities is profiting generation, various strategy types must be implemented under specific conditions.

A key trend in the economic development of SC is the transition to new technical solutions, the organization of functional activities, and improved management practices. Therefore, efficiency indicators should reflect not only quantitative changes but also the impact of structural shifts in the production system on overall SC performance. Efficiency gains should serve as the foundation for generating sources of further development.

For example, the use of bulk carriers in the dry cargo market is directly linked to their role in transporting key commodities in global maritime trade. Overall, dry bulk cargo transportation via bulk carriers nearly doubled between 2001 and 2024 (see Fig. 3.2).

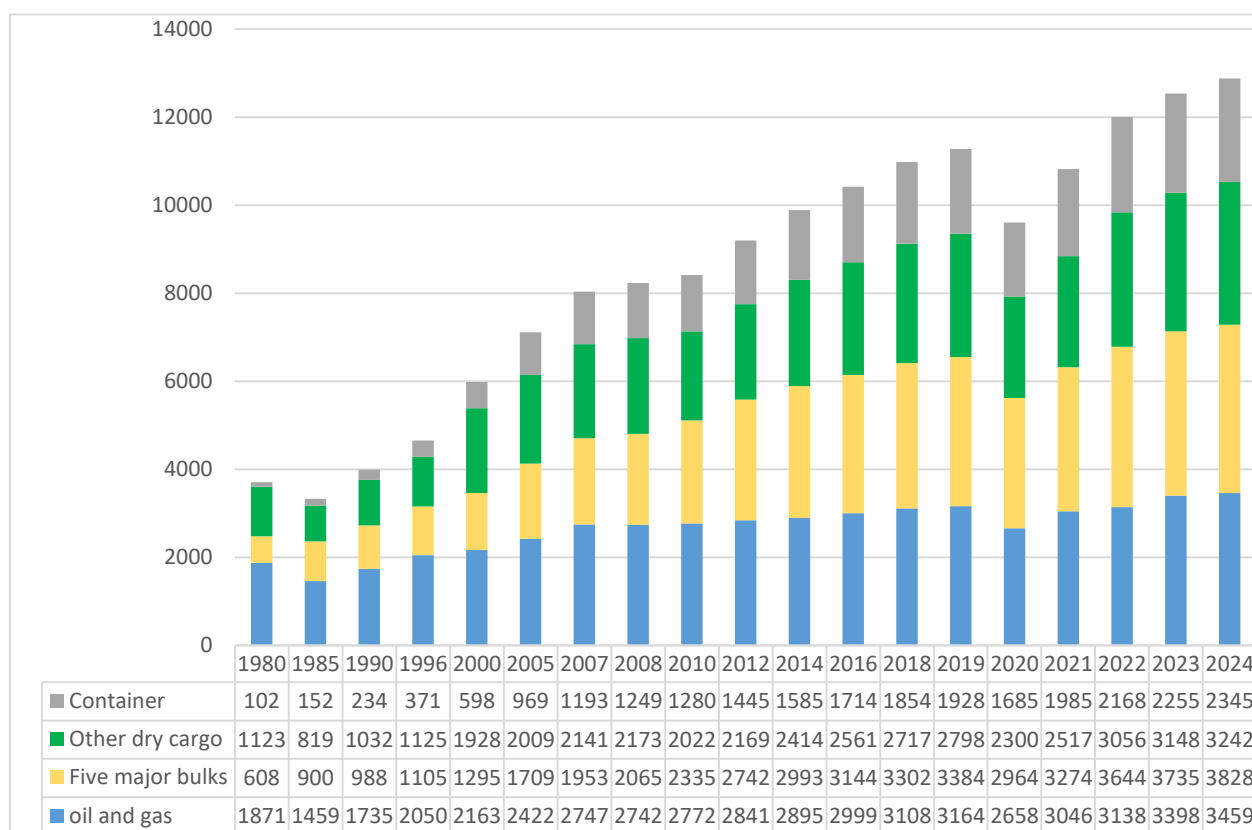


Fig. 3.2. Dynamics of Transportation by Main Specialization Groups of the Merchant Fleet

Managerial and organizational decisions in merchant shipping are based on the use of information resources. These resources represent a combination of knowledge of economic and legal provisions (conventions) and accumulated information in the form of documents and databases, which are used to effectively realize the production potential of a shipping company.

The main types of economic information necessary for the operation of a shipping company include: planning, accounting, financial, bookkeeping, reference, administrative, instructional, technological, regulatory, design, and others.

In operational activities, information flows are concentrated in agency companies. With the development of computer technologies, an agency company submits an application with a package of documents to the controlling authorities electronically within a day. Each service marks its approval. Either a free practice mode is granted, or additional information is required. At the same time, potential cargo risks are monitored. The central dispatching point receives information about granting free

practice to the vessel. Upon the ship's arrival and mooring at the berth, cargo operations begin. In this case, the waiting time for the commission's arrival on board is reduced.

3.5 Main ways and means of cargo transportation

Among the directions of structural transformation of the global market of maritime trade along with further concentration of carrying capacity of the fleet of the leading SC is the growth of the number of small and medium-sized operator units. The rapid growth in the number of shipping companies with insufficient capital concentration for systemic sustainability dictates the need to react quickly to the nature of current cyclical changes.

The main challenge remains the increased risk to the crews of vessels of such shipping companies due to the volatility of functional and financial activities.

The multitude of tasks and objectives predetermines a long sequence of elaboration and realization of the perspective strategy of development of all subdivisions of the national maritime economic complex and achievement of functional and economic sustainability of shipping companies and commercial seaports.

The main methods of cargo transportation are:

1. Piece-by-piece - stacking cargo in the holds of ships by individual cargo places.
2. Enlarged cargo places (containers, lighters ...).
3. Bulk.
4. Liquid bulk.

Means of consolidating cargo spaces to reduce costs and speed up ship handling include:

1. Universal pallets - wooden cargo platforms of 1200h1600 mm size with load capacity up to 5 tons. They are flat, honeycomb; racked.
2. Slings - designed to tie or tighten the cargo consisting of individual cargo places - strop containers.
3. Containers - a multi-turn type of container that protects cargo from damage and theft. Fittings - holes for fixing containers. There is a range of containers in terms of load capacity and height. But the classifications are 20 and 80 feet long, 8 feet wide and 9 - 9.5' high. They are accounted for in TEUs, which is the twenty-foot equivalent unit.

The maximum gross weight of 1 twenty-foot container is 20.5 tons. The maximum weight of the cargo in the container is 18.5 tons.

4. Flatbeds are lattice boxes without a roof.

5. Trailers - special wheeled accumulators of cargo consignments for subsequent delivery to consumers.
6. Lighters with load-carrying capacity of 200 - 1000 tons.
7. Railroad cars.
8. Forestry standards.
9. Soft containers.

In any economic system, the problem of balanced development of the transport complex is considered to be the way of measuring the volume of transport work. Focusing on the shortcomings of freight turnover in t-m and even transportation in tons has not led to the justification of a clearer measurement of products and works of transport enterprises. The main drawback remains the difficulty of reflecting the time of delivery, one of the goals and the most important transportation and market result.

In the economic and legal aspect, the CMM distinguishes the contract of carriage from the contract of affreightment. Separate articles of the CMM regulate the issues of the contract of carriage. Issues of the contract of chartering a vessel are regulated by other articles of the CMM. At the same time, it is taken into account and noted that the fee (freight) is charged both under contracts of carriage of goods by sea and under contracts of chartering a ship.

Economic growth in industrialized countries and intensive expansion of their trade is accompanied by the growing influence of international TNC on the maritime trade market. At the same time, the conditions of competition and the level of transportation tariffs are changing. Scientific and technical process and innovative technologies of cargo traffic service are of special importance in this process.

In addition to target results, merchant shipping forms externalities. According to the International Maritime Organization, up to 30 million tons of water ballast is imported to Ukraine annually. The problem of water ballast is regulated by international norms and standards.

3.6. Criteria-based requirements for efficiency

Marine Transportation Technologies

The formation of shipping policy reflects the dual nature of the functioning of the merchant fleet and the national infrastructure that ensures its effective use. On the one hand, sea transport is a natural part of material production with the main features of entrepreneurial activity. In this regard, the main purpose of maritime policy is to create conditions for the effective functioning of the national fleet and ports on the basis of: a system of crediting, stimulation of the investment process, pricing, fair taxation, financial stability, insurance, rational remuneration and adequate education.

On the other hand, the principal feature of the transport industry is that the transport system is a universal and necessary condition for the normal functioning of the economy on the basis of market mechanisms. At the same time, transport services form a special type of product in the world freight market.

As you know, the most important criterion of any production system, its technology and management are productivity. In merchant shipping, productivity is calculated by the ratio of the volume of transport work (tone-miles) to the carrying capacity potential (tonnage-day in operation).

$$\mu \frac{\sum_{i=1}^n Q_i l_i}{\sum_{j=1}^m D_{nj} T_{ej}} \quad 3.9$$

In world statistics according to the UNCTAD methodology, the productivity of one ton of deadweight in tons of transported cargo is calculated (Table 3.3).

Table 3.3. Dynamics of the productivity of the world merchant fleet

Year	World fleet (million tons of deadweight)	Quantity of cargo (million tons)	Solved thousand million tone-miles	Capacity of 1 ton of deadweight	
				Tons	t-miles
1990	658	4 008	17 121	6.1	26.0
1995	735	4 651	20 262	6.3	27.6
2000	808	5 871	23 693	7.3	29.3
2004	896	6 846	27 574	7.6	30.8
2005	960	7 109	29 094	7.4	30.3
2006	1002	7 416	30 686	7.4	20.7
2007	1042	7882	31425	7,6	30,1
2008	1118	8168	32746	7,3	29,3
2009	1192	7843	31245	6,6	28,1
2010	1234	8400	32840	6,8	26,6
2011	1396	8784	43150	6.3	30.8
2012	1534	9197	45300	6.0	29.5
2013	1625	9514	49500	5.9	30.5
2014	1690	9842	51300	5.8	30.4
2018	1929	10637	58403	5.7	30.1
2021	2168	11105	60124	5.2	28.6
2023	2100	11530	62037	4.9	26.4
2024	2350	12550	63200	4.8	26.0

Source: World Fleet: Lloyd's Register – Fair play deadweight: mid-year data, for other ships shown, total cargo carried: UNCTAD secretariat; tone-miles: Fernley's, *Review*: various publications. Information provided by the UNCTAD secretariat.

One of the factors in the trend of declining fleet productivity is the imbalance in supply and tonnage. Therefore, despite the increase in the share of the new fleet, the final productivity of 1 ton of deadweight is decreasing, which leads to a drop in the profitability of capital assets. In addition, the dynamics of the final productivity of 1 ton of cargo capacity of the merchant fleet reflected three main factors:

- change in the structure of cargo transportation,
- technical development of the fleet,
- improvement of management and technology of transportation. In times of crisis, productivity has fallen due to a significant decline in world trade. It is during this period that the importance of innovative forms of cargo flow management based on logistics and multimodal technologies increases. The main stages of technological processes in maritime transport are:

1. Preparation of the port for the reception of the vessel and loading of the consignment;
 - obtaining information from the vessel about the place of loading,
 - obtaining information about the cargo and its properties
 - preparation of the terminal for cargo operations.
- Preparation of stevedoring company resources and mechanisms for loading a batch of cargo
 - information of the vessel on the method of loading operations,
 - preparation of special devices or devices,
 - preparation of the vessel's cargo plan,
 - accumulation of the required amount of cargo,
 - drawing up a plan for handling the vessel, drawing up the necessary cargo documents.
2. Preparation of the vessel for cargo loading;
 - information for the port about the time of readiness to receive cargo (notice of readiness),
 - preparation of the final cargo plan,
 - preparation of cargo spaces and devices for receiving cargo (special devices, cleaning of cargo spaces, preparation of lighting, opening of holds),
 - obtaining a special permit from the State Grain Inspectorate, fire authorities, sanitary and port supervision,

- notification of the port about the need for fastening and separation materials,
- preparation of the ship's deck for cargo acceptance,
- preparation of measures to exclude damage and theft of cargo,
- preparation of tallyman's and bilge sailors,

3. Acceptance of a consignment

- control of the correctness of stowing, separation and acceptance of goods,
- execution of cargo documents for incoming consignments,
- verification of the correctness of the sealing of the means enlarging the cargo units or cargo spaces of vessels;
- checking the correctness of fastening during loading,
- installation of special protective or safety nets between the side of the vessel and the berth,
- control of the correct placement and fastening of deck cargo.

4. Control of the condition of the cargo during the voyage during the movement of the vessel

a. This is an event to regulate the microclimate of cargo spaces. The point of all measures comes down to regulating the dew point.

The dew point is the critical air temperature at which the moisture contained in the air begins to precipitate in the form of condensation.

During a cargo voyage, the question arises of the need to regulate the microclimate of the holds using natural or artificial ventilation.

The whole variety of cases of the need for ventilation can be reduced to two groups:

1. Passage of the vessel from north to south.

At first, the bilge air has a dew temperature lower than the outside temperature and the cargo sweats.

As you move south, the dew point of the bilge air rises and until it is equal to the dew point of the outside air, ventilation is prohibited.

2. Passage of the vessel from south to north.

At the same time, the dew point and outdoor temperature gradually decrease. Cooling of the ship's hull leads to the appearance of condensate on the surface of the cargo placed in the holds.

During the movement of the vessel, it is necessary to maintain continuous ventilation of the holds.

b. control of the process of cargo storage on the vessel.

c. control of the condition of goods subject to spontaneous combustion or which may emit poisonous substances,

5. Preparation of the vessel for delivery of the delivered cargo.

- preliminary information of the port about the transported cargo, date of arrival and needs of the vessel,
- notification of the master of the vessel about readiness for discharge (notice of readiness)
- filing a maritime protest (if necessary),
- preparation of cargo devices and systems of the vessel for unloading consignments.

With the use of innovative technologies, the effectiveness of the realized investment resources increases over time and there is an opportunity to accumulate additional net income for the construction of more advanced transport facilities in the future. In addition, it is necessary to take into account the presence of factors that reduce the cost of construction and installation works, which, while optimizing the time for the implementation of investment programs, allows you to reduce capital costs during the construction of transport facilities of similar quality.

Inspection, weighing and scanning of cargo is carried out directly at the terminals of port operators.

3.7. Innovative directions for the development of the merchant fleet

The economic situations in the maritime trade market, as a product of the intensification of international division of labor and the shipowners' focus on achieving competitive sustainability of the company, are formed as a result of the use of economic instruments. Among them, phenomena and elements that shape and modify production relations and management mechanisms are distinguished. These include management objectives and economic levers. A special place in this is occupied by the choice of innovative directions for the development of commercial shipping.

Thus, the SDARI design bureau, in collaboration with the Norwegian classification society DNV, has developed a new conceptual project of a Handy bulk carrier. The main dimensions are: length – 180 m, beam – 32 m, draft – 9.5 m, deadweight – 38,800 tons, speed – 14 knots.

The primary objectives of the Green Dolphin are to ensure maximum energy efficiency and compliance with environmental requirements of current regulations and future restrictions.

The project allows choosing the type of fuel for the main engine operation. The options include traditional heavy fuel oil, cleaner fuel grades, or LNG. The bulk carrier

is double-hulled and equipped with a ballast water treatment system. A system for treating dirty and bilge water is also provided.

The formed trend of the development of long-hull container vessels predetermines changes in feeder shipping. The main features of such Vessels with restricted navigation area become design and functionality. Such requirements are related to the doubling of feeder and intra-regional operations during the period 2002–2012.

To the 35th anniversary of the container line FAL 1 of the company “CMA CGM” was timed the first voyage of the third 16,000 TEU vessel Jules Verne. This confirms the intentions of global operators to concentrate attention on expanding the principle of economies of scale in the specialized high-capital-intensive container business.

Branded development plans are the initial stage and the basis of the system for managing competitive positioning of the shipping company (SC) in the segment of functional activity. In this case, the management of fleet operations in the system of the global maritime transportation market must be considered as part of the general problem of maintaining and expanding the position, taking into account a similar reaction of other operators.

The duration of the period during which Ukraine played the role of a raw-material appendage in the global economy is explained by the violation of the principle revealed in the work. "In a non-dynamic economy, business enterprises do not exist ... the main intermediary is a broker or ... a speculator who creates no value". This condition was demonstrated by Ukraine throughout the entire period of modern history. It is precisely innovation that is considered the most important function of business activity.

The principle of advancement and the diversity of the size range of the merchant fleet, considering specialization, predetermines the nature of the concentration of shipbuilding capacities in the country and the increase in the techno-economic level of new vessels.

The principle of normalizing fleet maintenance costs under the conditions of resource market instability contributes to the growing demand for large vessels that realize the economies of scale effect. Such vessels have advantages in cases of high-intensity port operations and when operating on long-distance routes. This trend determines the process of decommissioning smaller-capacity vessels in subsequent periods.

The differentiation in the operational efficiency of maritime transport companies is driven by the varying roles of individual divisions in forming the closing effect or

cost structure of the integrated transport system. The latter become the key link in servicing stable directions of global economic relations.

There are two methods by which shipowners establish a monopoly position in the freight market. The first is based on the correct choice of a shipping company's development strategy, given the necessary investment resources, which allows for a gradual increase in cargo flow handling through innovative capital growth. The second method relies on capital centralization processes, which are characteristic of integration within the transport service system of the international division of labor. This process involves voluntary consolidation of transport potential or economically rational acquisition of one shipping company by another.

Logically, a country participating in the global division of labor can develop its own merchant fleet within the limits of its national cargo base. However, due to the high unit cost of vessel construction and limited investment resources, most countries lack the required tonnage. These conditions have led to the specialization of the merchant fleets of certain countries in providing transport services exports in international shipping. The merchant fleet, under modern conditions, defines a specific type of international specialization and labor division. The primary strategy for such shipping companies is ensuring operational stability within the global economic relations system.

The foundation of national industries, regional formations, and the global transport services market consists of specialized transport enterprises. The functional activities of shipping companies, commercial ports, and other transport enterprises are focused on the competitive servicing of cargo flows based on innovative technologies. This process requires an adequate transport potential, which, in turn, is characterized by the cost and scale of implementing technological progress. The latter ultimately determines the role of individual enterprises within the transport services market system.

3.8. Transport and Technological Systems in Maritime Transport

The global shipping market is shaped by a complex set of factors, primarily the efforts of individual shipowners to ensure their participation in servicing global economic relations with the highest entrepreneurial efficiency. The self-regulation of the balance between cargo flow volumes and transport capacity necessitates coordination of commercial functions and a state-driven approach to ensuring favorable conditions for the development of the national merchant fleet.

The key factors influencing the formation of the maritime transport services market include:

- International division and cooperation of labor.
- Special and economic advantages of maritime cargo transportation.
- Geographic distribution of key production and consumption centers for industrial and agricultural goods, as well as natural resources.
- Entrepreneurial interests.

Based on these factors, programs and projects are developed and implemented to enhance the technical and economic level of the fleet, and management principles are selected according to subsystem sustainability criteria. In this context, special integrative approaches to the interaction of production and transport divisions are formed.

Transport and technological (production) systems (TTS) represent a combination of technical means, technologies, and actions of various transport modes that ensure the delivery of cargo from the place of production to the place of consumption.

The foundation of TTS lies in the close interaction between technical means and the creative participation of workers in various transport sectors. These systems exhibit a certain level of integration. Notable examples include logistics distribution systems, intermodal connections, cluster subsystems, and multimodal technologies.

A crucial component of these systems is transport and technological subsystems, which reflect the advantages of specialized cargo transportation.

TTS within a single mode of transport include:

- Selection of transportation technology.
- Selection of technical means (types and sizes of rolling stock and handling equipment).
- Selection of appropriate transportation process management systems.

The main elements of the maritime segment of TTS, MTK (Maritime Transport Corridors), and MMT (Multimodal Transport) are:

1. Cargo loading technologies based on safety and urgency criteria.
2. Cargo transportation technologies based on economic efficiency criteria.
3. Operational and commercial principles of cargo transport and vessel servicing.

The primary types of TTS in maritime transport include:

1. Unitized cargo transport.
2. Containerized transport.
3. Trailer transport.
4. Ferry transport.
5. Lighter transport.
6. Targeted specialization (e.g., transportation of hot conglomerates).

The economic benefits of fleet development strategies based on low-operational technological processes include cost savings in maritime and land transport due to reduced delivery time, lower cargo handling costs, and increased labor productivity throughout the cargo transfer chain. Additionally, there is a macroeconomic and extra-transport effect, leading to cost savings for cargo owners. This is a result of implementing key directions of scientific and technological progress in maritime transport.

A crucial criterion is the socio-economic efficiency of production. This aspect considers improvements in labor conditions and achieving economic benefits in the context of cooperation and labor division development.

Low-operational cargo transportation technologies include multimodal transport connections. In Ukraine, notable examples include the operations of SC Ukrferry within the Eurasian transport corridor system and the "Viking" container route from Illichivsk (Odesa) to Klaipeda. The record delivery time for containers between ports is 41.8 hours.

The inherent risks of commercial fleet operations affect the ability to achieve planned production, technical, and economic performance indicators. This creates challenges in optimizing operational costs and investment processes. These conditions intensify the need for better training of specialists and human capital due to the growing capital intensity of transport technologies.

In a competitive environment for servicing foreign trade relations in the freight market and improving the composition of the merchant fleet, the role of management organization and training of maritime professionals is increasing.

The growing share of large-tonnage vessels forms a distinct group that determines trends in cargo flow distribution and influences freight and tariff rate levels. This process is closely linked to the development of feeder services, transshipment, and coastal shipping.

The economic efficiency of the rational development of the maritime transport industry is reflected in increased productivity in cargo transportation, reduced average costs, minimized working capital tied up during transport, and reduced reliance on credit technologies to maintain cash flow.

3.9. Integration Transport Technologies

Traditionally, maritime transport of any organizational form has been based on the nature of optimizing the position within the space of international economic relations. The transportation of goods along domestic territorial routes has fallen under the responsibility of numerous railway, road, and inland waterway companies.

In the context of the dynamics of foreign trade and cargo flows, the interaction between maritime and inland modes of transport is strengthened based on the principles of integration processes. In particular, containerization, as a crucial innovative direction in processing cargo flows, has predetermined a significant differentiation of the maritime trade market based on the integrated interaction of various transport modes. This development of foreign trade transportation leads to the emergence of new challenges, among which the establishment and development of multimodal transport technologies stand out.

The concept of a multimodal transport operator (MTO) emerges. According to the UN Convention, it is defined as "any entrepreneur who, based on their decisions, implements a multimodal transport contract, not as an agent, or consignee, or carrier (participant) in multimodal transport operations, but who assumes responsibility for fulfilling the contract."

Thus, the main condition for carrying out such transport operations is the presence of a single document that defines the system of interaction between enterprises of various transport modes. In this regard, it is sufficient to consider the activities of one of the dominant multimodal operators.

In the system of globalizing transport services, the Taiwanese shipping company "Evergreen" ranks second in the world. The carrying capacity of its fleet exceeds 420,000 TEU. It has subsidiary automotive enterprises around the world and owns its own terminals in Taiwan, Thailand, the USA, Panama, and Italy. It includes a shipyard in Japan, as well as factories for the construction of cargo handling equipment and containers.

In the past, according to UNCTAD, the solution to the problems of effective transport servicing of international economic relations involved the establishment of around 80 multimodal terminal complexes along global maritime routes. These complexes were intended to provide the entire range of transport, forwarding, service, and commercial services. The main characteristic of such complexes should be the creation of inter-industry distribution centers. The integration system should provide for the functional unification of transport enterprises, inventory management systems, and insurance and banking operations.

The key task for the effective development of the national transport complex is to carry out economic and technical transformation that will allow participation in servicing regional and global freight flows in accordance with legislative and legal documents that ensure this process.

The results of the development of the fleet and ports should meet a unified efficiency criterion for functional activities – achieving the effect provided for in the strategy based on the normalization of resource use in an integrated transport space.

In accordance with the requirements of the efficiency criterion, the result of the development of transport complex enterprises should be an increase in profitability, improvement in quality, growth in profit, expansion of the scope of activities, and an optimal level of capitalization.

Improving management of development, aimed at enhancing the technical and economic level of operations, should be based on taking into account the peculiarities of transportation and transshipment p

With the shortening of the timelines for the construction of new vessels and handling equipment, regulating the process of acquiring and operating competitive means of transport becomes increasingly relevant. The natural limitation of financial resources necessitates the optimization of the distribution of available funds in order to ensure maximum efficiency in the operations of the SC fleet.

The main factors influencing the pace and directions of improvement in technology, techniques, and organization of freight delivery in the current context of integration of economic processes within the maritime transport industry include:

- 1) the scale of production assets and the number of employees ensuring a competitive position in the corresponding sector of the transport services market;
- 2) continuous improvement of the use of resources of maritime transport enterprises.

The fleet and ports, as economic subsystems implementing the demands of the freight market for efficient cargo delivery, require a balanced increase and economically effective use of production potential. In the process of implementing a development strategy aimed at improving the technological process of cargo transportation, a stage of adequate balance between the main production assets and sectors of operational activity is achieved. Investment resources from alternative sources serve as the foundation for this development.

The pace and direction of economic development in maritime transport, under conditions prioritizing integration and reducing cargo delivery time, should be assessed not only by the scale of transportation work but also by the nature of the correspondence between the quality parameters of the transport process and the structural characteristics of the freight market.

The organization of functional fleet activities at each stage of the life cycle allows for the maintenance of the adequacy of subsystem parameters. The level of interaction organization within the multimodal transport technology system ensures the necessary proportionality and rhythmic operation of the fleet, ground transport modes, and transport hubs, taking into account the achieved resource potential.

The specific conditions for implementing the transport process and the formation of production and financial results in complex circumstances of freight market

instability require the selection of economic solutions based on clear criteria and indicators of economic efficiency for the development of shipping companies.

The improvement of technological processes in cargo transportation and vehicle handling is a crucial element in the development of integration technologies under conditions of limited investment. An important feature of the current stage of transportation development is the tightening of requirements for the quality results of fleet and port operations. Enhancing the quality of the transportation process and its technological reliability is of absolute importance for the functional stability of maritime transport enterprises.

The key factor in the regulatory system for the development of maritime transport is ensuring the quality parameters of the transportation process. The economic stability of maritime transport enterprises depends on profit growth, profitability levels, the correspondence of production costs to price characteristics, and the scale of cash flow capitalization. This is achieved by ensuring competitiveness in the selection of development directions for shipping companies and ports.

In integrated transport systems, the role of the rhythmicity coefficient of transport operations increases. This coefficient indicates the degree of simultaneity in the receipt, processing, and dispatch of cargo, and consequently, the required level of reserves for carrying and throughput capacity. The rhythmicity coefficient of transport potential loading can be defined as the ratio of the sum of actual transportation (cargo handling) volumes, taken within the normative values of carrying (throughput) capacity, for each calculated time interval to the planned value of transport capacity:

The coefficient of continuity in the goods delivery process can be calculated as the ratio of the time goods spend within a given IMC to the weighted average duration of goods on transport enterprises and warehouses. This applies to any batches of cargo sent via export, import, or cabotage, that is, within the technologies that shape the implementation of logistics principles.

The entrepreneurial effectiveness of participation in integration processes should consider the overall systemic economic result of the functioning of the entire transport complex. Furthermore, it is essential to monitor the outcomes of other divisions within the national maritime transport subsystem that have been affected by changes in the conditions of the transport services market.

For a comprehensive assessment and rational behavior in the context of increased competitive confrontation, it is important to determine the trend of changes in the overall industry result. The integral effect and optimization of results among related transport sectors and cargo owners predetermine the trend of integration processes.

Control Questions

1. Main characteristics of the maritime cargo transportation production process.
2. The essence and content of the voyage of a transport vessel.
3. Structure of the voyage of a transport vessel.
4. Principles of fleet carrying capacity formation in a shipping company.
5. Reasons for structural shifts in the composition of the merchant fleet.
6. Parameter characteristics of cargo transportation technology.
7. The modern merchant fleet of Ukraine.
8. Organizational and economic foundations of the transportation process.
9. Patterns of managing fleet efficiency.
10. Principles of merchant fleet typology.
11. The essence of transport integration in the shipping space.
12. Differentiation of cargo delivery methods.
13. Criteria for the efficiency of maritime transport technology.
14. The essence of transport and technological systems.
15. Principles of integration in maritime shipping

Chapter 4.

MANAGEMENT OF THE FUNCTIONAL ACTIVITIES OF A SHIPPING COMPANY

4.1. Principles of Managing the Development and Operation of the Merchant Fleet

Economic management in commercial shipping represents a system and a set of processes utilizing economic methods to achieve set objectives. In this aspect, the management method is a specific form of influencing the will of employees to focus their efforts on optimizing key results.

In general, economic management of fleet development and operation includes the challenge of selecting the composition and structure of key functional tasks and corresponding indicators that require optimization. The primary principle and goal of the development of shipping companies is to focus on the sustainable economic efficiency of capital resources.

A significant aspect is the issue of informational and organizational support with data for the primary impacts of the workforce on achieving final results. The priority of targeting the functional activities of any fleet division is realized through special organizational and economic forms. The set of organizational subsystems in a shipping company traditionally includes the following blocks:

- Planning: Defined by the company's objectives and the tasks of effectively utilizing economic potential.
- Organizational and economic forms: Determine the tasks of managing relationships and responsibilities, ensuring legal order in the maritime trade market.
- Regulatory management: Includes the regulatory framework, international regulations, and rules governing the economic activity of the shipping company and maritime safety.
- The material interest and responsibility subsystem: Ensures the interest of owners and employees in achieving the stability and efficiency of the company's economic potential.
- The accounting, control, and analysis subsystem: Provides informational interconnection between all management and operational links of the shipping company, allowing for performance evaluation and appropriate decision-making.

Ownership forms are essentially indifferent to the systemic patterns of the global maritime trade market. However, corporatization in commercial shipping creates flexible decentralized management structures (Figure 4.1). These replace hierarchical management systems with network-based ones. In this aspect, company employees become involved in the goals of the company's owners.

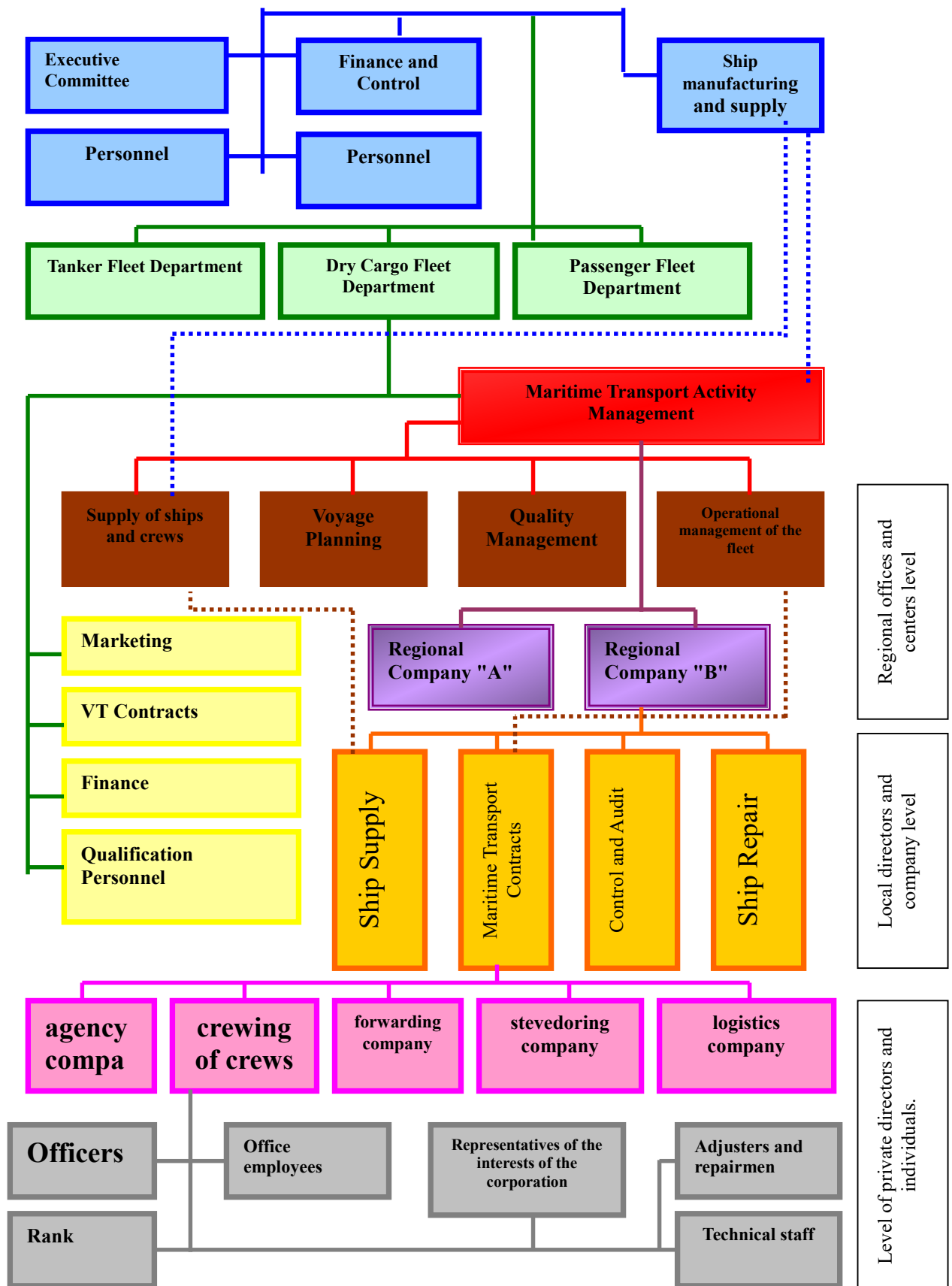


Fig. 4.1. Modern classical structure of a maritime corporation.

Ownership forms of capital assets in shipping primarily affect resource management and performance. Therefore, the staffing policy of modern high-tech enterprises is based on the principle: high technologies require an adequate socio-economic policy from the owners and management. The Fordist-Taylorism system is being replaced by enhanced crew qualification.

Fleet management is an integral part of the functional activities of shipping companies. The management process is based on creating an informational model of future potential states and production activities. Effective models should be based on the dynamics of merchant fleet development, technology, and cargo or passenger transport organization.

The statement that "management is not carried out through technology and equipment, but through human activity" is contradicted by the very principle of ship navigation, where a specialist navigator manages a complex production and economic system – the vessel, which generates the company's final financial result. Therefore, another viewpoint considers the management object as the production process, technical means, and the process of forming economic results.

The matrix management structure is quite complex, complicating responsibility distribution and generating a vast number of documents and bureaucracy. In a matrix model, it is difficult for an employee to identify their primary role and set priorities. It is essential to avoid an overgrown apparatus and the spread of bureaucratic work styles. For an exemplary company, it is crucial that each employee establishes clear priorities and target tasks. Such structuring is not observed in a matrix system. The production structure of the best shipping companies was built on a problem-solving principle: specialization in a specific area of operational activity. This forms the basis of organizational stability. Flexibility regarding temporary changes is built on the principle of specialized working groups. Deviations from stable concepts and the pursuit of reorganization with elements of outsourcing are allowed.

Coordination is understood as managing the connections between performers involved in implementing a set of tasks under a program or project.

The fundamental principle of effective merchant fleet activity is the focus on balancing the state of the maritime transport industry (Figure 4.2).

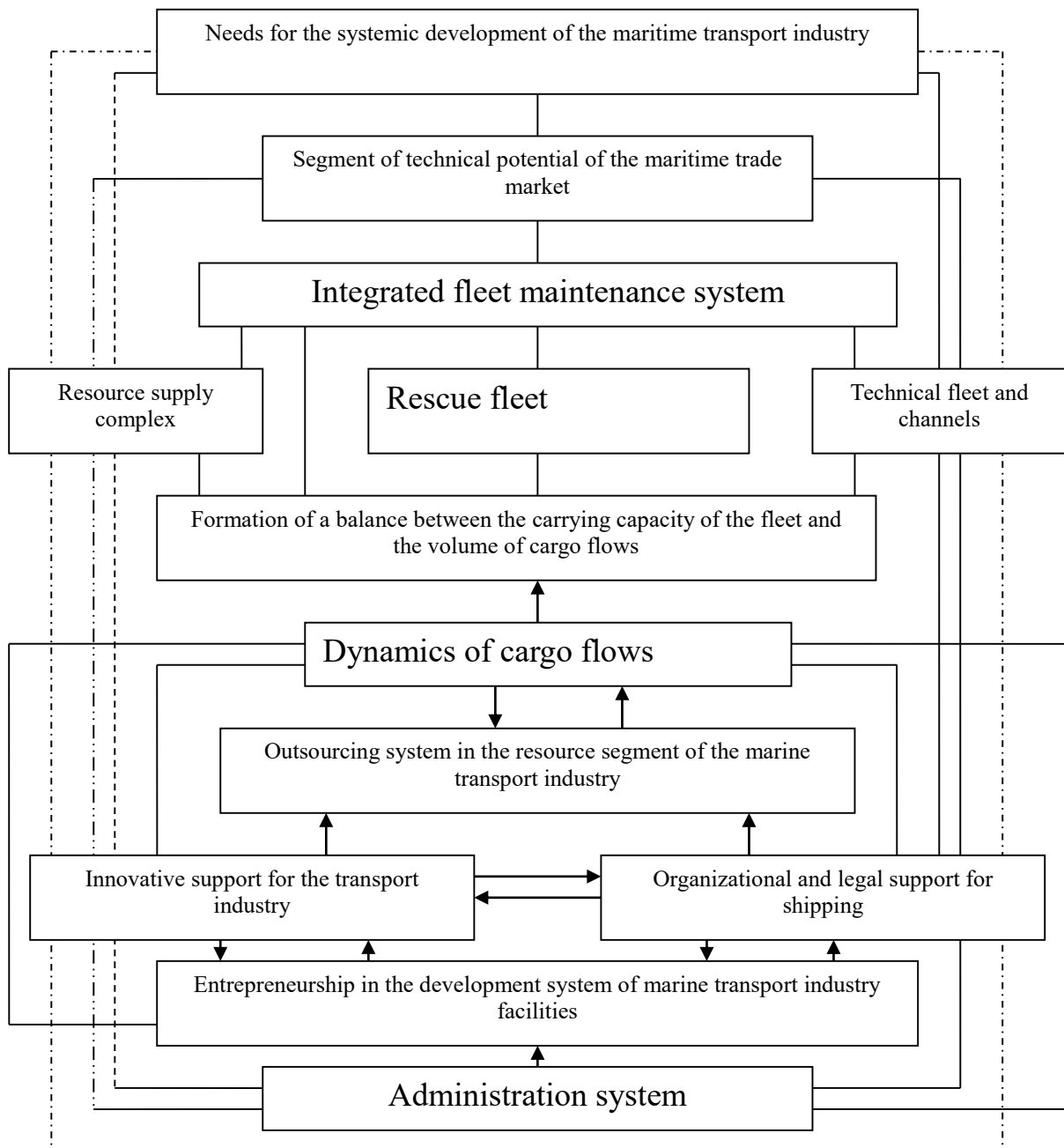


Fig. 4.2. Structure of functional activity resources of the main objects of the maritime transport industry

Among the tools for managing the balance of the maritime transport industry are regulatory documents, the level of transport process organization (standards, tariff rates, contracts, orders, rules for dealing with cargo owners and service units), resource provision conditions for fleet needs, technical and economic characteristics of vessels, and voyage execution conditions.

The transport process requires high organization of the shipping company's functional activities and crew labor. Therefore, the number of seafarers, considering all components of the maritime transport industry (Figure 4.2), is relatively small. However, the concentration of businesses serving commercial shipping is significant, which must be considered when implementing a strategy for the production potential growth of the merchant fleet.

Therefore, it is essential to maintain active investment activities. For example, the Chinese government offers a reward of 150 yuan per ton of vessel displacement to companies that send ships for recycling before reaching their maximum age.

Funding is provided on the condition that the shipping companies, simultaneously with vessel disposal, order the construction of a new vessel of the same displacement at Chinese shipyards. Additionally, the vessels must be registered under the Chinese flag. This approach creates a labor market segment with relatively high added value.

4.2. Loading plan of the vessel

The operational plan for utilizing a vessel's production potential represents the establishment of a system of goals and objectives, along with the means to achieve standardized results under given cargo flow conditions.

The basic level of transport service quality for cargo flows and the potential for its improvement are among the key factors ensuring the stable utilization of a country's transport capacity. Enhancing the quality of cargo transportation has become a strategic objective for national and local transport subsystems. In the context of economic globalization, the quality of transport services within trade and monetary relations has become a crucial factor in the competitive sustainability of fleets and ports. However, this issue remains unresolved both in practice and in theory.

This problem is addressed at the company management level and through the operational control of individual vessels when drafting the cargo plan. A cargo plan is a graphical representation of the placement of each cargo batch in the ship's cargo holds for a specific voyage.

There are two types of cargo plans: preliminary and final (**executive**).

The preliminary cargo plan is prepared by the port in multiple copies and approved by the captain.

The final cargo plan is created during the vessel's loading process and reflects the actual cargo placement on board.

Depending on the specific characteristics of a given vessel type and the cargo arrangement, cargo plans are classified as follows:

1. Single-line – a schematic placement of cargo and ship's representation on the centreline plane.

2. Multi-line – used when it is necessary to depict cargo distribution in the horizontal plane across holds, tween decks, and the deck.

The following key requirements apply to cargo placement on a vessel:

1. Preventing the mutual harmful effects of cargo properties to avoid damage.
2. Avoiding mechanical damage to the lower cargo layers caused by the upper cargo layers.
3. Ensuring unobstructed loading and unloading of individual cargo batches at intermediate ports of call.
4. Creating conditions for maximizing labour efficiency during cargo operations.
5. Preventing the mixing of different bill of lading cargo batches — each batch must be stored in separate compartments.
6. Ensuring that full bill of lading batches are loaded as a whole.
7. Maintaining both local and overall structural strength of the vessel's hull.
8. Maintaining the vessel's stability throughout the voyage.
9. Fully utilizing the ship's cargo capacity.
10. Maximizing possible freight earnings (revenue).

The implementation of the vessel's cargo plan and the control of cargo movement during loading and unloading are carried out by the chief officer, the senior mate. These conditions contribute to the efficient utilization of the shipping company's fleet. At the same time, the economic sustainability of shipping companies is addressed in two main directions: improving the techno-economic level of the fleet and utilizing organizational and economic factors to reduce operating costs. The latter, in addition to ongoing measures, includes the use of the foreign flag registration mechanism for vessels. The reduction of the tax burden resulting from this serves as an indirect factor in optimizing vessel utilization. Another factor driving the expansion of foreign registries has been the challenges in financing investment activities required for competitive fleet renewal.

A limiting factor in shipping is not only the parameters of cargo capacity, current cash flow, and investment streams but also the time required for executing competitive technological processes.

A properly drafted cargo plan ensures the protection of the shipowner's commercial interests. For example, during one voyage, at the end of unloading, mold was discovered in bags located in the last row near the aft bulkhead. A surveyor from the insurance company was invited on board. A marine protest was filed, citing adverse weather conditions encountered near the Cape of Good Hope. Due to sharp temperature fluctuations in air and water under stormy conditions, proper cargo ventilation was

impossible. Supporting documentation included hatch inspection reports issued by the surveyor before and during loading.

4.3. The stages of cargo plan development

The functional stability of maritime transport enterprises depends on three main types of constraints, the effective management of which should be the primary focus. The economic mechanism of the macro system and maritime shipping companies and ports should consider and reflect the nature of the impact of external conditions on the transport and logistics system; the technical and economic level of the fleet and ports, and the regulatory tax system. These constraints require the development of specialized tools for optimizing the parameters of the functioning of local transport subsystems.

However, the most important condition remains the maximization of the transport potential of each vessel based on the optimization of the cargo plan. Clear approaches and principles for developing a vessel's cargo plan have been developed.

Stage 1. Calculation of the amount of cargo that can be transported in the voyage.

For this, a table is created that contains the main characteristics of the cargo (total cargo quantity, specific loading volume – u_{average} , hold stowage factor – κ_{hold} , cargo mass – tons, and volume in m^3).

Based on these parameters and other commercial characteristics, the cargo is grouped into mandatory and optional cargoes.

Cargo mass (Q_{Σ}) = cargo quantity multiplied by κ_{hold} .

Volume (W_o) = cargo quantity multiplied by u_{average} .

The net cargo capacity and deadweight capacity of the vessel are known based on the vessel's size characteristics.

By calculating the mass and volume of mandatory cargo, the residual cargo capacity and cargo volume for optional cargo can be determined.

$$Q_{fac} = D_N - Q_n$$

$$W_{fac} = W - W_n$$

$$\bar{\omega}_{fac} = \frac{W_{fac}}{Q_{fac}}.$$

4.1 - 4.3

At the same time, it is necessary to keep in mind the presence of light and heavy optional cargoes.

$$Q_{fac} = Q_{fe} + Q_{fg}$$

$$W = \bar{u}_{fe} \cdot Q_{fe} + \bar{u}_{fg} Q_{fg}$$

4.4 – 4.5

The relationship between light and heavy cargoes is determined from the system of equations based on the criteria for full capacity utilization, maximum freight revenue, and normalized vessel stability.

Stage 2. Cargo distribution across the vessel's cargo holds.

The goal of cargo distribution across the cargo holds is to determine their compatibility based on physical and chemical properties. For this purpose, a compatibility table is used, where cargoes are arranged according to a special coding system:

- 1.– joint transport on the same vessel is prohibited.
- 2.– cargo can be placed in adjacent compartments.
- 3.– cargo is allowed in neighboring holds.
- 4.– cargo can be stored in the same hold but in different compartments.
- 5.– cargo is allowed in the same compartment but must be separated by other cargoes.
- 6.– cargo can be placed in the same compartment but with separation.
- 7.– cargo placement in the same hold is allowed.

Table 4.1. The characteristics of cargo compatibility

Cargo	Steel plate	Fire-resistant brick	Cotton	Timber	Galantry
Steel plate	X	7	6	6	6
Fire-resistant brick		X	6	6	5
Cotton			X	4	5
Timber				X	4
Galantry					X

Stage 3. Ensuring the strength of the vessel's hull

This condition is achieved through the optimal or permissible placement of cargo between the forward and aft compartments of the vessel, with restrictions in place to ensure that the optimal ship's trim moment is achieved.

The optimal trim moment of the vessel is determined based on the condition:

$$Md = D \cdot x_c - D_o \cdot x_o + m\delta d_{opt} \quad 4.6$$

where:

D – displacement of the vessel, in tons;

D_o – empty displacement of the vessel;

x_c – abscissa of the center of buoyancy of the vessel (positive from the midship towards the bow, and negative towards the stern);

x_o – abscissa of the center of gravity of the vessel;

m – specific differentiating moment;

δd_{opt} – optimal trim of the vessel.

If the calculated Md , based on the formula, exceeds the permissible limit, the correction is made by shifting the cargo from one hold to another at different horizontal levels.

Stage 4. Ensuring the stability of the vessel

The main characteristic of a vessel's stability is the initial metacentric height.

$$h_o = z_m - z_g \quad 4.7$$

where:

z_m – the distance from the keel to the metacenter;

z_g – the distance from the keel to the center of gravity.

If the vessel's stability is not within the permissible limits, the correction of the initial metacentric height is made by shifting the cargo vertically within the cargo holds. This adjustment helps to reposition the center of gravity and metacenter, thereby improving the vessel's stability to ensure it stays within safe operational limits.

Stage 5. Ensuring the Local Strength of the Vessel

The determination of the allowable load on any deck of the vessel is based on the vessel's technical and operational characteristics or by using an approximate formula.

$$g_{dop} = \frac{1}{3} H_{hold}, \text{ t/m}^2 \quad 4.8$$

Stage 6. This stage involves the representation of a graphical image of the vessel's cargo plan.

During the voyage, in accordance with the criteria of the cargo plan, the vessel's administration generates the necessary information and transmits it through the

relevant channels: current data, as well as more important reports such as departure notice and others. Additionally, the crew is required to prepare and submit the ship's equipment to the Register representatives.

A key task for the crew in commercial ports is the reception of bunkers and supplies. The captain is involved in a few different committees and has meetings with the ITF representative.

The macroeconomic perspective and the ability to maintain competitive positions in the original segment of the maritime trade market ensure the effectiveness of fleet and port positioning, despite the seasonal nature of cargo or passenger flows. At the same time, the high capital intensity required to build competitive production potential excludes the possibility of a quick response to subsequent changes. As a result, risks and reserves for the future use of the fleet's capacity are formed. In these conditions, it is important to implement the principle of supporting the entire system of jobs.

4.4. Standardization of Efficient Vessel Utilization

The global nature and universality of economic relations between maritime transport enterprises and foreign economic activity entities, along with the influence of the technical and economic level of the fleet and commercial ports on accelerating capital turnover, optimizing resource consumption among all participants in trade and economic relations, and intensifying the use of production potential, should be considered as a methodological basis for state support in the development of the national maritime transport complex. A key aspect of addressing this issue is the standardization of economic potential utilization, taking into account the limits of production factors and regulatory functions arising from the current IMO conventions.

In this regard, each shipping company establishes and maintains its own regulatory framework. This framework defines the principles and procedures for developing the necessary operational standards for business activities and the efficient use of the fleet.

A **norm** refers to the maximum allowable value of the absolute result of resource utilization in functional activities. This includes fuel consumption norms, cargo handling intensity norms, wage and working time norms for seafarers, and other standards.

Standards are considered parameters that characterize the degree of utilization of production potential in primary functional activities under standard conditions.

There are specific standards for the utilization of vessel cargo capacity, including:

Vessel loading norm (QE) – representing the amount of cargo loaded in tons with the corresponding loading volume.

Load per ton of registered cargo capacity upon departure (ε) – indicating the efficiency of cargo capacity utilization during a voyage.

The vessel loading norm determines the total weight of the loaded cargo, ensuring optimal ship performance and effective use of transport resources.

The load norm represents the amount of cargo, in tons, corresponding to one ton of registered cargo capacity. This metric reflects both the quality of the cargo planning process and its execution under the prevailing conditions.

$$\varepsilon = \frac{Q_E}{Q_P} \quad 4.9$$

The utilization of cargo capacity is determined by a combination of cargo characteristics and the structural features of the vessel. The key factors include:

1. Type of cargo.
2. Specific loading volume of the cargo.
3. Vessel's specific cargo capacity.
4. Port depth and cargo stowage density.

In vessel chartering practices, the condition of optimal cargo loading volume is achieved when the specific loading volume of the cargo equals the vessel's specific cargo capacity ($\omega_r = \omega_c$). This ensures the full utilization of both cargo capacity and cargo space.

One of the most critical factors influencing the global maritime transport services market and the operational activity of its participants is the efficiency of capital assets. To assess the effectiveness of various business strategies and the technical and economic development of fleets or ports, the ratio of profit mass to capital investment is used.

$$E_{KP} = \frac{R_V - C_S}{K_P} = \frac{P_R}{K_P} \quad 4.10$$

where:

R_V – revenue of transport enterprises engaged in freight or stevedoring markets.

C_S – current costs incurred due to the functional operations of a shipping enterprise's vessels.

K_P – cost of fixed assets or the capital investment required to ensure the normal operational activities of a transport company.

The quality of norms is largely determined not only by the structure and composition of the fleet but also by the management's interest in effectively reflecting objective processes in commercial shipping. The regulatory framework of a shipping company must be based on clear organizational principles and take into account institutional regulation methods set by international maritime organizations.

The regulatory framework of a shipping company includes:

1. The organizational and administrative management subsystem for the regulatory framework.
2. The subsystem of norms and standards.
3. The subsystem for the economic justification of the regulatory framework.

Ultimately, four groups of factors determine the tasks of improving the technical and economic level of the transport fleet and enhancing its efficiency:

1. **First group** – potential cargo and passenger transportation volumes, fleet cargo turnover, hydrometeorological parameters of navigation routes, transportation distances, and other external factors influencing transport results and production potential utilization.
2. **Second group** – tariffs for services provided by maritime transport enterprises, specific economic resource costs in fleet and port operations, resource intensity of transportation processes, and fleet labor productivity.
3. **Third group** – structure of capital assets by age, their role in the production process, vessel depreciation parameters, fleet renewal rates, reproduction, technological and industry structure of capital investments, and life cycle duration of projects.
4. **Fourth group** – technical and economic level of transport assets, productivity and time utilization efficiency, intensity of transport operations, integration of transport technologies and logistics systems, fleet and cargo terminal productivity, and the capital intensity of production potential units.

These factors influence the strategic development choices and operational activities, shaping the differentiation of segments within the maritime transport services market. In real operational conditions, taking into account competitiveness, shipping enterprises often face challenges related to investment activity limitations (see Figure 4.3)

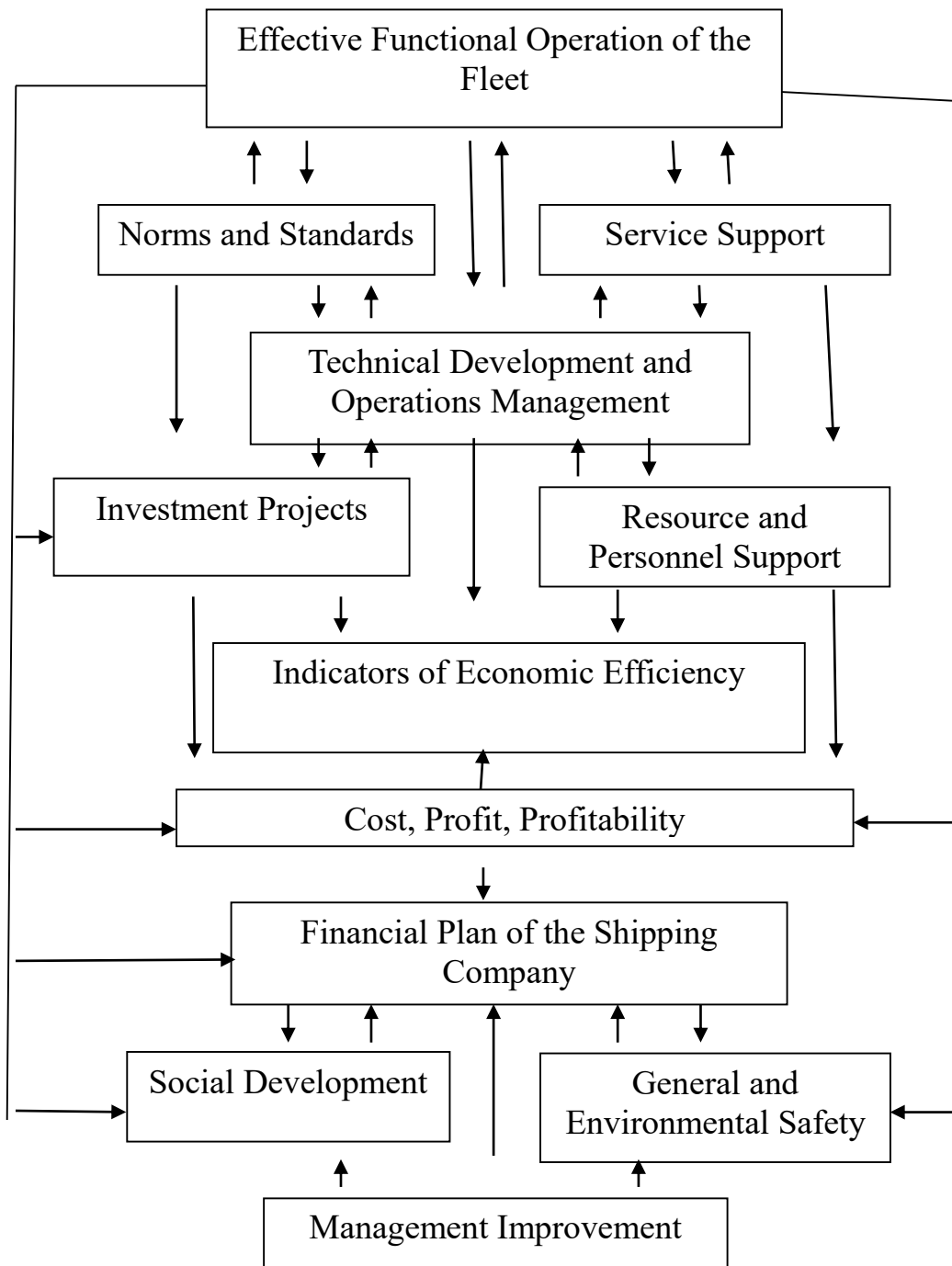


Figure 4.3. The Interrelation of Sections in a Shipping Company's Operational Plan

Integration processes aimed at maximizing capital returns dictate the need for effective management and control over both individual and aggregate results. Stability in this context should be understood as the optimal concentration of transport potential, regardless of the organizational and economic forms of ownership. The optimization of economic outcomes in multimodal transport technologies is based on the temporal concentration of labor and capital resources in transport hubs.

It is also important to highlight fundamentally new trends in the development of the commercial fleet's tonnage and the growing economic resource requirements for its normal functioning.

This primarily concerns navigation and shore-based safety support, as well as preparations for significantly reduced crew sizes. At the same time, labor intensity in liner shipping has increased, progressing alongside higher levels of automation in production processes.

One of the specific objectives of commercial fleet development is the ability to implement new technical innovations that significantly enhance seafarer productivity. Given the limited availability of core resources, the rising cost of training and compensating maritime professionals, and the increasing complexity of operational demands, fleet development is increasingly reliant on resource-efficient and diversified technological processes. As a result, major shipbuilding centers and shipowners prioritize ensuring the reliable operation of vessels with minimal crew sizes. However, the growing technical complexity and workload also lead to a higher frequency of emergency situations caused by human factors.

4.5. Pricing in the Maritime Trade Market System

The main disadvantage of assessing the state of maritime transportation is the limited analysis of tariff rate formation for specific cargo routes on relatively stable shipping lanes.

The fleet management system considers the absolute values of tariff rates and the index of their probable movement. These indices serve as a kind of regulatory framework for managing commercial shipping. Various methods for determining freight indices have been adopted.

The Baltic Dry Index (BDI) reflects changes in the cost of maritime transportation for raw materials such as metal, iron ore, coal, and grain. The index includes three other freight cost indices, differentiated by the sizes of the vessels for which they are calculated: Capesize, Supramax, and Panamax.

Based on the dynamics of the BDI, investors and market participants assess key trends in global supply and demand. The index is often considered a primary indicator of economic growth prospects or recession. This is because the raw materials included in the index have a low potential for speculative operations.

The index reached its maximum value of over 11,700 points in May 2008. However, starting in July, it experienced a sharp decline due to the unfolding global financial and economic crisis. By the end of that year, the BDI had dropped to 663 points. During a prolonged period of stagnation and slow global economic recovery,

the BDI peaked at 4,209 points in 2010, with a minimum value of 1,700 points that same year.

2010–2014: After the 2008 crisis, the index began to recover but remained unstable. In 2010, the BDI peaked at 4,209 points but then gradually declined, fluctuating between 1,000 and 2,500 points. The main reasons were the slowdown in China's economic growth and excess shipping capacity.

2015–2016: The index continued to fall in 2015 and hit a historic low of just 290 points in February 2016. This was due to a slowdown in global trade, declining demand for raw materials, and an oversupply of vessels.

2017–2019: A recovery period began, driven by growth in global trade and China's iron ore imports. In 2018, the index exceeded 1,700 points, and in September 2019, it reached 2,518 points.

2020 (COVID-19 Pandemic): At the beginning of the year, the index plummeted to 411 points but quickly rebounded due to supply chain disruptions and increased demand for raw materials.

2021: The index surged, reaching 5,650 points in October 2021 – its highest level since 2008. The rise was driven by a global container shortage, high shipping demand, and limited vessel supply.

2022–2023: The index gradually declined due to the normalization of supply chains, falling demand for shipping, and China's economic slowdown. In 2023, the BDI fluctuated between 1,000 and 2,000 points.

2024 – early 2025: The index remained volatile but showed an upward trend in early 2025, surpassing 1,000 points. This growth is linked to recovering demand for dry bulk shipping.

The BDI has experienced sharp declines (2016), recoveries (2017–2019), a COVID-19-driven surge (2021), and subsequent corrections. Currently, the index remains volatile but is showing signs of growth.

Freight indices take into account the specifics of rate changes depending on the tonnage size. Indices for dry bulk tramp tonnage are calculated monthly based on freight rates for cargo transported by tramp vessels under various flags. The index covers nine bulk commodities shipped along key trade routes. The weight of commodity indices is determined according to freight assessments for each commodity in the base year. The overall freight index is calculated using the method of commodity sub-indices.

The average rate level for the annual period in relatively stable market conditions is accepted as the baseline. For this same period, the positions of the indexed indicators – cargoes, routes, etc. – are established. The adjustment of ratios in accordance with the changing conditions of international maritime transportation is carried out when

revising the index base. When constructing time charter indices, individual indicators are determined by the specifics of freight transactions (see Fig. 4.4), which are tied to the operational characteristics of the vessels and the duration of their charter.

When assessing changes in freight rates reflected in the indices, it should be noted that only the average value established by the weighting method is considered. For the forecast period, the weight ratio represented by the index may not correspond to the actual movement of cargo. Freight indices, while reflecting changes in the level of maritime transport prices, cannot evaluate the impact of changes in supply and demand in the maritime trade market.

The situation of free competition in commercial shipping creates priorities for the development of the fleets of shipping companies and the terminals of trade ports. As practice has shown, departmental regulation of port tariffs leads to a loss of several positions in the transit business in the 21st century. During this period, tariffs in Ukraine were 1.5 to 2.0 times higher compared to the main Black Sea ports of Turkey, Russia, and Romania. This is why cargo flows and shipping traffic shifted to alternative routes. To maintain the adequacy of Ukraine's maritime transport potential in competitive conditions, pricing must be based on the principles of free competition among service providers.

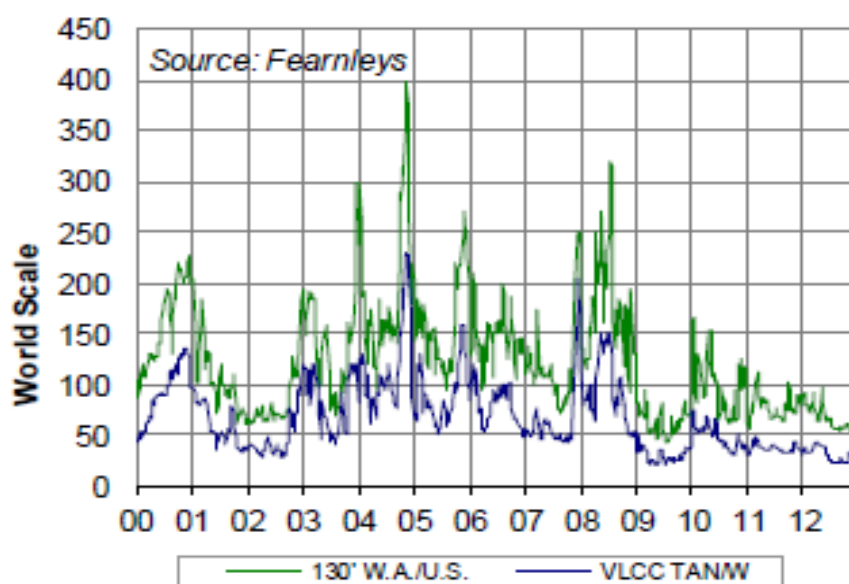


Figure 4.4. Changes in time charter rates by deadweight groups of the tanker fleet.

Considering the phase of the freight cycle, the shipping market corrects the imbalance between supply and demand by influencing freight rates to maintain cash flow. The main tool becomes the activation of new fleet capacity or, when freight rates contract, the sale of excess tonnage.

Once some vessels leave the market for scrap or when cargo flows begin to increase, freight rates rise, allowing operating companies to achieve significant profits.

Market conditions in the segment stabilize as a balance is reached between the demand for and supply of tonnage.

Decisions often need to be made under conditions where there are several alternative or mutually independent approaches. In this case, it is necessary to choose one or more alternatives based on a system of criteria. Clearly, the set of criteria can be contradictory, and there is a likelihood that one of the solutions may be more effective but carries a higher risk.

In the freight market system, the level of rates is determined by the main sections according to the methods of forming freight indices. As is well known, the Baltic Freight Index (BFI) has become the most widely used. Table 4.2 presents the characteristics of established rates for 13 routes.

Table 4.2. Formation of Freight Rate Levels According to the Baltic Freight Index.

Index 1.547 (-7) March 15.12					
Route		Cargo	Share, %	Current Period, \$/t	Base Level, \$/t
1	US Gulf – N Cont	Grain	10	15,414	15,394
1a	Transatlantic round	Time Charter	10	11.529	11.638
2	US Gulf – Japan	Grain	10	27.286	27,594
2a	US Gulf – FE time charter	Grain	10	15,157	15,231
3	US N Pacific Japan	Grain	10	15,479	15,544
3a	Transpacific round	Time Charter	10	10,321	10,225
6	H Roads -R Bay Japan	Coal	7,5	11,994	11,994
7	H Roads – Rotterdam	Coal	705	5,850	5,822
8	Queensland – Rotterdam	Coal	7,5	8,606	8,672
9	F. East – Nopac Cont.	Time Charter	10	7,586	7,638
10	Tubarao – Rotterdam	Iron Ore	10	5,525	5,517

Sharp changes in the Baltic Freight Index (BFI) over a short period, depending on the conditions for transporting dry cargo, create challenges in assessing the decline

of the freight market when forecasting future conditions. The problem lies in selecting the appropriate management mechanism for the transportation processes.

In changing conditions of the transport services market (RTU), it is important to ensure the optimal adaptation of shipping companies that traditionally provide transportation in this sector. For new shipowners, exceeding the technical-economic level (TÉU) of competitors becomes crucial, but it must be coordinated with the level of freight rates.

During periods when the average gross operating cost rates are exceeded, shipping activities in this sector of the freight market attract new shipowners. However, the expansion of operators will increase the supply of tonnage, negatively affecting the dynamics of freight rates. At low initial rates in this sector, shipping companies may become outliers. Over time, this will lead to financial losses for cargo owners due to a decline in the quality parameters of goods delivery, necessitating the stimulation of shipowners to increase the supply of adequate tonnage in terms of the quality of the transportation process.

4.6 Freight indices of the main segments of the maritime trade market

In the tanker segment, a single ‘Worldscale’ rate scale was established in the last third of the twentieth century. It was developed by the London Association of International Tanker Nominal Freight Scale and the American Association of Brokers and Agents. The rates were initially scaled to reflect changed costs and conditions relative to the bunker, stalemate time Average Freight Rate Assessment (AFRA). A standard tanker type is taken as the basis for calculating the current scale rates.

The Worldscale scale is expressed in the form of indices with a base rate of 100.

Weekly periodicity of indexes calculation makes them valuable for determination of current market conjuncture. It should be considered that significant number of deals in separate weeks leads to smoothing of monthly indicators, which are calculated based on indices for three weeks.

Different types of tanker chartering are accounted for by a combined indicator – AFRA. It characterizes the average cost of transporting oil and oil products in bulk. To calculate the AFRA, the share of oil monopolies' own tonnage in oil cargo transportation, as well as tonnage chartered from ship-owning companies, is determined on a quarterly basis. An average rate is determined for each direction for tonnage chartered by monopolies.

In order to compare freight indices calculated by different organisations, they are brought to a common base. Absolute values of indices for the selected base period are

taken as 100 per cent. The conversion of indices to a single base is performed by a special body of the maritime organisation.

The characterization of the indices is assessed by the changes in the merchant shipping environment that have occurred. Therefore, attention is focused on the assessment of changes in merchant shipping and their impact on the freight indices system. Of importance in the system impact is the increase in the global freight market volume (Table 4.3). Figure 4.5.1 shows the nature of changes in the tariff indices for two groups of tankers till 2012 year.

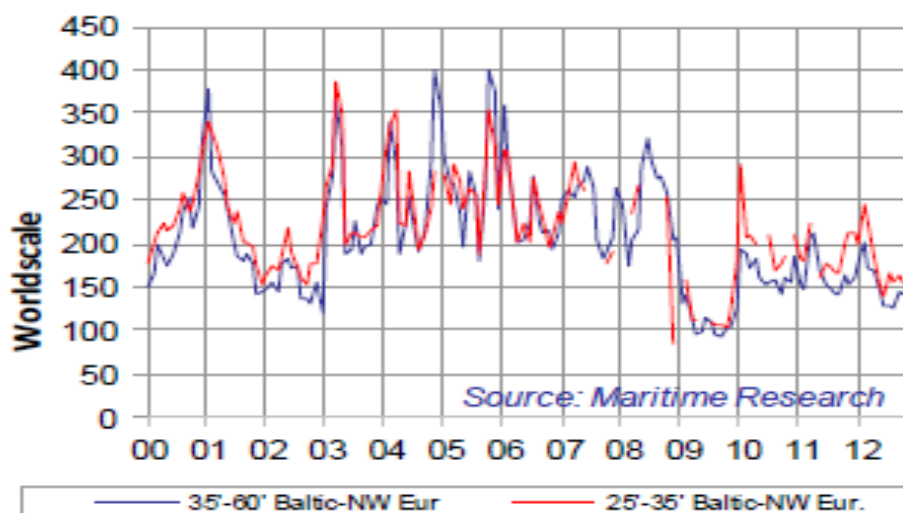


Figure 4.5.1 Dynamics of tanker freight index changes till 2012.

The rapid expansion of the freight market in the early 21st century was also characterized by qualitative transformations. The functioning of the maritime trade market has a significant impact on the economies of maritime nations.

The current methodology for constructing indices involves an annual review of their coverage and weighting coefficients in order to align the index with the changing structure of transportation. The set of cargo transport directions and their weighting coefficients correspond to the average ratio of freight sums between cargo groups and sections.

Over a long period, freight indices, reflecting the overall upward trend, accumulate not only changes in the linear and volumetric parameters of vessels but also the fluctuations in the international market conditions, which determine the short-term fluctuations in freight rates.

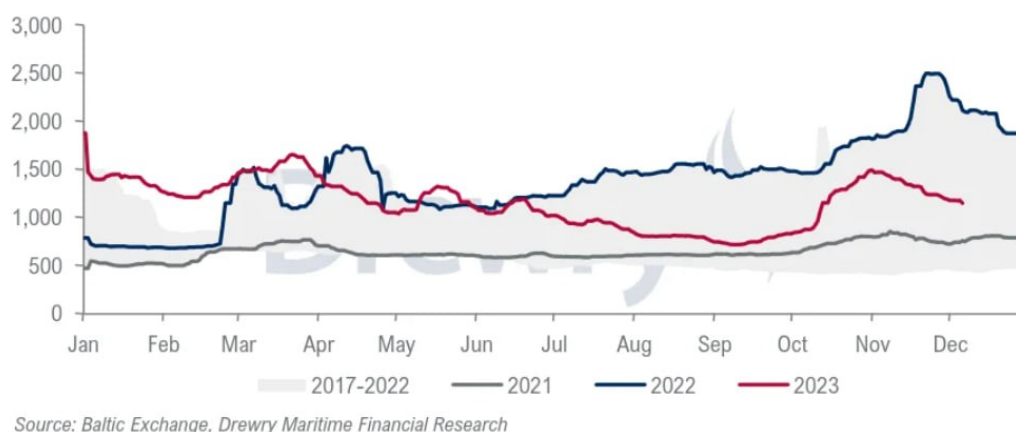


Figure 4.5.2 Dynamics of tanker freight index changes 2017-2023.

Source: Baltic Exchange, Drewry Maritime Financial Research

Above is attached the latest dynamic of tanker freight index changes (Figure 4.5.2). In 2022, there was a sharp rise in the index in March-April and November, which may be related to changes in the oil market. In 2023, the index remained below the 2022 level for most of the year.

The combination of cargoes, alternative routes, and weighting coefficients used for calculating one of the voyage indices is provided in Table 4.3.

Table 4.3. Differentiation of regional pricing conditions in the maritime trade market

Cargo	Weighting coefficients	Cargo routes
Grain	68	Ports of USA (Gulf of Mexico) – Northwestern Europe
		Ports of USA (Gulf of Mexico) – Western India
		South and East Australia – England
Coal	7	Hampton Roads – Japan
		Newcastle – Japan
Sugar	7	Philippines – Ports of USA
		Mauritius – London
		Queensland – England
		Queensland – Japan
Iron ore	6	Mormugao – Northwestern Europe
		Mormugao – Japan
		Madras – Baltic

Phosphate	-	Casablanca – China
Rice	-	Shanghai – Sri Lanka
Fertilizers	-	Ports of USA – Brazil
Dill	-	Philippines – Antwerp – Hamburg range

The freight index for bulk carrier tonnage is calculated based on the average rates for the base year. It represents the arithmetic mean of sub-indices, which are calculated for selected transportation routes. Additionally, group indices combine routes that are oriented towards specific continents. The indices are calculated based on the nominal values of freight rates for individual cargos.

The indices for dry cargo time charter tonnage are calculated monthly or quarterly based on the base year and tonnage groups. The dynamics of this freight index are presented in Figures 4.4 and 4.5.1.

These calculations are carried out monthly by the German Ministry of Transport. The chosen year's level (100%) is taken as the base for the index. The indices are calculated based on freight rates for major tonnage groups of vessels.

Indices for liner tonnage are calculated monthly and consider changes in liner tariffs for major cargos transported by vessels of all flags through the ports of the North Sea range.

When chartering ships, it is necessary to calculate the possible freight rate level based on the index level and determine the feasibility of making the relevant decisions. Maritime transport is characterized by a certain level of risk due to the volatility of the major segments of the maritime trade market.

UNCTAD has developed a methodology for constructing the liner tariff index for goods exported by developing countries. The calculations are based on the most significant cargo flows. The index is calculated using the aggregate index formula (Laspeyres) with constant weights. The calculation period is quarterly.

4.7. Programming Events to Ensure the Resilience of the Shipping Company

Operational activities in the current conditions of the freight market should be based on the assessment of freight index dynamics. This process can be examined in the grain segment, which is strategic for Ukraine. Chartering vessels requires ensuring their compliance with fundamental maritime safety regulations.

Any programming within the framework of crisis management activities takes into account the necessity of carrying out standard planned actions that fully correspond to the current conditions of market relations as well as special stabilization

measures in case of disruptions. There are several approaches to programming crisis management strategies.

Stabilization programs generally include cash maneuvers to bridge the gap between expenditures and inflows. The increase in cash is based on converting certain assets of a shipping or port enterprise into cash form. However, it is necessary to take into account the inevitability of losses influenced by the time aspects of implementing this strategy.

Among the programmed anti-crisis measures, the business activity of residents abroad stands out. The ambiguity of this strategy is due to a number of factors. On one hand, there are concerns about the impact of corporations on national governments; on the other hand, the population, by participating in the investment process, ultimately ensures an increase in the standard of living.

Foreign investments are subject to crisis situations for various reasons. Special attention is given to the ability to strengthen based on the implementation of a strategy for acquisitions by foreign competitors. This determines the tasks of maintaining competitiveness and implementing a quality management and control system for the transportation process.

In crisis situations, the issue of relationships between management and workers (crew members) becomes more acute. The balance of rights and responsibilities between management and employees is important, which is effectively realized in Japanese corporations. However, a significant responsibility lies with the management personnel. Employees exercise their rights through stable employment and wage levels.

At the same time, contradictions arise and persist between consumers and business people. The latter are perceived in crisis conditions as a distinct class of dishonest citizens, primarily focused on increasing profits and shifting financial problems onto workers. This is also confirmed by the nature of the anti-crisis measures implemented in Ukraine.

Most world economies have shown that this is largely true, despite the presence of patrons capable of implementing charitable programs. In this process, two anti-crisis approaches are distinguished. The first is the solution of macroeconomic tasks based on government programs supporting the national production sector and reducing certain institutional costs. The second is entrepreneurial strategies that take into account the reduced cash flow and the necessity of corresponding cost reductions.

The idea of free enterprise, without limiting the number of operators, somewhat contributes to an increased likelihood of crisis situations, as everyone focuses on a unified demand system without coordinating the quantity and quality of the fleet's cargo capacity supply.

The economic basis for stabilizing the situation can be risk management, which arises in the process of providing transport services and cargo delivery technologies.

Differentiation and diversification programs. When maritime transport enterprises interact with freight shippers, a number of factors emerge that lead to the formation of uncertainty and risk situations. This is due to financial instability in certain segments of international trade and the emergence of the factor of insolvency among freight forwarders and operators.

The effectiveness of lending (revolving financing) in the system of anti-crisis strategies for the development of maritime transport enterprises is based on taking into account the parameters of position retention and normalized payback period of capital expenditures. The latter include the increase in cost due to interest on loans in accordance with the discounted changes in the cash flow amount.

Measures to eliminate obstacles in the structure of current operational activities are implemented through short-term revolving investments. Creative managerial initiative in the system of evolutionary change in the charter market conditions should rely on the use of existing reserves.

In the management structure of a highly concentrated shipping company, it is essential to create a professionally strong and influential group of specialists who work closely with technological and organizational divisions. The key aspect becomes the timely differentiation of resources based on the parameters of changes in cargo flows within the operational segment. Overall, this approach can be viewed from the perspective of the effectiveness of adapting specialization and functional activity directions based on established technology within the logistics and intermodal communications structure.

4.8. Risks of financial stability of a shipping company

Among the many economic risks, the risk of insolvency of cargo owners or charterers should be considered central. This risk manifests as the possibility of revenue loss from vessel operations, which in turn increases the likelihood of low solvency for the shipping company or port.

To mitigate this risk, it is essential to conduct timely and comprehensive assessments of the financial and economic condition of cargo owners. The evaluation is based on indicators of solvency, financial stability, and liquidity of the enterprise. Standardly, a company's solvency is determined by its ability to meet payment obligations on time. In risk management strategy, the key objective is to ensure conditions that allow for the transformation of capital or other assets into necessary

cash flow within the accounting period. The stages of risk management in commercial shipping are illustrated in figure 4.6.

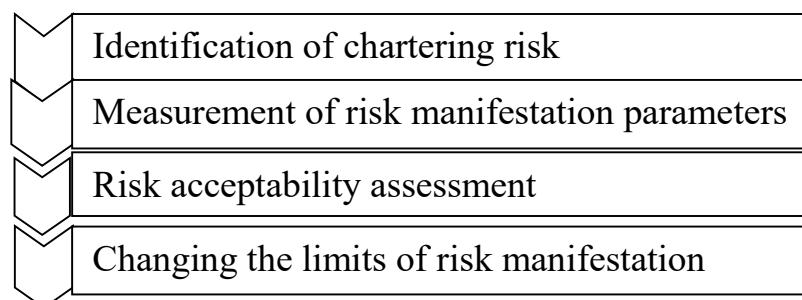


Figure 4.6. Stages of risk management

Financial stability of an enterprise is understood as its independence from external sources for obtaining the necessary amount of funds.

$$\frac{P_r(1-t_x)}{K_p} \geq \frac{P_{cmd} - P_{cp}}{P_{cm}} \leq \frac{V_{ad}}{R_v} \quad 4.11$$

where:

P_{cmd} – perceived value of products or services due to the development of the object;

P_{cp} – price per unit of transport services under market equilibrium conditions;

P_r – profit of the maritime transport enterprise;

t_x – profit tax rate;

K_p – value of nominal assets;

P_{cm} – marginal valuation of transport services in the current competitive environment;

V_{ad} – added value;

R_v – company revenue.

In the spot freight market, conducting a comprehensive systematic analysis of the financial condition of potential transport service consumers is challenging. Therefore, before making decisions, a quick risk analysis of charterers' solvency can be performed in a specific sequence.

Based on the accounting balance sheet, the calculation of indicators characterizing the level of risk in relations with traditional and new users of transport services is carried out. The basis of such an assessment is a system of indicators and norms known for the conditions of a market economy.

The current liquidity ratio reflects the ability to cover short-term debt with current assets. The stability of the shipping company is achieved when it complies with the norm of this condition, which is within the range of 1 – 2.

The equity adequacy ratio reflects the availability of resources and the sufficiency of own working capital. In a positive state, a ratio within the range of 0.1 – 0.5 indicates that the transport enterprise has no internal operational problems. If this condition is violated, a risk arises of non-payment for work performed by other participants in the maritime transport industry (port services, canal transit, ship supply).

The absolute liquidity ratio characterizes what portion of current liabilities can be covered as of the budgeting completion date. The sufficiency of this indicator is within the range of 0.2 – 0.5.

The critical liquidity ratio assesses the forecasted payment capacity of the shipping company, provided that settlements with debtors are made on time (0.5 – 1.0). This indicator specifically reflects the risk of timely and full payment of wages to the ship's crew.

The autonomy ratio characterizes the degree of independence from borrowed funds, taking into account the share of own cash deposits in the total financial resources of the shipping enterprise. It is the diversification by vessel types and regions of operational activity that reduces the risk of negative impacts from narrow market technologies.

Despite the relatively low share of working capital in the assets of a shipping company, the provision of current and emergency reserves and expenses with its own sources of formation is one of the characteristics of anti-crisis stability.

Bankruptcy is considered one of the legal grounds for the liquidation of a business entity – either a shipowner or an operator. The procedure and conditions for recognizing a shipping company as bankrupt in order to satisfy creditors' claims are regulated by the Law of Ukraine “On the Restoration of the Debtor's Solvency or Recognition of Bankruptcy”. The right to initiate bankruptcy proceedings is granted to both the debtor and the creditor. The grounds for creditor claims include: a three-month delay in fulfilling obligations to the initiating creditor; a total minimum claim amount of at least 300 times the minimum wage.

Control Questions

1. Principles of managing the efficiency of the SC fleet operations.
2. Characterize the structure of resources in the functional activities of the SC.
3. Purpose and principles of forming a ship's cargo plan.
4. Main stages of drafting a ship's cargo plan.
5. Concept of cargo compatibility.
6. Methods of standardizing the productivity of the commercial fleet.
7. Structure of the functional activity and development plan of the SC.
8. Pricing features in the structure of the maritime trade market.
9. Essence and principles of building freight indices.
10. Programming and planning the sustainability of SC's functional activities.
11. Set of risks associated with the sustainable positioning of the SC.

Chapter 5.

MARITIME TRANSPORTATION MANAGEMENT

5.1 Basic forms of merchant shipping management

Merchant shipping is based on the use of a complex structure of various types of fleet and organization of their work in segments of specialization. At the same time, it is necessary to distinguish the peculiarities of the current state of merchant shipping. There are purely market segments of merchant shipping, which are based on competitive strategies. Besides, merchant shipping subdivisions based on production and technological principles of activity are being actively formed. At present, organizational forms of maritime transport shipping have been formed:

- tramp;
- liner;
- industrial;
- coaster or short-run, including cabotage communications;
- offshore.

A special place is occupied by the organization and management of the cruise industry fleet operation.

All forms of maritime management organization differ in economic importance and principles of transportation process management.

At formation of shipping companies, it is necessary to keep in mind that the totality of production relations should be legally formalized and materialized based on contracts, obligations and various funds. At the same time, traditional or informal ties and relations of shipowners, operators, cargo owners and service complex of the marine transportation industry remain important.

Traditionally, the merchant fleet was developed in the system of the so-called leading maritime powers. Financing of fleet development was based on private capital with significant state support. Shipowners used the merchant fleet quite efficiently. The basis of ship crews was made up of experienced sailors, mostly citizens of these countries. Such crews functioned in accordance with national principles of labor organization.

The processes of integration and globalization transformed the national merchant fleet into an international industry.

Many real maritime powers establish the Chamber of Shipping as a unifying structure of national shipowners. Among the main tasks of this body stand out:

- holding consultations on financial, economic, legal and other issues of SC activity;

- prevention of unfair competition;
- improving the image of the national shipping industry;
- increasing the human resources potential;
- strengthening the business reputation of the Chamber members;
- increasing competitiveness in the maritime trade markets;
- development of state shipping policy.

Organizational forms of merchant shipping represent peculiarities of management of shipping companies' activity under the influence of specific conditions of cargo delivery and peculiarities of transport potential concentration.

Organizational forms of merchant shipping are determined by:

- capacity and structure of cargo flows;
- the type of transported cargoes;
- nature and economic parameters of commodity groups forming cargo flows;
- partiality, frequency and rhythm of cargo transportation;
- directions of cargo flows or routes.

In accordance with these characteristics the requirements to ships are formed, which can be grouped by three characteristics: technical, economic and operational-organizational.

The data for calculating fleet utilization and demand indicators are determined based on an analysis of their actual level in the base period, as well as planned changes in key factors. These factors include the volume and structure of cargo and passenger turnover, route length, ship navigation areas, measures to improve vessel loading and reduce empty runs, as well as technological progress in the fleet, ports, and shipbuilding enterprises.

5.2 Purpose and conditions for optimization of the state of shipping companies

Fleet management organization is aimed at optimization of transport potential use according to the criteria of cargo flows, transport fleet vessels and transportation process technology compliance. In this case, the effective realization of the functional purpose of shipping companies is ensured.

The maritime trade market (fig. 5.1) is represented in the form of separate functional branches united by a common task - the formation of maximum intrasystem cash flow on the basis of performed cargo and passenger transportation. The second

contour of the system should be considered reliable service and investment support of transport owners and cargo owners.

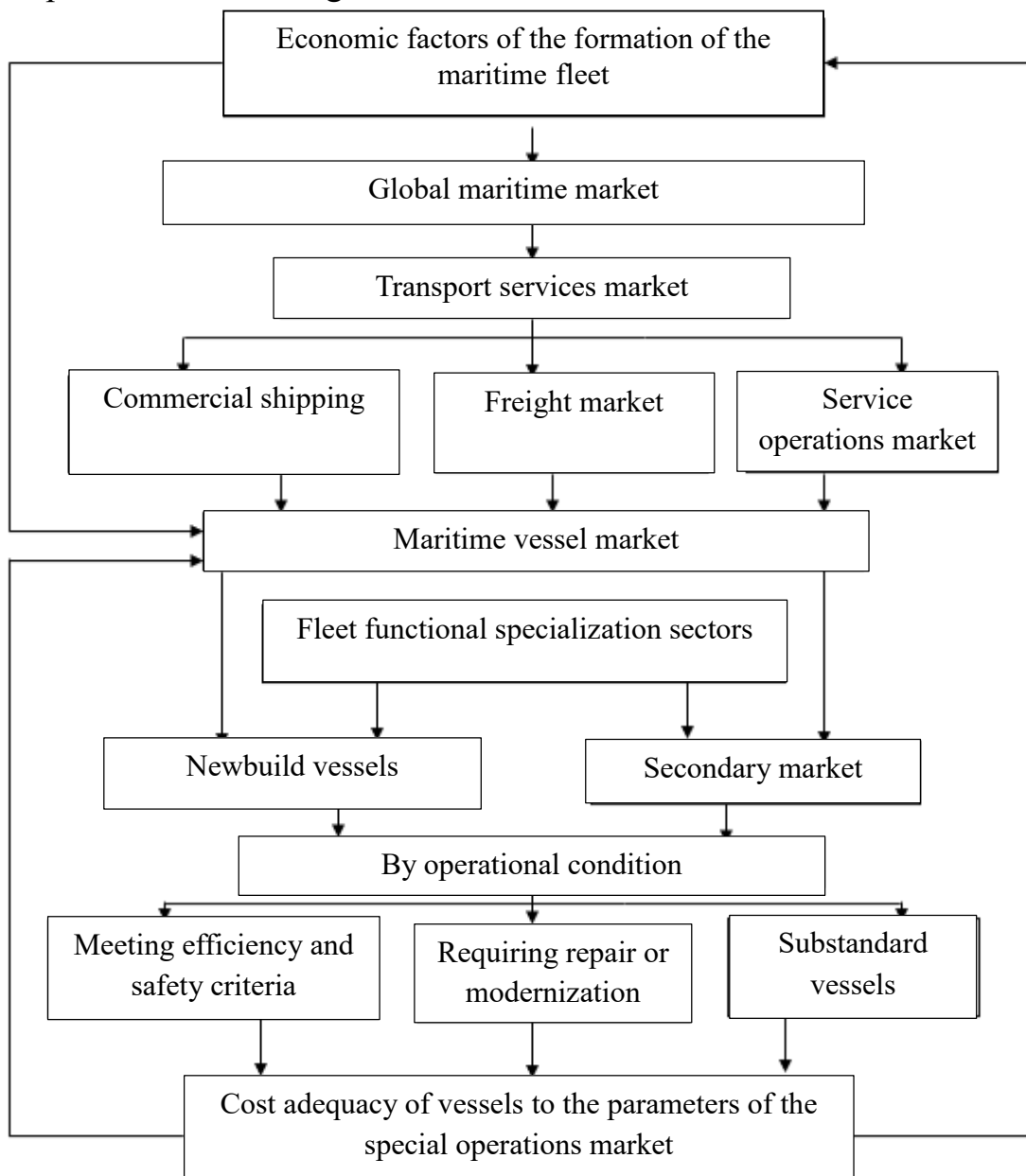


Figure 5.1. Decision-making conditions for optimizing fleet composition in relation to the state of the world maritime market

Large stable cargo flows form conditions for specialization and typing of the fleet by three main features:

- the type of cargo to be transported;
- transportation technology;
- region of operator activity.

Typization - takes into account the peculiarities of vessel operation in certain maritime regions.

Specialization and typification also take into account the rotation of ports, their number within the route. Vessel sizes are also limited by the intensity of handling in commercial ports, which largely depends on the category of the company. Therefore, large specialized shipping companies are focused on owning not only transshipment complexes but also trading ports.

With the increasing role of the international division of labor in the formation of sustainable economic relations, the zone of operation of regular liner shipping is expanding.

However, due to the peculiarities of formation of cargo flows for a number of commodity groups, irregular forms of transportation - voyage shipping - remain important.

In order to estimate cash receipts from any form of ship ownership, it is necessary to study and analyze the state of the main sectors of the maritime trade market. Systematization of such data makes it possible to forecast cash flows more accurately and to choose the discount rate and risk parameters for decision-making.

Information support of economic and investment decisions is formed under the influence of a number of regularities and permanent cyclicity of the freight market functioning. At the same time, a multitude of random external influences does not guarantee clear information flows neither in the system of operator decisions, nor in the structure of decisions on realization of excessive fleet carrying capacity. Therefore, it is necessary to take into account the presence of a group of permanent risks in the shipping company's asset management.

The most important features of regular forms of freight transportation and fleet movements are considered to be:

- clearly defined direction of transportation;
- fixation of tonnage and operation according to the established traffic scheme;
- observance of a certain traffic regime;
- conditioned degree of accuracy of ships' departure from ports.

Systematic and regularity of economic and production processes is characterized by the level of efficiency. The advantages of regular shipping include:

- simplicity of operational management and planning;
- rationality of ship selection according to adequate parameters;
- constancy of the vessel schedule reduces the need for redistribution of tonnage by transportation directions;
- reduction of losses of carrying capacity;
- creation of prerequisites for specialization of vessels and terminals;
- increasing the share of the typified part of the shipping company's fleet, which reduces capital expenditures for the acquisition and maintenance of vessels;

- professional skills of crews are improved and fleet productivity increases;
- the labor intensity of ship handling is reduced;
- the quality of the transportation process is improved;
- a preferential regime of service provision at minimum rates of charges is realized;
- safety increases due to orientation to known conditions;
- business contacts are optimized on the basis of constant communication between crews and terminal workers;
- there is an increase in the level of functional competitiveness.

The development of intermodal communications and multimodal transport technologies, logistics systems and international transport corridors is based on regular shipping and the use of such management methods in other modes of transport.

The main consequence and characteristic of regular form of transportation is considered to be the rhythmicity of cargo traffic processing and acceleration of goods delivery. Strengthening the incentive role of management implies the use of a set of evaluation indicators reflecting the intensity of SC potential utilization:

- coefficients of transportation capacity utilization;
- levels of fixed capital utilization;
- increase in fleet carrying capacity;
- labor productivity parameters.

Due to the growth of foreign economic relations, structural shifts are formed by groups of fleet specialization. In its turn, the dynamics of cargo flows by directions and groups of cargoes predetermines radical changes by types of vessels of close specialization. Thus, more than half of the total deadweight of bulk carriers is accounted for by vessels with deadweight more than 50 thousand tons. Increase of average cargo carrying capacity is not only the growth of cargo flows, but also factors of economy of scale.

5.3. Resources for Transport Operations and Fleet Utilization

A general characteristic of economic resources is their limited nature. Their condition and utilization determine the parameters of effectiveness. In addition, the quantitative formation of both physical and human capital requires the use of initial investments and current expenses. The basis for calculating the efficiency of resource potential formation is the comparison of individual components in terms of return.

The socio-economic consequences of a shortage in the carrying capacity of the fleet and maritime transport specialists are diverse. The role of labor, both of the crew

and management, is growing in the effective utilization of the capital assets of shipping companies.

In maritime transport, a complex system of operational and economic indicators is used to assess the functioning of SC and the implementation of the transportation process. These indicators reveal specific parameters reflecting various aspects of the transportation process. A special group consists of resulting indicators.

These indicators allow for planning fleet operations, organizing effective functional activities, justifying development forecasts, and assessing the efficiency of resource utilization and the transportation process. The basic classification of all indicators is formed along four main features:

1. By area of calculation:
 - a) general transportation ;
 - b) industry and entrepreneurial .
2. By purpose and initial data:
 - a) planning and forecasting ;
 - b) reporting.
3. By content:
 - a) economic ;
 - b) operational.
4. By significance:
 - a) primary;
 - b) additional.

In the system of operational indicators, alongside their quantitative and qualitative features, the following classification groups are highlighted:

1. Quantity flows and their characteristics
 - Amount of freight flow and its structure

$$\sum Q = \sum q_i \quad 5.1$$

- Volume of freight flow

$$W = \sum_{i=1}^n q_i \bar{u}_i \quad 5.2$$

- Magnitude of consolidation points

$$n_K = \frac{\sum Q}{q_n} \quad 5.3$$

2. Parameters characterizing the lines

a) Availability or requirement of tonnage

$$\sum D_N = \max\{D_{NQ}, D_{NW}\} \quad 5.4$$

b) Cargo turnover

$$\sum Ql = \sum_{i=1}^n q_i l_i \quad 5.5$$

c) Average distance for transporting 1 ton of cargo

$$l = \frac{\sum Ql}{\sum Q} \text{ mil} \quad 5.6$$

It actually averages the systemic operation, regardless of the conditions of commercial shipping (see Fig. 5.2).

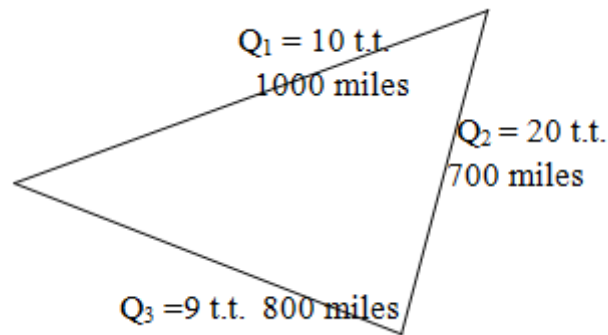


Figure 5.2. Scheme of the ship's movement and the formation of the average distance for transporting cargo

c) Total length of the line or distance traveled by the ship

$$L = \sum l_i \text{ miles} \quad 5.7$$

d) Cargo turnover ratio. It characterizes the operational capability of the vessel and the specifics of loading a ship operating on a route. The ratio varies from one to a maximum.

$$\beta = \frac{L}{l} \quad 5.8$$

e) Vessel's carrying capacity utilization ratio

$$\alpha = \frac{\sum Ql}{\sum D_N L} \quad 5.9$$

In the numerator is the useful transport work, and in the denominator is the potential transport work. The ratio ranges from zero to one. A minimum value indicates the absence of useful loading of the vessel's capacity

f) Intensity of line operation coefficient

$$I_n = \alpha \cdot \beta \quad 5.10$$

It varies from zero to infinity.

g) Weighted average gross rate of cargo operations on the line

$$M_B = \frac{2 \sum Q}{\sum \frac{Q_i}{M_i}} t/d - day \quad 5.11$$

The number 2 indicates that the cargo on the vessel is transported twice: first loading – then unloading.

h) Standard break coefficient

$$\kappa_M = \frac{\bar{M}_B}{\bar{M}_N} \quad 5.12$$

$$M_N = \frac{\sum Q}{t_{LO}}$$

$$M_B = \frac{\sum Q}{t_{LO} + t_{an}} \quad 5.13 - 5.14$$

The level of these indicators influences the choice of the calculated deadweight of the line or the maritime range. The primary reason for the increase in the unit deadweight, particularly for bulk carriers, is the stable development of maritime trade in bulk commodities of mineral and plant origin. The suppliers of these products are countries capable of ensuring significant cargo flows and located at considerable distances from the main consumers. Moreover, the development of production in post-industrial countries is increasing the demand for mineral and energy raw materials.

Improvements in shipbuilding and the enhanced reliability of large-tonnage vessels have also contributed to the stability of the large-tonnage fleet segment.

It is essential to emphasize that the use of various methods for assessing and analyzing the current situation allows for the consideration of forecast assessments and calculations. This diversity manifests itself in the form of alternative approaches to decision-making and achieving unquestionable feasibility by varying the main parameters. Simulation models can be employed in this process.

5.4. Indicators of Transport Resources of Shipping Companies

These indicators reveal the key parameters of production potential and the conditions for its implementation. The system of planned and evaluation indicators should ensure the assessment of how well the demand for cargo and passenger transportation is met.

The role and significance of an indicator in the management system and performance assessment are determined by its universality and its ability to reflect the main factors of the global maritime trade market. The system includes indicators that encourage the utilization level of fleet potential, efficiency, and quality of operations, as well as those that define the conditions for rationalizing the positioning of shipping companies within the maritime transportation system. A crucial structural component is formed by the indicators of the transport resources of the enterprise.

1. Ship's carrying capacity

a) Net cargo capacity

$$D_N = D_B - \Sigma P_{dz} \quad 5.15$$

b) Gross cargo capacity

$$D_B = D_W - D_{VO} \quad 5.16$$

where:

D_B – displacement

ΣP_{dz} – lightweight of the ship / **empty weight of the vessel**

c) Change in Ship's cargo capacity

$$\Delta \eta D = \frac{1}{48} a T_s \quad 5.17$$

where:

a – the number of tons per cm of the ship's draft, i.e., how much cargo must be loaded to change the ship's draft by 1 cm.

T_s – ship's draft at the summer load line, cm.

- d) Gross Register Tonnage – GRT B GT.
- e) Net Register Tonnage – NRT
- f) Bale Capacity – W_k
- g) Bulk Capacity – W_H
- h) Ship's daily supply consumption during sailing and berthing – $g_{s.t.b.}$;
 $g_{b.t.b.}$
- i) Ship's Production Capacity

$$N_c = D_N V_T \quad 5.18$$

V_T – ship's technical speed

2. Ship and fleet time budget

- a) Operational period of the vessel

$$T_{OP} = \sum t_s + \sum t_b \quad 5.19$$

- b) Non-operational period

$$T_{NOP} = 365 - T_{OP} \quad 5.20$$

- c) Average operational period of the fleet

$$\bar{T}_{OP} = \frac{\sum D_{Ni} T_{OPI}}{\sum D_{Ni}} \quad 5.21$$

The intensity of economic development of shipping companies (SC) based on high-tech processes determines the main requirement for transport services – timely delivery and reduced service time for cargo flows. This issue is addressed in two ways: through the technical and economic improvement of the merchant fleet and cargo terminals, as well as through the development of logistics technologies ensuring the continuity of resource flow management.

Labor resources play a fundamental role in merchant shipping. They ensure the efficiency of servicing global foreign trade flows and the productivity of the transport fleet. Ukrainian seafarers are in steady demand on the global labor market. However, it is also necessary to consider the traditional risks associated with this segment of human resources in merchant shipping.

It is enough to note that when the Greek company went bankrupt, 171 Ukrainian seafarers working on the liner “*Delphin Voyager*” were able to repatriate with the help of the ITF.

As global trade volumes and ship values grow, the role of labor resources in shipping companies increases, shaping the principle of their optimization and rational distribution among shipping companies. This resource is becoming internationally accessible.

5.5. Performance Indicators of a Transport Vessel

Management of fleet operations involves a systematic approach to accumulating, transmitting, and transforming relevant information. Accuracy, timeliness, and completeness of information are essential conditions for making qualified decisions and ensuring the quality of transport process management. The content and format of the information must reflect the requirements of managerial objectives.

Since the structure of the freight market is extremely dynamic, it is quite difficult to maintain proportional development across different service market sectors. However, a rigid pricing system, combined with high-quality requirements, serves as a natural selection criterion for market participants. At the same time, it is necessary to monitor and manage the condition of a shipping company using a specialized system of indicators.

It is crucial to clearly define the interrelationship between indicators that primarily stimulate the growth of transport operations and those that assess the efficiency and rational use of resources. The first group includes:

1. Quantitative operational indicators:

- a) net sailing time of the vessel – t_{ns} ;
- b) total sailing time of the vessel – t_s ;
- c) productive berthing time of the vessel – t_{pb} ;
- d) total berthing time of the vessel – t_b ;
- e) voyage time – t_v .

2. Loading and transport performance indicators of the vessel:

- a) cargo quantity transported per voyage – Q_{cq} ;
- b) transport work volume per voyage – Q_l ;
- c) required supply quantity per voyage

$$\Sigma P_q = P_{sq} + P_{bq} \quad 5.22$$

- d) potential transport work of the vessel – $\Sigma D_N L$.

IV. Operational indicators of transport efficiency:

a) number of voyages per operational period

$$n_v = \frac{T_p}{t_v} \quad 5.23$$

b) operational speed of the vessel

$$V_{op} = \frac{L}{t_s} \quad 5.24$$

c) coefficient of technical speed realization

$$k_r = \frac{V_{op}}{V_{tech}} \quad 5.25$$

d) sailing time coefficient

$$k_s = \frac{t_s}{t_v} \quad 5.26$$

e) berthing time coefficient

$$k_b = \frac{t_b}{t_v} \quad 5.27$$

$$k_s + k_b = 1 \quad 5.28$$

f) static cargo capacity utilization factor

$$\alpha = \frac{Q}{D_N} \quad 5.29$$

g) dynamic cargo capacity utilization factor

$$\alpha = \frac{\sum Ql}{\sum D_N L} \quad 5.30$$

h) productivity of one ton of vessel's cargo capacity

$$\mu = \alpha \cdot V_{OP} \cdot \varepsilon_s = \frac{\sum Ql}{\sum D_N T_{OP}} \text{ (t-m/t-d per day)} \quad 5.31$$

i) commercial speed

$$V_c = \frac{L}{t_v} \quad 5.32$$

The state of perfect competition and pure monopoly in the global transport services market is an exception. Most sectors of the freight market and many shipping companies are in an intermediate state, characterized by oligopolistic regulation of economic conditions and outcomes. The clearest reflection of this situation is container shipping, where monopolistic competition with elements of monopoly power is formed in the global freight market.

This is reflected in the quarterly fluctuations in tariffs, which depend on cargo flow parameters.

In commercial shipping, monopolistic competition is characterized by the fact that each SC holds a relatively small share of the global freight market. Therefore, the ability to control market rates is limited. At the same time, the presence of a large number of shipowners, despite international regulation of shipping companies' activities, does not eliminate the tendency of individual companies to reach agreements aimed at exerting price pressure on cargo owners.

For planning and implementing production and investment activities, preliminary analysis plays a crucial role. Conducted at the project development stage, it contributes to making well-founded and efficient managerial decisions.

5.6. Technical preparation of sea vessels

The central factor in the reliability of cargo transportation in global trade is the professionalism and experience of seafarers. This should determine the value of their labor. The principles of globalization and internationalization of commercial shipping predetermine, first, the unity of the economic and legal framework for the labor sector in the global transport services market and, second, the freedom of labor export based on professional competitiveness criteria. Considering these principles, a balanced state of job opportunities and labor supply is formed.

Organizational and technical measures for the development and functional activities of the shipping company cover the following issues:

1. Fleet Expansion, Vessel Acceptance, and Commissioning

Fleet expansion is based on orders for the construction of new vessels, the acquisition of new ships, and the purchase of vessels already in operation. A separate operation involves acquisition through bareboat charter.

2. Legal and Technical Regulation of Vessels

This is based on the preparation of ship documents that determine the vessel's legal status, including:

- a) Certificate of the right to fly the country's flag;
- b) Certificate of shipowner, vessel name, and home port;
- c) Ship operation form (specialization, year of construction).

The key documents regulating the vessel's technical standards include:

- a) Seaworthiness certificate (required for all vessels with a registered tonnage of 100 or more RT);
- b) Measurement certificate (linear and volumetric characteristics of the vessel);
- c) Load line certificate;
- d) Radio telegraph and radio telephone safety certificates;

e) Certificates for life-saving equipment, cargo handling devices, mooring equipment, and auxiliary mechanisms;

f) Certificate for anchors and anchor chains.

During operation, each vessel maintains the following types of logs, which record all processes, causes, and circumstances of the voyage:

a) Ship's log – the primary document with legal significance in case of any claims;

b) Engine room log – records the condition and operation of the engine, reversals, or propulsion status;

c) Radiotelegraph and radiotelephone logs;

d) Chronometer log – records the performance and condition of the ship's chronometers;

e) Compass log.

3. Fleet Passportization

This involves the preparation and completion of the ship's dispatch and operational form.

The form includes all linear, volumetric, weight, and speed characteristics of the vessel.

Attached to the dispatch and operational form are:

a) General arrangement drawings of the vessel;

b) Theoretical drawing of the vessel;

c) Curves of theoretical drawing elements.

4. Ensuring the Maritime Navigation Regime or Organizing Supervision of Maritime Navigation

To maintain the proper regime of commercial shipping, the following types of supervision are implemented:

a) Navigation supervision – Carried out by the captain of the seaport, whose responsibilities include registering vessels in the State Ship Register, issuing qualification certificates to crew members, and managing ship documents. It also includes processing ship arrivals and departures, issuing seafarers' documents, ensuring safety within the port waters, and granting permits for underwater operations.

b) Border supervision – Ensuring compliance with national border regulations.

c) Sanitary supervision – Inspection of quarantine cargoes for required certifications, control of rodents and pests, and implementation of degassing, deratization, etc.

d) Fire safety supervision – Monitoring the vessel's fire safety compliance.

e) Technical supervision – Carried out by the selected Classification Society to conduct technical inspections of vessels, including the following types of surveys:

- Initial survey – Conducted when the vessel is added to the shipping company's balance;
- Periodic survey – Conducted every four years;
- Annual survey – Performed once a year;
- Docking survey – Conducted after the vessel leaves the dry dock;
- Special survey – Conducted after repairs.

f) Labor supervision – Carried out by the trade union organization.

g) Flag state control – Ensuring compliance with the regulations of the vessel's flag state.

5. Formation of the Ship's Crew

The crew size depends on the vessel's purpose and specialization, displacement, the power of the ship's energy system (SES), and the level of automation.

In managing fleet efficiency, adherence to organizational procedures is considered a key factor. These procedures include rules and regulations governing the operational activities of shipping and operator companies. Most shipping companies develop specific action strategies for particular situations in the maritime trade market, ensuring the efficiency of the transportation process.

The selection of organizational procedures must ensure that the relevant management specialist considers all significant aspects that arise during the vessel's voyage. Furthermore, the organizational procedures include the company's programmatic provisions regarding the rules of commercial navigation.

The economic management of fleet operations is fundamentally based on various legal documents and customs. These documents serve as tools for managing the economic situation.

5.7. Institutional factors regulating fleet activities

The globalization of the maritime trade market and its dependence on the state of global socio-economic processes leads to an expansion of international administration in commercial shipping. With the full use of the MLC in commercial shipping, the Paris Memorandum has moved to new regulatory frameworks.

The MLC Convention applies to all commercial vessels. The activity of 500 GT vessels in international transport is based on international certification. The right to inspect vessels is differentiated in time. Port State Control (PSC) has the right of verification for countries that ratified the Convention prior to its accession, all others have this right after 12 months from the date of acceptance of its provisions.

The MLC Convention - sets standards for seafarers' living and working conditions. They form the requirements for compliance with the full set of rules by the

government and shipowners. Minimum international requirements have been established concerning the basic aspects of seamen's work and residence on board. This relates to minimum age, fitness for health, training and conditions of employment. The standards for pay, annual leave and repatriation have been formulated simultaneously.

Given the importance of the merchant fleet for the economic independence of the state, implementing a principle of government support is crucial. In this respect, the creation of conditions for budgetary self-sufficiency becomes urgent. The company's income under a system of benefits should contribute to the formation of investment resources. Selective tax concessions deter the fleet from going to the registry of necessity and allow to strengthen the country's freighter independence in foreign trade. Tax regulation is a form of disguised state aid in market conditions.

In accordance with the procedure for registration of arrival of ships at a seaport, approved by the Ministry of Infrastructure of Ukraine, before the start of loading and unloading operations, the vessel arrived in the port is inspected by an authorized person of the service of the captain. The International Shipping Company is inspected during the commission's work on board the ship to establish the absence of violations in the last voyage. For vessels that implement the principle of free practice in their operations, the control procedure is different.

The authorization for vessels to leave at sea and the discharge of maritime vessels from the port is carried out in accordance with the current Order and extends to ships entering the seaports of Ukraine. These procedures are carried out by the Port Master's Service.

It has been established that the master of a ship coming into port is obliged to provide the master of a seaport, either directly or through an agent, with information about the approach of the ship. In the event of a vessel entering cargo operations, the vessel shall be subject to control for safety of navigation in accordance with the Regulations.

Permission to leave the port is granted by the master of the commercial port after verification of the ship's documents, with positive results of the control of the condition of the ship and its readiness for departure at sea.

The master of the port shall not permit the master of a vessel engaged in cross-border navigation to leave the port area without customs marking on the general declaration.

The master of the vessel shall inform the master of the port of the planned departure of the vessel from that port no later than 56 hours before the scheduled time of departure for the voyage. Departure of the vessel within 2-3 hours before leaving

the port after completion of necessary procedures by port authorities. The main condition is the completion of loading and securing.

Departure from the port of a local communication vessel, the duration of which does not exceed 12 hours, it is allowed to process documents with his arrival in the port.

According to the SOLAS Convention (IMO), the term "company" refers to the shipowner or any other organization or individual, such as a manager or a bareboat charterer, who has taken responsibility for operating the ship on behalf of the owner. By doing so, they agree to fulfill all duties and responsibilities required by the Code.

International conventions set strict requirements for the technical condition of ships and the operation process, in which case the use of the ship may be administratively restricted or prohibited. A non-compliant vessel may be detained at the port, and its owner is forced to the consequences of unproductive downtime, additional port fees for the float and fines.

5.8. Integration technologies of cargo transport with the participation of merchant fleet

BIMCO plays a special role in regulating integration processes. It develops and revises standard forms of standard contracts of various types of chartering, transport documents of maritime and combined transport (pro-forma charters, bills of lading). Playing a significant role in the regulation of brokerage activities in the freight market, regulation of intermediation in maritime and related other modes of transport, it ensures the sustainability of integration processes. The documentation serving the sphere of trade in maritime transport products is developed. The practice of applying principles and rules is regulated in order to improve the efficiency of merchant shipping. An important function is to organize cooperation with other organisations whose activities are in the interests of merchant shipping.

Based on the implementation of the principle of integration, three forms of management of cargo flow processing efficiency are distinguished. The system of logistics technologies distinguishes between multimodal, intermodal and combined transport of goods. The following definition of these terms is used in the system of international transport.

In accordance with the UN Convention on the content of intermodal and multimodal transport technologies the following attributes are given:

Multimodal technologies are:

- the transport of goods,
- by at least two different modes of transport (such as ships, cars, wagons, airplanes and inland waterways);

- based on a multimodal transport contract;
- from the point of origin in one of the countries where the goods are accepted for responsible shipment by the multimodal transport operator to the point of receipt in another country.

Intermodal transport - the term originally originated in the USA. It reflects the delivery of goods by different means of transport based on a single transport contract.

Combined transport is often associated with multimodal transport process. However, the term mainly reflects the use of different means of transport in the delivery of goods in the national or international segment of the transport services market.

Multimodal technologies of transport service of specialized cargo flows are based on the clear interaction of all components of the infrastructure complex of the region or global transport space (Fig. 5.3)

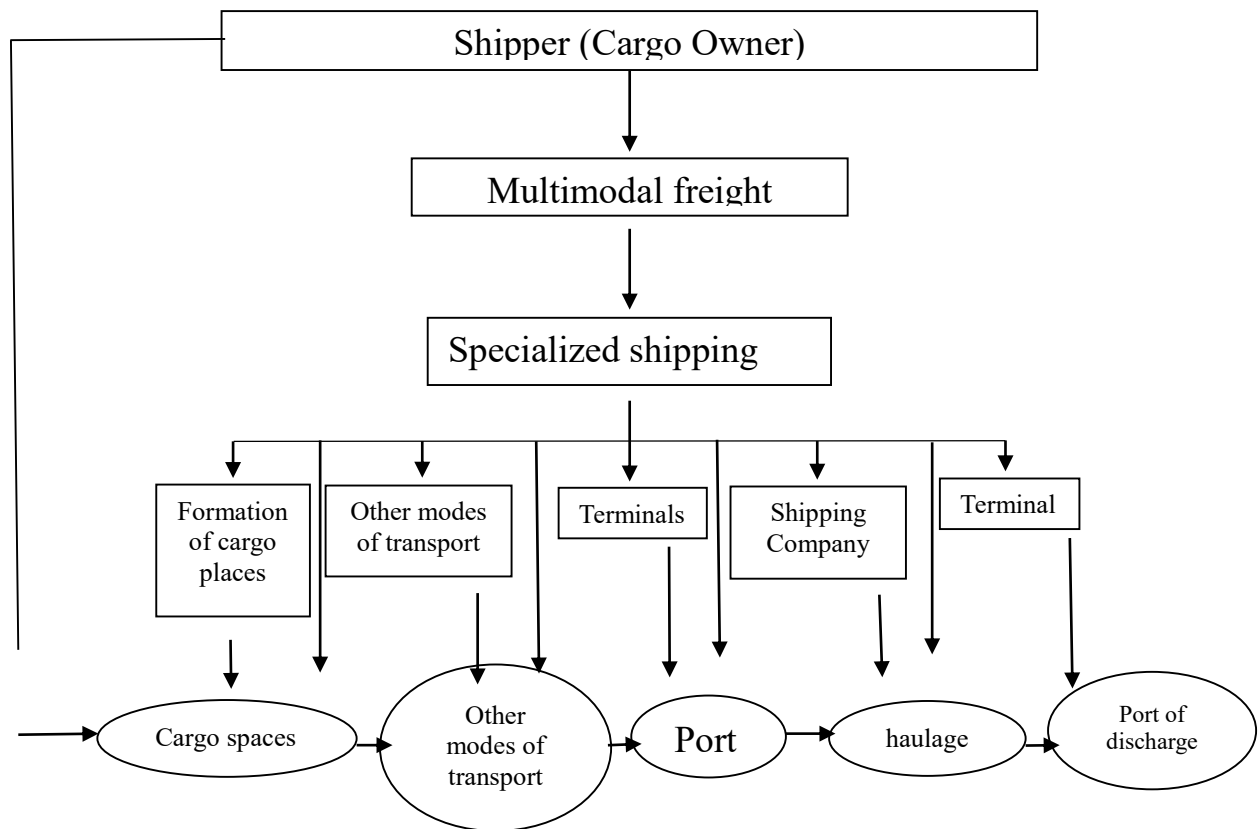


Figure 5.3. Shipping company in multimodal transport technologies

In multimodal technologies with the participation of container shipping companies, the distribution of risk is extremely unknown because there is a sharp differentiation of capital intensity of individual operations and subsystem participants.

A shipping company operating in multimodal technologies should consider the differentiation of costs by the main components of the process:

- vessel costs;
- expenses for the formation of multimodal contract means (containers, other ways of consolidation of cargo places);
- port charges and loading and unloading costs;
- costs of feeder shipments;
- costs of cargo delivery by land transport subsystems and inland waterway transport.

The optimal cost thus depends on a combination of factors and decisions. This accounts for the complexity of forecast calculations.

The International Shipowners Association was founded in 1970. Its members are national shipowners' associations, large shipping companies from Europe, Asia and America. Considering the problems arising as a result of introduction of new shipping technologies, it deals with development of joint lines, joint organization of feeder service of ocean lines, development of container shipping, unification of documents, tariffs and shipping rules, organization of mixed agency firms, coordination of fleet development prospects.

The average cost of sea transport depends on the cargo capacity of a vessel, predetermined by the factor of economies of scale. However, the use of such vessels requires appropriate ports and additional costs for dredging in ports and on approach channels. The efficiency of the large-capacity fleet is driving the construction of the second string of the Suez Canal and the construction of a new canal between the Atlantic and Pacific Oceans.

5.9. Features of coastal shipping

Despite the strengthening of commercial maritime navigation within the global maritime transport industry, increasing attention is being paid to enhancing the role of the coastal shipping segment. In the European Union's strategy, significant focus is placed on the development of shipping under the "Motorways of the Sea" project, concentrating resources on increasing the importance of short-sea shipping routes. Attention and efforts are directed toward addressing the following tasks:

- Improving port efficiency;
- Enhancing and increasing the quality of service operations in commercial shipping;
- Shifting part of the cargo flows from land transport modes to short-sea shipping routes.

The period of extensive development of the long-distance fleet is determined by the tasks of maintaining international economic relations. However, the simultaneous development of domestic cargo flows based on land transport modes has led to increasing environmental problems. That is why, considering the economic advantages of the small fleet, coastal “short-sea” shipping projects are expanding.

Its operational area includes domestic and international cargo and passenger transportation as an alternative to the expanded use of road transport.

In fact, the principle of optimizing interactions between different types of transport enterprises is being implemented based on the criteria of economic positioning by transportation distance.

It is necessary to distinguish the problems of developing and implementing coastal shipping:

- the lack of perception at the macroeconomic level of the methodology and organization for achieving the target goal;
- underestimation of the process and principles of planning this type of maritime communication;
- inadequacy of the response to external conditions for the operation and development of the specialized fleet;
- passivity of entrepreneurial structures and cargo owners;
- rising costs in forming competitive sustainability (problems of achieving a normalized state);
- the long duration of the process of developing, implementing the project, and forming positive results under conditions of moderate economic growth of relevant subsystems;
- complexity of entering existing segments of the transport services market and creating specialized (exclusive) advantages.

At the same time, it is necessary to monitor the set of factors that determine the features of the development of coastal shipping. In this segment, as in the maritime transport industry as a whole, internal (endogenous) and external (exogenous) factors of activation or problems of effective positioning are particularly highlighted.

Among endogenous factors, the following have fundamental significance:

- the general level of infrastructure development in the region of prospective operator activity;
- readiness to implement standard technologies and select advanced priorities;
- ability to form and provide a chain of competitive services;
- limits of personnel support in terms of adequate human capital.
- Among exogenous factors, special attention is paid to:

- objectivity and long-term nature of the existing socio-economic, political, and demographic conditions of enterprise activity;
- features of the implementation of scientific and technical solutions;
- historical and cultural potential;
- accessibility of investment resources.

The reason for the underdevelopment of freight chartering activity in Ukraine is the disregard by cargo owners for chartering national shipping companies. To stimulate this process, it is necessary to ensure appropriate economic incentives by exempting double the amount of charter payments from taxation, eliminating VAT on charter payments by Ukrainian charterers, and creating conditions for shipments on the principles of "part cargo" under a consolidated bill of lading.

Control Questions

1. Methods of realizing the advantages of different types of transport.
2. Distinctive features of commercial shipping management methods.
3. Institutional principles of managing and coordinating the merchant fleet.
4. Conditions for optimizing the fleet's condition under external constraints.
5. Structure of the merchant fleet's resources.
6. Differentiation of measuring transport resources in commercial shipping.
7. Key performance indicators of a transport vessel.
8. Tasks and principles of technical preparation of transport vessels.
9. Features of maintaining ship documentation.
10. Principles and limitations of regulatory activities in commercial shipping.
11. Principles of integrative approaches to selecting the optimal cargo delivery technology.
12. The place and tasks of developing specific types of commercial shipping.

Chapter 6

MANAGEMENT OF WORK BY SHIPPING COMPANY FORMS

6.1. Main Forms of Organization of Commercial Shipping

The development of regional shipping and individual shipping companies has both common features and specific characteristics that differentiate decisions. It is enough to mention the history and the principle of the creation of Russian shipping in the Black Sea. With the help of the state, but primarily through the efforts of private entrepreneurs, on May 16, 1833, an “Investment Company for Establishing Regular Ship Services between Odessa and Constantinople by Steamships” was founded. It was based on the resources of this company that the Black Sea Steamship Company later emerged.

Over time, two trends formed in the freight market: the cyclic growth of transport volumes and changes in the geography of maritime transport due to the shift of economic growth leadership from one country or group of countries to another. One can note the era of the formation of priorities by the USA, Japan, China, and BRICS.

In global practice, common approaches have developed to address the problems of efficient and economically sustainable operation of fleets and ports, regardless of ownership and organizational-legal status from a management system perspective:

- Protection of free access to the open global freight market;
- Achieving the principles of fair competition in the freight market under the regulation of the International Maritime Organization;
- Increasing the competitiveness of the national fleet;
- Enhancing the safety of navigation under strict international control;
- Effectiveness of government support for national transport companies.

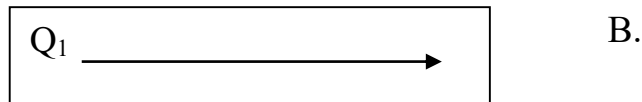
As is well known, the cargo flows of world trade are formed based on production volumes and transport-economic links. Transportation is built on potential cargo flows, which then create real cargo flows along specific routes. Cargo flows are considered as the transportation of goods included in the transport company's plan or those that have already been carried out.

The most important characteristics of cargo flows, which determine the principles and features of organizing the operation of the commercial fleet, are:

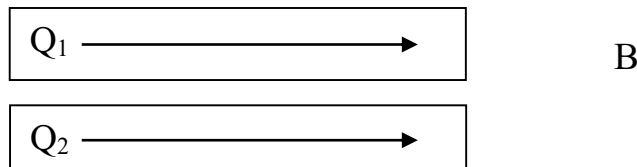
- The size of cargo batches and the total flow of goods;
- Competitive routes for transporting goods;
- The structure of transported goods.

All cargo flows, based on their structure, volumes, and directions, can be divided into four types:

1. Unidirectional Simple Cargo Flows. These are cargo flows between two regions involving a homogeneous type of cargo.



2. Unidirectional Complex Cargo Flows. These cargo flows include various types of goods.



3. Bilateral Balanced Cargo Flows reflect the nature of economic relationships and allow for the clear regulation of fleet capacity requirements and the feasibility of maintaining schedules or sequence of voyages. They represent the transportation of goods between two regions with equal opposing flows, i.e. $Q_1 = Q_2$



The main requirements include the adequacy of terminal capacities and management forms at the departure ports, as well as the timely accumulation of cargo batches or their rhythmic arrival when using a direct variant.

4. Bilateral Unbalanced Cargo Flows. The inbound and outbound cargo flows differ in volume and structure, which complicates the tasks of fleet deployment and utilization.

$$Q_1 \neq Q_2$$



Tonnage flows refer to the amount of cargo tonnage (the carrying capacity of the fleet of the corresponding specialization) required to handle the specified cargo flows under the primary conditions.

The factors of integration and globalization in the functional activities of the marine trade market entities are driven by key economic tasks, primarily achieving high efficiency in the transportation service of cargo flows. In this context, various methods and principles of organizing and managing maritime shipping are used to reduce fleet maintenance costs. A particular role in this process is played by the use of the “convenient” flag institution.

At the stage of developing a competitiveness management plan for shipping companies, the foundation for innovative solutions is considered. The decision-making criteria include the best technically and economically effective ship designs, ensuring increased productivity and improved per-unit profitability.

To characterize the market conditions of maritime trade, among the inherent informational parameters or endogenous factors, the movement of freight rates is primarily considered, as well as the demand for tonnage (cargo flow dynamics) and the availability of transport capacity (tonnage supply), the dynamics of costs for shipowners, and a number of other factors.

Index-based methods of analysis and decision-making justification are mainly used to assess the impact of freight rate fluctuations. However, the imperfections in calculations and the closed methodology narrow the scope for managerial and engineering decisions in commercial shipping. A fundamental drawback of the index method for assessing the freight market is the periodic change in the calculation base. This limits the period of comparability of indices and their use in forecasting systems.

6.2. Ship Operations Management on Tramp Shipping Routes

With the development of integration processes in the transport sector supporting global economic relations, the emergence of intermodal transport systems, and the adoption of logistics-based cargo flow management principles, the significance of organizational factors in optimizing the carrying and throughput capacity of fleets and ports has increased. Ignoring these advancements in cargo transportation can lead to substantial losses in transport potential. The highest risk of losing functional and economic stability is observed in progressive transport systems that guarantee timely cargo delivery.

Tramp shipping, which is essentially an irregular voyage-based transport system, has the following characteristics:

- Ships operate in various regions that are not predetermined in advance.
- The type of cargo to be transported is not specified beforehand.

-Freight charges are determined based on contractual rates (current market freight rates).

The primary operational model in tramp shipping is individual voyages, which require local agreements and specific contractual terms for each trip.

Under these conditions, tramp voyages are classified based on their objectives into the following categories:

1. Transport or Planned Voyages

These voyages are arranged to fulfill the transportation of goods essential for national economic needs, typically under government contracts in coastal or international shipping.

2. Special Voyages

These involve the transportation of oversized or heavy cargo that requires specialized handling and logistics solutions.

3. Expeditionary Voyages

Such voyages support complex expeditions, including missions to Antarctica, fishing operations, offshore oil platforms, and other specialized explorations.

4. Commercial Voyages

These voyages are driven by global trade cargo flows and operate based on market demand and profitability.

They are organized based on freight market conditions for transporting foreign trade cargo, regardless of the nationality of the cargo owners (charterers).

The content of standard management issues in the organizational preparation of individual transport voyages consists of the following:

A. Structuring cargo and transport flow schemes.

B. Establishing the technological voyage scheme.

The technological voyage scheme refers to the formation of the process of ship movement and handling in commercial ports and other points of functional and service operations.

The technological scheme includes the determination of:

-Initial, intermediate, and final ports of call.

-Time expenditures for all segments of the passage separately and the duration of port stays.

-Cargo volume for individual sections of the route.

-Necessary data defining the specifics of the voyage.

C. Selection of vessels for the transport voyage.

This is carried out considering the following constraints:

-Specialization and cargo capacity of the vessel.

-Route and port restrictions.

- Suitability of cargo holds for transporting a specific type of cargo.
- Competitiveness of vessels in relation to ships of companies operating in the same range.

D. Calculation of voyage duration and net cargo capacity.

For the clear organization of tramp voyages, shipowners, operators, and cargo owners compile a **commercial schedule** for cargo readiness, vessel availability, and chartered foreign tonnage in predetermined ports and on agreed dates.

Table 6.1. Characteristics of Bulk Cargo Transportation Changes

Year	Iron ore	Coking coal	Thermal coal	Grain	Other bulk cargo	Total bulk carriers
2007	8,4	3,0	10,9	3,0	3,6	6,3
2008	7,6	1,6	-1,2	2,9	1,6	2,9
2009	8,3	-23,7	2,3	-10,8	-0,6	-0,1
2010	7,7	26,2	13,8	18,3	4,8	9,9
2011	5,4	2,4	4,9	7,4	4,2	4,9
2012	6,2	2,1	7,1	2,5	4,5	5,3
2013	6,4	4,7	7,3	2,5	4,6	5,6
2014	6,7	3,5	7,6	2,5	4,6	5,7
2015	7,0	3,5	7,7	2,5	4,6	5,9
2016	7,2	3,6	7,8	2,6	4,7	6,0
2017	7,4	3,8	7,9	2,7	4,8	6,2
2018	7,6	4,0	8,0	2,8	4,9	6,4
2019	7,9	4,2	8,1	2,9	5,0	6,6
2020	7,1	3,9	7,5	2,5	4,6	5,9
2021	6,8	3,5	7,0	2,2	4,3	5,4
2022	6,5	3,2	6,7	2,0	4,1	5,1
2023	6,9	3,4	7,2	2,3	4,4	5,5
2024	7,3	3,7	7,7	2,5	4,6	5,9

The data in Table 6.1 reflects the variability of conditions influencing the development of specific segments of the global economy, considering both current trends and anticipated changes in cargo flow formation.

The figures presented in the table represent the expectations of operators and investors. Any subsequent deviations from the projected parameters will inevitably determine the level of risk faced by shipowners. Accepting this risk is a critical factor in the positioning of national shipping companies within the global maritime trade market.

The nature of global shipping and the freight market demonstrates that it is impossible to eliminate errors and financial losses. Therefore, a key objective of any methodological framework is to enhance the reliability of applied managerial and investment decisions. This can be achieved through the optimization of information databases, deeper situational analysis, comprehensive assessment of potential development models, selection of appropriate evaluation criteria, and the formulation of key performance indicators that define the future behavior of shipping companies.

The functional and economic stability of shipping companies in the freight market is determined by the implementation of strategies aimed at improving the quality of transport services provided to cargo owners. The annual cost savings for cargo owners and all participants in multimodal transport operations, resulting from the introduction of advanced vessel types, can be calculated based on the following conditions:

$$\Delta \mathcal{D}_{\mathcal{D}_b} = \sum \eta_{c_{si}} Q_{\mu} n_j, \quad 6.1$$

where:

$\eta_{c_{si}}$ - represents the magnitude of specific cost changes in divisions serviced by new vessels and technological processes;

Q_{μ} - denotes the annual productivity of new vessels requiring improvements in the organization and technology of cargo delivery;

n_j - refers to the scale of implementation of new transport technologies.

The primary resources ensuring the optimization of economic outcomes in shipping operations are capital assets and human capital.

At a certain stage of their development, organizational structures that maximize the full potential of the fleet become crucial for improving the efficiency of commercial shipping. Therefore, when making decisions regarding fleet chartering, in addition to freight indices, the fluctuations in freight rates - from minimum to maximum - are also considered.

In the shipping management system, a particularly important strategy is risk assessment related to pirate attacks. Despite existing legal frameworks aimed at combating piracy, the issue remains complex. The frequency of pirate attacks in traditional high-risk areas - such as the Malacca Strait, the South China Sea, the Gulf of Aden, the Somali region, West Africa, the Caribbean, and the northern part of the Indian Ocean - fluctuates periodically. However, despite the efforts of the global community, the risks persist.

It is essential to consider insurance risks and security measures, while also acknowledging the limitations in the quality of supply and demand assessments in various segments of the freight market

6.3. Features of Liner Shipping

Liner shipping is formed based on organizational and economic goals and criteria. It must comply with the provisions of the Code of Conduct for Liner Conferences. It effectively ensures the right of trading nations to participate in the transportation of their own cargo. The Code serves as a regulatory tool for liner shipping. It allows for a relatively fair distribution of fleet participation in bilateral transport with countries that cannot ensure a sufficient presence of their own fleet in the maritime transport market.

Liner shipping is characterized by strict regularity. It serves the cargo flows of expensive general cargo.

In this aspect, the main characteristics of general cargo are highlighted: heterogeneity, small batch sizes, large loading volume, distribution across a large number of ports, and a large number of shippers and receivers.

Therefore, a special management structure for this economic subsystem is formed at maritime transport enterprises, which includes:

- the composition of the company's transport potential;
- the organization of fleet operations;
- management of resources and economic parameters.

The standard form of operation for vessels is circular routes with numerous port calls.

In this regard, the liner SC independently determines:

- the composition of the fleet;
- the ports of call;
- the frequency of voyages;
- the schedule;
- the presence of agents in ports.

The published schedule in advance is a key characteristic of a liner service.

The network of SC in ports and industrial centers ensures:

1. Assistance to the captain in organizing the vessel's service.
2. The completion of all formalities by the vessel.
3. The organization of the vessel's handling.
4. The activation of cargo attraction.

In other words, the agent systematically influences the efficiency of the liner's operations.

The payment for the agent's work is not based on the salary principle, as in the case of bulk cargo transportation, but on a percentage of the freight amount attracted.

As a specific form of the maritime transport contract in liner shipping, a bill of lading is used. The bill of lading is issued by the shipowners. It serves as proof of the cargo being accepted for transport and the conclusion of the transport contract. The functions of the bill of lading are that it acts as a receipt from the carrier, contains the terms of the cargo transport contract, and serves as a security (document of title).

The documentary aspects of transporting small batches of general cargo are reflected.

The cargo is accepted without specifying a place on the ship. It is placed on the vessel with the aim of optimizing the voyage results, taking into account port rotation, safety, compatibility, increasing loading efficiency, and reducing costs.

The organization of the vessel's operations according to the schedule does not require the inclusion of the date of the vessel's arrival for loading, laytime, or dispatch - demurrage in the bill of lading.

The shipowner often owns or leases docks and warehouses in ports. They pay for and organize cargo handling operations. This is because the schedule's adherence and the intensity of fleet capacity utilization depend on it.

The freight rates are regulated by the liner's tariffs, set by the operators, taking into account cargo flow dynamics and the ability to make appropriate decisions.

Liner shipping is an independent niche in the global transport services market, distinguished by its scope of activity and a unique economic structure.

Specialized and multipurpose vessels capable of carrying general cargo are used. However, container ships dominate. Liner services are characterized by a certain unity of material resources and organizational potential, which include: terminals and cargo consolidation equipment; a permanent fleet composition; a route and schedule for service; the organization of circular voyages; a strict timetable; a standard liner bill of lading; and unified tariffs.

In this aspect, the evaluation of operating costs, conducted by the firm H. P. Drewry (Shipping Consultants), should be considered. They characterize the growth of depreciation charges, crew maintenance expenses, and fuel costs.

The customs regulations of the European Union introduced new concepts – regular and irregular shipping lines. A regular line is considered one that operates between EU ports, where the destination and departure or call ports are not located outside the EU territory or do not belong to the first type of free zone within the port area. All other lines are classified as irregular shipping lines.

When a shipping line starts its operational activities, it receives discounts on customs, pilotage fees, and tug services. However, according to the conditions of Ukraine, after the expiration of the term (calendar period), it is necessary to complete all the documents for re-registration of the line.

6.4. Management of Transport Vessels on the Line

The trade of the main commodity – transport services – is carried out in the form of selling the fleet's transport capacity, forming export or import freight flows in the transport services market. In another case, such operations are carried out together with the goods, that is, as part of direct foreign trade. In any case, the form of a foreign trade transaction predetermines the conditions for the tonnage's participation in external trade operations.

The foreign economic activity of maritime transport enterprises is carried out on the global transport services market in the form of various export-import operations related to fleet operations. The scope of external economic activities of a SC includes:

- Cargo and passenger transportation;
- Export and import of services provided by agency, stevedoring, ship Chandler, and other organizations servicing vessels;
- Time chartering of vessels;
- Leasing of ship and cargo equipment;
- Operations with bunker fuel, lubricants, and spare parts for vessels.

To open a shipping line, a technical and economic project or a business plan is developed. The key evaluation criterion is the efficiency of the line and the fleet group servicing the transportation.

Features of the linear form of shipping organization include:

1. Continuous transportation process between designated ports.
2. Predominance of high-value small-batch cargo transportation under the «just in time» system.
3. Fixed types of vessels assigned to specific routes.
4. Operation of vessels according to a predetermined schedule ensuring strict departure periodicity.
5. Relatively stable and pre-agreed tariffs.
6. No dependence on a single cargo owner.
7. Specific commercial conditions for vessel operations.

The totality and diversity of cargo lines are classified according to the following criteria

a) By navigation area and type:

- Coastal (cabotage);
- International.

b) By the number of shipowners on the line:

- Single-owner lines serviced by one shipowner;

- Joint lines serviced by two shipowners from different countries;
- Conference lines, where three or more shipowners operate on a designated route;
- Mixed lines, based on the operations of three or more shipowners not united in commercial conglomerates.

c) By operational mode:

- Regular lines, where only the departure interval is announced (e.g., once a week, twice a week);
- Express lines, where specific departure dates are announced.

d) By duration:

- Permanent lines;
- Periodic lines operating for a defined period.

A specific grouping and classification system is used for the main stages of the organizational preparation of cargo lines:

- a. Determining cargo and tonnage flows along the route;
- b. Defining cargo line parameters;
- c. Forming a system of lines in designated regions;
- d. Selecting vessels for the line;
- e. Calculating technological elements of vessel operation schemes;
- f. Defining mandatory and optional port calls;
- g. Developing a schedule for vessel operations.

Opening a shipping line requires extensive analysis, research, and justification of key transportation process parameters.

One of the most critical conditions is studying cargo flows. This includes clarifying fleet operation characteristics and the possibility of expanding the cargo base. Cargo base formation depends on foreign trade parameters and global economic relations. For efficient fleet operations, it is crucial to assess cargo flow dynamics, the distribution of maritime trade by directions, the structure of transported goods, and the seasonality of shipping specific product groups.

The internationalization of fleet operations, supported by logistic supply chain systems, multimodal transport technologies, and international transport corridors, plays a significant role.

For efficient organization of any form of commercial shipping, effective conditions for vessel handling in commercial ports are essential. The key conditions determining fleet demand on a line, its composition, and technical-economic characteristics include:

- Terminal characteristics and specialization;
- Technical equipment of berths and storage facilities;

- Cargo handling intensity;
- Duration of vessel downtime;
- Economic impact and outcomes of general and service-related operations;
- Cargo batch sizes and flow regularity;
- Technical-economic standards of competing shipping companies' vessels;
- Availability of feeder lines;
- Transit cargo delivery time;
- Development of advanced technologies and transport facility management.

A significant factor is analyzing conference agreements that shape relationships with cargo owners.

The efficiency of fleet operations also depends on accounting for government and legal regulations in foreign trade and transportation within the region of planned operations. Cargo flow characteristics, freight market pricing principles, and fleet cost efficiency of competitors determine the strategic positioning and scale of any shipping company.

Preliminary and subsequent studies of liner shipping organization should shape and refine key cargo flow and route characteristics:

- Cargo flow volume;
- Distribution structure and geography;
- Type of line based on its purpose and vessel movement organization;
- Application of modern technologies and navigation safety conventions;
- Fleet composition requirements;
- Principles of relationships with other shipowners and cargo owners.

The main characteristics of a shipping line are the frequency and regularity of voyages. These parameters affect the efficiency of foreign trade relations and the company's competitiveness.

Depending on cargo flow dynamics and other transport market characteristics, a wide range of frequencies is used—from one voyage per month to weekly and multiple departures per week. The nature of foreign trade contracts primarily determines vessel departure frequency. The frequency of shipments directly impacts cargo storage costs and the amount of working capital involved or credit financing.

The vessel's carrying capacity designated for the line must align with the shipment batch size per voyage (q):

$$q = \frac{Q \times I}{T_c} \quad 6.2$$

where:

I – interval between departures (days);

Q – annual cargo flow in the busiest direction (thousands of tons);

T_c – calendar period of the line operation (days).

An essential constraint is ensuring reserve transport capacity.

The main efficiency criterion for vessel operations is that revenue from transporting additional cargo must exceed the corresponding cost increase:

$$\Delta R_v = \Delta Q p_{fr} > \sum \Delta t_i C_{si} + \Delta B p_{cs} \quad 6.3$$

where:

ΔQ – additional (marginal) cargo volume;

p_{fr} – freight (tariff) rates for transportation in the analyzed operational range;

Δt_i – additional operational time required for transporting the calculated cargo volume;

C_{si} – vessel daily operating costs for transportation operations;

ΔB – volume of service operations provided to company vessels during additional transport work;

p_{cs} – tariffs and charges for service operations.

The required number of vessels for line operations is determined by:

$$n = \frac{t_v}{I} \quad 6.4$$

where:

t_v – voyage duration;

I – interval between vessel departures as per schedule.

The sequence of vessel port calls (rotation) is optimized to minimize distance and cargo delivery time.

Linear route – the vessel calls at intermediate ports separately for unloading and loading, minimizing delivery time but increasing port call frequency, leading to higher currency expenditures.

Round-trip route – the vessel makes a single port call per voyage for loading and unloading, minimizing port calls and reducing costs.

There is also a hybrid (looped) service scheme for intermediate ports.

In this context, freight indices must balance multiple competing requirements. On one hand, they should broadly cover key transportation routes and tonnage types,

while on the other, they must clearly reflect competitive freight conditions – ensuring the timely determination of appropriate tonnage based on current market conditions.

6.5. Management of passenger fleet operations

The dynamic nature of maritime transport market parameters and the ongoing structural shifts in the global shipping system necessitate monitoring the implementation of decisions based on a set of specific criteria and indicators. The use of efficiency criteria, regardless of market conditions, is unacceptable for shipping companies when solving optimization problems, as the fulfillment of macroeconomic objectives and business tasks is subject to the principle of resource efficiency. This, in turn, determines the importance of improving the economic efficiency of shipping enterprises.

The operation of passenger fleets is currently differentiated based on the specialization of passenger flows. In this regard, cruise, ferry, coastal, and offshore technologies or forms of regional positioning of shipping companies are distinguished.

The organization of passenger fleet operations plays a crucial role in this context. According to key characteristics, the maritime passenger fleet is classified as follows:

1. By type and distance of navigation: external and internal.
2. By type of fleet usage: transport and local.
3. By passenger delivery speed: express, high-speed, and passenger.
4. By travel purpose: business (2%) and tourism (98%).
5. By forms of shipping organization: liner and scheduled services.

The main forms of scheduled cruise shipping include:

- Autonomous cruises – a combination of sea travel with onboard relaxation and excursions during port stays.
- Special cruises – onboard trips designed for specific targeted purposes.
- Mini cruises – short trips lasting 2 to 5 days.
- Interrupted cruises – a combination of sea travel and land-based vacations.
- Combined cruises – involving multiple modes of transport.

As with other types of commercial transport fleets, the goal of passenger shipping companies' development and operations is to fulfill their designated purpose, contracts, and production potential plans based on the criterion of maximum profitability. Additionally, one of the most crucial conditions is ensuring high-quality services for passengers and tourists.

The scheduling of passenger vessels forms the foundation of the technical planning of the passenger fleet's operations.

At the same time, strict systemic requirements are imposed on the schedule. Particular attention is given to the following:

1. Ship departures must be scheduled at times convenient for passengers.
2. The schedule must be coordinated with other modes of transport.
3. Consideration must be given to urban transport schedules.
4. Time spent in ports must allow for the smooth boarding and disembarkation of passengers and, if necessary, cargo operations.
5. Ships should pass notable landmarks during daylight hours.
6. A rhythmic frequency of departures should be maintained.
7. To ensure strict and precise adherence to the schedule, time reserves should be allocated for transition segments.



Figure 6.1. Cruise liner Queen Mary 2

Passenger capacity – 2,620 people. Length – 345 m, width – 41 m. Height – 72 m. Gross tonnage – 151,400 GT. Net tonnage – 98,720 NT. Speed – 30 knots. Crew size – 1,253.

The organization of passenger ship services at marine terminal stations is of paramount importance. There are standard and customized types of such operations.

Rational resource utilization and timely capacity expansion are achieved through the interaction of two subsystems: operations within the respective segment of the passenger transport market and the development of the production infrastructure. The first subsystem is focused on achieving forecasted operational performance parameters. For the second one, the most critical aspect is accelerating the implementation of scientific and technological advancements to optimize the economic outcomes of high-cost liners.

In the management system for passenger fleet operations, the goal of economic development is not reflected as a self-regulating mechanism. This is due to the complex relationships between shipping companies, commercial ports, and service systems, each seeking to maximize their own results based on individual marginal costs within the maritime tourism complex.

Between 1991 and 2024, the carrying capacity of the domestic fleet was not actually based on modern shipbuilding. As a result, according to the Paris Memorandum, the fleet was classified as substandard.

There is a noted widespread aging of the cruise fleet, particularly river vessels, which have not been updated since the 1980s despite the increasing popularity of this type of passenger transportation. In Ukraine, nearly all key types (niches) of maritime passenger transportation have been lost.

In Russia, there are officially 140 shipbuilding enterprises for the river fleet. However, in reality, only 12 were operational as of 2011. A similar disparity between potential and actual usage is observed in Ukraine.

At the same time, all types of foreign passenger fleets, particularly cruise and ferry services, continue to develop actively.

Control Questions:

1. Features of organizational activities in commercial shipping.
2. Principles of structuring cargo flows.
3. Economic aspects of tramp shipping management.
4. Conditions for the functional sustainability of shipping.
5. Role in the maritime transport industry and characteristics of liner shipping.
6. Fleet management under liner shipping conditions.
7. Factors of efficiency in organizing liner shipping.
8. Principles and features of passenger fleet management.
9. The impact of passenger flow structure on passenger fleet operations.

Chapter 7.

MANAGEMENT OF FINANCIAL RESULTS OF SHIPPING COMPANIES

7.1. Peculiarities of income formation in segments of the maritime trade market

Revenues of all divisions of the maritime transportation industry depend on the activity of the state of international economic relations and the balance of the maritime trade market. Therefore, it is important to monitor the future state of the socio-economic system, its political goals and technological changes. It is from the clarity of perception of the situation in the global and national economy and the creation of competitive potential of the divisions of the maritime transportation industry that cash flows are formed and distributed.

The form of the maritime trade market segment, in which the parameters of a shipping company's operating activity are chosen, influences the character of income dynamics to a determining extent. This is conditioned by two factors:

- the nature of formation of the level of tariff rates and the stability of the maritime trade segment;
- the structure and constancy of cargo traffic.

The form of organization and management of fleet operation determinately affects the methods and level of formation of revenues and expenditures. Therefore, it is necessary to recall the main types of transportation service of economic processes.

Tramp shipping is characterized by a number of features, among which stand out the relative short- or medium-term nature of the relationship with the cargo owner (charterer) in transportation or time charter. An individual vessel or the carrying capacity of the fleet is used on the basis of a charter contract. As a rule, the cargo flow is based on bulk cargoes (in bulk or in the form of consolidated places) with a significant single shipment.

Linear shipping is characterized by its main feature - regularity. The basis of this type of shipping is a schedule of ship movements by days of the week with visits a set of ports, taking into account the intensity of cargo traffic. The structure of the latter is dominated by general cargoes characterized by low partiality. The principal feature of liner shipping is clearly defined tariff rates set by the carrier.

Industrial shipping - formed by the largest industrial structures - initial cargo owners. The largest oil companies, steel producers, energy companies and others create their own specialized fleet. In a number of cases they take the fleet on long-term charter. This ensures their transportation independence and economic efficiency of transportation operations.

In accordance with the above approach, only a limited part of the world shipping, within 10 - 15% of global maritime transport, forms a relatively free competitive segment of the maritime trade market. It is characterized by temporary fluctuations in the level of freight rates and requires special skills and resources for sustainable positioning of a shipping company's fleet.

The target central task of the shipping company's resource management is to maximize the flow (CF) and income reserve. At the same time, it is important to achieve both the planned sum of revenues and to optimize its structure.

In the work of merchant fleet several classification groups of income stream are distinguished, the classification of which is based on the nature of connection with the main functional activity. The following income groupings are used in the world shipping industry:

Table 7.1. Structure of the income stream of a shipping company

Revenue from Functional Activities		
	By tariff rates	50%
	From time charter operations	20%
	From bareboat charter operations	15%
Other revenues		15%
Including	Other operating revenues	
	From property sales	
	From product sales	
	Revenues from previous periods	
	Rental income and equity participation	
	From loans provided	
	Extraordinary	

The tasks of the country's competitive participation in the international division of labor predetermine, along with the shortage of investment resources, the tasks of planning and forecasting the development of fleet carrying capacity, throughput capacity of commercial ports and alternative approach to the selection of a new shipbuilding base. To avoid a subjective approach, calculations of the efficiency of new transportation potential increment should be based on the comparison of alternative approaches.

The priority of quality characteristics of fleet and port operation in the current conditions of competition in the maritime trade market predetermines the forms of

management and control of development and activity. The complexity of management lies in the fact that quality and achievement of safety are realized at different stages and technological processes of cargo delivery. In addition, the multidimensionality of the quality characteristic is predetermined by various participants in the functional activities of the fleet and ports.

In any case, the most important attention should be paid to the maximization of economic results in relation to the scale of transport potential and rationality of its use. The tasks of optimizing entrepreneurial interests in the system of actually unified (global) maritime trade market should be implemented on the basis of a set of criteria that form the differentiation of system-wide, local and individual efficiency of capital assets realization.

7.2 Classification of merchant shipping operating costs

Costs play a special role in evaluating SC performance. During transportation, they not only increase the cost of commodity mass, but also limit the profitability of SC capital. Therefore, the average cost of cargo transportation is considered the most important indicator of fleet performance.

Ultimately, the leading role in assessing SC efficiency is played by the attitude - costs - results. Costs include all limited resources that ensure the financial sustainability of the functional activity of the enterprise.

The system of classification or grouping of costs of a shipping enterprise is conditioned by the main economic regularities and tasks, the solution of which arises in the process of functional activity or development design. Traditionally, four classifications of operating costs of maritime transportation enterprises are used.

1. From the position of the economic content of production costs, they can be divided into basic and overhead costs.

The main costs include those directly related to the production process of cargo delivery by technical means of transportation.

The group of overhead costs includes those costs that are conditioned by the units of management, organization and maintenance of the main production process.

2. Common methods of costing lead to the division of costs into direct and indirect (allocable). This grouping does not reflect the economic content of current costs, but only the costing process.

Direct costs include costs that can be directly and directly attributed to a specific type and volume of products or a specific type of transportation work.

Allocable costs are more general in nature. They are independent of the nature of a work and are not related to its structure and, in some cases, to the volume of

products, works or services. They are equal for all types of transportation works. When calculating the cost of transportation or handling, they should be allocated to groups of cargoes, vessels or handling complexes.

Allocation is done using the indirect method. First, it is important to correctly allocate indirect costs to the cost objects. Second, all costs that can be attributed to a technology should be planned and recorded as direct costs.

3. According to the degree of dependence of costs on changes in the volume of work or products, they are divided into costs that are independent (fixed) of the volume of production and variable costs that depend on the scale of production activity.

Independent costs include those costs, the total amount of which does not change much with the increase (decrease) of production.

The cost of maintenance of the port water area and access channels does not depend on the turnover of cargoes within the limits of their carrying capacity. The same is true for the maintenance costs of hydraulic structures. Independent (fixed) costs include, first of all, administrative and management costs and depreciation costs.

Expenses depending on cargo turnover parameters include: dockers' salary, fuel and electricity costs. The nature of change in costs depending on the amount of transportation work is shown at the graphs (Fig. 7.1).

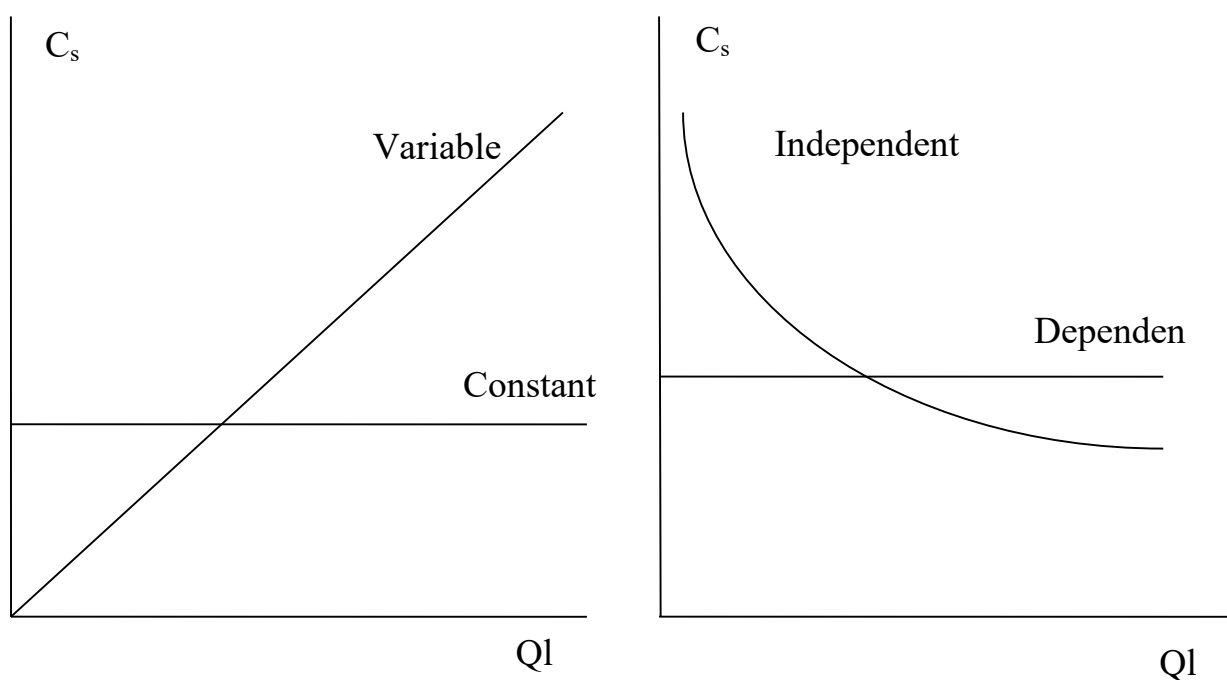


Fig. 7.1. Nature of changes in individual groups of SC expenditures

The second graph reflects the dependence of costs (fixed and variable) per unit of transportation work (cargo turnover).

The considered division of costs allows us to assess the impact of cargo turnover dynamics on the cost of transportation work and form the principles and directions of concentration (achieving economies of scale) in the conditions of maritime transport.

4. Costs are formed by individual cost elements reflecting the use of resources or factors of production. The division provides for a few cost elements of varying importance. The entire nomenclature of production costs can be grouped according to three characteristics:

- costs due to the maintenance of workers (labor remuneration);
- costs associated with the use of labor items (raw materials, materials, fuel);
- costs reflecting the use of means of production (depreciation and maintenance of capital facilities).

When calculating the cost of operation of the company's vessels, separate heterogeneous economic cost elements are considered in the composition of costs and complex cost items are formed along with them.

When calculating the cost of marine transportation, fixed costs in project calculations are distributed as a percentage of total direct costs (5-7%), or of seafarers' wages within the range of 16-18%.

The main factor in reducing this group of costs is the realization of economies of scale under the condition of increasing the volume of transportation work. This group of costs does not change with the growth of transportation volumes, so the reduction of production cost can be calculated by the condition:

$$\eta C_{sa} = C_{sab} \gamma_{fc} \left(1 - \frac{1}{1 + \Delta Q}\right), \quad 7.1$$

where:

C_{sab} – cost of freight transportation using standard technology;

γ_{fc} – share of fixed costs in the operating cost structure of a shipping company;

ΔQ – rate of increase in transportation work volume.

Shipowners and maritime trade market operators are free to choose appropriate ways and means to achieve target results and strive to satisfy financial interests based on rational fulfillment of production tasks.

The value of current costs (operational costs of transportation) for the maintenance of any types of ships when designing their acquisition and planning their use is determined on the basis of standards of ship-daily costs, taking into account price characteristics and volumes of necessary resources. The analysis of operating costs is based on statistical and reporting data.

7.3. Features of cost calculation in foreign shipping companies

In commercial shipping, the formation of different cost groups varies depending on the route and the specifics of reflecting different phases of the transportation process. Typically, four classification categories of shipping company expenses are distinguished.

Operating costs. These expenses arise throughout the entire period of the vessel's operation and include crew maintenance costs, supply expenses, and costs related to keeping the vessel in operational condition. They are determined by market conditions, time, and the location of the vessel. The primary condition for managing and controlling these costs is the availability of funds in the shipping company's accounts.

Voyage costs. This category of expenses varies depending on the specifics of the vessel's movement and includes fuel costs, port fees, and canal transit charges.

Capital costs. These include interest on loans, contributions related to participation in equity capital, and depreciation charges—essentially, any funds determined by the acquisition and use of production assets, primarily vessels.

Cargo handling costs. These expenses are related to loading, storage, and unloading of cargo. This process is characteristic of liner shipping, especially when a company owns or leases berths. Such conditions reduce port downtime and increase the productivity of fleet operations.

Attention should be paid to the structure of expenses of foreign shipping companies based on their accepted classification (Table 7.2).

Table 7.2. Features of the cost structure of an average foreign shipping company

Expense Group	Expense Items	Share, %
Operating cost	Manning costs	40 -42
	Stores & lubricants	26 -28
	Repair & maintenances	10 -12
	Insurance	10-14
	Administration	8 -10
Voyage cost	Bunker	
	Loading costs	
	Unloading costs	
	Port and canal costs	10
	Commissions	
	Other costs of voyage	
	Expenditures for containers	
	Expenditures or common vessel operation	

	Supplementary expenditures	
Capital cost & repayments		

A distinctive feature of the cost calculation method is the identification not only of the sources based on the structure of utilized resources but also of cost allocation according to their purpose and the operations within the transportation process. In shipping companies, applying this principle of expense formation enables control over the fleet's functional activities by accounting for cost structures based on cost centers.

Three main cost calculation groups are distinguished when using the respective resources:

- capital costs – (depreciation, interests);
- operating costs – (manning costs, stores & lubricants, repairs and maintenance, insurance, administration);
- voyage costs – (fuel oil, diesel oil, port costs).

Despite constant fluctuations in the pricing characteristics of the maritime trade market, an approximate cost structure of the functional activities of foreign shipping companies can be outlined (Table 7.2). On average, port fees and navigational expenses account for 12–15% of a vessel's total operating expenses.

The mechanism and tools for optimizing costs by key sources of their formation play a crucial role in the financial stability management system of a shipping company. In this regard, costs are grouped based on the resources used (fuel, labor) and their origins (port fees, vessel maintenance).

Although labor costs represent a relatively small share of expenses for ship-owning and operating companies, labor cost optimization is given top priority. The following traditional approaches to reducing current transportation process costs are highlighted in measures to improve fleet efficiency:

- efficient use of all material resources;
- careful handling of vessel equipment and systems to optimize repair and maintenance expenses;
- creative utilization of the company's potential and workplace resources;
- maintaining work discipline, schedules, and procedures;
- effective resource utilization within the company;
- collaboration between structural divisions to ensure rational potential use;
- reliability and conscientious fulfillment of functional obligations by all employees;
- timely provision of information for decision-making in critical situations;
- overall discipline and punctuality in performing duties;
- loyalty to the company's actions and management;

- continuous improvement of knowledge and professional competencies;
- focus on implementing current operational requirements, rather than just maintaining a prestigious image;
- critical assessment of daily situations to optimize conditions;
- a responsible attitude toward overtime work;
- enhancing expertise and minimizing professional errors.

The way these principles are integrated into the shipping company's operations determines its functional and financial stability.

The efficiency of fleet operations in changing freight market conditions primarily depends on productivity and resource utilization efficiency. Therefore, at the core of justifying the types of vessels in the commercial fleet lies the projected cost of transporting cargo and passengers.

7.4. Economic Performance Indicators of a Transport Vessel

The modern maritime trade market is characterized by a certain degree of instability. This complicates the formation of long-term activity plans for both producers and transport companies. The root cause of this instability lies in the efforts of business entities to expand their influence within the international economic system while its overall development remains relatively slow. At the same time, many countries address the issue of protecting their national markets through quota systems and anti-dumping investigations. As a result, cargo owners primarily adopt a strategy of signing short-term charters. This, to some extent, limits the level of operational efficiency management and introduces a certain degree of commercial risk. Therefore, special performance indicators are calculated and monitored to assess operator activities.

a. In Coastal Shipping.

Quantitative Results.

1. Vessel Revenue from Cargo Transportation

$$R_{VF} = f_{cs} \cdot \Sigma Q \quad 7.2$$

where:

f_{cs} – the freight charge (cost) per ton of cargo in the operator's region of activity;

Q – quantity of cargo transported.

2. Vessel Operating Expenses

$$\Sigma C_{ss} = C_{sc-v} t_v + C_{sc-b} t_b \quad 7.3$$

C_{sc-v} – daily vessel operating costs while voyage;

C_{sc-b} – daily vessel operating costs while at berth;

t_v – voyage sailing time;

t_b – voyage berthing time.

The vessel's speed determines the delivery time parameters for goods in all forms of global economic relations and depends on the installed power and route conditions.

3. Financial result for the production cycle or for the year

$$Pr = R_{VF} - \Sigma C_{ss} \quad 7.4$$

4. Cost of sea transportation of 1 ton of cargo.

$$C_{ST} = \frac{\Sigma C_{ss}}{\Sigma Q}, \text{ UAH/ton} \quad 7.5$$

$$C_{ST} = \Sigma \alpha + \beta l \quad 7.6$$

where:

α – cost rate of the berthing operation, monetary units/ton;

$$\alpha = \frac{A_b t_{lo}}{Q} = \frac{A_b}{M_{lo}} = \frac{a}{m} \quad 7.7$$

β – cost rate of the movement operation

$$\beta = \frac{(B_m + A_b \kappa_{zp})(1 + \delta_b)}{\varepsilon V} = \frac{B_m t_m}{Q l_f} = \frac{b}{\varepsilon} \quad 7.8$$

$$a = \frac{A}{D_v} \quad 7.9$$

$$b = \frac{B}{V D_v} \quad 7.10$$

$$C_{ST} = \frac{a}{m_l} + \frac{a}{m_{ol}} + \frac{at_b}{\varepsilon} + \frac{at_a}{\varepsilon} + \frac{b}{\varepsilon} (1 + \delta_b) \quad 7.11$$

$$m = \frac{M}{D_v} \quad 7.12$$

5. Cost per unit of transport work

$$C_{STM} = \frac{\Sigma C_{ss}}{\Sigma Q l}, \text{ UAH/10 t-m} \quad 7.13$$

$$C_{STM} = \frac{\Sigma \alpha}{l} + \beta \quad 7.14$$

$$C_{STM} = \frac{1}{l} \left(\frac{A}{M_l} + \frac{A}{M_{ol}} + \frac{A \cdot t_{tnk}}{\varepsilon D_n} \right) + \frac{B}{\varepsilon V D_n} (1 + \kappa_b) \quad 7.15$$

where:

A – daily vessel berthing costs;

B – daily vessel operating costs during voyage.

6. Profitability of the transportation process

$$e_q = \frac{Pr}{\sum C_{SS}} \quad 7.16$$

7. Profit generation intensity in the course of functional activities

$$\mu_{pr} = \frac{Pr}{\sum D_{NTE}}, \text{ UAH/ton-day} \quad 7.17$$

Increasing the role of efficiency and quality of work and development of maritime transport enterprises is carried out in two directions of management and administration improvement.

Firstly, operational activities are focused on the full utilization of resources and on improving the quality of cargo and passenger transportation.

Secondly, increased attention is paid to the selection of a system of assessment indicators that fully take into account the specifics of shipping companies' activities in the maritime trade market.

At the same time, it is necessary to consider the reality of the risk system in commercial shipping, taking into account that "In a real, dynamic economy, the future is always uncertain and unpredictable. This means that the entrepreneur takes on risk" [McConnell, p. 377]. This risk primarily concerns the scale of capital and the level of profitability. The sources of uninsurable risks are highlighted:

- Changes in the general economic situation;
- Structural changes in the economy;
- Changes in government policy.

Thus, the main elements of the economic situation in commercial shipping that need to be taken into account in management are the system of indicators for fulfilling contractual obligations and the rational realization of the shipping company's economic potential, the set of characteristics of resource conditions, competitive positioning conditions, and others.

7.5. Export of Transport Services in the System of Financial Indicators of a Shipping Company

The role of the rational use of resources, which ensures the expansion and maintenance of the production potential of shipping companies and commercial ports in an adequate state, is constantly increasing. The rational scale of resource formation becomes a key factor in the economic efficiency of maritime transport development. Therefore, in the economic management mechanism for ensuring the functional stability of shipping enterprises, the principle of resource limitation based on the balance of freight tariffs is applied. In addition to commercial objectives, special economic and legal instruments are used to regulate the state of commercial shipping.

1. Foreign currency revenues from completed shipments in the freight market

$$R_{VV} = f_v \cdot \Sigma Q, \text{ foreign currency} \quad 7.18$$

where:

f_v – freight (tariff) rates for cargo transportation in the maritime trade market.

2. Revenues in national currency

$$R_{VN} = \kappa_v \cdot R_{VV} \quad 7.19$$

where:

κ_v – exchange rate of the national currency.

3. Annual total expenses in the national currency system

$$\Sigma C_{SN} = (C_{sn}t_s + C_{scb}t_b)n_r \quad 7.20$$

where:

n_r – number of ship voyages in the calculation period.

4. Ship expenses in foreign currency

$$C_{STV} = \Sigma C_{ssi}t_{cvi}n_v \quad 7.21$$

where:

C_{ssi} – groups of expenses in foreign currency related to the voyage execution;

t_{cvi} – time during which expenses in foreign currency are incurred;

n_v – number of voyages during which foreign currency expenses are determined.

5. Total or aggregate expenses of the ship's functional activity

$$C_{S\Sigma} = \Sigma C_{SN} + \kappa_V C_{STV} \quad 7.22$$

where:

κ_v – exchange rate of the national currency relative to the respective foreign currency.

6. Net foreign currency revenue

$$\Delta P_{RV} = R_{vv} - C_{sv} \quad 7.23$$

7. Overall financial result of the ship or shipping company

$$R_{rs} = R_{vs} - C_s \Sigma. \quad 7.24$$

8. Net financial result

$$P_{RC} = P_{rs}(1 - t_s) \quad 7.25$$

9. Profitability level (control-analytical indicator)

$$\rho_F = \frac{RV\Sigma}{C_{ST}} \quad 7.26$$

10. Foreign exchange efficiency of the functional activities of a shipping company in the maritime trade market system

$$e_v = \frac{\Delta P_{RV}}{C_{ST}} \quad 7.27$$

11. The cost of cargo or passenger transportation and its justification in relation to the equilibrium tariffs of this freight market sector is calculated using the traditional method and is limited by condition 7.28.

$$c_{sq} = \frac{C_{ST}}{\Sigma Q} \leq p_{cf}(1 - e_n) \quad 7.28$$

where:

e_n – efficiency standard of functional activities adopted by the given shipping company.

12. The intensity of foreign exchange inflows reflects the realization of the shipping company's production potential according to this indicator

$$\mu_V = \frac{\Delta P_{RV}}{\Sigma D_N T_E} \quad 7.29$$

13. The profitability of the transport potential of the shipping company reflects the most important final indicator of the efficiency of carrying capacity

utilization, as the main characteristic of the shipping company's production potential

$$\mu_{pr} = \frac{P_{RC}}{\sum D_N T_E} \quad 7.30$$

14. Labor productivity in transportation characterizes the efficiency of utilizing the competence of the shipping company's employees

$$\rho_t = \frac{\Delta P_{RVT}}{t_r N_{CR}} \quad 7.31$$

In global shipping and the main freight market ranges, constant cyclical and structural changes are taking place. These changes simultaneously influence the transformation of the time factor's role and the increasing dynamism (intensity) of resource utilization. Therefore, the system of operations in the freight market must take into account the specifics of the relationship between tariffs, costs, and results both within the accounting period and throughout the life cycle of a company or investment project.

The profit of a shipping company should reflect the impact of fleet production potential utilization, consider international factors, structural shifts in cargo flows, and convention requirements.

Profit reflects efficiency, taking into account the dynamics of transportation costs. However, the income redistribution system based on tax regulation does not allow for a complete reflection of efficiency trends solely through profit growth.

Under conditions of uncertain freight market cyclicity, the role of profit as a generalized indicator of efficiency in assessing functional and investment activities is being transformed, which should be taken into account in the current operations of a shipping company.

In general, the traditional principle of calculating cost and specific capital intensity is maintained by comparing annual total operating expenses with the market (construction) value of the vessel and its annual transport capacity (productivity) in the relevant transport performance metrics. When freight revenue remains stable, the specific indicators used in efficiency calculations can be compared with the financial results of the fleet's operational activities in accordance with EBITDA calculation methods.

Control Questions

1. Sources of income for operators in the maritime trade market.
2. Features of the revenue flow structure of a shipping company.
3. Patterns of operating expense formation in shipping companies.

4. Define the term “cost” related to business management.
5. Which is the basis for calculation notional costs?
6. Which methods of unit cost calculation do exist?
7. Please explain the basic principle of direct costing.
8. Provide a brief description of a vessel’s operating expenses.

1	Crew costs
2	Equipment and repair
3	Other ship operating costs
4	Insurance
5	Costs for chartered-in tonnage
6	Overheads liner shipping
7	Land-based staff costs
8	Other land-based administrative costs
9	Expenditures for ship management

9. Explain the content of the “other expenses” category in a shipping company.

1	Depreciation on fixed assets
2	Depreciation on current assets
3	Depreciation on receivables
4	Depreciation on current assets securities
5	Interests and similar expenditures
6	Extraordinary expenditures
7	Taxes on income and profit
8	Others taxes
9	Compensation of losses of other companies
10	Profit remittance

10. Features of the classification of operating expenses.
11. The nature of changes in individual expense groups under the influence of scientific and technological progress.
12. Features of cost calculation in foreign shipping companies.
13. List the key economic performance indicators of transport vessels.
14. Principles and conditions for the formation of financial indicators of a shipping company

Chapter 8.

RESOURCE MANAGEMENT OF SHIPPING COMPANIES

8.1. Forecasting the Development of Maritime Transport

In the system of the maritime trade market, it is necessary to distinguish between the stage of market condition forecasting and the stage of development of individual subsystems that ensure the satisfaction of demand in the freight market. The unpredictable variability of numerous factors that determine the formation of key characteristics of individual segments of the maritime trade market complicates the tasks of a shipping company's development based on principles of sustainable adequacy. In this regard, it is essential to differentiate between the objectives and tasks that arise within the management structure, taking into account the following distinctions of key terms.

The procedure for forecasting the maritime trade market condition includes three steps. The first is the establishment of key tasks; the second is determining the qualified level of forecasting; the third is assessing the main approaches to selecting the conditions for market formation and the objectivity of resolving interrelated expected parameters.

The forecasted state of the shipping market includes the assessment and prediction of the future condition of transport volumes as a whole or the most critical components of cargo flow formation, such as the tanker or container segments.

The study of regularities in the shipping market is based on focusing on the economic conditions of a company's operations in the selected segment of operational activity. In commercial shipping, decision-making requires clarifying the specifics of changes in the environment, commodity flows, and the nature of enterprise development, which ultimately shape the dynamics of demand for fleet carrying capacity.

The complexity of forecasting the development of a shipping company is driven by informational limitations and the inability to precisely determine the parameters of global trade, which the fleet is selected to serve. Routes and trade contracts are constantly changing. The highest accuracy is achieved when carrying capacity is oriented towards domestic foreign trade relations. This is precisely the policy of national maritime transport development implemented by Japan, Germany, and China.

Figure 8.1 illustrates the features of implementing these approaches in selecting the positioning strategy of the fleet within the respective segment of the shipping market.

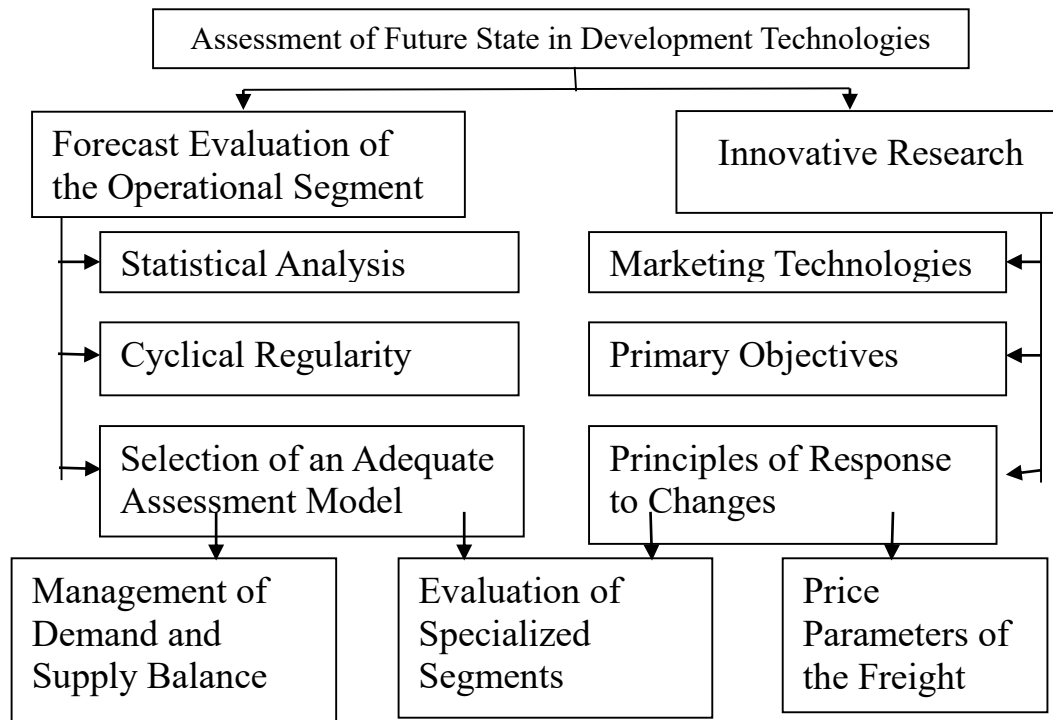


Figure 8.1. Decision-Making Structure in Commercial Shipping

The process of forecasting the global shipping market gains independent significance. The primary focus is on assessing the patterns of key parameter formation and determining the stability of the prevailing trends in the maritime transport system to select an appropriate fleet capacity growth strategy.

Among the key principles of forecasting in maritime transport, the following are distinguished:

- **Relevance** – forecasting should align with development objectives. That is, shipping must take into account possible transformations in shipbuilding over the projected period. A fundamental aspect of maintaining competitiveness is the adequacy of assessing the freight market condition. In this process, it is crucial to achieve a balance between shipbuilding prices and the demand parameters in the main segments of the maritime trade market.
- **Rationality** – predictive assessments should be based on objective trends. This is achieved through analysis, consulting evaluations, and heuristic approaches.
- **Multifactoriality** – forecasting should be based on high-level scientific research and consider the complex combination of factors that determine the nature of market development trends in maritime transport.

Marketing research in the methodology of forecasting the state of maritime trade market segments involves the implementation of the following assessments and the selection of an appropriate response strategy:

- **Strategic and corporate planning**, which is based on the specifics of the freight market's formation and transformation to ensure the stable positioning of the fleet and company according to key criteria.
- **Analysis of the dynamics of the main structures forming cargo flows**, particularly the impact of macroeconomic conditions on the activation of microeconomic subsystems generating these flows.
- **International cooperation in the maritime transport industry**, particularly in shipbuilding across different world regions.
- **The presence of state policies to support market relations**, considering changes in external systemic conditions.
- **The nature of relationships within the maritime transport industry**, taking into account the specifics of the shipping and shipbuilding market development.
- **Bank credit policy**, where, to minimize commercial risks, the flow of credit resources should be based on future characteristics of cargo flow stability and tariff rate levels.

Considering these factors allows for an evaluation of various future scenarios for both the freight market segment and potential strategic decisions regarding the functional activities and development of a shipping company.

8.2. Economic and Operational Justification of Transport and Technological Systems

The stability, direction, and scale of development depend on the resource availability of shipping companies. Therefore, in the management system, indicators are highlighted that reflect both the resource intensity of the transportation process and the cost-effectiveness of decisions. The demand for resources is determined by the goals of maximizing profit and improving operational quality.

The economic resources of shipping companies include the totality of production and material assets and their monetary value, the number of employees, information support, as well as the land and water area owned by the enterprise.

Taking into account the general patterns of forming an equilibrium state in the market, based on the adequacy of supply and demand, which ultimately determines the price level, the scale of participation of individual shipping companies in functional activities is established. Decision-making is based on the assessment of economic results or consequences. A particularly important role is played by the choice of a

strategy for competitively sustainable operation in the region of specialization of this transport enterprise.

It is important to consider the increasing significance of the technical and economic characteristics of the fleet in this process. The primary method for the operational and economic justification of technical means in maritime transport is the variant method.

Its principles when selecting an alternative economic and investment solution are as follows:

1. The task of project decision-making from a strategic approach is formulated.
2. An analysis of the operating conditions of vessels on the chosen route is conducted.

The main elements of the analysis include:

- Overall characteristics of the navigational conditions of the route;
- Key parameters of the trading ports where the vessels are to be processed;
- Transport characteristics of the cargo being carried.

3. Selection of the optimality criterion for the technical and economic solutions and the method for solving the problem.

The optimality criterion is established in accordance with the objectives of economic development within the system of market relations, based on the general principles of managing functional activities, investment projects, and economic processes.

In commercial shipping, net present value is used as the criterion for the optimality of economic and investment decisions that involve choosing one of the possible options.

$$N_{PV} = \sum (R_V - C_{ST}) \alpha_{ti} - K_{PI} - K_W \quad 8.1$$

where:

R_V - income (cash inflows) from the operational activities of the shipping company, which utilizes investment resources for development;

C_{ST} - annual current costs to ensure stable operations during the year in the projected life cycle (T);

$$K_W = \frac{\bar{p}_c Q_t t_t}{365}$$

$$t_t = 1/2 \alpha D_N \left(\frac{T_E}{\sum Q} + \frac{1}{M_B} \right) + \frac{l}{v_E} \quad 8.2 - 8.3$$

The delivery time of the cargo, t_t , is determined by the guiding freight flow of the considered route. The average price per ton of transported cargo is calculated based on the relationship:

$$\ddot{p}_C = \frac{0,1 \sum p_{CI_i} Q_I}{\sum Q_I} \quad 8.4$$

The amount of working capital for imported goods is taken in full, which stems from the payment terms stipulated and considering the possibility of technical credit. For exported goods, the freezing of working capital is accepted within the range of 0.1. Both the structure of exports and the nature of settlements are taken into account.

The freezing or diversion of working capital in transportation is influenced by the consumption pattern of certain types of cargo, seasonality, or the necessity for long-term storage of goods. The operation of the merchant fleet in the conditions of the charter market assumes the use of freely convertible currency; therefore, when calculating indicators, it is necessary to consider the exchange rate of the national currency.

Calculations are performed for the operational period. During this time, the volume of transportation work and cash flow are formed. However, expenses occur throughout the entire calendar period. Therefore, the arrangement of the fleet must ensure economic efficiency that is not lower than the level of normative fund accumulation for subsequent development. Transport and technological systems differ in capital intensity and delivery times for cargo. They vary not only in speed but also in the effectiveness of their implementation (Fig. 8.2).

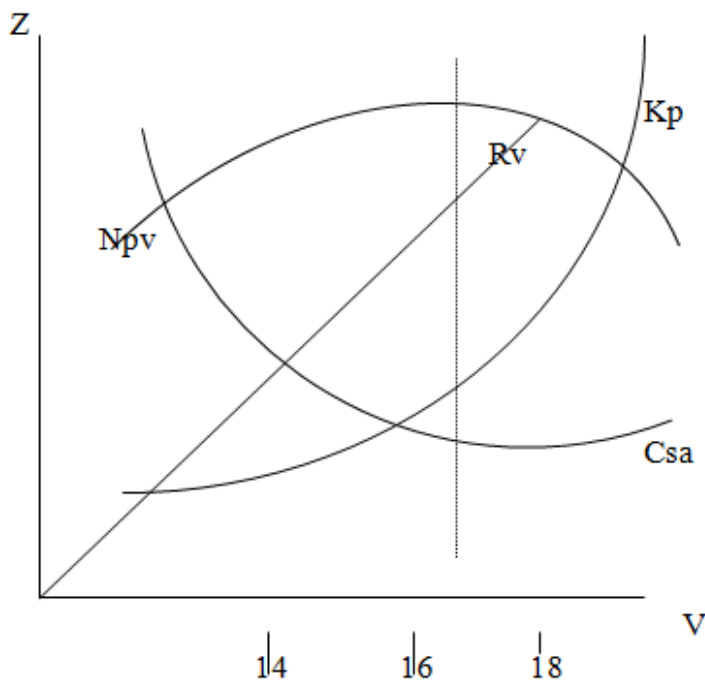


Figure 8.2. Dependence of Key Indicators on Ship Speed

The economic feasibility of making operational and investment decisions is evaluated based on the fleet's performance through the calculation of the efficiency coefficient, which should not be lower than the profit norm or the bank's interest rate.

$$e_a = \frac{P_R}{K_p} \geq E_r \quad 8.5$$

In this case, the design solution meets the objectives of entrepreneurial activity; however, it is necessary to consider the level of risk, which is determined by a number of uncontrolled external factors. In cargo transportation, the rhythm and reliability of delivery create the attractiveness of the shipping company based on competitiveness factors, but working capital is not calculated.

When addressing the implementation of an investment project aimed at developing shipping under the national flag, it is important to monitor the payback period for the costs of ship construction.

$$t_{ok} = \frac{1}{e_e} \leq \frac{1}{0.14} = 7.1 \quad 8.6$$

The nature of changes in the key criteria indicators in relation to the main characteristics of the vessel can be traced through the dynamics of the indicators during the various stages of the life cycle.

4. In the system of managing competitive parameters, the preparation of initial data is of fundamental importance. This includes:

- a. hydrometeorological and oceanographic characteristics of the ship's transit route between ports;
- b. characteristics of the ports of call;
- c. transport characteristics of the cargo being transported;
- d. special operating conditions for ships (delta transitions, channels, tides, ice parameters, transshipment complexes)

5. When justifying the means of transportation for effective operation in a competitive charter market, the approach to selecting possible solutions to the problem becomes of paramount importance. The process of comparing alternative implementation options for the strategy acquires fundamental significance. Among the main differences between the options are highlighted:

- cargo capacity of the vessels;
- operational speed;
- type of power installation.

6. The analysis of options is carried out according to a standard model based on the comparison of final quantitative and qualitative indicators.

7. The main requirement for the calculations of the key indicators across the options is comparability and adequacy.

8. This allows for making investment and management decisions regarding the implementation of shipping development options. To achieve stable positioning of the merchant fleet in the chartering market, it is critically important within the management system of economic and investment processes to monitor the state of shipping companies in relation to the constantly changing parameters of cargo flows and competition. The effectiveness of operational activities depends on the level of utilization of transport potential in an equilibrium state of the transport services market.

The ongoing improvement of the organization of intensive resource use is based on normalizing the relationship between costs and results. This requirement is determined by the principles and conditions of the equilibrium state of the chartering market.

Despite the diversity of conditions and factors influencing the cyclicity of various economic systems, a number of common features can be observed in the temporary changes in business activity. Their analysis and systematization allow for the development of anti-crisis mechanisms and tools to mitigate negative consequences and reduce losses in the balance of functioning and development.

8.3. Price Characteristics of the Merchant Shipping Industry

The price characteristics of the merchant fleet largely determine its competitiveness and the expected financial stability of shipping companies.

Prices within the structure of the maritime transport industry, including interest rates, perform distributive functions. This, in turn, determines the flow of real capital across different types of activities, taking into account expected profitability levels and interest rates.

From this perspective, the economic independence of maritime transport enterprises is viewed as a form of self-regulation in the creation of resource potential, based on the adequacy of capital asset prices and tariff rates. This ensures self-sufficiency. At the same time, it is necessary to consider the requirements for proper incentives for employees based on the results of their functional activities.

The secondary market for merchant fleet vessels arises for two reasons. The first is the intensive renewal of vessels by leading shipping companies during periods of an

active freight market. As a result, the cost of vessels in this group is relatively high (see Fig. 8.3), which limits the pool of potential investors.

The second reason is a crisis-induced decline in transport capacity during periods of falling freight rates. However, despite the decreasing cost of vessels in this category, the risk of their further efficient use by new owners remains. Therefore, a significant share of such vessels is sold in the scrapping segment.

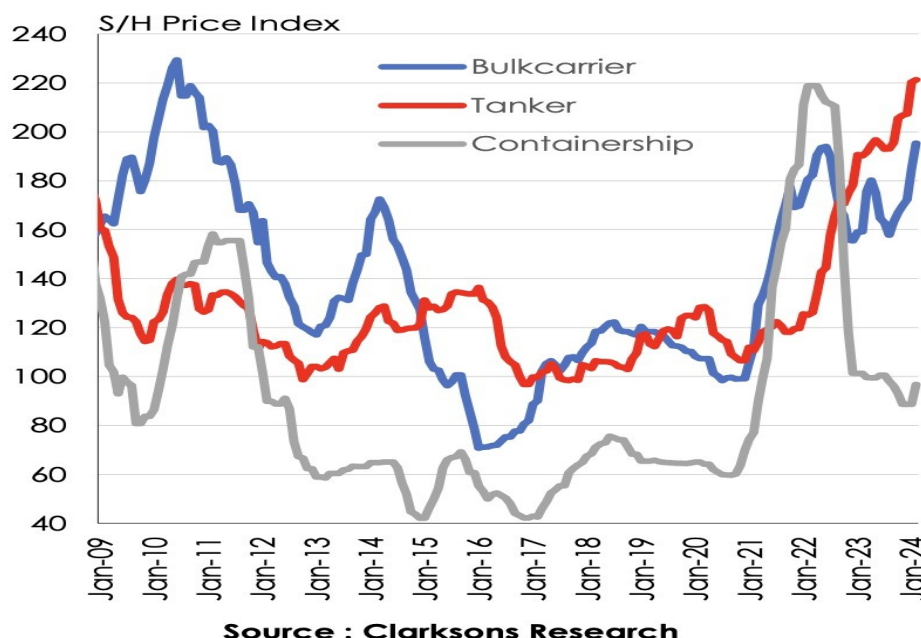


Figure 8.3. Pricing Characteristics in the Secondary Market of the Bulk Carrier Segment

When financing shipbuilding, it is essential to consider the fundamental stance of commercial banks. The level of lending activity depends on the availability of government guarantees for debt coverage. The low profitability of shipbuilding and merchant shipping necessitates a mechanism to protect investment flows under conditions of low credit rates.

At the same time, changes in the economic development of the shipping industry must be assessed based on the dynamics and productivity of its overall potential as well as its individual components. The nature of price fluctuations in the shipbuilding market is presented in Table 8.1.

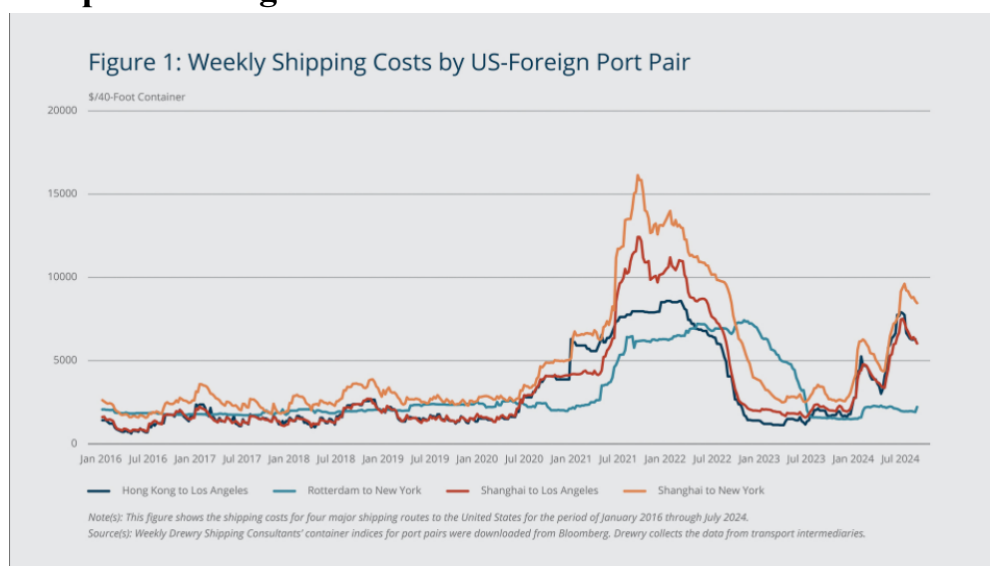
Table 8.1. Price Change Patterns in the Shipbuilding Market (Tankers, million USD)

Tanker Type	2002	2008	2014 China	2014 S. Korea	2020	2024
VLCC	64	150	92	97	~90-95	~129
Suezmax	44	95	60	67	~60-65	~75-85
Aframax	34	72	51	57	~50-55	~65-70
MR Product	27	50	35	37	~35-40	~45-50

Forecasting pricing trends in any segment of the maritime transport industry should be regarded as a research tool that helps refine information about the future dynamics of the analyzed system.

Justifying competitive vessel types in the transport fleet requires selecting optimal size and design characteristics for tankers, bulk carriers, container ships, cruise liners, ferries, gas carriers, and other specialized vessels. The primary requirement is the development of key technical specifications that ensure both functional and financial stability within a standardized lifecycle.

Figure 8.4. Changes in the Pricing Influence of Maritime Transport on the Cost of Transported Cargo



A crucial mechanism for accumulating and redistributing investment resources is the stock market. Its primary function is to mobilize and efficiently reallocate financial savings and capital from individuals and businesses. Besides these domestic financial sources, attracting foreign investments is also considered advisable. However, this source is subject not only to reliability and repayment efficiency requirements but also to considerations of maintaining market segment balance without intensifying competitive tensions from new operators.

In the maritime transport sector, time-charter operational processes generate the first category of income. In contrast, leasing vessels under bareboat charter forms the second category of shipowners' revenues. Additionally, mechanisms such as rental, leasing, and other specialized forms of capital utilization create direct or off-system passive incomes. The last group includes revenues generated through reflagging instruments.

This classification of revenues takes into account the nature of taxable income formation for both legal entities and individuals. The second and third income

categories face strict limitations due to the total cost of investment maintenance and capital expenditures.

8.4. Subsidization of Commercial Shipping

Subsidies for ship construction, as part of the strategy to stimulate the development of the national commercial fleet, are provided both directly to shipowners and to shipbuilding enterprises.

In the United States, shipbuilding subsidies played a significant role in the economic regulation of maritime transport development, as governed by the Merchant Marine Act of 1936. The primary reason for implementing the subsidy principle was the high cost of fleet construction at domestic shipyards. In this regard, shipbuilding costs in the U.S. were 35–50% higher than in other countries. Subsidies were granted under the condition that the fleet would be used for transporting the country's foreign trade cargoes. As a result, American shipowners were able to purchase vessels from domestic manufacturers at prices comparable to their foreign counterparts.

Amendments to the Act, introduced in 1978, limited subsidies to 50% of a vessel's construction cost. Under subsidy conditions, the crew had to be composed of the country's citizens, and the vessel was required to remain under national jurisdiction for at least five years. For tankers, this period extended to 20 years. The abolition of subsidies in the 1980s was driven by conflicts of interest among different groups of shipowners. Those operating outdated fleets preferred operational subsidies, while others prioritized shipbuilding subsidies.

As financial difficulties in fleet construction emerged, the U.S. Maritime Administration faced a shortage of private investment for commercial fleet development. Shipowners were then allowed to redirect funds originally allocated for operational subsidies toward the construction and acquisition of ships abroad.

To enhance the competitiveness of the American merchant fleet, the U.S. Maritime Administration, in cooperation with the Federal Maritime Commission, considered establishing a second (international) register and abandoning the requirement for exclusively U.S. citizen crews.

Compared to this strategy, Japan's fleet development up to 1975 was based on an active policy of subsidizing national shipowners. Once shipping companies had built a sufficient financial base for fleet expansion, subsidies were suspended. After their abolition, the Japanese government continued to support shipowners by providing low-interest loans covering 60–70% of vessel costs, primarily benefiting the largest shipping companies.

In Italy, shipbuilding subsidies and subsidies for purchasing vessels on the secondary market ranged from 5.5% to 10% of the ship's value. The age of the vessels was not to exceed five years. A similar approach was adopted in France.

In Germany, the shipbuilding subsidy system had been in place since 1965. Vessels had to be registered in the national registry, with contractual restrictions on their resale to foreign citizens. This contractual period lasted up to 10 years, and the subsidy amount ranged from 10% to 12.5% of the vessel's construction cost. Subsequently, a new shipbuilding subsidy system was introduced for shipyards, allowing enterprises engaged in ship construction and modernization to receive subsidies of up to 20% of the contract price. Two-thirds of these subsidies were financed by the federal budget, while one-third was covered by regional governments.

In the Netherlands, national shipowners were eligible for subsidies of up to 20% for building or purchasing a vessel, provided the ship was no older than five years.

A key role in many countries is played by subsidies aimed at tonnage renewal. In Japan, a tonnage renewal incentive system was introduced. Under this system, when a coastal vessel is decommissioned, the shipowner is granted the right to operate a new vessel, with 70–80% of the contract price financed by the Maritime Credit Corporation, under a subsequent joint ownership arrangement of the vessel.

Operational Subsidies. In the United States, operational subsidies are provided to align operating costs with those of foreign shipowners. To receive a subsidy, a shipowner must sign a 20-year contract with MARAD (U.S. Maritime Administration), which specifies voyages on designated trade routes.

A key challenge is that wages in the U.S. are traditionally uncompetitive. More than 85% of operational subsidies are allocated to cover labor costs. These subsidies are available to both company owners and vessels operated under leasing agreements. To qualify for a subsidy, the following conditions must be met:

- The shipowner must be a U.S. citizen;
- The vessel must be built in a U.S. shipyard;
- Operations must contribute to U.S. foreign trade;
- The vessel must face competition from foreign fleets.

Nevertheless, the subsidy system is often criticized for failing to ensure fleet efficiency and competitiveness. A real alternative to government subsidies is the long-term chartering of vessels to the Military Sealift Command or registering ships under open registries. Subsidies alone do not guarantee fleet profitability.

In Japan, operational subsidies were provided to shipowners serving inter-island transportation.

In Italy, operational subsidies remained in place for companies engaged in cabotage transport in the Tyrrhenian and Adriatic Seas. As a temporary measure,

subsidies were granted to state-owned shipping companies to compensate for losses in international maritime transport.

In France, operational subsidies were granted to national shipping companies to offset financial losses. Additionally, subsidies were available for loan interest payments and maritime research programs.

A key role in government regulation of maritime transport is played by credit-based incentives for national shipowners. Special financial institutions have been established to fund fleet construction and modernization. These institutions operate primarily on state funds, which are loaned to credit organizations for subsequent redistribution.

Ukraine's transport management is based on the principle of optimal integration of key production infrastructure components. However, a balanced approach to functional activities has not yet been achieved, particularly in harmonizing industry-specific features and intermodal transport cooperation.

8.5. Staffing of shipping companies

The stability of shipping companies is determined by the activity of the maritime trade market and the compliance of fixed capital and crew competence with competitive conditions. By the decision of the IMO on November 29, 2000, Ukraine was included in the first edition of the "White List" of seafarers. This granted them the right to work freely in the global maritime labor market. At the same time, the country's fleet fluctuated between the gray and black lists.

The development of the outsourcing principle led to the separation of management functions for core operational activities and the resource support system of shipping companies. Instead of labor departments within enterprises, specialized intermediary organizations emerged between the maritime labor market and fleet operators.

Shipowners who hire the corresponding specialists must pay for such services. However, according to the MLC Convention, these services should be free for crews. Despite the convention's implementation starting in August 2013 as the main institutional organizer of the maritime labor market, contradictory opinions continue to arise.

Under international conventions, it is prohibited to demand advance payment for future work on a ship when hiring for any shipping company and through any specialized divisions. This is the main reason why the 2006 Maritime Labor Convention is unacceptable to all intermediaries. Furthermore, it is argued that

ratifying the convention is not advisable due to the absence of a commercial fleet in Ukraine.

According to the current legislation, for a seafarer to work on a ship, they must have an employment contract, signed by the union, and a collective agreement between the union and the shipowner company. The interview is a sign of the intermediary's responsibility for the candidate they propose.

In accordance with the mentality of shipping companies in traditional maritime nations, anyone wishing to work for the company must strictly adhere to the terms of the contract. Any deviation from the behavioral norms, suggested by the employer and voluntarily accepted by the seafarer, undermines human trust, leading to the subsequent loss of the job.

The International Safety Management Code states: "Each shipping company has its own policy regarding all aspects of its operations, including staffing". All behavioral standards are closely related to the approach to accident-free operations. This is also linked to the main requirements for maritime professionals and their conduct during a voyage.

Labor productivity management standards must take into account not only the results but also the costs of maintaining maritime professionals. Any indicator – whether comparative, average, or marginal – provides the opportunity to compare the achieved results with the initial ones. In this context, the role of resource utilization standards in the system of performance assessment and management is significantly enhanced.

The balance of the labor market for seafarers and the number of ships in the merchant fleet is determined by the nature of the global economy's development. In the post-crisis period of 2010 – 2013, the demand for maritime transport specialists significantly decreased due to the scrapping of outdated vessels and the slow renewal of tonnage with newly built ships. As a result, the requirements for the competence and integrity of seafarers have become stricter. Characteristics such as reliability, politeness, economy, neatness, and attitude toward alcohol are emphasized.

The shipowner has the right to dismiss a crew member without compensation or costs associated with their return to their homeland if the seafarer fails to follow the behavioral rules established by the shipping company. Such violations include:

- refusal to perform work assigned by a superior;
- use or transportation of narcotics or contraband;
- being late for a watch;
- deliberately causing damage to the ship or cargo;
- intentionally disregarding local rules of the country or port of arrival;
- alcohol addiction or bringing alcohol aboard.

Despite the challenging nature of working at sea, one percent of seafarers are women (65% of them work on passenger vessels). Of this number, 68% work on ferries, and 18% of cruise ship crews are women.

Unfortunately, up to 10% of seafarers working for foreign shipping companies violate fundamental behavioral rules. As a result, their further professional development becomes impossible. These negative characteristics affect the reputation of other seafarers from the same country.

2014–2016: The demand for maritime transport specialists continued to decrease, especially in the dry bulk and container shipping segments, due to the crisis in the shipping industry and record-low freight rates. Many shipping companies froze hiring or reduced salaries.

2017–2019: A gradual recovery of the market led to an increased demand for skilled seafarers, particularly for work on new eco-friendly vessels. The active introduction of digital technologies required crews to acquire new knowledge, especially in the field of automated ship management systems.

2020–2021: The COVID-19 pandemic triggered a global crew change crisis – thousands of seafarers were stranded on board ships due to closed borders and quarantine restrictions. This led to stronger requirements for the physical and psychological health of crews, as well as accelerated digitalization in maritime logistics.

2022–2023: The market recovery after the pandemic was accompanied by a shortage of qualified personnel, especially engineers and captains. Shipowners began offering more competitive salaries, but at the same time, there was increased oversight of contract compliance and professional training for seafarers.

2024–2025: The shipping industry faces new challenges: stricter environmental standards (IMO 2050), the development of autonomous shipping, and the introduction of alternative fuels. Seafarers must now have knowledge in cybersecurity, sustainable technologies, and working with new types of ship energy systems (methanol, ammonia, LNG). This has led to a further increase in crew qualification requirements and a greater role for maritime educational institutions.

In summary, from 2010 to 2025, the maritime labor market went through phases of crisis, recovery, and adaptation to new technologies. Today, it demands not only traditional maritime competencies but also knowledge in digital technologies, environmental science, and automation.

According to the classification society DNV GL, in the next decade, the concept of crewless shipping will be implemented globally, based on the operation of vessels without onboard crews.

The advantages of this strategy include the reduction of labor costs for seafarers due to the high degree of automation of production processes, which would also allow for uninterrupted operation of vessels.

However, the main drawback of “crewless shipping” is the ease with which such vessels can be hijacked or captured by destructive forces.

At the same time, the International Labour Organization (ILO) has introduced material liability for shipowners in cases of abandonment, injury, or death of seafarers. By 2014, up to 150 ships had been abandoned by their owners. A principle of insurance coverage for seafarers' wages is under consideration.

Additionally, seafarers must be guaranteed repatriation and compensation when the shipowner is unable to fulfill these obligations for valid reasons.

The compliance with working conditions, as per the contract, should be monitored by the flag state. Based on the provisions of the Maritime Labour Convention (MLC), the most common reasons for prohibiting ships from leaving port include non-compliance with reports on seafarers' rest hours under the International Convention on Standards of Training, Certification, and Watchkeeping for Seafarers (STCW), lack of contracts or incorrect completion of contracts, wage arrears, or incorrect payment to crew members.

It is important to remember that the nature of labor has been recognized since ancient times. The ancient Greeks distinguished three hypostases of the human being: “People are divided into three categories: the living, the dead, and those who float in the sea”. Humanity should be grateful to the latter for maintaining international trade. Shipowners, who cannot ensure profitability without sailors, must timely pay rewards for their hard work.

Information about current job vacancies for sailors on vessels of the global fleet is published in the Seafarers Journal – Marin Panel app. This serves as an alternative to mass mailings of Application Forms and inquiries to various crewing agencies. To use this, sailors must register in the Marin Panel app, provide their data, and upload their resume. Registration in Marin Panel allows sailors to receive notifications about job vacancies. These listings are updated daily by potential employers.

In addition to the Marin Panel app from Seafarers Journal, there are other platforms where sailors can find up-to-date job vacancies and post their resumes. Here are some of them:

1. Maritime Zone: A platform offering more than 3,000 urgent vacancies from crewing companies. Registration allows sailors to receive job offers and promote their profiles to the top of the search results for companies.

2. Crewings.Me: A website with an up-to-date database containing over 5,000 companies and job vacancies from crewing agencies and shipowners. It provides a quick and free way to search for sea jobs without the need for registration.
3. Global Application (GloAp): A platform with more than 3,000 current job vacancies. Sailors can freely upload their resumes for job searches, as well as take CES tests to assess their knowledge.
4. Crewell: A resource offering vacancies in commercial, offshore, cruise, and other maritime sectors. Creation of an online CV and application for vacancies is available after registration.
5. Maritime Union: A union of sailors, maritime companies, and crewing agencies that publishes job vacancies for various positions and types of vessels. It provides free job search services and up-to-date vacancies.
6. CrewServices: A platform that offers resume creation and posting on the website, as well as distribution of the resume to more than 1,000 shipping and crewing companies.

Using these platforms can significantly increase the chances of finding employment in the maritime industry, providing access to a wide range of vacancies and direct interaction with potential employers.

8.6. Management of Capital Assets of a Shipping Company

Each transportation enterprise possesses production factors, including the means of production necessary for the normal functioning of the production process. These production assets consist of means of labor and objects of labor. Means of labor, or fixed capital, include machines, vessels, handling equipment, facilities, buildings, and tools.

By means of these instruments, workers act upon the objects of labor. Instruments of labor, together with objects of labor, constitute the essence of production assets, which undergo a continuous process, transitioning from one stage to another.

Depending on their role and nature of participation in the production process, production assets are divided into fixed and working assets. They also differ in the way they transfer their value to the cost of products.

The fixed production assets of a shipping company serve its operational activities (transportation) over an extended lifecycle. Throughout this period, they maintain their physical form, meaning that vessels remain capable of safely and efficiently transporting cargo. The value of these vessels is gradually transferred to the produced output (transport work volume) in proportion to their service life through

depreciation. The fixed assets of maritime transport enterprises include transportation vessels, handling machinery, equipment, buildings, structures, and more.

The fixed assets (fixed capital) of maritime transport enterprises encompass a smaller set of objects than means of labor (all factors of production) since they include only assets that have value. A special role in this process is played by the use of land resources.

The quantity, quality, and degree of utilization of production assets directly determine the volume of production and the level of labor productivity. With technological progress, the role of fixed assets in production increases, and their share in the production infrastructure grows.

The place of fixed assets in the national wealth of the country is reflected in the diagram.

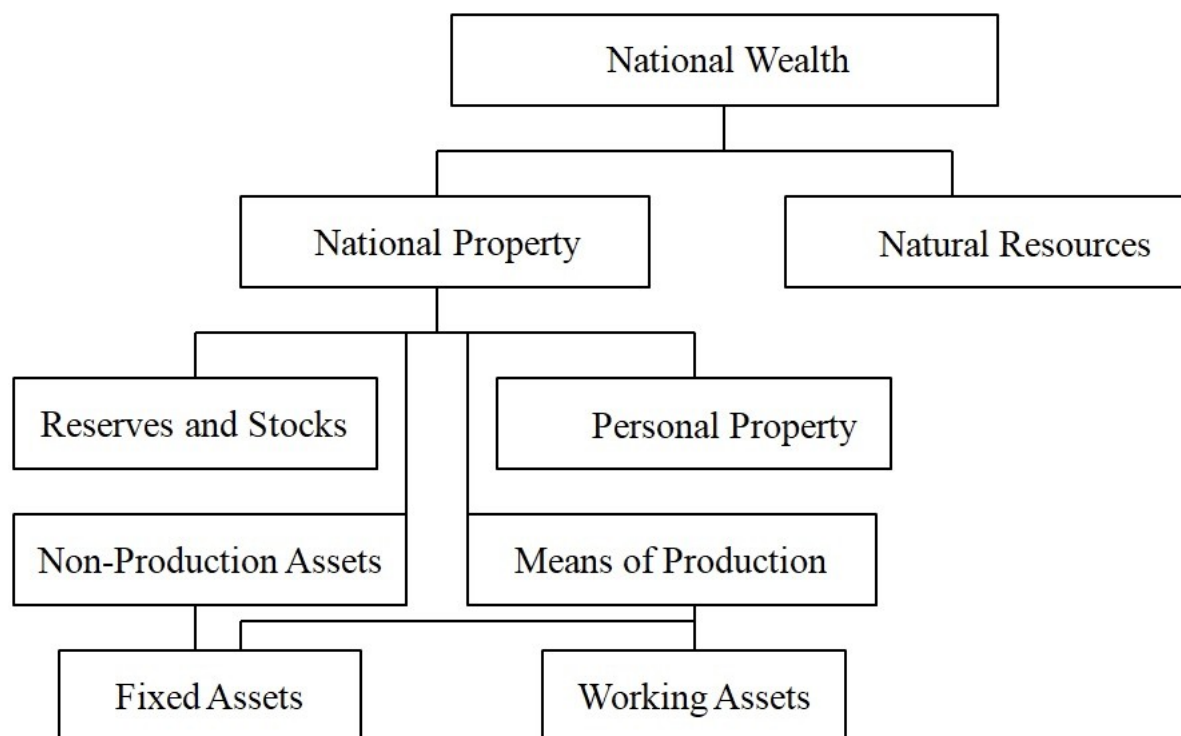


Figure 8.5. Structure of the Production Potential of a Shipping Company

Fixed and working assets differ in three key aspects:

1. Method of transferring their value to products – Unlike working assets, whose full value is incorporated into the finished product, fixed assets participate

repeatedly in the transportation process. They transfer their value to transportation operations gradually, in parts, as they wear out.

2. Turnover duration – Fixed capital (assets), unlike working assets, serves as a means of labor across multiple production cycles while retaining its physical form.

3. Nature of reproduction – Unlike working assets, which need to be replenished after each production cycle, fixed assets require replacement in their original physical form only after a certain number of years and as a whole, rather than in parts.

Thus, fixed production assets include means of production that, while being used in business operations, serve multiple production cycles and gradually transfer their value to the final product in parts.

Working assets, on the other hand, participate in the labor process for only one production cycle, with their full value being transferred to the corresponding volume of transportation work.

8.7. Forming a Strategy for Systemic Development of a Shipping Company

Any stage of environmental research and the development of investor or operator objectives is aimed at selecting a strategy for effective development and sustainable positioning of potential based on the principles of the market and company life cycle. A strict sequence for developing strategic policy has been established. At the first stage, in accordance with the phases of assessing the state of the external and internal environment, analysis is carried out in the following sequence:

1. Analysis of the dynamics of fleet carrying capacity in the specialization segment.

The key characteristics include the growth rates of the fleet's deadweight in this group and the actual possibilities for further tonnage expansion.

Age characteristics of the commercial fleet segment and the decommissioning program based on the level of wear and tear.

When focusing on potential participation in the export of transport services, the choice of an adequate speed for new vessels becomes a critical issue. It should correspond to the conditions of stability within the segment and the objectives of accelerating cargo delivery, considering the future growth of cargo flow.

2. Analysis of demand – cargo flow dynamics. To assess the scale of future development in the priority segment of maritime trade, it is necessary to study the patterns of changes in international trade parameters.

The assessment and consideration of the impact of global and national economic growth on the demand for the carrying capacity of the corresponding fleet are essential.

The choice of a geographic segment of the International Maritime Transport (IMT) market ensuring the efficient realization of the shipping company's fleet potential is of particular importance.

Special attention is given to evaluating the dynamics of freight (tariff) rates and the response mechanism to significant deviations of the shipping complex from a normal state.

In the country's maritime space, the Association of Container Lines of Ukraine has been established. Customs and border services have confirmed the compliance of this process with the legislative framework. Thus, conditions are being created for the effective functioning of progressive transport subsystems within the national maritime transport industry.

When alternative options for improving the technical and economic level of the shipping company's fleet are available, the issue of choice becomes crucial in accordance with the tasks of prospective growth in cargo transportation volumes or cruise passenger traffic. The decision-making method is based on comparing investment feasibility and matching calculated indicators by vessel types to critical constraints.

Among the systemic and external constraints affecting the forecast of the technical development of a shipping company, a combination of conditions is identified. In this regard, the forecast of changes in the technical parameters of the maritime trade market becomes a key factor, following these directions:

- Analysis of trends in changing fleet technical characteristics in response to demand, especially in the case of structural transformations in the maritime trade market. Therefore, assessing changes in demand (dynamics and qualitative characteristics of cargo flows) and selecting characteristics for the prospective fleet become fundamental.
- Developing a forecasting model for processes and substantiating actions regarding the expected situation in the maritime transport market.
- Comparison of alternatives.
- Conditions and opportunities for the efficient use of the replenished fleet by directions and types of operations.

8.8. General principles of planning the development of shipping companies

The long-term development plan of any shipping company is aimed at fulfilling the primary objective of the maritime trade market—ensuring the completeness and timeliness of transport demand satisfaction under competitive access conditions to the cargo base.

Fleet development planning should be aligned with the country's macroeconomic goals and the activity of the global shipping market. In this aspect, there is a distinction between the general principles of economic subsystem development and the justification of a business plan for individual shipping companies.

The main goal of substantiating the long-term development of the fleet during the next business cycle is:

1. Selecting the optimal development path for all types of fleets.
2. Calculating the key development parameters.
3. Justifying the company's structure, considering potential resource constraints.
4. Conducting a comprehensive assessment of possible options for selecting the most suitable technical and economic parameters, reflecting market trends in maritime transportation.
5. Controlling the qualitative development parameters, particularly concerning the protection of the marine environment.

The initial data for the development of maritime transport enterprises include the general trend of international economic relations, changes in the global distribution of productive forces, forecasts of economic development, investment program concepts, and entrepreneurial activity.

Key development objectives:

1. Defining and selecting the scale of development based on capital investment efficiency strategy and structural rationality within budgetary constraints.
2. Justifying the fleet renewal program.
3. Optimizing the transport capacity formation for selected ship types.
4. Selecting the types and number of vessels.
5. Forming orders for fleet construction.
6. Determining the necessary reserves of transport capacity and improving its operational reliability.
7. Ensuring the technical and economic competitiveness of the national fleet at the global level.

8. Assessing the planned fleet development level under capital investment limitations and intense competition in the maritime trade market.

9. Developing requirements for related industries (cargo shippers, shipbuilders, and other transport sectors).

10. Developing and refining technical and economic standards for long-term planning.

Fleet development requires considering a complex set of informational flows, including:

- the current state of the maritime trade market;
- fleet development objectives stemming from national maritime policy;
- justification for fleet decommissioning, sales, and modernization;
- determining operational performance indicators of the fleet;
- calculating required transport capacity reserves;
- assessing and justifying final financial results.

Modern resource accounting and performance measurement are not strictly linked to the optimization of socio-economic outcomes at the macroeconomic and entrepreneurial levels. The increasing role of labor in ensuring the economic stability of commercial shipping necessitates the extensive use of labor indicators. A practical realization of this principle is the Maritime Labour Convention (MLC) 2006, which represents a simple and objective group of indicators. However, it is essential to account for the polarization of the capital market in commercial shipping and the seafarers' labor market. Their balanced integration requires specific principles and management conditions.

In the management system of a shipping company's development, return on equity (ROE) becomes a key factor. Efficiency is systematically reflected in the profit capitalization ratio, which represents the share of profit reinvested within the company.

A scientific and technical forecast is also crucial in this aspect, detailing future technical characteristics of the fleet and terminals.

The forms and parameters of such development should be based on quantitative analysis and the logic of future cargo flow changes and fleet productivity.

At the core of any development plan is a program for achieving final goals, which substantiates the expected state of the company within a fixed future period and explores possible ways to reach this state.

Control questions

1. Assessment of global and national demand for maritime specialists in the shipping industry.
2. Planning the training of specialists for shipping companies.
3. Conditions for ensuring the competitiveness of Ukraine's sector in the global maritime labor market.
4. Economic and legal guarantees for effective participation in the global labor market.
5. Efficiency of labor export and positioning of Ukrainian seafarers in the shipping market.
6. Mechanism and guarantees of seafarers' investment activities based on savings parameters.
7. Define the tasks of forecasting the parameters of maritime shipping development.
8. Features of structuring managerial decisions in commercial shipping.
9. Technical and economic justifications for transport and terminal service (TTS) of cargo flows.
10. Interrelation between technical parameters and fleet performance efficiency.
11. Pricing features in the maritime trade market.
12. Tasks and methods of subsidizing the shipbuilding sector.
13. Tasks and principles of personnel support for the needs of commercial shipping.
14. Formulate methods for managing the efficiency of capital assets in shipping.
15. Features of choosing a sustainable development strategy for a shipping company.
16. Structure of planning principles for shipping company development.

Chapter 9.

PLANNING OF CARGO TRANSPORTATION AND FLEET RESOURCE POTENTIAL

9.1. Organization of Economic Process Planning

The planning of the development of the merchant fleet is subordinated to the main objective – the full satisfaction of the demand for cargo and passenger transportation. As a planning criterion, the balance between revenue and operating costs of the fleet's activities is considered. Among the numerous definitions of the concepts of "plan" and "planning," we will focus on the most precise ones.

A **plan** is a pre-determined system of measures that outlines the order, sequence, and timing of task execution. The operational plan of a shipping company represents a concrete framework for achieving the goals of this production system.

At the same time, a plan is a structured system or sequence of actions aimed at achieving a set objective. The development plan must foresee both qualitative and quantitative changes in the composition of the fleet and the technology of maritime transportation.

The **fleet development plan** is a crucial part of the economic strategy for positioning an enterprise in the freight market system. The development of such a plan is based on general principles of managing competitive parameters of a company's economic and social state.

The objective of development is to implement the optimal approach to increasing the carrying capacity of the fleet while considering possible resource constraints.

Key Tasks of Fleet Development:

- Determining the scale and structure of the fleet's development to ensure effective positioning in the export-import cargo flows and competitive sectors of the freight market;
- Justification of the fleet replenishment program;
- Defining the development scale of the fleet by vessel types, purposes, and categories;
- Formation of an order portfolio for ship deliveries by type;
- Creating the necessary reserves of the fleet's carrying capacity and increasing operational reliability;

- Defining the proportional relationship between the fleet and its servicing divisions;
- Considering alternative fleet development options under investment constraints;
- Assessing losses due to limitations on the normalized expansion of carrying capacity;
- Developing technical and economic standards for the prospective development of the fleet.

Cargo transportation volumes serve as the foundation for designing the operational and development plan of a shipping company's fleet. Economically justified projections of cargo and passenger transportation volumes determine the necessary technical equipment for transport operations and, consequently, the amount of investment resources required for competitive capacity growth.

Traditionally, the economic development of the merchant fleet follows these stages:

1. Analysis of the current state of the merchant fleet;
2. Defining the objectives of the fleet's prospective development;
3. Formulating the functional activity concept within the freight market system;
4. Selecting the optimal development strategy for the fleet over the forecast period.

The analysis of the current fleet condition, both of the shipping company and its competitors, is based on statistical accounting data, analytical information flows, research findings, forecasts, and existing development projects.

Based on these data, the following aspects must be established:

- Development trends of commercial shipping;
- The correlation between fleet development scale and structure with cargo flow volumes, application areas, and operational conditions;
- Identification of disproportions in the development of the shipping company;
- Determination of development needs based on prospective vessel types and assessment of functional activity efficiency;
- Evaluation of the own fleet's compliance with the technical and economic level of major competitors;
- Selection of the information and regulatory framework for the prospective development of the shipping company.

The **parameters and structure of fleet replenishment** are determined based on vessel demand calculations, considering the market conditions of freight sectors. The

basis of calculations includes projected cargo and passenger flows and the expected level of competitive positioning. Specific indicators defining the fleet replenishment parameters include: cargo batch sizes, seasonality of transportation, external navigation conditions, dimensions of waterways, technical equipment of ports, organization of cargo flows.

Systematic Organization of Economic Process Planning

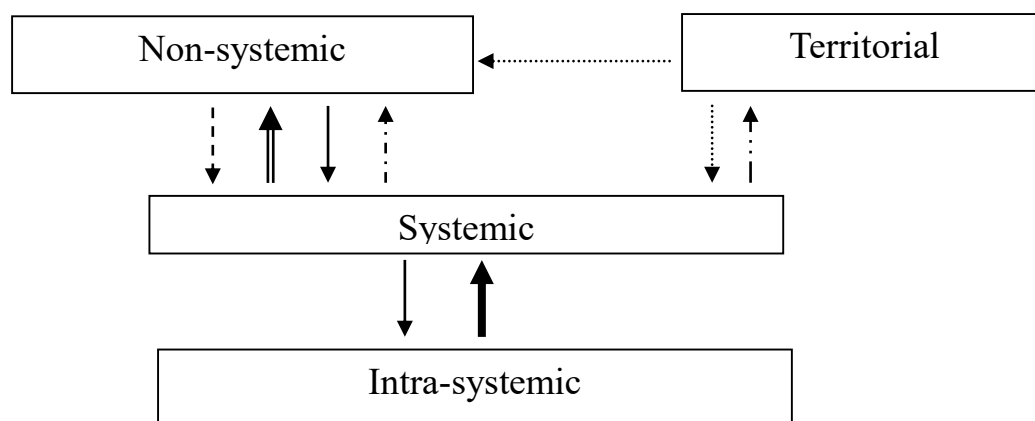


Figure 9.1: The Process of Structuring the Plan

- Development of growth forecasts
- ====► Transport service projects
- .-.-.-.-► Coordination of territorial changes in transport enterprise parameters
- Formation of land relations
- Refinement of positioning considering changes in external market conditions
- Key business plan parameters

A unified planning process is presented as a series of sequential stages reflecting the application of economic laws:

1. Analysis of the achieved level of economic development, identifying patterns of formation, trends, and causal relationships.
2. Forecasting economic, social, and technical parameters of development with justification of operational directions and assessment of alternative approaches to addressing current and future challenges.
3. Formation of specific planning goals:
 - General concept of the plan
 - Implementation conditions
4. Specific tasks

In the system of fleet development tasks, the following elements are distinguished: the goal, the main conditions and factors of fleet development, the volumes and structure of transportation and cargo turnover, as well as the volume and

structure of ship calls. These data are necessary for justifying the prospective parameters of the shipping company's development.

When developing the concept of long-term development, the most important directions and problems of the shipping company's fleet development are considered. The main emphasis is on ensuring stable operations for prospective cargo flows within the life cycle.

Among the alternative approaches within the system of socio-economic constraints, the following options are considered:

- further specialization of the enterprise based on cargo types, transportation technology, routes, and operational directions;
- comprehensive standardization and unification of the fleet;
- increasing the carrying capacity, speed, and productivity of vessels within economically justified limits for different specialization groups and areas of use;
- effective automation of management and production processes based on safety criteria;
- ensuring that commercial vessels meet the key requirements for intensive handling.
- optimal reliability and maintainability of vessels.

The development options for a shipping company's fleet differ in terms of tonnage structure by purpose and vessel type, as well as the form and balance of fleet replenishment, modernization, and decommissioning.

The assessment of the economic efficiency of fleet development options is based on the integral effect, which includes associated costs related to the structure of the material and technical base. These costs arise from the implementation of mutually complementary investment projects.

The selection of the optimal fleet development option, given similar efficiency indicators, is carried out through additional analysis of absolute efficiency, labor productivity, and the rational utilization of resources.

Based on the calculations ensuring long-term development, fleet replenishment or renewal programs should be developed according to vessel types and competitive acquisition bases.

The goal of the positioning strategy is to achieve a rational allocation and efficient utilization of the fleet to meet key financial and operational sustainability criteria for the shipping company.

One of the applicable methods for calculating freight indices under various shipping conditions, which accounts for the characteristics of specific tonnage and cargo groups, is determining the proportional contribution of the analyzed structural segments. The average freight rate for the analyzed group will be equal to

$$l_{pf} = \frac{\sum_i^n l_{di} \cdot \gamma_j}{\sum_j^m \gamma_j} \quad 9.1$$

where:

γ_i – the weight of individual commodity groups;

l_{di} – indices for the considered (j) size groups of vessels.

$$l_{dj} = \frac{p_{cfjx}}{p_{cfjb}} \quad 9.2$$

p_{cfjx} – the freight rate for vessels of a given deadweight group, chartered in the reporting period;

p_{cfjb} – the freight rate for vessels of a given group (j), chartered in the base period.

The freight index for the utilization of deadweight capacity, considering different proportions of commodity groups, is calculated based on their share in forming the cargo flow.

$$l_m = \frac{\sum l_{dqj} \gamma_{cfj}}{\sum \gamma_{cfj}} \quad 9.3$$

where:

γ_{cfj} – the weights of individual commodity groups;

l_{dqj} – indices for a specific commodity (by individual tonnage groups of the fleet). They are calculated under the condition:

$$l_{dqj} = \frac{p_{sfj1}}{p_{cfj0}} \quad 9.4$$

where:

p_{cfj1} – the freight rate for vessels of a given group, chartered in the analyzed period;

p_{cfj0} – the freight rate for vessels of a given group, chartered in the base period.

The main thing is to achieve methodological unity in calculating indicators so that multifunctional shipping companies can determine the effectiveness of using certain actions.

9.2. Fleet work planning

The planning of fleet operations is closely linked to shipping plans on the one hand, and on the other hand, it forms the foundation for decision-making regarding the further development and current resource provision of production activities. The fleet's availability, structure, and time budget are of paramount importance.

The ultimate goal of fleet planning is to calculate its normalized carrying capacity, measured by cargo turnover in ton-miles. Based on this, decisions regarding transportation plans or the loading of the fleet's operational potential are made.

The fleet work plan is developed in the following sections:

- Fleet balance
- Fleet time budget
- Fleet utilization indicators

The fleet balance, time budget, and utilization indicators are calculated based on fleet specialization groups.

The phased justification of the fleet work plan indicators.

At the first stage, the fleet balance is established, which defines the production potential of the company. The fleet balance reflects its availability and movement during the accounting period.

Traditionally, it is calculated in tabular form.

Table 9.1. Fleet balance calculation structure

Type of vessel	Opening availability		Fleet acquisition		Fleet reduction		End-of-period availability	
	Amount	Tonnage	Amount	Tonnage				
Dry cargo ship								
Tanker								

The availability of tonnage at the beginning of the accounting period is determined based on accounting records.

The fleet acquisition section accounts for all sources of transport potential growth within the shipping company, including new shipbuilding, market purchases, and capacity changes due to modernization.

Fleet reduction reflects any changes in the company's fleet composition that lead to a decrease in carrying capacity. However, the primary reason for fleet reduction is the decommissioning of vessels due to wear and loss of competitiveness.

At the second stage of fleet operation planning, the *time budget* is justified. The main elements of the time budget include the distribution of the calendar period into operational and non-operational time and the calculation of ship-days and tonnage-days as the potential transport capacity. Tonnage-days reflect the differentiation of vessel potential based on their cargo capacity, allowing for an accurate calculation of the fleet's possible transport capacity.

The time budget calculation begins with determining the duration of the period during which vessels will be out of operation for various reasons.

One of the main reasons for downtime is the need for different types of maintenance and repairs.

The calendar period is set in full accordance with the fleet balance and is calculated as follows

$$\sum D_N T_K = \sum D_{NN} t_K + \sum D_{NP} t_P - \sum D_{NY} t_Y \quad 9.5$$

By subtracting the time spent on repairs and other non-operational periods from the total calendar period, the overall time budget available for the fleet's potential transport operations is determined.

Within the operational period, time is allocated for transportation, chartering, and other types of work.

Table 9.2. Time Budget Calculation Scheme for Vessels

Indicators	Quantifiers	Vessel specialisation groups			Total fleet
		Universal	Container ships		
Carrying capacity, Calendar period. incl. on transport, on lease	T, ship-days, tonnage-days				
Total					
Out of service					

The standard requirement for the number and total cargo capacity of vessels refers to the amount of transport resources needed during the navigation (operational) period to perform a unit of transport work – Q, QL. It represents the carrying capacity per \$1 million of the fleet's balance sheet value, considering the level of technology and organization of transport processes.

The transport resource requirements can be calculated based on cargo turnover, foreign exchange revenue, or income.

The transport asset norms per \$1 million of fixed assets are established in the subsystems of the service-auxiliary fleet and auxiliary production.

The replacement requirement standard for worn-out transport assets refers to the number of vessels or transport and handling machines (THM) needed to compensate for the decommissioning of operational units due to wear and tear, considering changes in cargo transportation technology and vessel TEU capacity.

The most labor-intensive aspect of fleet planning is the calculation of the gross tonnage productivity indicator. This indicator comprehensively reflects the quality and efficiency of fleet operations.

The mechanism and tools for managing the commercial fleet's potential and its utilization are shown in figure 9.2. The framework highlights not only business objectives but also external constraints.

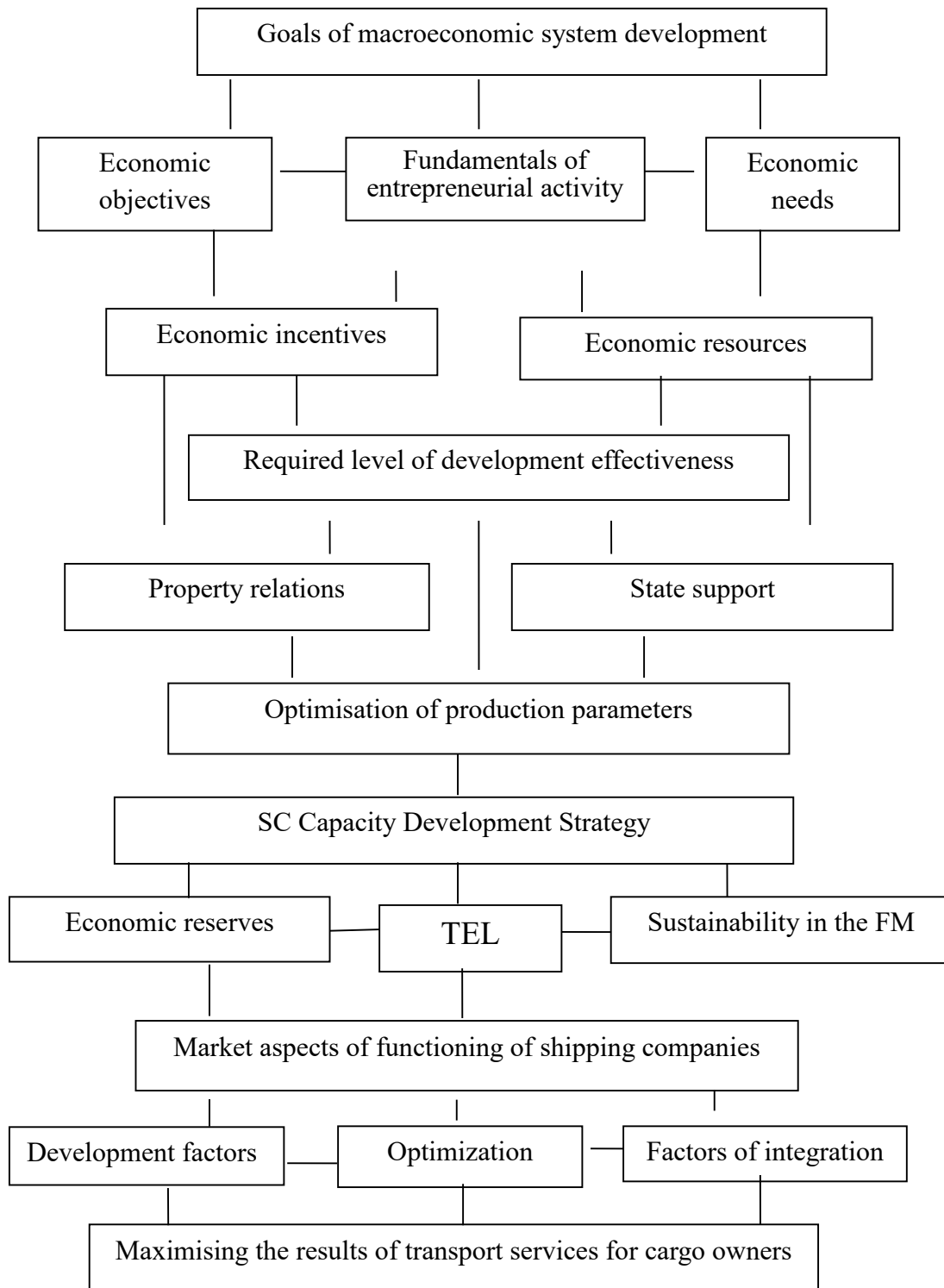


Figure 9.2. Economic Conditions for Shaping the Development Outcomes of Maritime Transport

The quality of the goods delivery process determines the non-transport effect, which should serve as the basis for additional funding for initiatives aimed at accelerating the turnover of cargo owners' working capital.

The high significance of economic levers in market relations necessitates improvements in management organization based on targeted results. Strengthening economic incentives and corporate responsibility for fulfilling contractual obligations in the maritime trade market – while considering operational conditions – should be reflected in a regulatory mechanism that balances business and regional systems' results and costs.

Planning economic development based on the criterion of functional stability in the freight market should be founded on determining the necessary expenditure to achieve the set goals.

As a measurement indicator for the replacement requirement of the baseline potential, the following factors are considered:

- Total cargo turnover;
- Differentiation of total value within \$1 million of capital cost;
- Percentage applied to existing assets and resources.

The demand standards are also intended to justify and implement an investment program when the existing fleet's capacity does not meet market demand parameters.

To manage the factors that determine the selection of organizational development directions for maritime transport enterprises, it is essential to use indicators that reflect the level of interaction within the system. These include:

- Proportionality coefficient,
- Transport capacity utilization coefficient over time,
- Rhythmicity coefficient,
- Continuity coefficient.

9.3. Principles and Methods of Planning Maritime Transportation

A defining part of the operations of shipping companies is the freight transport plan. It determines all the key performance indicators of the company and the utilization of its resources.

Planning for the upcoming period begins with an analysis of historical data on freight transport and cargo turnover, as well as in accordance with forecasts and contracts.

A crucial aspect of preparing the planning baseline for freight transport is identifying the existing characteristics of various types of transport enterprises' participation in the delivery of goods. Special attention is given to the reasons that reveal the actual state of the shipping company in terms of quantitative and qualitative engagement in the transport services market sector. This also involves anticipating potential redistribution of cargo flows among individual competing enterprises.

There are two approaches to developing a transportation activity plan for the SC: a prospective approach and a current approach.

Cargo transportation plans are an integral part of the macroeconomic system and commodity-market relations. They are developed based on plans for industrial and agricultural production, capital construction, material and technical supply, and parameters of internal and external trade turnover.

Therefore, the transportation plan must ensure:

- complete and timely satisfaction of cargo owners' needs for goods transportation with maximum efficiency;
- rational transport and economic connections;
- economically viable participation of each mode of transport in freight transportation;
- rational interaction of all modes of transport throughout the year;
- maximum reduction of transportation unevenness considering the seasonality of production and consumption;
- effective use of transport resources;
- regular dispatch of cargo.

To reduce transportation costs, ensure the rational use of various modes of transport, and eliminate irrational transportation, planning for freight transportation is carried out in accordance with ITC and established directions of cargo flows.

The prospective plan cannot be based solely on analytical data, as significant shifts in the placement of productive forces across the country and in international labor division occur during the prospective period. Consequently, the geography of transportation (of petroleum products, grain, liquefied gases) changes. Additionally, new routes and new ports emerge, which significantly alters the direction of freight movement.

The prospective plan should be developed based on economic research taking into account the production and consumption outlook for specific types of products, marketing studies of product supply, and the rationalization of the participation of various modes of transport in the management of the corresponding segment of the cargo flow.

A scientifically justified plan is the result of engineering and economic calculations. The basis for prospective planning of transportation volumes is the intersectoral balance of production and consumption of products both domestically and in the external market. The intersectoral balance represents a set of indicators and calculations that define the proportions of production and consumption of the most important types of products, taking into account stable international economic relations. It is developed in both monetary and physical terms and considers forecasts of demand and supply balance. This allows for the expression of relationships between individual sectors in the structure of commodity-money relations that arise in the process of production, sale, and consumption of specific types of products.

The intersectoral balance was first developed using the methodology of W. W. Leontief in the mid-1920s. Subsequently, it was widely used in the economy of the United States.

The entire process of creating a prospective plan for the formation of freight flows and the transportation of goods can be divided into three sequential stages.

First stage.

Preparation of regional transportation and economic balances for each type of cargo in internal and external trade operations. For specific manufactured goods, a regional balance of production and consumption of products is compiled, highlighting transportation residuals.

Table 9.3. The process of forming transport balance

Type of goods or cargo	Resources			Availability of resources in the region			Transport balance +, -
	Availability at the beginning of the year	Production	Total	Consumption	Balance at the end of the year	Total	
Grain							
Coal							
Metal							
Cargo timber round timber							
Cars							

Second stage.

Establishment of rational interregional connections (rational attachment of consumption regions to production regions). This way, the most efficient economic links between deficit consumption regions and production regions oriented towards foreign markets are achieved. This, along with competitiveness, determines the formation of demand for the shipping capacity of the fleet.

When forecasting or planning cargo turnover, it is essential to consider the constraining influence of price growth in international trade. Therefore, the rates of increase in transportation do not coincide with the rates of growth in foreign trade. At the same time, structural shifts in international maritime trade not only lead to changes in fleet operational intensity but also necessitate the optimization of its structure. It is important to monitor the nature of the average transportation distance for cargo (Table 9.4).

Table 9.4. Interregional Exchange of Timber Cargoes for 2025

Production regions	Consumption regions				Total
	First	Second	Third	Fourth	
First					
Second					
Third					
Fourth					
Total					

The main goal of selecting production regions to meet the needs of consumption regions is to ensure complete satisfaction of the needs of regions with a negative balance. It is important to achieve a steady supply of products to domestic markets or the delivery of export cargo to seaports.

The criterion for the relationships between districts is achieving a minimum of total costs, time, and transportation distance. Adjustments to the nature of market formation are influenced by:

- The unequal quality of the (product nomenclature) cargo;

- The mismatch between the quantitative supply capacity of certain regions and the needs of others that are optimal for transportation;
- The cost of transportation;
- The specific (incremental) capital intensity of delivering goods.

This was particularly evident in Ukraine in 2014 when searching for sources to cover the deficit of energy coal. Among the alternatives considered were South Africa, Kazakhstan, and even, despite hostility, Russia (Kuzbass). The main issue becomes the price. For consumers and the transportation system, the task is to achieve a minimum of transportation costs.

Stage Three.

Mastering freight flows by different types of transport and selecting delivery routes for goods, as well as loading transport hubs.

The options for freight flows are compared in terms of delivery speed, cost, and capital investments.

Table 9.5. Correspondence of departure and arrival points (for coal).

Departure Points	Destination Points						Volume of Shipment
	J	K	X	W	N	Q	
A							
B							
C							
D							
E							
G							
H							
Volume of Delivery							

In the planning and forecasting of freight transportation, two trends must be taken into account:

- the improvement of transport and economic links, leading to a reduction in cargo turnover per unit value of transported goods;
- the extensive or intensive development of production and commodity exchange operations, which drives the physical growth of transportation work to meet the needs of the national economy and global economic connections.

The methods and approaches to transportation planning in an open freight market require significant clarification of the principles of the balance approach due to the complexity of accounting for the decision-making behavior of competing shipping companies. Summary tables of external trade freight transportation serve as an informational basis for assessing trends and selecting a development model and fleet deployment. At the same time, it is essential to consider free competitive offers of the fleet's carrying capacity, regardless of the flag of ownership and the registration flag of the vessels.

The quantity of cargo turnover depends, to a certain extent, on the quality of transportation planning. The main criterion for transportation planning is the achievement of a minimum total cost for the delivery of goods and the operation of transport. In some cases, irrational routes arise, leading to additional transportation work.

In the system of global trade, various problematic cargo flows emerge: excessively long, counter, and circular routes.

Excessively long transports refer to those based on the delivery of goods over distances that exceed the economically justified range of transport. They arise as a result of specific foreign trade contracts and political considerations. In this regard, the European Union's refusal to construct the South Stream gas pipeline - 2 is characteristic.

Reciprocal transportation refers to the transport of homogeneous or similar goods in opposite directions. This occurs in two cases: based on special preferences in global trade contracts and due to the contradictory placement of enterprises concerning raw material extraction regions. Powerful flows of ore move in one direction, while metallurgical products flow in the opposite direction. To produce 1 ton of steel, 3.3 tons of other goods must be imported.

Repeating transportation refers to shipments carried out in several stages, such as transshipment or feeder services. These also occur in the context of building construction and the implementation of various corporate projects.

Circular transportation involves the delivery of goods not along the shortest routes. It arises due to various factors, such as congestion on shorter routes or the influence of external forces. For example, instead of using the Suez Canal during the period of increased Somali pirate activity, a route around Africa was utilized.

Special attention is paid to the factors that cause uneven freight flows over time and across directions (both forward and reverse), which affects the nature of the fleet's carrying capacity utilization.

In the system of planning maritime transport, it is essential to consider the trends in changes in the structure of transportation, which are driven by the development of global and national economies. In the overall process of changing the structure of transportation, three groups of factors play a crucial role:

- the increasing importance of industrial output, which leads to a faster growth of container technologies;
- uneven production across geographical and economic regions of the world;
- the enhancement of the rational use of natural and energy resources. The principle of reducing resource intensity in production dictates the relatively slow growth in the deadweight of the tanker fleet. The development pace of the bulk carrier fleet is determined by the dispersion of production regions and raw material supply.

9.4. Transportation Planning System

The problems of economic and functional sustainability of maritime market entities are closely related to the implementation of advanced transportation organization methods and the development of shipping companies based on modern scientific and technological progress (STP) trends. In this regard, containerization of transportation is one of the key principles for managing the competitive stability of global and regional transport systems.

As the main performance indicators of any economic system, various results of production or investment activities are most commonly used:

- the time required to complete the main production task;
- the time needed to recover the resources spent;
- the amount of material and other costs;
- the net income of the enterprise or revenue from a specific operation;
- net present value.

In maritime transport, the time required to complete key operations determines that time itself serves as a direct measure of the enterprise's external efficiency.

At the same time, all major production (material) costs, as well as their value equivalents – revenues and expenses – are shaped under the influence of the time factor. Therefore, these indicators take the form of final values, reflecting not only the nature of resource participation in fulfilling the functional purpose of individual divisions of

the shipping company (CK) or port but also the time spent on performing tasks and services.

In a highly competitive freight market, regulating the development of maritime transport enterprises based on qualitative parameters of the transportation process becomes crucial.

In this regard, key indicators include profit growth rates, profitability levels, cost efficiency, resource productivity, as well as the speed and reliability of cargo delivery. These improvements are achieved by enhancing the quality of transport operations. A fundamental condition for such development is maintaining the necessary technical and economic level of transport assets.

In the system of advanced transport technologies, assessing development efficiency and functional performance based on added value is well-founded. In particular, the efficiency of utilizing the production potential of a maritime transport enterprise can be determined by the amount of added value per unit of production potential cost.

$$e_{ds} = \frac{P_r + G_w}{V_{pc}} \quad 9.6$$

where:

P_r – the profit of the enterprise generated from economic activities;

G_w – the total wages of the company's employees;

V_{pc} – the monetary valuation of the transport enterprise's production potential.

For certain specialized goods, transnational companies control up to 90% of global trade, which facilitates the stable utilization of transport capacity, the organization of maritime shipments, and the adoption of advanced technologies. This enables the establishment of uniform liner tariffs for container transportation, regardless of the distance between key production and consumption regions.

The traditional directions for implementing scientific and technological progress (STP) factors in the modern development of maritime transport include fleet renewal based on minimizing the average service life, replenishing the fleet with highly efficient and economical vessels, optimizing cost recovery periods during active transport capacity utilization, and increasing cargo transportation by containers and ferry fleets.

The projected potential cargo flow can be estimated using various methods. First, let us consider the method based on the global average level of competitiveness. In this case, the maximum volume of maritime transportation in the projected fleet development period can be determined as:

$$Q_{mp} = \left(\frac{1}{p_t} - \frac{1}{p_o} \right) \cdot V_{GNP} \cdot j_{in} \cdot X_{cc} \cdot u_{ec} \cdot k_{cm} \quad 9.7$$

p_t, p_o – the weighted average unit cost of one ton of goods, contributing to the total sales according to the gross national product (V_{GNP}), corresponding to the global level (p_t) and the national baseline condition (p_o);

j_{in} – the necessary level of participation in international division of labor;

X_{cc} – the coefficient of structural shifts in national foreign trade from the state of global commodity turnover;

u_{ec} – the level of external conditions influencing the nature of the national fleet's participation in external trade cargo flows;

k_{cm} – the level of competitiveness of the fleet of national shipowners.

Unfortunately, the loss of a nationwide approach to ensuring national interests, along with, in some cases, incompetent solutions to strategic tasks, has significantly harmed Ukraine's prestige as a maritime power, resulting in a complete loss of macroeconomic and commercial effectiveness in commercial shipping.

Considering these conditions, an urgent task for the development of Ukraine's economy and statehood is its effective integration into the global economic space. Maritime transport is expected to play a leading role in this process.

Global practice shows that failures in economic reform and the abrupt dissolution of established connections manifest most acutely in transportation. Any technical solutions in maritime transport must meet the requirements of a clear system of criteria. Among the most important conditions are the timeframes for solving the task – short-term, medium-term, and long-term periods.

9.5. Planning of fleet demand and utilization

Fleet demand in the estimated period is calculated on the basis of cargo and passenger transportation volumes, vessel utilization rates, taking into account the conditions and factors of the global maritime trade market.

The planned fleet requirement is reflected in the required number of vessels, their cargo and passenger capacity and time budget.

Planning of utilization indicators (tonnage productivity, capacity utilization factor, average operating speed, duration of the operating period, shift ratio etc.) should take into account upcoming structural shifts in the fleet composition and in the levels of operational indicators that ensure the fulfillment of the established volumes of transportation under the formed nomenclature.

Justification of the shipping company fleet replenishment program is carried out step by step by two methods.

According to the first method:

- availability of all vessels at the beginning of the calculation period is determined;
- the number of ships to be written off by amortization period and technical condition in this period is determined;
- the volumes of work that can be performed by the remaining fleet are determined;
- prospective volumes of transportation on the directions that require additional carrying capacity of the fleet are estimated;
- the necessary deadweight is determined according to the current methodological provisions and standards for the volumes of work not provided for the estimated period.

According to the second method firstly the necessary number of vessels for the design volume of transportation is determined, then it is reduced by the amount of available carrying capacity without vessels to be written off from the existing fleet. The difference expresses the required fleet replenishment.

The first technique is advisable to apply in cases when the parametric series of ships of the purpose under consideration is not established, and the second one - when the parametric series is clear. New ships replacing old ones do not create conditions for diversification.

The last stage of justification of the SC fleet replenishment program is preceded by selection of optimal types of vessels from the grid, which most fully provide the functional purpose in the selected segment of operator activity.

Fleet supply from alternative sources is planned on the basis of real financial base, demand for transportation capacity, availability of vessels at the beginning of the planned period and the need to replace the outdated fleet.

The amount of fleet supply during the planned period is calculated according to the condition:

$$\Delta W_{ni} = \frac{W_{ei} - W_{oi}}{1 - \frac{0.5}{t}} + W_{li} \quad 9.8$$

where:

W_{ei} – average annual demand of the fleet of the type i at the end of the planned period;

W_{oi} – fleet availability at the beginning of the planned period;

W_{li} – number of vessels to be decommissioned for various reasons;

t – duration of the planned period.

As measures of parameters W_{ei} , W_{oi} , W_{li} are used, accepted in management characteristics of target functions number of vessels, deadweight or cargo capacity for transport vessels, capacity of tugboats, passenger-seats for passenger vessels.

Indicators of transport vessels utilization, their demand for cargo and passenger transportation and fleet balance are calculated on the basis of accepted methodological provisions.

It should be taken into account that cargo turnover of sea transport depends on technical and economic features of certain types of vessels and their efficient chartering. That is why cabotage transportation has not been developed due to significant costs for initial and final operations.

The most important feature of the merchant fleet development should be considered the uniformity of formation of carrying capacity in relation to the dynamics of cargo turnover. Cargo turnover reflects the nature of economic development, international economic relations and changes in the distribution of productive forces.

The main thing is to achieve a balance between demand for cargo turnover parameters and supply in terms of available carrying capacity of the fleet.

Volumes of transportation work and development of shipping companies are determined based on the results of technical and economic calculations of the efficiency of the functional activity of enterprises. At the same time, in order to work out an optimal variant, along with direct net present value and income flow, cargo owners' expenses and parameters of ecological consequences of fleet development are taken into account.

Then the need for capital investments can be calculated in an aggregated form according to the following expression:

$$K_{psn} = \Delta q_n k_{un} + \frac{\Delta q_{lg}}{Q_n} D_w k_u + l_{nc} k_b, \quad 9.9$$

where:

Δq_n – additional cargo flow of new transportation directions;

k_{un} – unit cost of a unit of transportation potential, calculated on the density of cargo traffic;

Δq_{lg} – additional load of the existing potential;

Q_n – normalized load of transport potential according to standard characteristics;

D_w – deadweight of the fleet requiring replacement according to standards and life cycle parameters;

k_u – specific cost per unit of carrying capacity of the fleet of the given characteristic;

l_{nc} – characteristic of the transport potential requiring replacement according to the parameters of substandard characteristics and severe limitation in operation;

k_b – specific capital expenditures for restoration of transportation potential indicators according to the current standards.

Many different directions of merchant fleet development form the structural characteristics of the maritime trade market. Planning and decision making is based on appropriate methods of accounting the problem. The main thing becomes the choice of appropriate solutions.

9.6 Justification of qualitative parameters of fleet operation

According to the historically established logic of SC activity planning, the fleet performance section is developed in the middle of the pre-planning period as information resources are accumulated. Therefore, the indicator of gross tonnage productivity is determined based on the current year fleet operation plan-schedule considering programmed changes. This initial policy statement is based on several considerations.

1. Fleet schedule is a thoroughly substantiated technological basis for the transportation and vessel utilization plan. The schedule provides for rational arrangement of all types of vessels along the lines and directions of operation, i.e. forms the scheme of utilization of the entire fleet. The schedule regulates to a certain extent the coordination of fleet and port operations.

2. The experience of transportation planning and fleet scheduling shows that in the transition from the plan of one year to the plan of the next year, the cargo flows of cabotage and export directions do not change dramatically. Considering this condition, to some extent the scheme of fleet utilization in the subsequent period is preserved. Therefore, the planned level of gross productivity of the fleet can be set in the following order:

- planned cargo flows for the design period by lines and directions are developed;
- the expediency of organizing new lines is established;
- the scale of implementation of innovative technologies of cargo delivery and fleet service is assessed;
- technical norms of vessel utilization is adjusted.

At this stage the technically possible and rationally necessary increase of load per 1 ton of cargo capacity, time reduction for each transport operation of ship handling in ports, realization of technical speed is established. Such a detailed approach to planning the operation of each line allows to project the fleet utilization rates for the next year.

This method facilitates the development of the traffic schedule and expresses a direct link between annual planning and technological by logistic links.

3. Availability of distributed planned cargo flows by lines, adjusted technical norms of vessel utilization for each line is a source material for calculation of productivity indicators by vessels and types of transportation.

The gross throughput based on the noted inputs is calculated initially for each line and subsequently the average throughput of 1 ton of tonnage for the shipping company is determined.

To perform calculations for an individual line, the following data must be prepared:

- volume of cargo turnover by direction;
- volume of transportation by direction. This information is based on the volume of planned and sustainable cargo flows of the maritime trade market.
- The distance traveled by the vessel, with a breakdown of the distance with cargo and in ballast. These data on voyages are taken based on planned cargo flows, and in terms of ballast passages - according to the current schedule, considering planned cargo flows from the current scheme of fleet utilization.
- types of vessels, their carrying capacity and number of vessels. The data shall be disclosed on the basis of fleet arrangement and traffic schedule;
- technical norms of vessels use: load per 1 ton of cargo capacity by directions of movement; operational speed of movement with cargo and in ballast by directions; loading and unloading norms per ship-day by vessel types; time of technical operations;
- time losses due to meteorological reasons (% of running time by line sections);
- working period coefficient. It expresses the share of time of vessels' stay on transportation work from the operational period. The working time does not include preventive repairs and docking;
- coefficient of technological breaks - waiting for loading and unloading. The time of technological breaks can be established by the ratio:

$$\gamma = \frac{d}{\eta - 1} \quad 9.10$$

where:

γ – vessel cargo handling waiting time factor, reflecting the proportion of loading-unloading waiting time (Fig. 9.3);

d – the coefficient of probability of disturbance of vessel traffic and handling;

η – the ratio of daily terminal throughput to average daily cargo turnover:

$$\eta = \frac{Q_{tm}}{\bar{Q}_{nd}} > 1 \quad 9.11$$

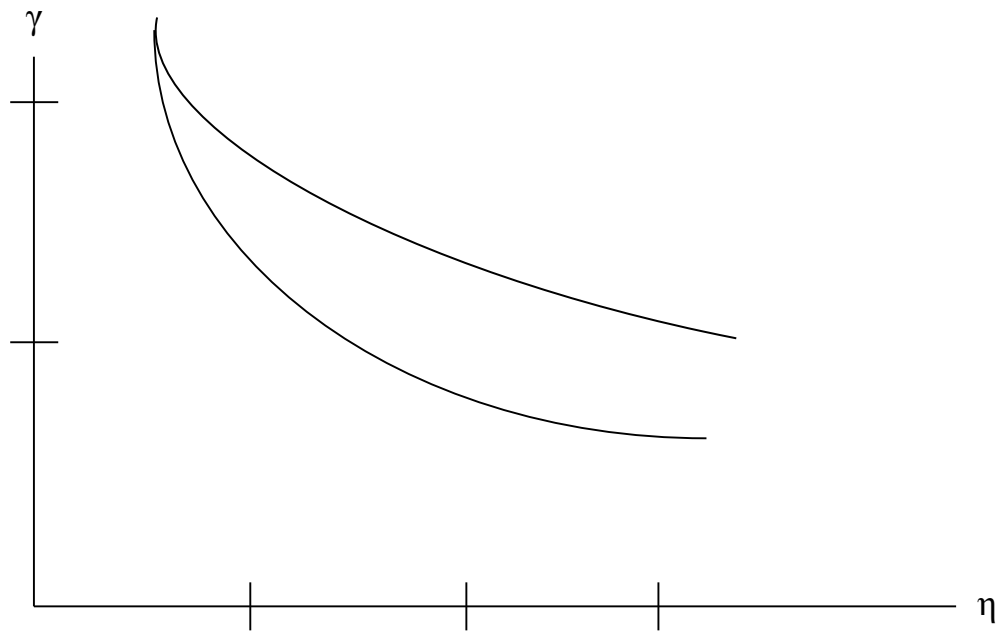


Figure 9.3. Changing situation of vessel capacity utilization

Expectation of cargo operations grows in a higher proportion than the capacity reserve.

$$d = 0,3$$

$$\gamma = \frac{t_{olo}}{t_{lo}} \quad 9.12$$

The numerator reflects the waiting time for the vessel to load/unload, and the denominator reflects the time of these operations (t_{olo}).

In this case γ expresses the relative value of waiting time per vessel for cargo operations. If the number of ships is greater than the number of specialized berths, the absolute value of waiting increases.

The order of estimation of reasonable limits of transportation process quality improvement is presented in Fig. 9.6.

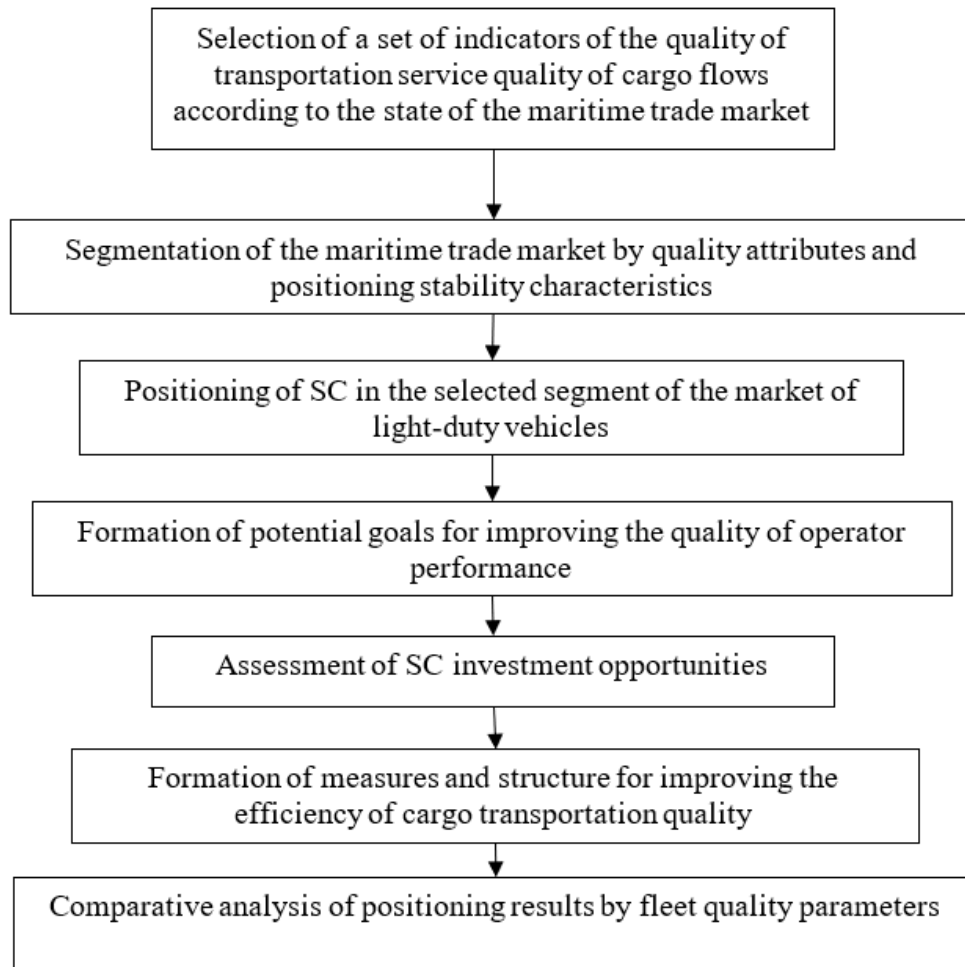


Figure 9.6. Order of formation of competitive quality of fleet performance

The regularity of expectation, and hence the possible fleet losses and port rating is predetermined by the relationship represented by the condition below.

n_s – number of ships loaded with homogeneous cargo;

z - the number of specialized berths.

Suppose that $z=1$ $n_s \geq 1$

at $n_s = 1$ the expectation is $\gamma \cdot t_{lo}$

at $n_s = 2$ the expectation is $(1+\gamma)t_{lo}$

at $n_s = 3$ the expectation is $(2+\gamma)t_{lo}$

at $n_s = n$ the expectation is $(n - 1 + \gamma)t_{lo}$

at $n_s = 3$ the expectation is $(1+\gamma)t_{lo}$

To assess the relationship between the results of national subsystems of the maritime transportation industry with the formation of system-wide indicators and control of efficiency on the basis of net result, it is necessary to provide a clear link between resource costs and production economic parameters. The structure of calculation parameters for determining the national subsystems of maritime transport

with cost recovery under the multimodal tariff should be optimal in terms of the ratio of profit and costs of the main groups of resources.

9.7. Planning the operations of a shipping company

Planning, as a system for decision-making in the economic and technical development of shipping companies, must clearly reflect both short-term and long-term goals. Given the multifaceted development of the maritime trade market and the increasing complexity of transport-economic relations, the role of medium-term planning is growing. The forms and methods of fleet planning should be improved in accordance with changes in the balance of the maritime trade market.

To ensure the stability of functional activities and the optimal development of shipping companies, selecting the target function and key planning indicators is of utmost importance.

Among these indicators, the following stand out:

- Total cargo volume transported (in tons);
- Fleet revenue by type of navigation;
- Volume of export-import cargo and cargo from the open freight market;
- Total profit from all activities;
- Commissioning of major assets.

The accelerated handling of cargo turnover by highly efficient vessels changes the role of individual fleet specialization groups (Table 9.7).

Table 9.7

Initial data for justifying the calculated freight revenue rate

Transport structure	Share of transport types, %		Basic revenue rate, \$/ton	Percentage value $3 \cdot 4$
	Base year	Planned year		
1	2	3	4	5
Bulk fleet	x_1	x_1^*	y_1	$x_1^* y_1$
Container ship	x_2	x_2^*	y_2	$x_2^* y_2$
Tanker fleet	x_3	x_3^*	y_3	$x_3^* y_3$
Universal fleet	x_4	x_4'	y_4	$x_4' y_4$
Total	100	100	y_0	$\Sigma x' y_n$

Change in the planned revenue rate

$$\Delta y = \frac{y_n}{y_0} 100 \quad 9.13$$

$$y_n = \frac{\sum x'_i y_i}{100} \quad 9.14$$

$$d_n = d_b (1 \pm \Delta x_d)^t \quad 9.15$$

The selection of the average revenue rate is determined by the level of tariff or freight rates in the region of the operator's activity. The primary condition is cost recovery and the formation of the necessary accumulation. Therefore, it is advisable to calculate the cost of transport operations to control the allowable expenses for cargo and passenger transportation.

The tariff rate serves as one of the key indicators of the functional value of operations, guiding fleet development programs and the management of its utilization.

The marginal revenue is allocated to cover fixed costs and forms a certain portion of the profit.

Ultimately, the total revenue of the shipping company is divided into three parts:

- revenue covering expenses;
- profit allocated to the budget;
- profit retained by the company.

The ratio of these parts is determined by business efficiency and the institutional foundations of business management.

Therefore, it is essential to optimize the process of utilizing a vessel's transport capacity. From this perspective, ship management and control functions are formed. A key factor in solving this issue is the intensity of ship handling in ports. Unfortunately, in Ukrainian ports, bureaucratic administration has created non-competitive conditions for vessel processing.

One of the ongoing issues is the number of documents the captain must present upon the ship's arrival.

The procedure for a vessel's arrival and departure is regulated by Order № 430, which requires the submission of 23 documents for all scheduled ship calls at a given port. However, under the 1965 Convention, only 9 documents are considered necessary.

The increase in required documents adds to the crew's workload, despite the ship's typically short stay in port. A particularly significant factor reducing the competitiveness of Ukrainian commercial ports has been the requirement to submit an

environmental declaration and undergo chemical control of isolated ballast water, which contradicts international standards.

9.8. Planning of Container Transportation

The volume of work of the merchant fleet is significantly influenced by the development of foreign economic relations. The foundation of their formation lies in the industrial potential of major economically developed countries, the wealth of natural resources, and the efficiency of international division of labor. This is particularly evident in the container segment of the maritime trade market.

The combination of competitive advantages of container transportation determines the priorities of its development. Before the global crisis, according to forecasts of world economic relations development, approximately 1,900 new container ships were expected to be commissioned by 2012, while simultaneously decommissioning outdated, low-capacity vessels. However, this created an issue with feeder services due to the limited number of such vessels in the main basins where large-tonnage container ships are processed.

When determining the future level of cargo transportation development, it is necessary to consider a comprehensive set of factors, among which the key ones include:

- The volume of cargo transportation that can be conducted using container technologies.
- The state of the material and technical base of container transportation.
- The level of utilization of transport facilities in the competitive segment of the maritime transport market.
- The condition and structure of the container fleet.
- Directions and distance of transportation.
- The turnover rate of container transportation per container slot.
- The development of foreign trade relations within the global economic system.

Table 9.8 presents the structure of Ukraine's foreign trade turnover.

Indicators	Years			
	2009	2014	2020	2023
Foreign trade turnover, dollars	30,2 trillion	46,6 trillion	43,8 trillion	49,6 trillion
Developed countries (Denmark)	175,997 billion	210,32 billion	202,65 billion	262 billion

CIS (Ukraine)	106,7 billion	108,4 billion	103,4 billion	137 billion
Developing (India)	423 billion	765 billion	634,5 billion	1161,5 trillion
Export	15,2 trillion	23,4 trillion	22 trillion	24,9 trillion
Import	15 trillion	23,2 trillion	21,8 trillion	24,7 trillion

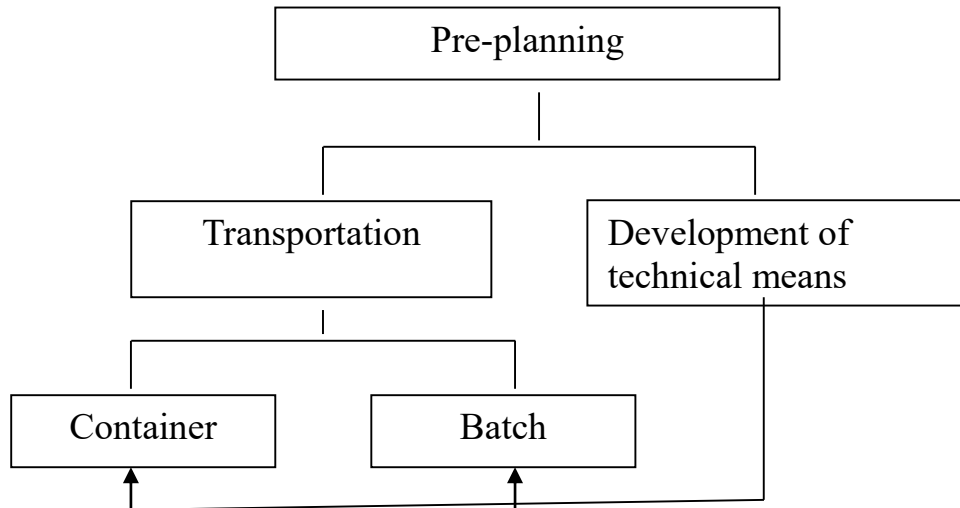
A key characteristic of Ukraine's foreign trade relations is their instability, imbalance, and the low share of exports of high value-added products, which limits container cargo. This volume fluctuates around 1 million TEU, whereas in Turkish ports, this figure reaches 7 million TEU.

In accordance with the objectives of crisis management and the functional stability of a shipping company, a set of interrelated economic operation and development plans should be developed (Figure 9.4), including:

- Long-term strategic plans that account for key directions in improving cargo transportation technology.
- Medium-term plans, which serve as the main framework for forming and utilizing transportation capacity based on foreign economic relations parameters.
- Current plans aimed at achieving optimal cash flows and effective utilization of basic potential.

The acceleration of cargo delivery through new transport technologies and the corresponding reduction in the need for working capital (or funds) of cargo owners becomes a central indicator of economic efficiency in the International Maritime System (IMS). From this perspective, the effect of relative savings on other production factors is also considered. This is formed in proportion to the increase in cargo transportation volumes within the Maritime Transport Corridor (MTC) compared to baseline delivery types and the reduction in resource intensity of operations in the Freight Market (FM).

The goal of container cargo transportation is to ensure the continuous development and improvement of maritime transport operations. The primary objective is to achieve stability in the freight market and the efficient operation of vessels.



The most critical indicators in planning include transportation volumes and directions, which determine the technical development objectives of the fleet and the structure of the container fleet. Among the key planning and accounting indicators, those most closely linked to resources and financial performance are distinguished. These include measuring transportation volumes in gross tons: TEU, 20-foot, 40-foot, and specialized containers.

The foundation of container transportation planning consists of:

- Economic and scientific-technical forecasts.
- Agreements with foreign economic activity entities.
- The condition of the freight market.
- Transit cargo flows.
- Project materials and scientific research.
- Analysis of the state of container transportation in the pre-planning period.

Nevertheless, the prioritization and high rates of cargo flow containerization are among the causes of system imbalance due to the corporate interests pursued by major operators.

9.9. Management of Container Fleet Development

In the development of the container fleet and specialized shipping companies, it is important to distinguish between the period of innovative strategies and the period of steady capacity growth. The latter is shaped by the competitive advantages of container transportation.

The justification for the optimal characteristics of vessels intended for fleet expansion within a shipping company is based on cargo flow parameters, which define

the technical and operational constraints. The optimal vessel type must ensure competitive transport productivity while aligning operational costs with the pricing conditions of the selected maritime trade segment. At the same time, operational routes are determined both by the needs of the national economy and by access conditions to competitive (open-entry) segments of the maritime trade market.

Traditionally, generations of the container fleet are considered, reflecting shipowners' responses to the dynamic expansion of the corresponding segment of the global maritime industry (Table 9.9).

Table 9.9. Key Characteristics of Container Ship Generations

Generation	Period of Emergence	Vessel Capacity, TEU
First	Before 1969	600 – 900
Second	1969 – 1971	➤ 1200
Third	1971 – 1973	2600 – 3000
Fourth	1974	➤ 4000
Fifth	1990	9000
Sixth	2010	18000
Seventh	2014	22000
Eighth	2019	23756
Ninth	2020	17000
Tenth	2024	24000

The development of long-term plans for container transportation is based on:

- economic and scientific-technical forecasts of mega-economy, national economy, and the maritime trade market;
- trends and principles of cargo flow service intensification;
- project materials and scientific research conducted by various organizations and analytical centers.

The medium-term plan is developed based on economic growth forecasts and trends, which determine the levels of container transport development. The shipping company (SK) focuses primarily on justifying key indicators. The main objective is to establish an effective market position in the maritime trade segment. Therefore, calculations take into account cargo flow volumes, shipment batch sizes, characteristics of corresponding ports, and constraints defining the technical and economic characteristics of vessels.

The criteria for selecting the range of cargo types usually include:

- the effect of full or partial elimination of packaging;
- shipment batch size;

- the volume of cargo flow, which justifies the necessary additional capital investments in the creation of a new transportation organization model.

The calculated cargo transportation volumes in containers serve as the baseline for determining the required tonnage of specialized vessels and planning the fleet expansion program.

For example, to streamline the operations of competing container companies, the P3 Network alliance was established on the East-West route. It was formed by container operators Maersk Line, MSC, and CMA CGM with the goal of optimizing operations and services provided by the companies.

At the time of its creation, P3 Network controlled 259 vessels with a total capacity of 2.6 million TEU (29 rotations). The alliance's vessels operate independently under the management of a joint operational center. Each of the liner services conducts more weekly sailings within the P3 Network than they did before the merger. To implement this strategy, the companies had to obtain approval from government authorities.

9.10. Container Demand Planning

One of the key directions for improving the efficiency of maritime transport enterprises, reducing cargo delivery time, and increasing fleet handling intensity is the coordination of efforts among all related stakeholders, primarily shippers, to enhance the transportability of cargo flows. To date, not all cargo suitable for containerization is being shipped in containers.

The container fleet of Ukrainian transport enterprises has not been replenished for the past ten years. This has led to a decline in freight revenue and a loss of financial capacity to align TEU levels of transport enterprises with FR parameters.

The primary indicator for managing transport potential utilization and developing containerized cargo delivery technologies is the annual throughput of a calculated (TEU) or standard container.

The throughput of a calculated container represents the weighted average productivity of all standard containers (of varying weights) owned or operated by a company.

$$\mu_{kr} = \frac{\sum \mu_{kfj} n_{kfj} \beta_{uj}}{\sum n_{kfj} \beta_{uj}} \quad 9.16$$

where:

μ_{kfj} – annual throughput of a physical container of a specific type, tons;

n_{kfj} – operational fleet of physical containers of corresponding types, units;

β_{kfj} – conversion coefficient of a physical container of type iii to a calculated container.

The annual throughput of any type of physical container is planned based on actual load, operational period duration, and the average scheduled time the container spends in the cargo delivery process.

$$\mu_{kfj} = \frac{q_{ck}T_E}{\bar{t}_{ok}} \quad 9.17$$

where:

q_{ck} – static load capacity of the container, tons;

T_E – operational period of the container;

t_{ok} – average container turnaround time, days.

$$t_{ok} = t_{ol} + t_{bl} + t_{kn} + t_{nn} \quad 9.18$$

where:

t_{ol} – time a loaded container spends in transit via maritime transport;

t_{bl} – time an empty container spends in transit;

t_{kn} – average container dwell time at terminals (loading and unloading operations, technical, and commercial procedures);

t_{nn} – average container dwell time at cargo owners' premises.

After preliminary calculations, assessing the nature and intensity of container fleet utilization allows determining the demand for containers by specific types or in terms of equivalent or converted containers (TEU).

In general, the inventory fleet of containers (calculated or standard) is determined based on the following condition:

$$N_{kp} = \frac{Q_{nk}}{\mu_k} (1 + a_1 + a_2 + a_3) \quad 9.19$$

where:

a_1 – reserve coefficient;

a_2 – coefficient accounting for potential losses due to maintenance and repairs;

a_3 – coefficient considering other influencing factors (leasing, being outside the management zone).

The next stage involves planning container procurement based on prospective demand. Furthermore, procurement is determined by the available stock at the beginning of the calculation period and the financial feasibility of the development program. It is crucial to forecast structural shifts in the container fleet composition.

Subsequently, the carrying capacity of container vessels of different types is determined, considering the existing cargo flow conditions, using the following formula:

$$q_{kc} = \frac{n_{ki} T_E \alpha_{ki} \beta}{t_{pj}} \quad 9.20$$

where:

n_{ki} – container capacity of the considered vessel;

α – vessel container space utilization coefficient;

β – container slot turnover rate per voyage;

t_{pj} – voyage duration on the j-th route, days.

The next step is determining the planned demand for container vessels required to transport containers of type i on the j-th route:

$$n_{kcij} = \frac{\sum b_p Q_{kj}}{q_{kci}} \quad 9.21$$

where:

b_p – reserve coefficient for transport capacity;

Q_{kj} – container transportation volume on the j-th route, units;

q_{kci} – transport capacity of a vessel of type i, containers.

The implementation of the program and the company's development plan depends on the feasibility and parameters of investment activities, which are determined through specialized calculations.

9.11. Planning the Demand for Passenger Ships Operating in Specific Conditions

Maritime passenger transportation includes the specifics of fleet operation and determining its demand depending on the type of maritime passenger services. Determining the demand for passenger ships operating in specific conditions reflects the specific conditions for forming the structure and parameters of the estimated passenger flow, taking into account the intensity of navigation.

$$n_{sp} = \frac{Q_p l_{ml} K_{mb}}{b_m V_{tk} \varepsilon_v \lambda D_{pe} T_n} \quad 9.22$$

where:

Q – passenger flow on the route for the navigation (annual) period, passenger-seats;

l_{ml} – average travel distance of one passenger on the calculated route, miles;

K_{mb} – coefficient of monthly irregularity of passenger flow;

b – coefficient of passenger flow turnover along route segments;
 V_{tk} – operational speed of the vessel, knots;
 ε_v – coefficient of voyage time.

$$\varepsilon = \frac{T_m}{T_n} \quad 9.23$$

T_m – sailing time of the fleet for the navigation period or during a voyage;
 λ – coefficient of fleet passenger capacity utilization;
 D_{pc} – passenger capacity of the calculated vessel;
 T_n – operating time budget of vessels on the route, hours.

It is important to distinguish the characteristics of the modern structure of passenger flows. All types of cruise technologies are becoming dominant. At the same time, the role and scale of ferry transportation, which performs various functions, are expanding. In some regions, the significance of coastal and other types of passenger transportation remains.

The parameters of the necessary development of cruise shipping in a maritime region are determined by the following factors:

- natural and climatic conditions;
- cultural, historical, and civilizational aspects;
- availability of capital resources;
- availability of human capital resources and competence;
- development of infrastructure resources;
- economic and legal conditions for potential formation.



Figure 9.5. Cruise Ship Anthem of the Seas

Flag: Bahamas (BS)/ **AIS Type:** Passenger (Cruise)/ **Gross Tonnage:** 168.666

Length and Beam: 347.06 m × 41.4 m / **Draft:** 8.5 m/ **Speed (Max/Average):** 22/18 knots

Year Built: 2015

The priority is to ensure high-quality service in the main specialization segments of cruise shipping.

Therefore, each country and cruise industry subsystems develop policies for industry growth and investment promotion.

At the same time, a strategy is being formed to expand the national cruise shipping segment and manage passenger flows.

The principle of increasing employment and generating net cash flow determines the tasks of stimulating the expansion of fleet, port, and service subsystem operations in the following key areas:

- differentiation of distinctive qualities;
- proactive demand formation;
- strengthening the competitive advantages of local assets.

It is important to highlight innovative approaches and openness in investment strategies while maintaining wage levels as a factor in corporate profitability.

Control Questions:

1. Name the fundamentals of organizing economic process planning in commercial shipping.
2. Structure of planned decisions in CS.
3. Features of calculating and substantiating CS development indices.
4. Content of the comprehensive operational plan for the transport fleet.
5. The role of balance calculations in the functional and financial activities of CS.
6. Features of forming fleet operational results.
7. Name the principles and methods of maritime transportation planning.
8. What is the basis of the freight and passenger transportation planning system?
9. Explain the content of the fleet demand and utilization plan.
10. What are the qualitative parameters of fleet utilization?
11. Outline the process of forming the competitive qualities of company vessel operations.
12. Content of the comprehensive CS operational plan.
13. Features of container transportation planning.
14. Characteristics of forming the parameters of the container market segment in maritime trade.
15. How is the need for a container fleet calculated?
16. Planning the demand for the carrying capacity of the container fleet

Chapter 10.

MANAGEMENT OF FLEET DEVELOPMENT EFFICIENCY AND FUNCTIONAL OPERATIONS

10.1. Concept of a Shipping Company Business Plan

The concept of economic independence for shipping companies enhances the role of internal financial sources for covering both operational and one-time expenditures. The relevance of newly created value accounting and the implementation of regulatory principles in managing economic and investment processes have necessitated performance evaluation based on the net results of each market participant.

The business plan highlights two primary objectives:

1) Justification of the need for investment resources required to implement the chosen development strategy and ensure competitive operations.

2) Identifying where and under what conditions the missing funds can be obtained and determining the optimal form of investment flow (e.g., credit terms).

Determining a company's capital requirements typically relies on a combination of research and intuition. In many cases, this process is complicated by uncertainties in the freight market and the inherent inaccuracies of forecasting. Nevertheless, there remains a certain degree of risk in achieving investment project efficiency in commercial shipping. This was particularly evident in the global maritime trade and shipbuilding markets in 2009.

In the business activities of a shipping company (SC), a key focus is the strategy of increasing cargo transportation volumes along traditional routes while diversifying services by region and technology. Decision-making is based on relevant technical and economic justifications, alongside a comprehensive set of performance indicators.

For investment strategy formulation, several conditions must be met, primarily the stability characteristics of the chosen freight market sector. Therefore, investment alternatives are considered, such as financing a newbuild order portfolio or acquiring a second-hand vessel that maintains competitive viability.

A crucial aspect is the process of developing and comparing alternative options for the technical and economic parameters of commercial fleet vessels (Table 10.1). The selection of vessels for comparison must align with the shipping company's specialization and the external constraints of effective market positioning.

Table 10.1. Comparative Characteristics of Vessels for Alternative Fleet Capacity Formation

Indicators	Vessel Type			
	Handysize	Handymax	Panamax	Capecize
Year Built				
Length, m				
Beam, m				
Draft, m				
Deadweight, t	30000	50000	75000	100000
Net Cargo Capacity, t				
Loaded Speed, knots				
Fuel Consumption Norms				
At Sea, t/day				
At Port, t/day				
Crew Size, persons				
Operational Period, days				
Voyage Duration, days				
Number of Voyages				
Capital Intensity Threshold, \$/t				
Capital Investments, million \$				
Net Present Value (NPV)				

When comparing calculation indicators, the selected development option should address two key objectives: competitive stability **and** leadership in cost efficiency and service quality.

During the development process, it is necessary to determine the required investment resources and self-financing capabilities based on actual cash flows while considering inflation growth. The possible investment resources for the calculation period can then be estimated under the following condition:

$$K_r = \sum_{i=1}^T \left[Q_{np} (p_{sf} \cdot 0.8 - c_s) \cdot (1 - 0.3) + K_p h_a \frac{1}{100} \right] (1 + 0.05)^{\alpha_{ii}} \quad 10.1$$

where:

Q_{np} – projected cargo transportation volume;

p_{sf} – projected tariff (freight) rates;

c_s – projected transportation cost;

K_p – book value of vessels;

h_a – depreciation rate.

It is essential to consider that banks, as lending institutions, generally seek to minimize their risks, assuming that entrepreneurs should bear the primary risk burden.

As a result, financing through credit becomes preferable for projects aimed at expanding the operational activities of financially stable shipping companies (SCs), such as **Ukrferry**.

A competitive market-oriented approach requires identifying the demand for transport capacity and securing contract-based service requests. This determines the economies of scale, which develop based on the ratio of fixed and variable costs.

Key indicators in the structure of an SC business plan include:

- Functional, cost, and time-related objectives;
- Conditions and factors influencing the development of SC transport capacity;
- Cargo and passenger transportation volumes and structure;
- Data defining alternative strategies and risk levels associated with the SC's target function implementation.

The overall (absolute) efficiency of investment or business decisions and expenditures reflects the ratio of net results to the cost of the SC's established production potential.

Comparative efficiency involves evaluating a decision based on the difference between comparable results and costs. This is relevant in situations where alternative approaches exist or when assessing the feasibility of responding to competitors' actions.

10.2. Justification of Parameters for the Medium-Term Development Plan of a Shipping Company

One of the key characteristics of maritime transport enterprises is the necessity to account for the specifics of cargo turnover growth. This growth is influenced by the uneven expansion of the global economy across different regions and the structure of trade operations. Therefore, when planning cargo turnover, it is crucial to consider the risk of incomplete information, which may hinder completely risk-free decision-making.

The main objective of this type of planning is to ensure the rational allocation and utilization of the fleet to achieve optimal performance within the existing resource structure (see Fig. 10.2).

This objective determines a corresponding set of tasks:

- Identifying the dynamics of the maritime transport market and fleet structure.
- Evaluating options for the effective acquisition of fleet assets.

A clear framework for formulating and controlling the implementation stages of planned objectives is essential:

1. Determining the scope of operations and utilization of potential.
2. Selecting standards and constraints for achieving the final goal.

Cargo turnover growth is accompanied by changes in transportation routes and structure due to the redistribution of productive forces and shifts in international economic relations. A particularly significant factor is the development of trade ports, which determines cargo flow concentration in international transport corridor strategies. This, in turn, enhances the role of the commercial fleet in the development of transport and economic relations.

Changes in cargo transport routes and distances are driven by two factors:

1. The equalization of productive force distribution.
2. The emergence of new production facilities and resource extraction regions in remote areas of the world.

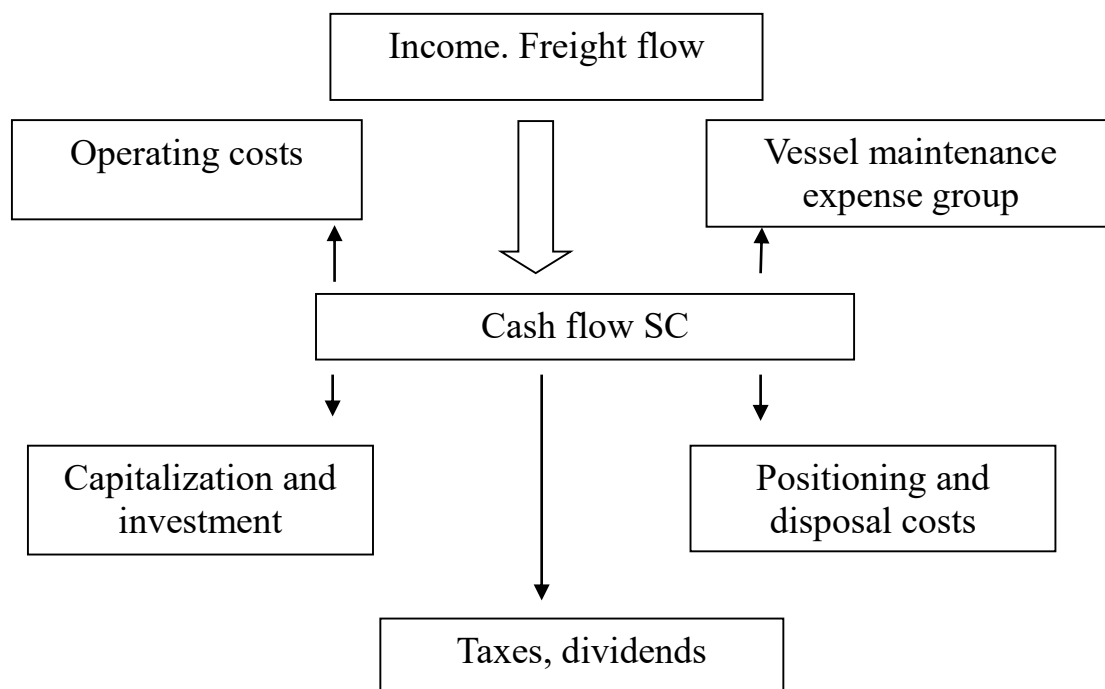


Figure 10.1. Key components of a shipping company's cash flow

The focus of shipping companies on those that hold competitive positions represents a specific criterion of entrepreneurial activity. This enables the selection of an appropriate long-term positioning strategy. A shipping company that is capable of monitoring the state of the operator segment can implement short-term adjustments to neutralize any adverse situations in the freight market system.

In commercial shipping, orientation towards leading shipping companies becomes a crucial factor in creating favorable conditions for cargo owners. In this way, the value of transport services for cargo owners increases, and fleet operational efficiency is optimized. By considering strengths and weaknesses, shipping or operator companies develop long-term strategies taking into account the capabilities of key competitors.

10.3. Management of Fleet Operational Cost Efficiency

The approaches and methods for managing the cost-effectiveness of fleet operations vary. The foundation of cost-effectiveness lies in planning and managing the amount of current (operational) expenses and ensuring that costs align with the established pricing characteristics in the segment of maritime cargo or passenger transport. The primary focus is on calculating current expenses based on key cost components.

The calculation of transportation costs is referred to as costing. Given the changing operating conditions of vessels over time, planned, actual, and projected costs are calculated. The latter is used in various economic justifications.

Planned cost is an integral part of the comprehensive operational plan of the shipping company and aims to manage profitability or implement a cost leadership strategy.

The management of cost-effectiveness in the functional activities of a shipping company is based on the absolute and comparative reduction of average operational costs, which form the transportation cost and correspond to the average level of tariff rates. The use of the direct management method is advisable when it is possible to account for the reduction of costs in specific expense categories. In this case, the reduction in expenses can be determined and predicted under the following condition:

$$\eta C_{ss} = \sum \gamma_i \delta_{sa} Q = \sum \gamma_i \delta_{st} C_{st}, \quad 10.2$$

Where γ_i – the share of reduction in the managed expense category based on innovative solutions for project tasks (energy consumption, maintenance, supply, crew costs, overhead, etc.);

δ – the weight of the corresponding expense category in the formation of transportation costs (Table 10.2).

Table 10.2. Characteristics of the Impact of Individual Production Factors on the Cost Flow of the Commercial Fleet

Name of Expense Categories	Share
Labor Costs	0,12 – 0,18
Fuel	0,25 – 0,30
Repairs	0,07 – 0,10
Depreciation	
Supply	0,06
Overhead	0,10

When reducing the consumption norms of individual expenses or resources, the savings will amount to:

$$\eta C_{sm} = \eta c_{sm} Q \quad 10.3$$

where ηc_{sm} - the reduction in costs in monetary units per unit of transport work.

If the optimization of current costs is achieved across the entire range of expense categories, the following condition can be used:

$$\eta C_{sts} = \eta c_{sa} Q \quad 10.4$$

where η – the parameter (coefficient) for the reduction of total costs on average relative to the baseline cost.

With an increase in the productivity of the shipping company's fleet and the potential for increased output (products, services)

$$\eta C_{st4} = c_{s0} \delta_{fc} \left(1 - \frac{1}{1 + t_q} \right) Q, \quad 10.5$$

Where

c_{s0} – the baseline cost of transport work per unit;

δ_{fc} – the share of fixed (constant) costs that do not depend on the volume of transport work, which is 0.45 for the fleet;

t_q – the index of growth in the volume of transport work or productivity.

If savings in the idle time of transport vessels are achieved and subsequently realized in operational time, this increases the volume of transport work.

$$\eta C_{ss} = A_{ss} \eta T_e \mathcal{E}_s, \quad 10.6$$

A_{ss} – the cost of keeping a vessel at berth per day of operation;

η – the parameter (coefficient) for reducing the vessel's idle time;

T_e – the duration of the operational period, 330 days;

ε – the coefficient of idle time.

In the system of commercial shipping, technological, technical, and organizational innovations are the key determinants of a shipping company's effectiveness in competitive segments. This is characteristic of such shipping companies as Maersk and MSC in container transportation, and Royal Caribbean and Carnival in the cruise business.

10.4. Techno-economic justification in the system of commercial shipping

The development of a shipping company is based on a targeted program. It represents a set of time-planned measures aimed at achieving the main goal. A key condition is the balance of resource-related tasks that reflect the cyclical dynamics of the maritime trade market, which limits the level of growth in final results.

The foundation of planning investment and operational activities of a shipping company (SC) is a business plan, which includes classical sections with a detailed techno-economic justification (TEJ) for comprehensive development.

TEJ is an economic document that determines the economic feasibility and technical possibility of implementing the chosen direction of development and functional activities of the shipping company.

In the structure of fleet development planning tasks, the following aspects should be highlighted:

- determining the scale of SC development and fleet structure;
- controlling fleet supply sources based on financing conditions;
- forecasting fleet utilization in terms of directions and chartering conditions;
- justifying fleet decommissioning and modernization;
- defining key fleet utilization indicators;
- assessing the feasibility of forming fleet capacity reserves;
- evaluating losses due to the limited possibility of adequate fleet development.

The structure of the business plan is traditional and generally coincides with the plan of economic activity and its forecast for the medium term but differs in the level of detail of calculations.

The TEJ of vessel types is developed based on forecasts of cargo flow development and freight market conditions. This forms the key characteristics of future fleet additions. TEJ considers programmatic provisions for the development of the

shipping complex and allows for the selection of reliable methods to achieve the target objective.

TEJ consists of the following sections:

1. Analysis of the actual operational and economic performance of analogous vessels. Prerequisites for building or acquiring this type of vessel. These issues are addressed based on the main trends in commercial shipping, considering time-adjusted factors. Evaluation of the current state of the SC fleet and future operating conditions of the vessels.

2. Vessel operating conditions. Requirements for vessels with specific characteristics and justification of the economic efficiency of a vessel type.

3. Determining rational proportions in the development of maritime transport potential.

4. Calculation of techno-economic indicators for improving cargo transportation technology, organization, and equipment.

To solve the first task, it is necessary to establish: trends in global shipping; specifics of the transportation process; current state of the SC fleet; assessment of cargo capacity shortages in the given vessel specialization; information on the functional performance of this type of vessel.

Prospective operational conditions of any vessel type to be considered include:

- maritime range, ports, and transport directions;
- cargo flow volumes and structure;
- navigation conditions;
- the scale of multimodal transport technology usage.

At the same time, the economic efficiency of a vessel type depends not only on its techno-economic characteristics but is also determined by the conditions mentioned above.

Prospective development plans for a shipping company are based on a system of norms for capacity utilization and expense formation.

To justify the main directions of economic fleet development, norms are established at two levels:

1. First-level regulatory framework – the entire set of norms and standards used to justify the program of fleet expansion, deployment, and utilization.

2. Second-level regulatory framework – developed for different fleet types and used to consolidate and adjust calculations. These standards are formed by aggregating first-level norms.

To determine fleet needs and utilization, the following standards are required:

- productivity per ton of cargo capacity;
- duration of the operational period;

- reserve of production capacity.

For the comprehensive development of a shipping company, justifications must be carried out in stages:

- a) identifying competitive cargo flows, passenger flows, and vessel handling standards in ports, including vessel calls per port
- b) developing a preliminary program for replenishing the commercial fleet without considering associated costs. It is important to implement a variant-based approach that considers interchangeable ship designs;
- c) justifying the forecasted replenishment of other divisions of the maritime transport enterprise;
- d) assessing the feasibility of alternative approaches to gaining effective access to cargo terminals;
- e) adjusting fleet development program options considering total costs, decommissioning volumes and efficiency, and investment project volume and efficiency. A fleet balance and utilization indicators are developed.

Thus, a targeted approach to implementing key criteria is realized. A fundamental aspect is the universal assessment of the impact of each production factor. This allows for a clearer application of an alternative formation and realization mechanism for potential with a comparable cost.

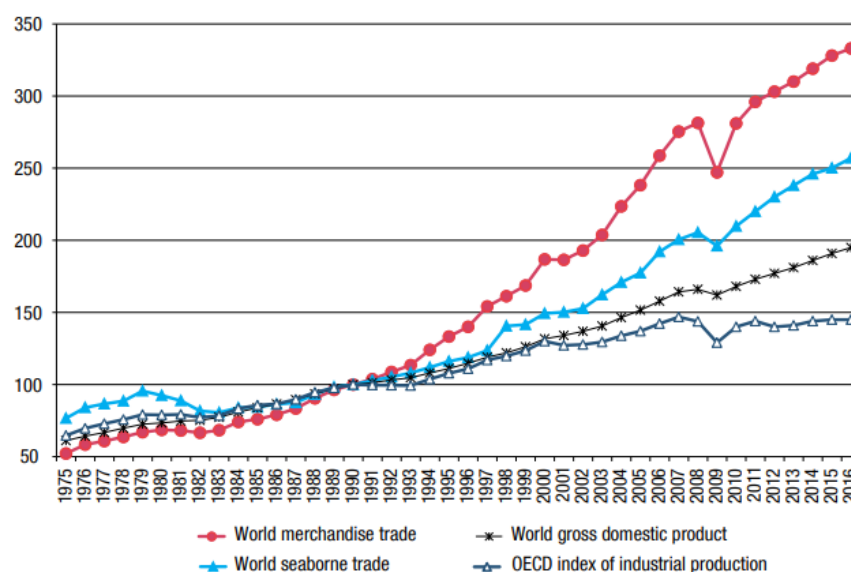
For maritime transport enterprises, expanding their position in the maritime transport market is typically characterized by the long-term comprehensive development based on the constant expansion of the SC fleet's cargo capacity or the port complex's terminal throughput capacity. Under these conditions, the effect is calculated cumulatively, and investment costs are determined using the net present value method on a cumulative basis.

10.5. Formation of a shipping company's position in the development trend of the maritime trade market

The large-scale development of maritime transport is driven by its role in shaping macroeconomic outcomes by ensuring the participation of a country's residents in the international division of labor and creating new efficient jobs, not only within the maritime transport industry. Therefore, the development options for maritime transport industry entities, based on investment flows, should be compared, including their non-systemic results. A crucial aspect of transport services for global and national economies is the diversion of working capital from the production process during transportation. Reducing delivery times for cargo categories that affect the required working capital generates an impact on production subsystems that rely on this type of transport and economic connections.

The development of individual shipping companies is determined by two main groups of factors. The first is the dynamism of the cargo base. The second is the availability of investment resources and the response to competitors' behavior.

The processes of forming and providing transport services for the cargo base are based on the nature and pace of development of global and national economies, as well as the corresponding types of transport. Due to factors of scientific and technological progress, an objective trend has emerged in the transformation of interrelated parameters of the maritime trade market (Fig. 10.2). This allows for a certain degree of accuracy in assessing the probability of steady formation of maritime transport industry characteristics in future periods.



Sources: UNCTAD secretariat calculations, based on data from OECD, 2017; United Nations, 2017; UNCTAD Review of Maritime Transport, various issues; World Trade Organization, 2012.

Note: Index calculations are based on GDP and merchandise trade in dollars, and seaborne trade in metric tons.

Figure 10.2. Organization for Economic Cooperation and Development index of industrial production and world indices: Gross domestic product, merchandise trade and seaborne shipments, 1975–2016 (1990 = 100)

The graph shows a strong upward trend in global trade, GDP, and seaborne shipments from 1975 to 2016. Trade and seaborne shipments grew faster than GDP, reflecting globalization and the increasing role of maritime transport. The 2008–2009 financial crisis caused a sharp decline, but trade rebounded quickly. Industrial production lagged behind, indicating a shift toward service-based economies. Overall, the data highlights the growing interdependence of global markets and the resilience of trade.

Real economic processes in the specialized segments of shipping companies predetermine the sequence of decision-making. In projects aimed at optimizing functional activities, attention should be given to:

- a set of principles implemented in the socio-economic environment according to the criteria of effective transport support;
- the reduction of all administrative procedures to optimize the time required for handling transport and cargo flows;
- the concentration of resources on routes with high-performance terminals and the implementation of innovative solutions;
- the orientation toward integration systems;
- the minimization of external negative impacts based on technical and organizational solutions.

The main focus should be on the development trends of other operational activity subsystems, compliance with IMO regulatory positions, and the ability to address priority positioning tasks.



Figure 1. General Cargo Ship T-Moon

LOA – 92,8 m, beam – 17 m. Gross tonnage – 2988 GT. TEU – 320. Average speed / Max Speed - 8.6 / 11.7 knots. Year of Build – 1994.

Mv T-Moon performed the regular voyages from Constanta to Chornomorsk during 2023 year

Under objective conditions, maritime activities should have become a key factor in Ukraine's national economic development, as is the case in most countries worldwide. This is supported by the dynamics of global, including maritime, trade, whose growth rates exceed GDP growth rates by approximately 1.2 times.

In addition to the national cargo base, a potential source of growth for Ukrainian shipping could be transit cargo. According to estimates from the British institute Rendall, Ukraine has a high transit coefficient of 2.7 and possesses a well-developed transport network. Transit flows are primarily associated with the passage of cargo from Russia through Ukraine's western border (via the Lviv railway) and to Ukrainian

seaports. Currently, these flows mainly consist of coal and chemical cargo, with significantly smaller volumes of metals and almost no general cargo. From a profitability perspective, this cargo flow is unprofitable for Ukraine, and current trends in the structure of transit cargo turnover are leading to a decline in profits for Ukrainian transport enterprises, even as cargo handling volumes increase.

The key component of the organizational and economic mechanism for the development of Ukraine's merchant shipping is the creation of an effective system of economic and legal relations. This should focus on protecting shipowners' property rights, safeguarding the financial interests of investors and creditors, and regulating economic relations between the state, shipowners, and fleet operators. A crucial aspect of this mechanism is the establishment of a unified tonnage tax instead of the existing taxation system.

Control Questions

1. What is the foundation of a shipping company's business plan concept?
2. Name the main indicators of a medium-term functional activity plan for a shipping company.
3. What are the goals and objectives of managing the economic activities of a shipping company?
4. What is the essence of the technical and economic justification for the development of a merchant fleet?
5. How is a shipping company's position formed within the maritime trade market system?
6. What are the key changes in the interconnection of maritime transport industry indicators?

Chapter 11

OPERATIONAL MANAGEMENT AND PLANNING IN MERCHANT SHIPPING

11.1. Operational planning of cargo transportation

Planning, as both an instrument and a key management component, effectively defines the main directions for a shipping company's development based on a detailed assessment of the freight market. In commercial shipping, a well-established system of operational fleet and port planning exists. The effectiveness of such planning is most clearly reflected in the regularity of cargo flow servicing.

Operational planning of cargo transportation by shipping companies follows a general methodology and principles for managing and monitoring functional performance outcomes.

It is regulated by legislative and instructional provisions and is aligned with both current and long-term strategic planning for the company's development. This ensures a continuous formation of outcomes and potential in accordance with the company's primary economic objectives.

The operational transport plan is developed for specific time periods within the year (quarterly with a monthly breakdown and per voyage). Operational planning includes the development of quarterly and voyage-specific assignments. A crucial aspect of operational planning is the management of production processes in an environment where multiple transport structures interact.

Planning is based on clear principles, system-wide regulations, instructions, and standards, including:

1. The fundamental provisions on current and operational cargo transportation planning.
2. The key principles of a continuous operational planning system for transportation and the interaction of transport complexes within the structure of global maritime transport, multimodal transport corridors, and logistics.

Operational planning for the transportation of export and transit cargo is carried out according to requests from shippers or their freight forwarders. The relevant authority has approved an official instruction for operational cargo transportation planning.

«Applications from shippers (freight forwarders) are accepted by ports and shipowners in accordance with regulatory documents governing foreign economic activities.

Shippers (freight forwarders) must submit transportation plans for export and transit cargo to railways no later than 20 days before the start of the planned month. These plans must specify the seaports through which the cargo will be directed, the destination country, and the buyer's chartering details. Based on this, a schedule for vessel arrivals for cargo shipments is developed.

Shippers (freight forwarders) provide seaports and railways with a detailed breakdown of cargo nomenclature. Railways coordinate export and transit cargo volumes with ports. Ukrzaliznytsia, foreign trade authorities, ports, shipowners, and cargo owners (freight forwarders) jointly approve a transportation plan for the relevant cargo through maritime and river ports.

Shippers and railways ensure the even dispatch of planned export and transit cargo. In cases where transportation plans are not fulfilled due to conventional restrictions, the shortfall is made up by mutual agreement of the parties.

The planning of import and transit cargo transportation is carried out based on applications from cargo owners or their freight forwarders. Cargo owners, under contracts with ports, submit monthly transportation requests to Ukrainian shipowners or chartering organizations. These applications specify the cargo volume, the country and port of departure, the country and port of destination, and the required shipment dates.

Shipowners or chartering organizations, together with ports, prepare a draft monthly schedule for the deployment of national and chartered fleets before the start of the planned month.

Cargo owners (freight forwarders) must submit any unallocated cargo requests to chartering organizations by the 20th of the month preceding the planned period. These requests are used to charter foreign tonnage under the conditions specified in the freight order and cargo chartering instructions.

Relations and settlements between cargo owners and shipowners regarding cargo transportation are conducted under a charter (transportation contract).

For FOB (Free on Board) cargo shipments, cargo owners must notify shipowners and seaports by the 15th of the month preceding the planned period. This notification includes the monthly tonnage schedule for the export and import of goods under CIF (Cost, Insurance, and Freight) terms.

Freight payments for the transportation of transit cargo passing through Ukraine are made by cargo owners in accordance with the terms of the contract».

Below is a subsystem of operational planning from an international shipping company.

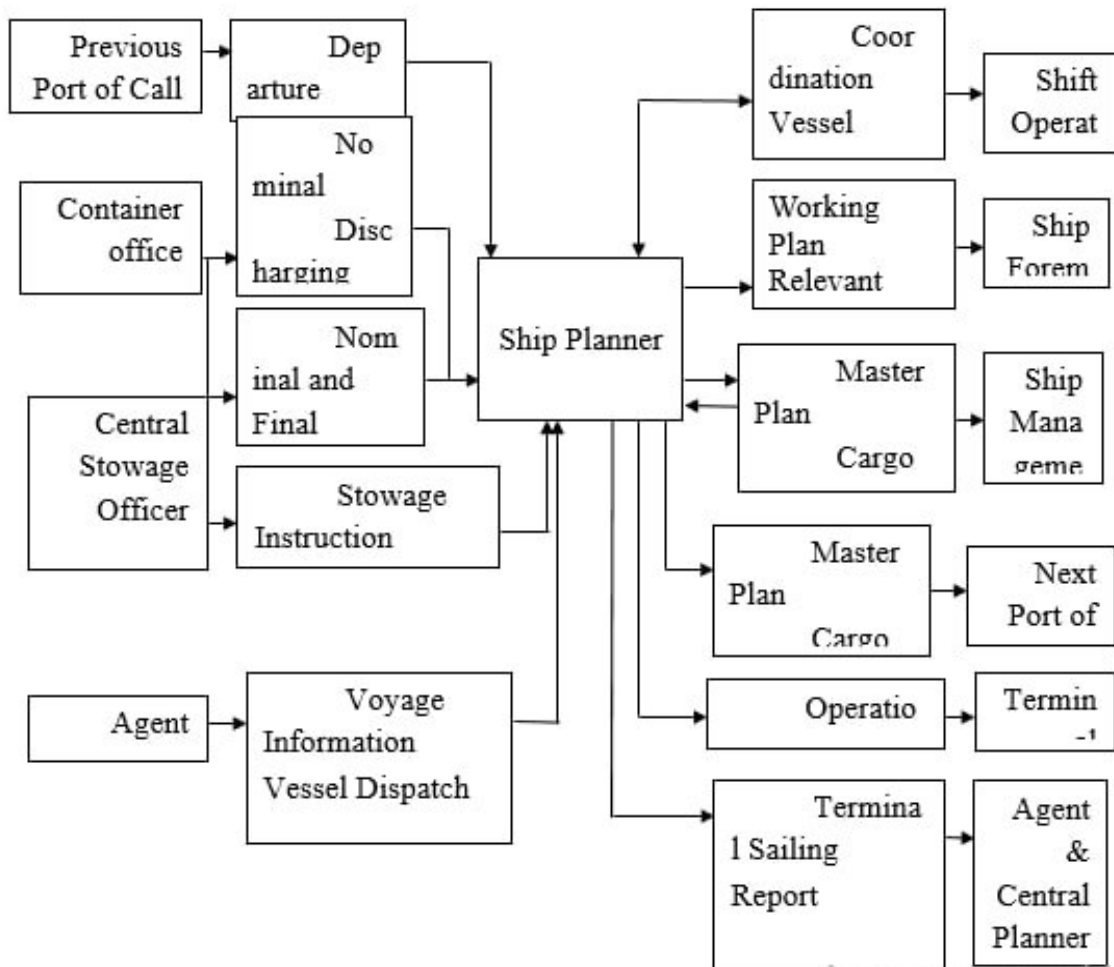


Figure 11.1. Formation of the vessel's operational plan

Depending on the position of a shipping company within the transport and economic service system, the structure of planned indicators is formed. However, the key objectives of operational planning are best reflected in:

1. The total volume of transportation, with a breakdown by specific types and routes.
2. The volume of export-import cargo transportation by type of sale or purchase.
3. The most important financial indicators (net foreign exchange profit, revenues, expenses).

These are regulated by the instructions of the Ministry of Infrastructure of Ukraine.

The free-practice module used in the port of "Pivdennyi" saves two hours of auxiliary time. The cargo processing chain begins with preliminary information. Before the vessel arrives, the agent submits the necessary data to port control authorities via the Internet. If there are no objections from regulatory bodies, the vessel is granted free practice. This means unloading can begin immediately after mooring, even before the inspection commission boards the vessel.

By reducing the ship's port stay, cost savings range from \$1,500 to \$4,000. The absence of commission-related delays allows the agent to plan operations efficiently.

When selecting a development strategy for the national maritime transport sector, the efficiency of investment resources is analyzed at the level of individual maritime transport complex divisions. For each facility, statistical data must be collected and processed, representing dynamic economic indicators over the study period.

11.2. Production and Financial Plan of a Vessel

A vessel, as the primary economic unit of a shipping enterprise, can be considered a separate entity in terms of the completeness of its production process. Vessels may operate under entrepreneurial principles, focusing on localized financial performance indicators that characterize the transport services market. However, the financial independence of vessels is limited by their lack of a fully developed system for independent participation in banking operations. This limitation persists even under the "one vessel – one shipping company" principle.

Therefore, the vessel's production and financial plan is part of the overall operational plan of the shipping company. The vessel's production and financial plan must ensure:

1. Maximization of the shipping company's transport volume based on the criterion of sufficient profitability.
2. Technical and economic fleet utilization indicators established according to potential capabilities.
3. Strict adherence to vessel schedules or calculated timetables.
4. Relative reduction of transport costs and increased operational profitability.
5. Implementation of advanced labor methods and transportation organization.

6. Improvement of forms and methods for maintaining competitiveness in the freight market sector.

A comprehensive production and financial plan for a vessel is developed in accordance with chartering parameters and conditions. There are three conditions for drafting an annual operational plan for vessels, depending on their mode of operation:

- Operating on scheduled liner services.
- Operating on specific routes based on a predefined timetable.
- Operating on various routes under spot chartering agreements.

The comprehensive vessel plan is based on information reflecting regulatory standards and operational rules for the chosen route. This approach allows for the alignment of performance indicators for individual voyages with overall annual results.

According to the applicable taxation system for financial results, the vessel's operational plan is developed for the entire service period with a breakdown by quarter and voyage.

Based on the logic of a vessel's economic and financial activities, three main sections form the comprehensive operational plan:

1. Transport operations, reflecting transport volume and cargo turnover across main shipping segments.
2. Technical and operational performance indicators and vessel utilization resources.
3. Financial performance indicators of vessel operations.

The inability to plan on a monthly or even quarterly basis is explained by the long duration of voyage cycles. Under these conditions, the vessel's production plan is developed by the operations (operational planning) department, while the financial plan is prepared by the planning and economic as well as financial and foreign exchange departments.

The Production and Financial Plan of a Vessel consists of three sections:

- Volume of cargo transportation, transport work, or net foreign currency revenue;
- Technical and operational indicators of vessel utilization;
- Financial indicators.

The volume of transport work for any planned period can be calculated using two methods:

- Based on the number of voyages during the planned period;
- Based on the transport work performed by the vessel per voyage (when operating on a route or in sequential voyages).

The number of voyages in the planned period is determined by the formula:

$$n_r = \frac{T_l - (t_{km} - t_{nt})}{t_r}, \quad 11.1$$

where:

T_l - period of vessel operation on the route (days);

t_{km} - time spent on navigational maintenance and survey;

t_{nt} - time spent on other non-transport activities;

t_r - planned voyage duration according to the route or operational norms.

According to the second method, the volume of transport work is determined considering transport potential and its productivity:

$$Ql = T_{wl} \mu D_{qv}, \quad 11.2$$

where:

Ql - volume of transport work of the vessel on the route (ton-mile);

T_{wl} - period of vessel operation on the route;

μ - gross productivity per 1 ton of carrying capacity during the planned period for the given route;

D_{qv} - gross carrying capacity of the vessel for which the transport and financial planning is conducted.

In general, the transport work volume can be calculated by multiplying the vessel's carrying capacity by the period of operation on the route and the gross productivity of 1 ton of carrying capacity for vessels engaged in this type of transportation.

The second section of the vessel's production and financial plan examines the following technical and economic indicators:

- Operational period on the route;
- Time spent on engine cleaning, docking, and navigational repairs leading to vessel downtime;
- Voyage duration according to the schedule, specifying the sailing time under cargo load;
- Operational speed;
- Gross productivity per 1 ton of carrying capacity per day of operation.

All these technical and economic indicators are determined based on the schedule or timetable of the vessel's route operation. They reflect the conditions for forming the financial performance of the operator's activities.

In the third section of the vessel's production and financial plan, financial indicators are established for the entire year with a quarterly breakdown. This section primarily includes all direct operating expenses under the main cost items:

- Wages (base salary according to position grades with allowances and additional wages);
- Collective catering ration costs;
- Fuel expenses;
- Repair expenses;
- Material and technical supply costs;
- Depreciation charges;
- Navigation expenses and dues;
- Other direct costs.

Foreign currency expenses for key operational segments are planned and accounted for according to the main characteristics of the operator's business activity.

The financial indicators section includes the cost of revenue generation from freight earnings in convertible currency, the currency efficiency ratio, and the cost of transport operations.

The production and financial plan for a vessel operating in coastal and short-sea shipping may be set for a year with a quarterly breakdown. The monthly plan represents the sum of voyage-based plans in accordance with the schedule (timetable). The optimality of the annual plan is achieved when it aligns with the fleet deployment plan.

Vessel operations planning and performance accounting are carried out based on completed voyages. This means that cargo volume and turnover are included in the performance report only if the vessel's unloading is completed within the planned period.

The sum of annual plans across the fleet, in terms of key indicators such as cargo volume (tons), cargo turnover (ton-miles), revenue, and expenses, must correspond to the company's plan or contractual obligations. In other words, the shipping company's (SC) plan must be distributed across all transport vessels, ensuring sufficient own resources or identifying the need for vessel chartering for operational activities.

When drafting the vessel's annual plan, the operational period is first determined—the number of days in the year minus planned repair periods, chartering, lay-up, and other non-operational days.

11.3. Distribution and Allocation of Vessels by Transport Routes

One of the most critical tasks in management is achieving the highest possible efficiency of the transport potential within the shipping complex. This goal can be attained by ensuring the optimal utilization of the company's vessels in terms of both cargo capacity and operational time.

For the stable functioning and balanced economic inflows of regional transport systems, it is essential to consider the leading role of transport services. All other related types of service or cargo flow control must be based on the principles of necessity and efficiency. The criteria for implementing transport capacity through the rational distribution of vessels by type and region of operation aim to maximize:

- the overall effect;
- the company's profit;
- foreign currency earnings from the export of transport services.

Additionally, optimizing net present value and profit capitalization is of great importance.

This organizational and economic task is addressed based on the calculation and justification of:

- the tonnage movement scheme;
- general and specific fleet performance indicators;
- vessel distribution by cargo flow directions.

The developed scheme must comply with logistics requirements regarding cost and delivery time while minimizing ballast voyages. A balance optimization method is used in combination with a transportation model.

$$D_{KO} + \sum_S D_{KS} = D_p + \sum_p D_{PK}, \quad 11.3$$

where D_{KO} – the amount of tonnage departing from port k with cargo;

$\sum_S D_{KS}$ – the amount of tonnage leaving port k in ballast to ports s ;

D_p – the tonnage arriving at port k with cargo;

$\sum_p D_{PK}$ – the tonnage of vessels arriving in ballast from other ports (p).

Vessels depart in ballast in the absence of a suitable cargo. At the same time, it is necessary to consider both the queue of vessels at the anchorage and, on the other hand, periods when certain cargo batches lack available tonnage.

The shipowner (operator) must monitor the fleet's location and control the number of vessels in the region that are not assigned cargo.

Vessels depart in ballast when there is no corresponding cargo available. At the same time, it is necessary to consider both the queue of vessels at the anchorage and, on the other hand, periods when certain cargo batches lack available tonnage.

The shipowner (operator) must monitor the fleet's location and control the number of vessels in the region that are not assigned cargo.

$$n_{si} = D_{PK} - D_{KO}, \quad 11.4$$

A key criterion for the effective organization of vessel movements is minimizing the loss of transport potential over the planned period. In this case, the task is reduced to minimizing ballast voyages.

$$\sum_i \sum_j l_{ij} D_{ij} \rightarrow \min , \quad 11.5$$

The amount of tonnage arriving at the commercial port for loading must correspond to the cargo shipment requirements.

$$\sum DN_{IJ} = \sum Q_j \quad 11.6$$

At the same time, it is essential to consider the ratio of the cargo batch volume in metric tons, loading volume, and the vessels' registered tonnage.

The formation of vessel traffic and the distribution of ships are carried out in stages:

1. Optimization of informational support for the problems and tasks of forming the required technical and economic fleet level, considering:
 - route and maritime range restrictions (depth, draft, berth length);
 - vessel compliance with commercial chartering conditions;
 - specification and selection of bunkering and supply bases.
2. Evaluation and selection of fleet utilization options.
3. Calculation of the fleet performance indicator system.
4. Assessment of compliance with the selected management criterion to optimize the shipping company's current operational task.

The comprehensive goal of fleet distribution across operational segments is to minimize total costs and maximize the overall financial outcome.

Traditionally, total expenditures must align with the principle:

$$C_{st} = \sum_i \sum_j C_{stchij} T_{Eij} \rightarrow \min , \quad 11.7$$

where C_{stchij} – vessel maintenance costs per day during the operational period for transport operations;

T_{Eij} – distribution of the operational period between transit and idle operations.

A fundamental condition for sustainable efficiency is maintaining a balance between transport potential and the transport workload within the operator's area of activity.

$$\sum D_N T_E \mu = \sum Q_i I_i , \quad 11.8$$

The ultimate goal of fleet positioning is the maximization of freight revenue.

$$R_{VN} = \sum_i \sum_j Q_{ij} p_{cij} \rightarrow \min, \quad 11.9$$

As a key criterion for the formation and utilization of the shipping company's (SC) potential, the maximization of profit in the shipping market is considered.

$$P_r = R_{VN} - C_{ST} \rightarrow \max, \quad 11.10$$

The outlined strategy is implemented under conditions of exogenously determined tariffs in the transport services market, which is approximated to a state of perfect competition.

The task of optimizing transport capacity utilization through vessel allocation arises at the stage of calculating fleet loading and utilization within the current calendar period.

The prerequisites for formulating this task include:

- establishment of new work volumes;
- emergence of new shipping routes or expansion of existing ones;
- changes in the quantitative and qualitative composition of the fleet due to vessel additions and decommissioning;
- modifications to the technical infrastructure of the shore-based transport complex divisions;
- changes in the commercial operating conditions of vessels.

The problem of tonnage allocation is solved using either an empirical or computational approach.

The sequence of solving the allocation task under stable cargo flow and chartering conditions involves the following steps:

1. Development of rational vessel movement schemes.
2. Identification and calculation of key parameters of vessel movement schemes.
3. Selection of vessels based on specialization, technology, and technical-distinctive characteristics, considering operational zone restrictions.

Selection based on technical constraints is further refined according to the following vessel parameter compliance conditions:

- a) Structural features (number of decks, degree of hatch opening, etc.);
- b) Overall vessel dimensions (draft, maximum length, maximum width);
- c) Autonomy of vessel navigation;
- d) Cargo capacity (handling intensity, batch shipment capacity).

4. Under changing conditions, selecting the optimality criterion for vessel allocation becomes fundamental.

11.4. Fleet schedules and timetables

Activity of shipping companies within limited time and certain space becomes the most important condition for managing the efficiency of transportation potential realization. The independence of external demand factors should be taken into account.

The role of progressive forms of transportation process management based on the selection of ship types and transshipment complexes in the formation of the transportation result can be calculated by the ratio of the estimated carrying or throughput capacity of new types of ships or transshipment complexes to the annual value of indicators for the shipping company or port as a whole.

$$\epsilon. = \frac{N_{nn}}{\sum N_{pi}}, \quad 11.11$$

Where: N_{nn} - economic result of using new progressive means of maritime transport, reflecting the target function of development;

$\sum N$ - the total result of using the fixed capital of the SC and commercial seaport, taking into account the adopted system of planning financial flows.

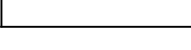
The most important form of management in the system of time limitation is the ship traffic schedule.

Vessel movement schedule is a sequence of voyage performance and represented by a graphical reflection of the real work of each vessel in time and space.

Before drawing up a vessel traffic schedule it is necessary to determine the main technological schemes of voyages of each type of vessel within each voyage range.

Determination of technological schemes of voyages consists in calculation of time expenditures for sailing and berthing components of each type of vessel.

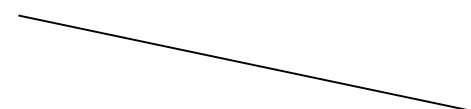
The following designations of the nature and time of individual operations of the unified technological process of ship handling and cargo delivery are adopted when drawing up the ship schedule.

Loading the vessel 

Unloading the vessel 

The vessel is under repair

Vessel crossing with cargo



Vessel crossing in ballast

Figure 11.2. Main symbols of ship schedule construction

The slanted graph is a graphic representation of cargo ships' work by main elements of transportation operations, distributed sequentially and taking into account rotation of ports of call, i.e. in space. The schedule reflects the vessel's operation for a certain period, during which it is agreed to perform a specified volume of transportation (fig. 11.3**).

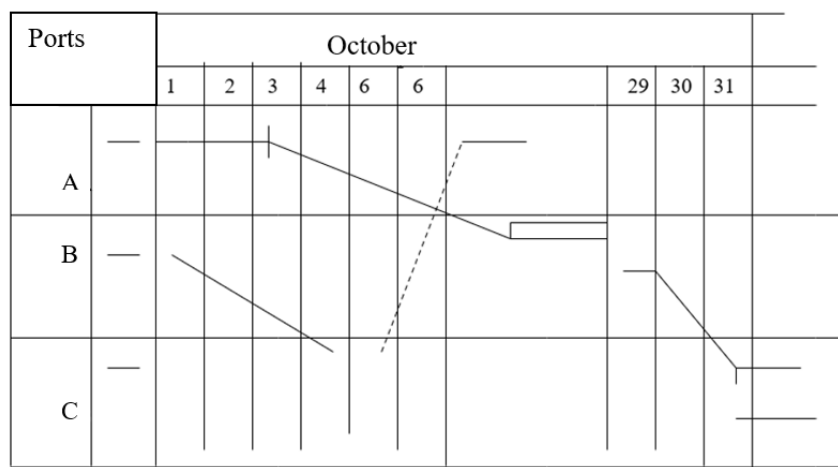


Figure 11.4. Example of a vessel's voyage schedule

For some cargo flow and frequency of vessel calls at commercial ports, it is important to control the availability of adequate berthing frontage. In order to effectively utilize the carrying capacity of the fleet, the number of berths in the port should not be less than

$$N = \frac{\sum Q}{23M_{dl}} \cdot , \quad 11.12$$

23 - number of working days during the month according to the port operation conditions.

Spatial characteristics of the routes predetermine the peculiarities of the ship traffic schedule (fig.**).

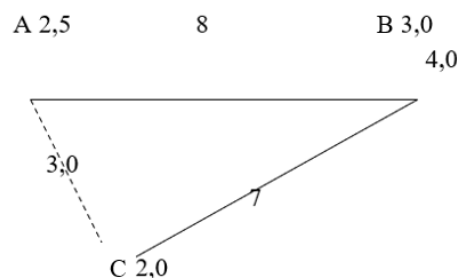


Figure 11.4. One of the vessel's itineraries

Two methods of accounting for vessel performance have been adopted: departure and arrival. The first one takes into account the initial conditions of operation, the second one is aimed at matching the process of formation of financial costs and results.

The advantages of the oblique schedule, which provides the possibility of controlling the state of the ship operation process, include:

1. In any calendar period it is possible to determine the nature of ship processing in the port.
2. The situation with loading parameters of port terminals on the line of call of ships in the calculation period is clearly visible.
3. The frequency of vessel departures from any port is clearly controlled.

The oblique schedule is also characterized by disadvantages of information and logical plan. The main difficulty lies in tracking the location of a particular ship, if not to consider the possibility of electronic communication and the system of control of the ship's location by satellite system under the IMO program.

This disadvantage can be eliminated by building and controlling the fleet operation on the principles of direct schedule (fig. 11.5).

Ports	October									
	1	2	3	4	5	6			30	31
1		A					B	B		
2										
3										

Figure 11.5. General view of the direct ship movement schedule

However, this form of schedule does not allow assessing the situation in commercial ports, which creates risks of long idle times waiting for the time of staging to terminals.

The linear form of shipping organization is characterized by a pre-announced schedule, which is prepared on the basis of an oblique schedule in the following form (fig. 11.6):

Port	Operation	Pallada			Hermes	
A	Coming	01.10	31.10			
	Outflow	03.10	5.11			
B	Coming	11.10				
	Outflow	15.10				
C	Coming	25.10				
	Outflow	27.10-				

Continuity of planning on the basis of interaction in the intermodal system provides solution of the following tasks:

1. Accuracy of transportation planning within a quarter.
2. Reasonableness of monthly plans of cargo dispatch and preparation of vessels for their realization.
3. Planning and regulation of ships' work and their handling in commercial ports.
4. Preparation of voyage assignments for vessels on the basis of interaction norms.
5. Resolving issues of chartering vessels on terms that ensure the necessary intensity of utilization of production potential and efficiency improvement.
6. Daily monitoring of the progress of plans and schedules.
7. Accumulation of operational information for the purpose of regulating and adjusting ship utilization plans.
8. Controlling relations with cargo owners and charterers.
9. Early resolution of issues on vessel utilization.

In this respect, the calculation of the proportionality coefficient is important as a reflection of the interaction of all participants in intermodal transportation. It can be calculated by the ratio of the operation mode coefficient for the system as a whole to the operation mode coefficient of the busiest subdivisions of the integrated transport complex.

11.5. Operations of service divisions in the maritime transport industry

The intensification of fleet operations is impossible without the balanced development of service divisions within the maritime transport complex. Therefore, in the management mechanism ensuring the stability of the transport system, the interconnection between fleet carrying capacity and port throughput capacity must be considered for each coastal region (range).

The increasing specialization of fleets and ports necessitates the development of comprehensive shore-based service systems for vessels, fostering intra-system cooperation and labor division.

The structure of service businesses in commercial shipping includes agency, forwarding, and surveyor firms, fleet maintenance bases, pilotage services, auxiliary fleets, and more.

A ship agent's role can prevent conflicts with regulatory authorities, influence cargo operations, handle formalities, and provide the captain with sound advice. In this way, the informational role in the transport process becomes a crucial factor in enhancing fleet efficiency.

When selecting a port, the charterer consults the agent regarding relevant regulations and the current situation. The agent informs shipowners about port supervision requirements and potential issues. Through the agent, the shipowner gains insights that help assess risks and their parameters.

The organization of service firms has reached a high level in service delivery. Significant advancements in automation and process programming, based on market demand analysis and forecasting, allow for quick problem resolution and mitigation of crisis impacts.

A key characteristic of consumer demand for maritime services in Ukraine is the limited scale of national industrial production, which directly affects the need for domestic transportation services. Additionally, there is a divergence in optimization strategies between the production and transportation sectors. The effectiveness of economic and investment decisions in maritime services depends on the widespread adoption of efficient resource utilization methods, minimizing the negative impact of declining cargo flows, optimizing carrying capacity usage, enhancing competitiveness, and adjusting fleet structure as needed.

The optimal functioning of maritime services as an integral part of the national economic complex requires a balanced alignment of interests among the state, labor collectives, and individual workers on one side, and producers, consumers, and the investment sector on the other. In the system of final results, consumer interests serve as the primary driving force.

Enhancing the economic stability of service companies depends on the accuracy of project decisions and the interconnection between systemic and business needs. The improvement of evaluation metrics should be based on functional processes, economic principles, and the profitability of commercial operations.

The assessment of organizational efficiency and innovative technologies at fleet maintenance bases – designed to reduce the repair time budget – relies on the potential increase in profits driven by key factors. As transport volumes grow, time is proportionally redistributed between fleet operations, repair periods, and other activities.

$$\Delta P_{rt} = \Delta T_m D_v P_{rtc}, \quad 11.13$$

Reduction of vessel maintenance costs during repair or technical servicing:

$$\eta C_{st} = \Delta T_m D c_{ste}, \quad 11.14$$

where :

$\Delta T_m D_v$ – savings in tonnage-days during repair or technical servicing based on the selected fleet service technology;

p_{rtc} – average profitability per tonnage-day of fleet operation;

c_{stc} – average maintenance costs per tonnage-day during the vessel's downtime.

Since 2013, ultra-compact tugboats have been in operation. In addition to their primary functional purpose, they are also used for training personnel in real-life conditions.

Enhancing the competitiveness of transport assets increasingly depends on the quality of fleet and cargo handling operations. The quality of operations is reflected in the precise organization of technological processes, strict adherence to ISO standards, and the rational use of time and resources. It is expressed through economic and operational results and is influenced by the improvement of work organization and the balanced development of the fleet and cargo base.

When organizing local and feeder maritime services, it is important to consider that transportation in these routes initially has low cargo flow concentration. As a result, shipping companies face an increased risk of profitability fluctuations in their operational activities.

When choosing a strategy for the development of regional maritime transport services, it is essential to consider that shipping companies and commercial ports operate based on real market relations, meaning they rely on demand. Shipowners cannot independently shape the transport services market. Maritime transport enterprises are highly dependent on external conditions.

In a market economy, where constant changes affect the position of a shipping company, its competitors, service subsystems, cargo owners, financing models, and the state of the maritime transport industry in which the operator functions, minimizing operational risks becomes a fundamental management requirement – not only in the present but also for the future.

11.6. Development of the Cruise Potential of the Seaside Region

In the history of transformative processes within the maritime passenger fleet system, a distinction is made regarding the objectives of passenger voyages. The boundary is viewed as the transition process from catering to business travel to adopting a cruise shipping strategy. In this context, the development of the passenger fleet of the Black Sea Shipping Company holds a prominent position. By the time the role of sea cruises began to rise, the company had 30 displacement vessels and 7 hydrofoil ships in its fleet.

The shipping company operated unique liners for that era: "Maxim Gorky," "Fyodor Dostoevsky," and "Odessa." Special groups of vessels were formed, consisting of ships specifically constructed for cruise services, such as "Ivan Franko," "Belarus," and others.

Three cabotage routes and four international lines were in operation. Various cruise itineraries were organized and effectively executed. The Passenger Fleet Administration oversaw three research vessels, and four training-production vessels were under its operational management.

The annual net foreign currency revenue (profit) of the entire passenger fleet group reached 40 to 50 million dollars.

At the same time, the global cruise industry has been steadily developing in the main regional segments of the World Ocean. The characteristics of the formation of the main parameters of cruise shipping are presented in Table 11.1. North America maintains its leadership in positioning cruise technologies. Up to 160 cruise ships are utilized in operational activities, serving more than 13 million passengers. The total cash flow reached \$20.7 billion, accounting for 61.2% of the overall revenue level of the global cruise market. In 2014, ships operating in the European cruise zone transported 6.4 million passengers, generating a cash income of \$10.1 billion. The Asian segment of the global cruise market is extensively increasing its potential. However, both its potential and that of the Black Sea region remain insufficiently explored.

Table 11.1

General Characteristics of the Global Cruise Market (2014)

	Cruise fleet	Passengers (million)	Income (billion dollars)	Global market share
Global	296	21,4	33,8	
America	156	13,1	20,7	61,20%
Europe	114	6,4	30,1	29,90%
Asia / Pacific Ocean	26	1,9	3	8,90%

Source: : **Cruise Industry News (2015). 2014-2015 Annual Report**

Cruise shipping is characterized by a complex interplay with shore infrastructure. In 2013, cruise passengers and crew members made 114.9 million shore visits, generating a revenue of \$52.3 billion for service and other subsystems. This

means that cruise shipping creates a unique cluster of effective activities among various organizations.

The demand for jobs in shore infrastructure to produce the corresponding products and services reaches up to 900,000 positions. In the United States, revenue from the cruise industry has increased by 26% since 2009, compared to a 14% increase in GDP during the same period.

Source Region	2023	2019	% Change (2019 to 2023)
Global	31.7 million	29.7 million	+6.8%
North America	18.1million	15.4 million	+17.5%
Europe	8.2 million	7.7 million	+6.5%
Asia	2.3 million	3.7 million	-37.7%
Australasia	1.34 million	1.35 million	-1.0%
South America	996 k	935 k	+6.6%

Figure 11.8. 2023 Passenger Volume

Source: : **Cruise Lines International Association (2024). May 2024 State of the Cruise Industry Report**

The U.S. cruise industry has demonstrated significant growth and development in recent years. According to the Cruise Lines International Association (CLIA) report for 2024, passenger traffic in 2023 reached 31.7 million people, exceeding 2019 figures by 7%

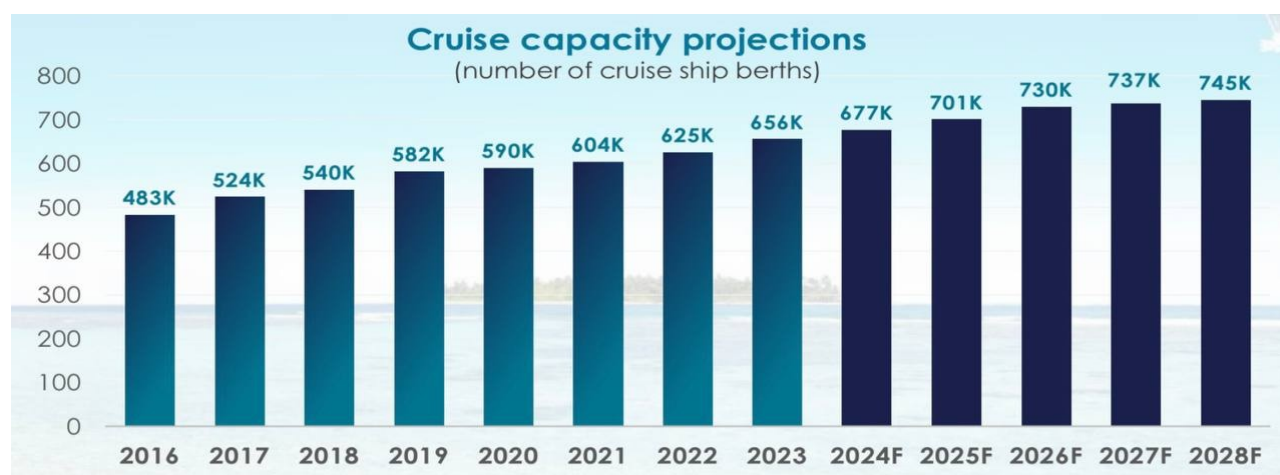


Figure 11.9. Cruise capacity projections

Source: : **Cruise Lines International Association (2024). May 2024 State of the Cruise Industry Report**

Forecasts for the coming years are also optimistic. Cruise capacity is expected to increase by 10% during the period from 2024 to 2028, driven by cruise companies' efforts to achieve net-zero emissions by 2050.

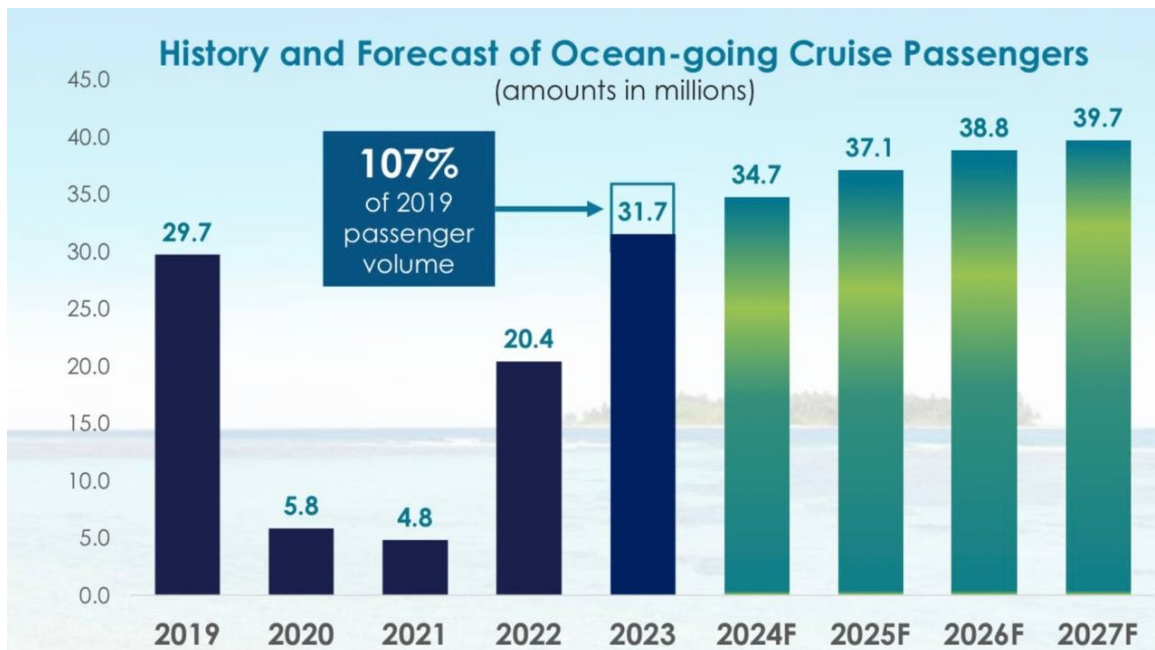


Figure 11.10. History and Forecast of Ocean-going Cruise Passengers

Source: : **Cruise Lines International Association (2024). May 2024 State of the Cruise Industry Report**

Cruise tourism is resilient—rebounding faster than other forms of travel and tourism. Cruise travel reached 107% of 2019 levels in 2023—with 31.7 million passengers sailing. This compares to overall international tourism arrivals, which are 12% lower than 2019. By 2027, cruise is forecast to grow to nearly 40 million passengers

In 2024, the Port of Galveston in Texas became the fourth-busiest cruise port in the world, servicing a record 1.5 million passengers. In 2025, more than 400 cruises and 1.75 million passengers are expected, along with the opening of a fourth cruise terminal in November 2025, which will expand the presence of MSC Cruises and Norwegian Cruise Line.

The financial performance of leading cruise companies is also improving. In 2024, Carnival Corporation reported an increase in adjusted EBITDA to \$6.1 billion, which is 40% higher than the previous year's figures.

In Europe, local regions of extensive cruise technologies are forming. The cruise cash flow in US dollars is distributed as follows: the UK and Ireland (\$3.2 billion), Germany (\$3.1 billion), with Italy in third place (including shipbuilding at \$4.6 billion), followed by Spain (\$2.3 billion), the Scandinavian countries (\$1.5 billion), and France (\$1.1 billion).

Unfortunately, the transformation of the potential and activities of the passenger fleet of the Ukrainian Maritime Industry, which began in 1986 after the tragic sinking of the steamship "Admiral Nakhimov," completely excluded Ukraine from participation in this rapidly developing segment of the maritime trade market. Some vessels were urgently sold at low prices to the first buyers who showed interest. Others were scrapped. The rest were laid up without repairs and without the renewal of Registration documents.

Against this background, it is necessary to outline the chronology of the formation of the passenger fleet based in Odessa. Starting from the "porto-franco" period, the passenger fleet was established during the 1820s to 1840s of the 19th century. Then, after the Crimean War, the Russian Society of Shipping and Trade was formed to service passenger traffic. In the subsequent period, the era of the Voluntary Fleet began. In the 1920s and 1930s, a new passenger fleet was built and procured.

A special place is occupied by the targeted construction of passenger vessels based on original designs that supported the Crimean-Caucasian line and served maritime tourists in various regions of the World Ocean. However, this capital potential was subsequently squandered. The revival of Ukraine's passenger fleet can be based on the assessment of the significance of this resource and the search for forms to activate investment activities in this segment.

Planning the development of a modern passenger fleet should begin with justifying the level of efficiency and selecting vessel capacity options accordingly. It is important to coordinate the ratio between the new fleet and the existing one. Entrepreneurial efficiency is based on the growth of integral productivity and the intensity of utilizing the carrying capacity of the entire fleet of the company.

In developing the cruise market, alongside changes in the economic segment, attention should also be paid to changes in social relations and values, which significantly determine the marketing system. This includes both standard and specific methods, as well as a complex set of specialized service intermediary enterprises.

The demand that drives the development of the cruise business is determined by the need for recreation and the sufficient purchasing power of potential passengers. At

the core of the supply lies the presence of entrepreneurial structures capable of concentrating investment activities in the cruise shipping segment. Based on this strategy, the United States maintains its leadership in the global cruise market. Cruise shipping companies that leverage American capital hold leading positions in the global cruise industry. In terms of value, 8 out of the 10 leading operators have vessels that also operate in the European segment, representing American capital.

It is also necessary to consider the important patterns of the global cruise market. The limited scale of cruise technologies does not allow for the development of perfect competition. The global cruise market, in terms of potential supply (carrying capacity), includes a total of around 450,000 passenger ship berths. Nevertheless, the cruise segment of the maritime trade market is characterized by a systemic response to negative manifestations of external risks. Among the factors of negative impact are threats to navigation safety, slow development, and political instability in various countries.

Control Questions

1. Formulate the main functions of creating and implementing an operational plan for the vessel's operations.
2. Present the procedure for developing the operational plan of a shipping company.
3. Describe the characteristics of relationships with cargo owners as the basis for planning the transportation process.
4. Pay attention to the structure and objectives of developing the production and financial plan for the vessel's operations.
5. The procedure for developing the production and financial plan for a vessel representing a shipping company.
6. How is the distribution and positioning of vessels across market segments in maritime trade carried out?
7. Reflect the set of indicators for the effective utilization of the fleet in cargo transportation directions.
8. General principles and characteristics of creating a schedule and timetable for vessel operations.
9. Characteristics of preparing a vessel's schedule for line operations.
10. Characterize the role and functions of service divisions in the maritime transport industry as conditions for the effective use of the fleet's carrying capacity.
11. Tasks and factors for the development of the Black Sea cruise zone.
12. Characteristics of the structure of modern passenger transportation in maritime regions.

Chapter 12.

ANALYSIS OF OPERATIONS AND FORMATION OF INFORMATION FLOWS IN FLEET MANAGEMENT

12.1. General Principles and Structure of Market Situation Analysis

The volatility of the shipping market and its primary influence on the nature and conditions of fleet utilization for any shipping company determine the need for analyzing the market situation within the relevant segment of commercial shipping.

It is essential to examine the interconnection between the volume of maritime trade, the technical and economic level of the fleet, and the key factors shaping these parameters in the future. The primary objective is to identify relationships between the core parameters of a shipping company and demand factors in such a way that the production and economic potential can be projected for the forecast period.

The concept of economic forecasting of future external conditions and expected parameters is based on an assessment of global and national economic trends. The differentiation of the global market space necessitates a focus on the specific characteristics of the analysis and forecasting period. A critical aspect is the analysis of economic growth rates based on GDP indicators. It is also important to identify the factors influencing changes in the share of added value, which affect the growth rates of transportation driven by global economic expansion and production output.

A key element in analyzing market factors is the assessment of price transformations in the energy and raw materials segments of maritime trade. These segments largely determine and regulate the demand for shipping capacity.

The next step is to analyze the dynamics and key factors shaping maritime trade. A crucial aspect is identifying the relationship between the future state of the shipping industry and the fundamental factors driving growth in trade volume or demand for tonnage. Traditionally, this dependency model takes the following form:

$$Q_{mt} = f.(GNP)_t \quad 12.1$$

where:

Q_{mt} – volume of maritime trade;

GNP – global output in the form of Gross National Product;

t – forecast period.

Additionally, when analyzing the financial condition of a shipping company, it is important to distinguish between cash reserves and cash flow. Profit is typically considered a reserve, calculated and accounted for at a specific date or at the end of a period. In contrast, cash flow is examined over a specific operational period and reflects the actual availability of funds in the company's accounts.

Profit ensures the recovery of capital investments and the subsequent expansion of production capacity.

In a market characterized by free operational activity and open competition, analyzing the factors influencing the foreign exchange efficiency of fleet operations becomes critical. Traditionally, this process relies on the calculation and analysis of EBITDA metrics.

Ultimately, the key outcome is an increase in the efficiency of vessel utilization. The effectiveness of the modern fleet is based on reducing capital intensity per unit, increasing labor productivity, and improving cost efficiency through economies of scale.

$$\Delta E_q = q \frac{C_{sf}}{Q} \left(1 - \frac{1}{1+i_q}\right) \quad 12.2$$

q – growth in transport work volume due to economies of scale;

C_{sf} – fixed costs of the company;

Q – baseline transport work volume (before the transition to advanced cargo service technologies);

i_q – index of transport work volume growth due to industry development.

The complexity of ensuring the adequate development of a national commercial fleet and ports is driven by two main factors: intense competition in the global maritime trade market from established operators and the limited investment resources available to emerging maritime nations. This increases the importance of scientifically justified decision-making and the selection of cost-effective transport service technologies.

A crucial aspect is the identification of key trends in maritime trade market development and the differentiation of its segments to select an appropriate strategy for expanding a shipping company's production capacity.

To analyze the actual state of a shipping company, two primary financial indicators are used:

- Return on Investment (ROI) – a measure of investment profitability;
- Return on Equity (ROE) – an indicator of shareholder profitability.

The market segment of maritime trade in which a shipping company operates serves as a key indicator for assessing its future position. Of particular importance are the nature and direction of changes in the structure and volume of cargo flows.

12.2 Determination and analysis of the cost of fleet operation on the line

With the help of the analysis it is necessary to study those aspects of merchant shipping, which relate to setting, changing and refining the plans of current and prospective work of the SC. Along with technical and operational indicators, each line is characterized by the cost of transportation. Among the indicators of line efficiency, the cost of transportation is the most important at the first stage of calculation.

Calculation of the cost price according to the accounting data and transportation statistics data provides control of the tendency of changes in planned conditions and estimation of parameters of deviation from the revenue rate.

Detailed costing by separate processes and areas of fleet operation increases its operational and practical value.

Calculation of the cost of ship maintenance and cargo transportation should meet the following requirements:

1. Cost calculation should be based on progressive norms of resource costs. The cost price should determine one of the most important aspects of the shipping company's competitiveness.

2. in order to ensure operational control, the actual cost price should be determined for individual voyages or parts of the operational period;

3. cost indicators should be established with necessary detailing of the structure of changing cost items by external factors;

4. the methodology for compiling planned and reported cost of sales should be characterized by unity of approaches in order to achieve comparability of indicators;

5. planning and cost accounting as an element of the cost leadership strategy should be accompanied by the analysis of indicators in order to develop measures for the implementation of programs to improve the cost-effectiveness of the functional activities of the SC.

Classification of costs into fixed and variable predetermines the methods of attributing individual groups of costs to the cost of transportation and considering the nature of economies of scale. Thus, the planning and control of profitability of the IC functional activity is ensured. This indicator acts in the form of marginal income and represents the difference between the revenue from transportation and variable costs.

At linear operation of the fleet the cost of transportation is calculated for a round trip or its completed elements in contrast to the method of elemental rates, which is recommended in economic research.

$$St = \frac{C_x t_x + C_{ct} t_{ct}}{\varepsilon D_n} grn / t, \quad 12.3$$

where,

C_x – cost of vessel maintenance per day of operation, uah;

C_{ct} – cost of vessel maintenance per day of berthing, uah;

$Q_r = \varepsilon D_n$ – the amount of cargo transported per trip

$$t_r = t_x + t_{ct} \quad 12.4$$

By comparing the cost of cargo transportation in each direction with the income rate on the same line, the profitability of transportation and expediency of the vessel operation are determined.

In project calculations, in addition to the indicator of transportation cost, the indicator of specific capital investments by fleet is used. This indicator is calculated based on the following initial data:

The construction value of the vessel (K_{pc});

Length of operational period;

Voyage time;

The quantity of the voyages n_r ;

Vessel loads.

$$k_u = \frac{K_{pc}}{\varepsilon D n_r}, \quad 12.5$$

After determining the specific (average) economic indicators, either the payback period of marginal (additional) capital costs or the net present value (NPV) is calculated.

Calculation of elemental rates

Elemental rate for the movement operation

$$\beta = \frac{(S_x t_x + \kappa_{zp} t S_{st})(1 + \kappa_b)}{\sum Q^l}, \quad 12.6$$

where, κ_{zp} – traffic delay coefficient;

κ_b – ballast transition coefficient.

Paying the attention for the degree of utilization of carrying capacity and daily speed, the calculation may be made with conditions that consider the nature of the vessel's use during the transportation work.

$$\beta = \frac{(S'_x + \kappa_{zp} S'_{st})(1 + \kappa_b)}{\varepsilon V}, \quad 12.7$$

$$\varepsilon = \frac{Q}{Dn},$$

$$S'_x = \frac{S}{D_n} \quad 12.8$$

where, V – operational speed.

Cost (elementary rate) of parking operation:

$$\alpha = \frac{S_{st} t_{st}}{Q_r}, \text{ and}$$

$$\alpha = \frac{S'_{st} t_{st}}{\varepsilon} \quad 12.9$$

The elemental cost rate under loading or unloading for design calculations is set in a sequence based on the use of the daily cost indicator for the vessel. Elemental rates for the main transportation operations are then determined.

Elemental rates for the time of cargo operations

Loading

$$\alpha_n = \frac{S_{st} t_{stn}}{Q} \text{ cnt} / t$$

$$t_n = \frac{Q}{M_n} \quad 12.10, 12.11$$

where, M_n – vessel-daily rate of cargo operations for loading the vessel (t/v-d),

$$\text{then } \alpha_n = \frac{S_{st}}{M_n}.$$

Elemental cost rate of parking under unloading

$$\alpha_b = \frac{S_{st}}{M_b} \text{ cnt} / t \quad 12.12$$

Usually, $\alpha_b \succ \alpha_n$ because unloading norms for several works (types of cargo) are less (excluding pneumatic unloading).

Using tonnage-per-day cost measures elemental cost rates can be calculated as follows:

$$\begin{aligned} \alpha_n &= \frac{s'_{st} D_n}{M_n}, \\ \alpha_b &= \frac{s'_{st} D_n}{M_b}. \end{aligned} \quad 12.13$$

where, $s'_{st} D_n$ – expenses for the vessel per day of mooring.

Total cost of transportation for the entire journey with the cargo:

$$C_n = \sum \alpha + \beta l_{2PH} / m \quad 12.14$$

Thus, the cost of functional activities of the fleet and cargo or passenger transportation connects the two main subsystems of the company's potential - production and financial and is the most important resultant qualitative indicator of SC performance. Cost is a means of production and financial control. The programs of competitive stability provide for measures to consistently optimize the financial results of transport work.

It should be considered that along with technical and operational indicators each line is characterized by price parameters and cost of transportation. Among the indicators of line efficiency, the cost price is the most important at the first stage of calculation.

After determining specific (average) economic indicators, either the payback period of marginal (additional) capital costs or net present value (NPV) is calculated.

12.3. Analysis of the fleet operations of a shipping company

To ensure high-quality planning based on the consideration of factors influencing the dynamics of key parameters of a shipping company, special attention is given to analyzing the conditions under which results are formed. In this regard, it is necessary to identify and summarize the main trends in cargo flow formation, the operational characteristics of competing fleets, and to select principles for responding to and managing the stability of one's own fleet.

These studies are based on data from operational, statistical, or accounting reports, depending on the type of data required for the analysis. The differentiation of analysis objectives is also important. Therefore, shipping companies use various systems for tracking parameters and performance results.

The analysis of the current state of a SC involves solving a complex set of tasks that highlight the need to select and implement further steps for optimizing its position:

- identifying and summarizing patterns in the development of fleet carrying capacity;
- assessing the scale of development, fleet structure, and their alignment with transport volumes, transport structures, operational types, application areas, and operating conditions;
- identifying imbalances and bottlenecks in the SC's development;
- determining shortages in specialized vessel types, costs of chartering foreign tonnage, unproductive downtimes, underutilization of cargo capacity, and other negative factors;
- evaluating whether the technical and economic level of the national fleet corresponds to that of major competitors operating on the selected route;
- preparing information for developing a regulatory framework for strategic planning.

There are two main types of analysis applied to individual vessels and shipping companies as a whole:

- current analysis;
- operational analysis.

Current analysis is based on statistical or accounting data regarding a vessel's or a company's operations. Its advantage lies in its reliability, while its disadvantage is that the results are obtained only after the completion of transportation activities.

Operational analysis, on the other hand, relies on data from operational and managerial accounting and reporting. It can be conducted at any time (per watch, per day, per week, per ten-day period, per voyage). The key advantage of operational analysis is its ability to influence the production process in real time and adjust

subsequent actions. However, its drawback is that in some cases, it is impossible to obtain entirely reliable data.

The advantage of current analysis is its reliability, while its drawback is that the analysis results are obtained only after the transportation process has been completed.

Operational analysis is based on data from operational and managerial accounting and reporting and can be conducted at any convenient time (watch, day, week, ten-day period, voyage).

The necessity and advantage of conducting operational analysis of a shipping company's (SC) operations lie in its ability to use the results to intervene in the production process and adjust subsequent actions.

The disadvantage of operational analysis is that in some cases, it is impossible to obtain fully reliable data.

The analysis examines the dynamics of fleet operational performance and development indicators, such as the number of vessels, total deadweight, cargo capacity, passenger capacity, average vessel age, etc. It also evaluates fleet utilization performance, including productivity per ton of cargo capacity, duration of operational periods, cargo capacity utilization ratio, and transportation process profitability, as well as the volumes and structure of fleet renewal and decommissioning.

The standard analysis process includes the following steps (fig. 12.1):

1. Preparation of initial data – systematizing information based on planned (baseline) and actual transportation and fleet operation reports.
2. Development of an analysis model – defining the objects to be included in the analysis results.
3. Selection of analytical methods – choosing approaches based on the nature of the tasks and the requirements for their resolution.
4. Conducting the analysis and refining the obtained data.

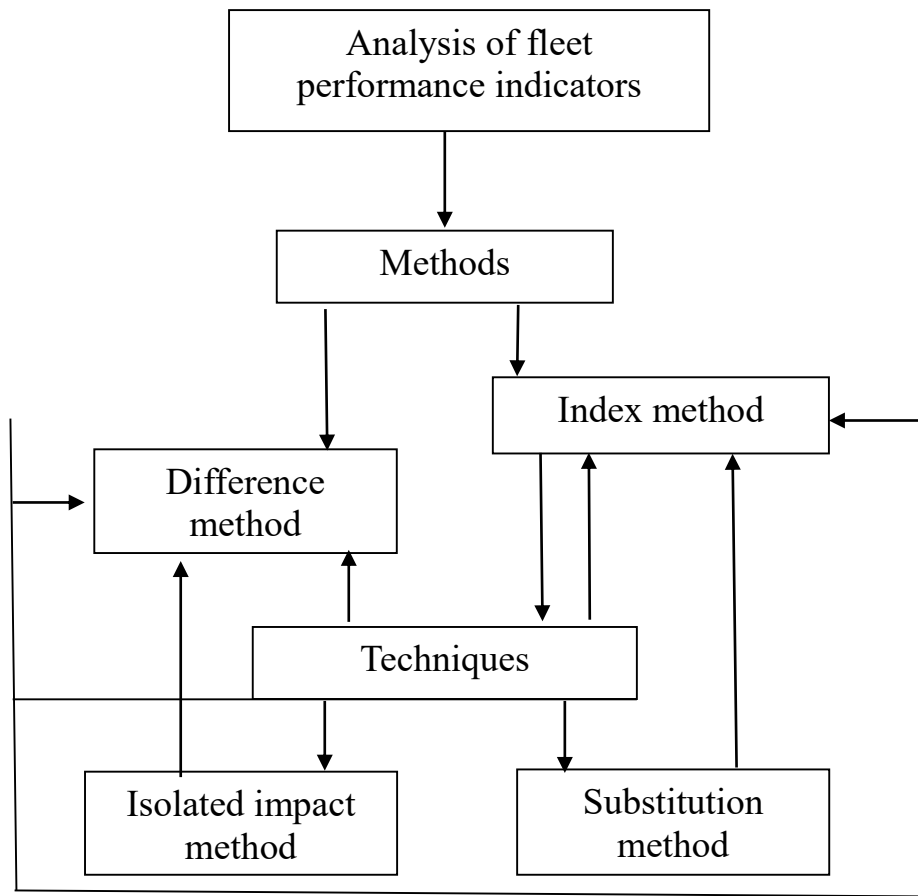


Figure 12.1. Scheme of operational analysis of the fleet performance of a shipping company

To quantitatively assess the achievement of transportation plans, methods of comparison, relative values, and time series analysis are used.

The average annual growth rate of any indicator is determined using the geometric mean formula:

$$\overline{x_g} = \sqrt[n-1]{x_1 * x_2 * x_3 * ... x_n} , \quad \text{or}$$

$$\bar{x}_g = \sqrt[n-1]{\frac{y_n}{y_0}}, \quad 12.15$$

where:

x - the growth rate for each year;

N - the number of years in the period;

y_n - the absolute level of the indicator in the final year;

y_0 - the absolute level of the indicator in the base year.

The analysis of shipping companies is carried out in the following sequence:

1. evaluating cargo transportation by type (coastal, export-import, transit, cross-trade) and by transportation scheme.

2. determining the share of transportation by type and organizational form of fleet operations.

3. assessing the state and structure of the SC's production potential and its compliance with market demands in maritime trade.

4. examining operational and economic transportation indicators: changes in average transport distances, fleet processing intensity, the ratio of gross and net port idle times, and financial indicators (profit, revenue, expenses, profitability, transportation costs).

Depending on the evaluation objective—whether it is a comparison with a plan or competitors—two methods are applied when analyzing results:

1. The differential method – used to obtain comparative parameters and form a comprehensive assessment of achieved results.

2. The systemic method – provides a holistic evaluation of performance.

Additionally, the index method is widely used for assessing qualitative changes in results.

The differential method evaluates the magnitude and nature of discrepancies between actual and planned values of analyzed indicators or potential parameters:

$$\Delta a = a_0 - a_b, \quad 12.16$$

An index, in this context, is a relative number characterizing the quantitative change of an analyzed parameter in relation to a base value:

$$l_a = \frac{a_0}{a_b}, \quad 12.17$$

The ultimate goal of the analysis is to determine the degree of influence of a selected set of factors on a specific result of the fleet's operational activity. Depending on the completeness of the information available, as well as the objectives and tasks of the analysis, two elimination techniques (i.e., methods for identifying the degree of influence of individual elements) are applied.

These techniques enable a transformation of values in such a way that the influence of all elements on the analyzed indicator is accounted for, except for one at a time.

These techniques include:

- the method of isolated factor influence;
- the method of chain substitution for each factor, which determines the dynamic changes in resource consumption, result formation, and cost allocation.

The method of isolated factor influence involves identifying the increment in the analyzed indicators that has occurred due to changes in each element or factor included in the indicator separately (see fig. 12.2).

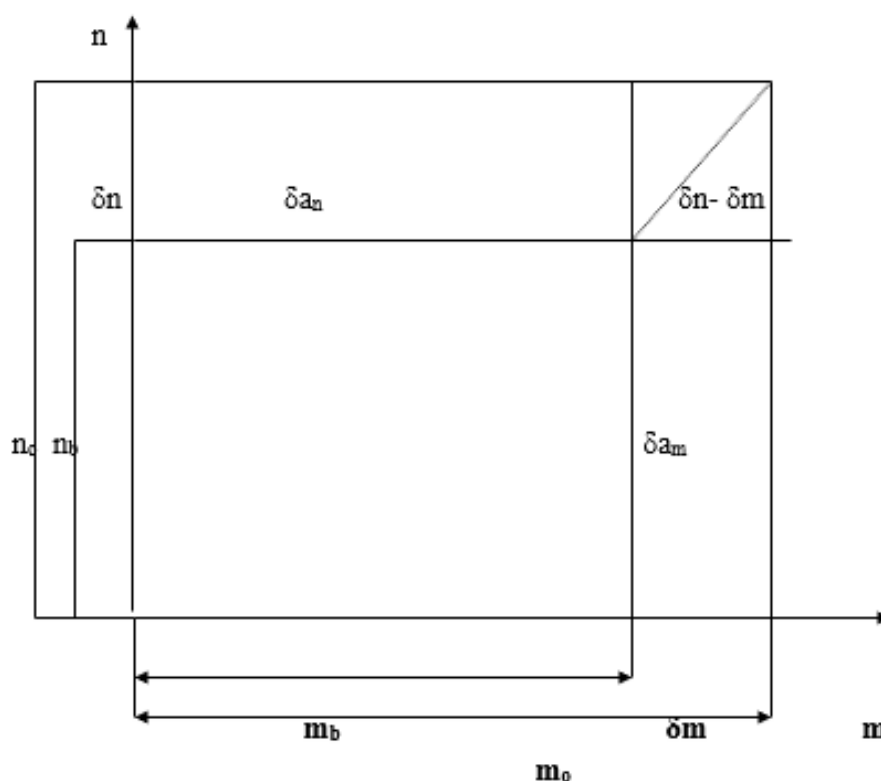


Figure 12.2. Features of the interrelation of factors and the consequences of their changes

$$\begin{aligned}
a &= nm \\
\delta a_n &= \delta n m_b \\
\delta a_m &= \delta m n_b \\
\Delta a &= \delta a_n + \delta a_m + \delta n \delta m
\end{aligned}
\tag{12.18}$$

The premise of approximate measurement is that each factor included in the indicator manifests itself in isolation, meaning that the combined influence with other factors is not taken into account. As a result of this condition, so-called “non-decomposable residuals” arise, which must be distributed among the factors that caused their appearance.

An assessment is made of the main trends and key parameters of fleet development, including average carrying capacity, speed, and lifecycle duration.

The presence of a non-decomposable residual is a drawback of this method, i.e., the approach of isolated influence, which limits its use in managerial analysis.

$$\Delta a_n = \delta a_n + 1/2 \delta n \delta m,$$

$$\Delta a_m = \delta a_m + 1/2 \delta n \delta m,$$

$$\Delta a = \Delta a_n + \Delta a_m \tag{12.19}$$

There are two ways to resolve the issue of analysis accuracy due to the non-decomposable residual:

- a) equally among the factors that caused it;
- b) proportionally to the magnitude of the factors that caused it. In any case, a certain degree of conditionality in result evaluation remains.

In the process of analyzing and justifying the projected level of specialization of maritime transport enterprises, a system of specialized indicators can be applied:

- the share in the total volume of transport and transshipment work performed by specialized fleets or transshipment complexes.
- the number of specialized vessels and transshipment complexes ensuring the priority positioning of economic potential.
- the share of specialized vessels, commercial ports, and transshipment terminals in the total transport capacity or port capacity of a maritime transport region.
- the share of main (core) types of transported or transshipped cargo in the total volume of transport work or the enterprise’s cash flow.
- the average number of cargo types per vessel or transshipment complex (terminal).

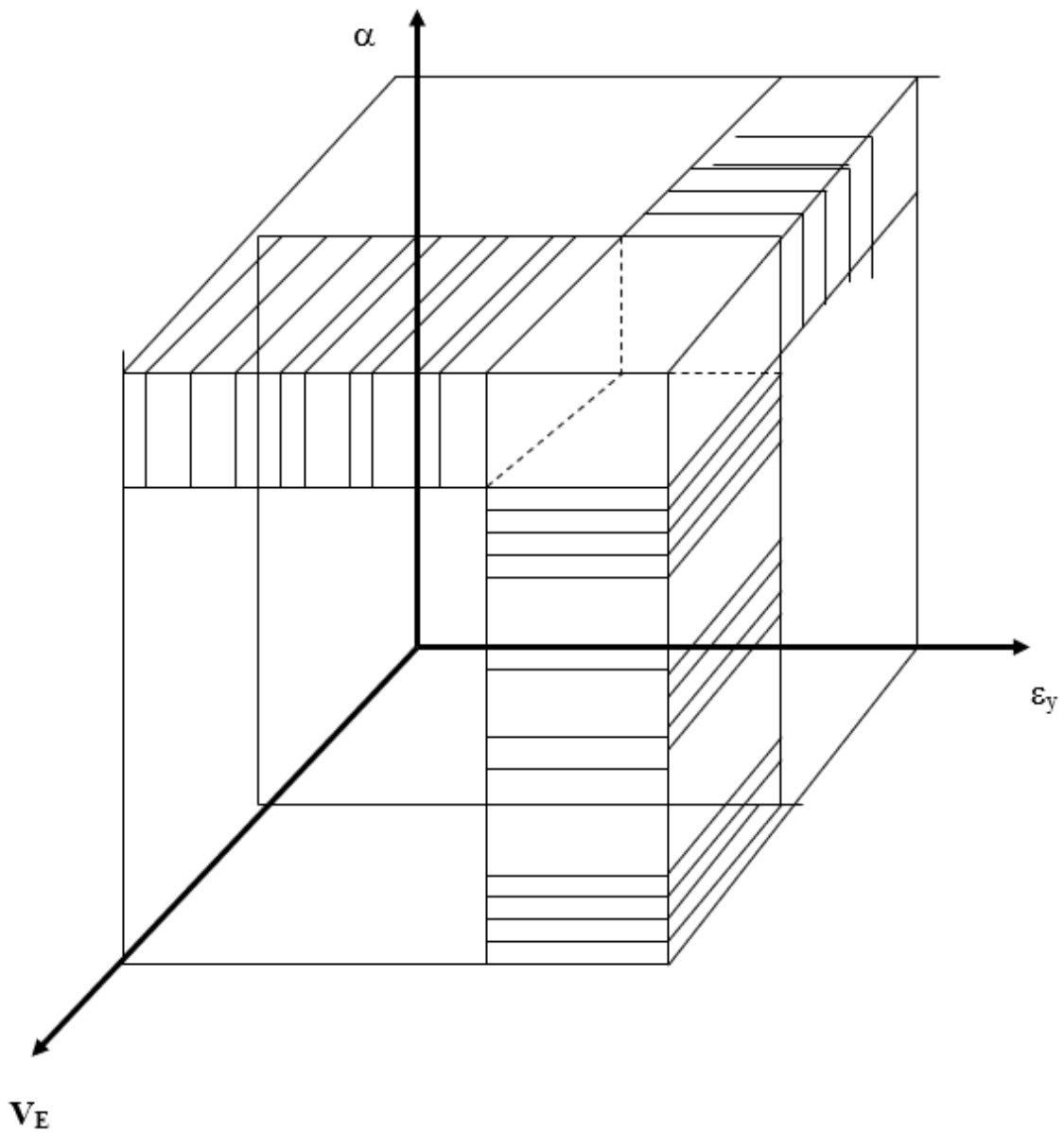


Figure 12.3. Features of iterating results and factors

In a three-factor model for calculating the productivity of 1 ton of deadweight, it is possible to determine the influence of each component.

$$\mu = a * V_e * \varepsilon_x , \quad 12.20$$

$$\mu' = \alpha' + V'_E + \varepsilon'_x + \alpha'V'_E + \alpha'\varepsilon_x + \alpha'V'_E\varepsilon_x , \quad 12.21$$

$$\mu' = \frac{\Delta\mu}{\mu_6} , \quad 12.22$$

$$\Delta\mu = \mu_0 - \mu_6 , \quad 12.23$$

Similarly, an analysis is conducted on changes in parameters that characterize the utilization of cargo capacity and the operational speed of vessels.

The degree of influence of each factor on the final result is determined based on the dynamics of the main conditions for forming the overall outcome:

a) the change in the productivity of 1 ton of cargo capacity under the influence of the dynamics of the cargo capacity utilization coefficient will be:

$$\mu_\alpha = \iota_\alpha + \frac{1}{2}\iota_\alpha V_E + \frac{1}{2}\iota_\alpha \varepsilon_x + \frac{1}{3}\iota_\alpha \varepsilon_x V_E , \quad 12.24$$

b) the change in the productivity of 1 ton of cargo capacity under the influence of the characteristics of forming operational speed is assessed based on the relationship:

$$\mu_s = t_s + \frac{1}{2}a_{t_s} + \frac{1}{2}l_s + \frac{1}{3}a_{t_s}l_s , \quad 12.25$$

c) the change in the productivity of 1 ton of cargo capacity under the influence of changes in the voyage time coefficient.

$$\mu_s = t_s + \frac{1}{2}a_{t_s} + \frac{1}{2}l_s + \frac{1}{3}a_{t_s}l_s \quad 12.26$$

With increasing reliability of the transport fleet, the cost-effective implementation of strategies for improving productivity and system durability becomes crucial. The associated changes in shipowner expenses for maintaining normal competitive operations must meet the necessary parameters for enhancing the TEU (Twenty-foot Equivalent Unit) efficiency of the enterprise.

The limit of additional costs for improving reliability and competitiveness, which are necessary to maintain a position in the market segment, is described by the condition:

$$\Delta E = \sum \delta_q \delta_f f_r \alpha_\pi \geq \Delta C_{qt} \leq \sum_1^T \Delta R_{Bn} \alpha_\pi \quad 12.27$$

where:

δ_u - increase in the productivity of the transport facility as a result of the implementation of the investment project;

δ_t - increase in the longevity of the efficient operation of the transport facility;

f_r - marginal cost results (price) of improving the quality of cargo delivery and the reliability of fleet operation;

ΔC_{qt} - increase in fixed capital (required investments) that ensured the growth of the TEU capacity of the transport enterprise;

T - the estimated life cycle period of the project, aimed at improving the quality parameters of the maritime transport enterprise;

ΔR_{bn} - Additional non-systemic result for maritime transport service consumers, driven by the influence of competitiveness on their value.

Thus, improving the reliability of maritime transport assets is necessary not only to ensure the safe operation of vessels and cargo terminals. At the same time, the increasing technical complexity of the fleet and lifting and transport machinery determines a rise in capital intensity and potentially leads to higher direct operating costs.

Enhancing the reliability of transport assets should generate an additional effect by reducing losses, shortening cargo delivery times, and optimizing carrying capacity. This, in turn, improves the profitability of freight transportation services. Therefore, to ensure the economic interest of transport asset owners, a mechanism is needed to reflect the normalization of the enterprise's condition based on its impact on the formation of a non-systemic effect (perceived value). In any case, the factors contributing to this outcome, reflecting the competitiveness of vessels or terminals, must be assessed.

The level of losses varies significantly from year to year, depending on hydrometeorological conditions, freight market conditions, and socio-economic factors. At the same time, statistical data show that commercial losses exceed accident-related losses by a factor of 2 to 3.

The impact of reducing transportation costs due to an increase in the fleet's technical and economic level on profit growth can be analyzed and evaluated based on the following condition:

$$\Delta P_r = \Delta Q_o [(c_{sb} - c_{sr}) - h_a(u_{kr} - u_{kb})] \quad , \quad 12.28$$

where:

ΔQ_c - increase in transportation volume due to the fleet's techno-economic advantages;

C_{sb} - transportation cost based on the baseline technology;

C_{sr} - transportation cost using a fleet with advanced technologies;

h_a - return on capital assets standard

uk_r - capital intensity of transportation operations in the innovative development approach;

uk_b - capital intensity of transportation operations at the baseline techno-economic level.

The level of rational reliability in the transportation of cargo flows is determined by economic and social criteria. The assessment of the effectiveness of increasing the relative reliability of the fleet and port technical facilities is based on risk reduction and the decrease of technical and commercial losses. At the same time, it should be noted that losses from emergency situations are closely related to the techno-economic parameters of maritime transport assets.

The analysis of vessel operations in relation to the transportation process is a subject of scientific research, focusing on identifying the formation patterns of operational or financial performance indicators of a vessel.

12.4. Method of Chain Substitution

In the analysis of the impact on changes in fleet productivity and efficiency, the traditional method of chain substitution of changing factors or components is used alongside modern methods. The chain substitution method is based on the assumption that it is important to consider the nature of the influence of key factors on the final result or parameter. However, the challenge remains in assessing the accuracy of the relationship between the final indicator and individual conditions. The calculation of the influence is closely related to the chosen sequence of factor consideration and the internal content of individual conditions shaping results and costs.

When using these methods, the sequence of factor input and the determination of their influence are of fundamental importance. The dependence of factor influence on the analyzed indicator based on the order of its forming elements is the main drawback of the chain substitution method.

When determining the degree of influence of a factor on the final result, the preceding factors (whose partial influences have already been determined) are taken at the reported level, while the subsequent factors (whose degree of influence is yet to be determined) are taken at the baseline or planned level.

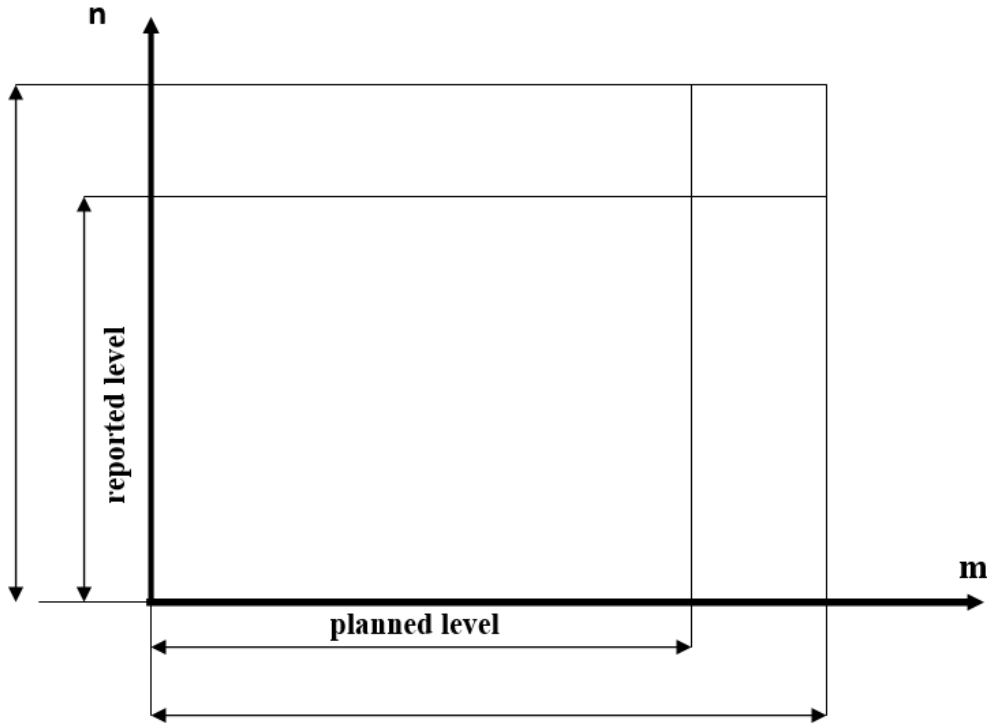


Fig. 12.4. Conditions for Conducting Chain Substitution of Factors

Despite the challenges of the considered method, the principle used to determine the sequence of factors affecting fleet capacity utilization is important. The selection of the order in which factors are introduced into the analysis (to avoid erroneous decisions) should follow the rule: from extensive to intensive factors. This is evident in the analysis of changes in the productivity of 1 ton of a vessel's deadweight. In the annual UNCTAD analysis, this indicator is provided for the global fleet, primarily considering the impact of extensive growth in the total deadweight tonnage of vessels.

$$\mu = \alpha \cdot V_e \cdot \varepsilon_x, \quad 12.29$$

The traditional principle for determining the degree of impact of each factor affecting the productivity of 1 ton of cargo capacity (μ) using the chain substitution method is presented in a differential manner through the following formulaic relationship (12.29).

The total change in the productivity of a ton of cargo capacity

$$\Delta\mu = \mu_s - \mu_x. \quad 12.30$$

The degree of influence of indicators is determined based on the logical relationship and the impact of factors on the final results in accordance with the following sequence:

a) The change in μ under the influence of the dynamics of α can be calculated using the condition

$$\Delta\mu_a = (\alpha_x - \alpha_s) V_e \varepsilon_{x\beta}, \quad 12.31$$

b) The change in μ under the influence of shifts in operational speed due to development factors or external conditions.

$$\Delta\mu_{vt} = \alpha_x (V_o - V_e) \varepsilon_{x\beta}, \quad 12.32$$

c) The change in μ due to the influence of the operating time coefficient is assessed within the following condition.

$$\Delta\mu_{te} = \alpha_x V_o (\varepsilon_{x0} - \varepsilon_{x\beta}), \quad 12.33$$

Ultimately, the balance between actual changes and the combination of individual components is crucial.

$$\Delta\mu = \Delta\mu_a + \Delta\mu_{vt} + \Delta\mu_{te}, \quad 12.34$$

To illustrate the complexity of using this method, let us consider the change in cargo turnover of the shipping company under the influence of one of its defining factors.

$$\sum Q^1 = \sum D_n T_x \alpha V_x \varepsilon_x, \quad 12.35$$

a) speed of travel.

$$\Delta Q^1 = \sum D_{n0} T_{e0} \alpha_0 (V_o - V_e) \varepsilon_x. \quad 12.36$$

However, it should be noted that cargo turnover is closely linked to the formation of costs that affect the magnitude of the final profit. Therefore, when assessing productivity and transportation results, it is important to control the factors that alter the conditions for profit formation.

Throughout the life cycle of a shipping company, crisis situations arise, which can be mitigated by crisis management methods. One form of restoring operational capability is rehabilitation. This involves a system of measures aimed at improving its financial condition, preventing bankruptcy, and restoring competitiveness.

In any case, increasing the role of the human factor and ensuring guarantees of decent working conditions and pay must be reflected in the results of shipping companies. It is possible, with a certain degree of conditionality, to calculate the impact of labor productivity growth among employees of a maritime transport enterprise on the reduction of transportation costs through algebraic dependence

$$\eta C_{sp} = \left(100 - \frac{I_w 100}{I_{pl}} \right) u_w C_{sb} , \quad 12.37$$

Where I_w , I_{pl} – the indices of growth in sailors' wages and labor productivity, respectively;

u_w – the weight of wages in the cost of transporting cargo or passengers;

C_{sb} – the baseline cost of maritime transportation.

The reduction in the cost of maritime transportation resulting from the optimization of fuel costs, spare parts, and the improvement of technical maintenance can be calculated using the following condition:

$$\eta C_{sm} = C_{sb} u_{mt} \frac{\Delta C_{mr} + \Delta C_{me}}{100} + C_{sb} d_{nz} \left(1 - \frac{1}{1 + \Delta q} \right), \quad 12.38$$

where u_{mt} – the weight of material resources in the cost of products or services;

ΔC_{mr} – the reduction in losses of material resources and fuel;

ΔC_{me} – the targets for optimizing the resource intensity of production activities;

d_{nz} – the weight of fixed costs in operational expenses;

Δq – the increase (coefficient) in the volume of work or productivity.

In the structure of functional activities and in the system of managing fleet performance results, the following order of calculating the influence of factors on the cost of maritime transportation is accepted:

- The operational expenses per unit of transport work are determined based on the baseline year's projects;
- The cost for the calculation year is calculated based on the projected (planned) expenses of the previous year;;
- The influence of each factor on the level of costs relative to the tariff rates and conditions of the previous year is determined;

- The total savings due to the influence of factors are subtracted from the cost based on the previous year's expense levels to calculate the cost for the calculation period;
- The cost per unit of production for the calculation year is determined, along with the reduction compared to other expenses from the previous year;
- Changes in tariffs and the conditions affecting the dynamics of transport work volume and costs, as well as their impact on total expenses, are determined;
- The cost per unit of work is calculated, taking into account the indicated changes.

The main sources of information for analyzing the operations of a shipping company and the state of any segment of the global maritime trade market are:

- Annual statistical reporting forms on cargo turnover and international cargo exchange;
- Scientific and analytical reviews from UNCTAD, IMO, and industry research institutes;
- Materials (plans, reports, research reports, applications) from various organizations that utilize maritime transport services.

Based on the analysis results, a quantitative and qualitative assessment of the decisions made is compiled. The quantitative assessment reflects the achieved level of results, while the qualitative assessment reveals the reasons for deviations of the results from the normalized level. The conclusions are used to develop measures aimed at improving the operations of the shipping company.

Based on the analysis data, a strategy for maximizing the use of the shipping company's production potential and meeting the needs of the operational activity segment is developed. The conclusions and recommendations for future development directions are built on actual indicators:

- the number of vessels
- deadweight capacity
- productivity per ton of deadweight
- passenger capacity
- utilization rate
- established structure of fleet replenishment and disposal
- average age of vessels

Within these constraints and in the presence of multiple factors, a well-known regression analysis method is used to construct the appropriate model for expected changes.

12.5. Analysis of Vessel Operating Conditions

The diversity and variability of vessel operating conditions on cargo transportation routes determine the necessity of analysing and controlling decision-making based on standard production and economic performance indicators.

It is important to focus on parameters that are influenced both by the technical condition of the fleet and the efficiency of management decisions. In this regard, all results and information flows can be divided into those that are to some extent dependent on management decisions and those that are strictly tied to external conditions shaping the maritime trade market segment. A significant portion of current expenses (Table 12.1) depends on the nature and scale of the shipping company's operations.

Table 12.1. Vessel performance during the Mumbai – Buenos Aires voyage, US\$.

Main Expense Categories	Unit	Value
Capital Assets	USD	1,212
Maintenance and Payments		
Insurance	USD	300
Maintenance and Survey Expenses	USD	175
Hull and Main Engine Stock	USD	190
Crew Expenses	USD/day	1,000
Interest	USD	150
Pro Rate Association Cost	USD	10
Taxes	USD	40
Other Operating Expenses	USD	75
Cargo – Heavy Grain	Tons	30,000
Port Charges in Buenos Aires	USD/voyage	8,000
Port Fees and Other Charges in Mumbai	USD/voyage	6,875
Other (Freight Forwarding, Warehousing)	USD/voyage	2,450
Cargo Handling Costs Paid by Charterer	-	-

Voyage Duration	Days	32
Port Stay for Cargo Operations	Days	6
Ballast Passage	-	Not applicable
Heavy Fuel Oil Consumption	Tons/day	30
Heavy Fuel Oil Price	USD/ton	220
Light Fuel Consumption	Tons/day	1
Light Diesel Fuel Price	USD/ton	350
Exchange Rate of National Currency	UAH/USD	-
Profit as a Percentage of Total Costs	%	10

When forming and analyzing these indicators, it is crucial to consider vessel handling conditions at the port. Minimizing losses caused by corruption-related issues in certain ports is essential. The implementation of an administration and control program should be emphasized.

In some cases, port authorities and cargo receivers fail to ensure timely unloading by not removing seals from cargo compartments. At the same time, during cargo inspections, there should be no complaints about the cargo condition. A key requirement is the precision of the deck crew in performing tally procedures.

During port stays, the engine crew must conduct maintenance on mechanisms and ensure the proper operation of cranes using the vessel's resources.

The initial data, considering the expected operational period, should be used to calculate two main parameters:

12.6. Analysis of Financial Stability in Maritime Transport Enterprises

Financial stability of a shipping company refers to the shipowner's or operator's ability to operate using own funds, achieving financial independence within a specific time frame. The level of financial stability determines the degree of risk associated with dependence on borrowed capital.

The solvency of shipping companies (SCs), commercial ports, and other business entities in the maritime transport industry directly depends on their ability to promptly convert current assets (services) into cash flows. Thus, the speed of asset turnover becomes a key focus.

The strategy for ensuring financial security in commercial shipping includes the following key areas:

- Risk management across all operational activities;
- Capital efficiency management in the shipping company;
- Cash flow management based on sufficiency criteria;
- Selection and activation of crisis financial strategies.

The efficiency of shipping companies and other maritime transport enterprises is determined by the composition and structure of their assets. However, the primary focus is on the effective utilization of key structural assets, such as fleet and terminals. In this regard, financial position indicators of a shipping company or commercial port become crucial.

To assess the financial stability of shipping companies within their operational framework, it is necessary to analyze the level of asset coverage by funding sources.

Sustainable operations in a competitive freight market are impossible without optimizing the use of economic resources and controlling operational costs. This process requires constant monitoring, with performance indicators (revenues, profits) being measured against corresponding expenses.

For analyzing the financial stability of individual shipping companies or commercial ports, a clear set of indicators is applied within crisis management programs (see Table 12.2).

Table 12.2

Key Parameters of Financial Stability in Maritime Transport Enterprises

Nº	Indicator	Calculation Method	Normalization Parameter
1	Instant Liquidity Ratio	High-yield assets / Current liabilities	Not less than 0.2
2	Current Liquidity Ratio	Liquid assets / Current liabilities	Not less than 0.5
3	Overall Liquidity Ratio	Current assets / Current liabilities	Not less than 2.0
4	Maneuverability Ratio	Shipping company's equity / Non-current assets	Not less than 0.5
5	Independence Ratio	Borrowed funds / Equity capital	Not more than 1.0
6	Return on Assets (ROA)	Net profit / Total assets	Industry average value
7	Loan Coverage Ratio	Net cash inflows / (Principal loan amount + Interest payments)	Not less than 1.5

In crisis management for commercial shipping, it is essential to consider the distinct characteristics of the transport fleet and ports. As is well known, the capital structure of maritime enterprises is predominantly fixed assets, with current assets making up no more than 15%. However, the absence of these resources was one of the key factors leading to the financial collapse of Black Sea Shipping Company (ChMP) and Azov Shipping Company (AMP). The first company's debt, which amounted to approximately \$300 million, ultimately resulted in the loss of its fleet, despite its fixed assets being valued at \$1.5 billion.

Therefore, at various stages of the business lifecycle, it is crucial to monitor the parameters and trends of all key financial indicators.

The Self-Sufficiency Ratio of Material Reserves reflects the extent to which a port's or shipping company's material reserves are covered by internal funding sources, excluding reliance on borrowed capital.

High-yield assets include cash, cash equivalents, and short-term financial investments.

Current liabilities consist of short-term loans and accounts payable.

Liquid assets comprise highly liquid assets, accounts receivable, and received promissory notes.

Borrowed funds include both long-term and short-term liabilities.

The Self-Sufficiency Ratio of Material Reserves is calculated as follows:

$$\kappa_o = \frac{R_{vz}}{Z_m}, \quad 12.39$$

where:

R_{vz} – internal funds covering material reserves;

Z_m – required material reserves (fuel, spare parts, and navigational supplies).

If the self-sufficiency ratio falls below 1, it is necessary to assess the shipping company's (SC) ability to maintain operational reserves for stable functional activity. To evaluate transformation processes, changes in the components of the ratio must be analyzed. This helps determine the need and directions for optimizing financial stability based on asset coverage parameters.

The implementation of innovative projects in maritime transport enterprises, aimed at profit growth through market expansion, requires an evaluation of other systemic characteristics. Among them, labor productivity and profitability are key, as they ultimately determine the intensity level of fleet and port complex operations, optimizing their financial position (Fig. 12.5).

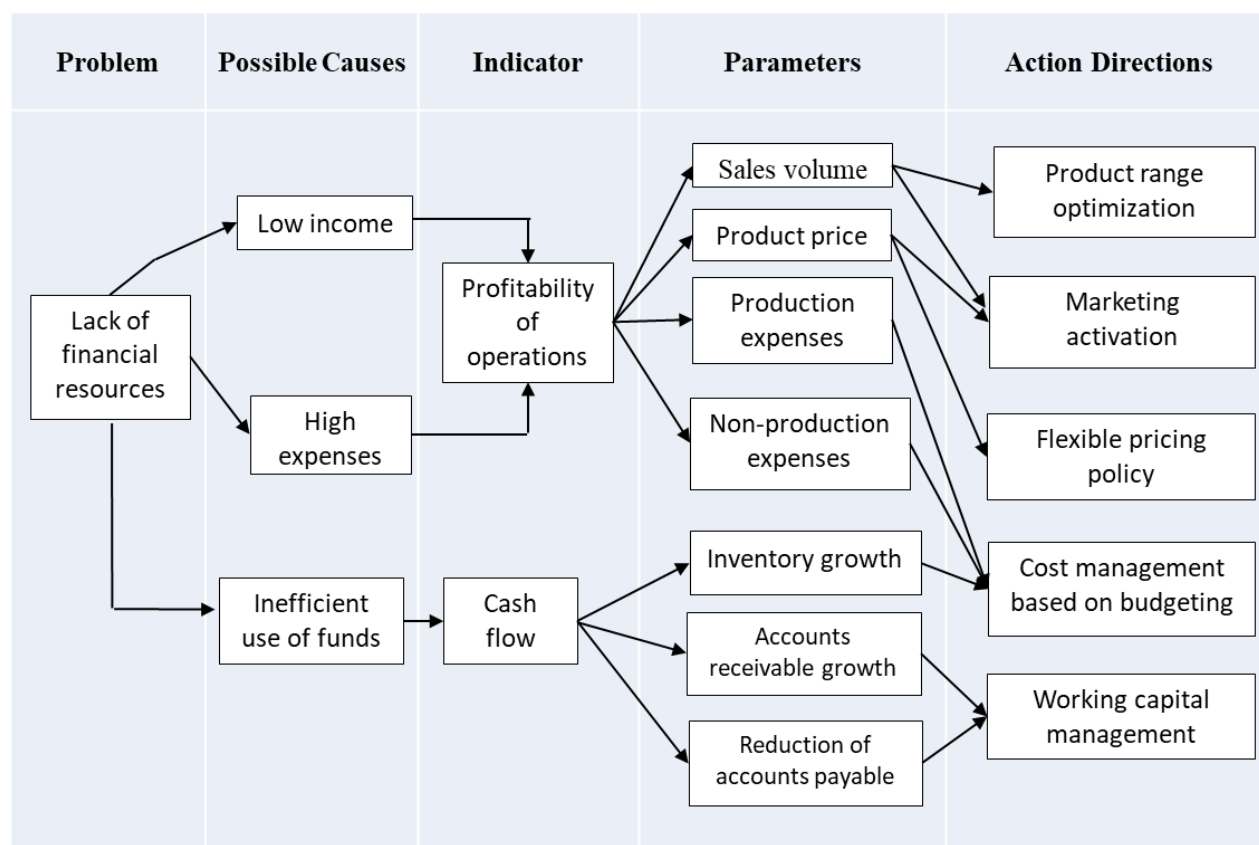


Figure 12.5. Set of Problems, Factors of Their Formation, and Directions for Standardization of the Situation

Figure 12.5 presents a set of problems and possible solutions within the real operating conditions of fleets and ports across selected freight and stevedoring market segments.

In the administrative system, the International Maritime Organization (IMO) focuses on two key aspects of commercial shipping sustainability:

- Enhancing vessel and terminal safety and reliability standards;
- Increasing qualification requirements for maritime transport workers.

With the growing scale and value of the commercial fleet, the competence and training levels of seafarers play an increasingly critical role in ensuring operational efficiency and navigational safety.

As part of crisis management measures, the International Transport Federation (ITF) is implementing a strategy to reduce the duration of seafarers' contracts. Extended contracts lead to fatigue accumulation due to time and workload intensity. At the same time, reducing contracts to 4-5 months helps lower seafarer unemployment rates, while shipowners' additional costs increase only slightly—mainly in terms of crew transportation expenses.

In this regard, the Tripartite Committee of the International Labour Organization (ILO) has supported a package of measures to protect abandoned crews and financially

secure compensation payments. A total 312 vessels were abandoned in 2024 compared to 132 vessels in 2023 – a staggering 136% increase.

A notable case involved the Rhosus, a Moldovan-flagged vessel owned by Teto Shipping (Cyprus). The ship was detained in Beirut due to its hazardous cargo, which could not be offloaded at the port. Authorities refused to repatriate the crew to prevent the vessel from being left unattended. However, the shipowner failed to dispatch a replacement crew, leaving the seafarers stranded.

12.7. Analysis of the state of container shipping

Container shipping is carried out by highly productive fleets that require significant investment in construction and operation. At the same time, the acceleration of cargo delivery generates substantial non-transport economic effects. Therefore, it is particularly important to maximize the utilization of this transport potential. The information system for assessing the actual efficiency of a shipping company includes the structure and composition of data on operational performance and the sources of this data. The data structure reflects resource-based and outcome-oriented indicators of fleet utilization. These indicators include statistical data or other accounting records for each structural element, ensuring a comprehensive and complete description of the processes involved in optimizing fleet carrying capacity.

Various methods of economic analysis serve as tools for organizing commercial shipping as an economic system. From a systems analysis perspective, different management approaches at the shipping company level vary in terms of feedback mechanisms and regulatory specifics.

Containerization of cargo transportation in maritime transport since the 1960s has marked the beginning of a revolution in the maritime trade market. With the transition to container technologies, transportation costs for many types of cargo have decreased. Ports have been actively constructing container terminals, the unit capacity of container ships has significantly increased, and computer technologies have been introduced, drastically reducing labor costs for managing and handling cargo flows. For ports, containerization has proven to be a highly profitable type of stevedoring operation.

To identify emerging patterns and trends in the development of container shipping, the analysis is based on data from a five-year period. This period appears to be relatively homogeneous in terms of technology, organization, and the structure of production activities of entities that form container cargo flows. It is crucial to identify shortcomings in the strategy of the shipping company as well as the impact of external and internal factors on the dynamics of production and economic performance.

In this regard, when analyzing container transportation, it is necessary to:

- evaluate the development of cargo transportation in export, import, transit, transshipment, and cross-trade;
- identify and justify the main trends and patterns in the formation of volumes and structure of transported cargo, with distribution by transportation options;
- determine the degree of satisfaction of the segment's operational activities and responsibilities;
- assess the condition and structure of the fleet's material and technical base;
- determine the share of container transportation in the total cargo flow;
- examine the operational and economic indicators of container transportation (average transport distance, cargo handling intensity, total berthing time, productivity, revenues, expenses, profitability);
- develop proposals to ensure the effective satisfaction of the demand for containerized cargo transportation.

At the same time, it is necessary to consider that the planning methodology is summarized as follows:

Evaluation of cargo nomenclature as a key factor in planning container transportation. In this regard, all cargo is divided into four groups:

- a) Valuable cargo (unitized, bulk, liquid);
- b) Unitized cargo of moderate value;
- c) Wheeled vehicles and oversized equipment;
- d) Mass cargo.

The first group consists of efficiently containerized cargo. The second group gravitates towards palletized technology (this also includes timber and lumber).

The priority of containerization arises from a combination of socio-economic factors. This is the first stage in examining and assessing the expansion of containerization technology.

Methods of planning and analyzing container transportation include:

- computational-analytical methods (balance, normative, direct calculation);
- expert assessments;
- economic-mathematical methods (extrapolation).

The prospective development of container transportation is shaped and assessed based on the following factors:

- dynamics of potential cargo flows suitable for containerization;
- material and technical base of container transportation;
- indicators of equipment utilization efficiency;
- established structure of the fleet and container inventory;
- directions and structure of transportation;

- development of foreign trade relations.

In general terms, two main information bases for analysis and planning should be distinguished:

- normative-calculation (domestic production structures);
- reporting (achieved levels) of operator activity in the freight market.

The calculation of the prospective volume of transportation according to the second approach is based on the compound interest method and average annual growth rates:

$$Q_n' = Q_{bi} \cdot (1 \pm \Delta X_q)^i \cdot \delta, \quad 12.40$$

where δ – the expected impact of new factors on the formation of cargo flows.

When implementing the first approach, the calculation is based on considering the interrelationship:

$$Q' = \sum Q_i \cdot \beta_i, \quad 12.41$$

where Q_i – the transportation of containerized cargoes of the i -th group.

β_i – the containerization coefficient for the i -th group of cargo. It is determined based on analysis or expert assessment.

In this case, the grouping by countries is important, taking into account the nature of integration and the balance of economic relations. It should be noted that specific unions or groupings of states not only form the dynamics and structure of cargo flows but also create special regimes for servicing cargo flows.

There are specific types of transportation that should be handled by national tonnage (for economically developed countries – 50%, developing countries – 80%, with subsequent reduction to 40-50%).

The transportation volumes determined in this way serve as the basis for calculating financial results, fleet development rates, and the program for replenishing tonnage and containerization resources.

12.8. Ship management reporting and control of the vessel's condition and region of navigation

At the end of a voyage, and in some cases at intermediate ports, classification societies and port administrations perform control functions. The ship management, which also serves as the administration, submits reports to the shipowner (or managing company) regarding received supplies, inspection results of onboard systems, departure notices, work time and overtime sheets, as well as fuel and material consumption.

After unloading is completed, a separate recount of intact slings and the total number of loose bags is conducted. This is done to prepare a consolidated protest if necessary in case of claims from the receiving party regarding cargo shortages.

The efficiency of a shipping company's functional activities is known to depend on the state of the freight market, the economic competitiveness of the fleet, and stable external conditions. Among these, hydro-meteorological factors, navigational characteristics of the route, and non-systemic threats – primarily the risk of pirate attacks – are highlighted.

For example, on December 5, 2012, after colliding with the container ship *Corvus J*, the car carrier *Baltic Ace* sank in a busy shipping lane near Rotterdam. On board were 1,400 cars and over 500 tons of fuel oil. As a result, a salvage operation was conducted to raise the vessel and prevent further environmental disasters.

The western coast of Africa, including the entire Gulf of Guinea, bounded by the waters of the exclusive economic zones of Benin and Nigeria, is considered a high-risk zone. However, the coastline from Togo to Côte d'Ivoire also exhibits signs of navigational danger.

To ensure normal working conditions for ship crews, shipowners must provide financial guarantees for the sailors before departure. Failure to do so increases the risk of company bankruptcy.

Typically, captains plan the vessel's approach to the pilot station in the morning. This operation requires intensifying the labor resources of the crew members. Therefore, effective planning ensures the smooth execution of mooring operations or anchoring the vessel. It is essential that crew members are present on the navigation bridge according to the mooring schedule, mooring mechanisms are checked and engaged, mooring lines are prepared, and the checklist for arrival inspections is completed without omissions.

Control questions

1. Formulate the objectives of analyzing the performance results of a shipping company.
2. What are the main principles for analyzing the situation in the segments of the maritime trade market?
3. Provide a general description of the methods for calculating and analyzing the cost structure of maritime transportation.
4. What are element rates of average costs per vessel, what is their purpose, and how are they calculated?
5. Structure of conducting a comprehensive analysis of fleet operations for a shipping company.

6. What does the operational analysis scheme of fleet performance reflect?
7. Name the main methods of analyzing the performance results of a group of vessels.
8. Formulate the advantages and disadvantages of specific methods for analyzing the economic situation in commercial shipping.
9. Recall the features and limitations of the chain substitution method for individual factors in fleet operations.
10. Systemic methods for evaluating the state of resources and the results of a shipping company's functional activities.
11. How is the selection of priorities for assessing development alternatives and forecasting results carried out?
12. Features of analyzing the financial stability of maritime transport companies.
13. Why is attention focused on the patterns and characteristics of container shipping?
14. Name the structure of reporting materials for shipping management.
15. What are the tasks of controlling the condition of vessels in maritime segments?

Chapter 13

DEVELOPMENT OF THE TRANSPORT POTENTIAL OF A SHIPPING CORPORATION

13.1. Principles of Managing the Functional Stability of a Shipping Company

The main focus of crisis management in commercial shipping should be the implementation of a comprehensive approach based on the unity of efforts from both governmental and entrepreneurial structures. Even in conditions of a total investment deficit, it is necessary to develop a forward-looking model for the maritime transport business based on the key forms of sustainable positioning in the operator's activity segments.

The political approaches of governments regarding the use of concession and corporate principles for capital formation in the maritime transport business are crucial. At the same time, it is necessary to consider the social orientation of economic development and the issues of adjusting these approaches according to the phases of various types of cycles. For the current conditions of a maritime country, the factors that hinder the normalization of parameters for the national segment of commercial shipping include:

- the difficulty of forming a flexible and standardized overall state policy and economic integration based on international division of labor;
- the influence of global trends, structural crises, and other types of external crises in the global economy and commercial shipping;
- the lack of a clear maritime transport policy, a forward-looking strategy for positioning in the global market based on the local characteristics of the Black Sea region;
- the underdevelopment of infrastructure in most ports, which fail to meet the criteria for efficiently handling modern commercial vessels. The systemic limitations of most well-known ports in terms of their ability to accommodate modern competitive vessels, according to technical and safety criteria, reduce the stability of the country's maritime transport complex in terms of transit cargo flows.

Exceptions may be made for cargo delivery technologies based on the use of highly specialized vessels. It is necessary to determine the real carrying capacity with the modernization of terminals and channels of small and medium ports, as well as the connectivity of base ports with regions for transshipment flows. The parameters for developing coastal infrastructure are determined taking into account the features of water region fund division.

Considering the combination of general system and specific factors, it is possible to build a shipping company based on the principles of crisis resilience according to the criteria of functional reliability (Figure 13.1).

The implementation of competitive management technologies for ensuring the functional sustainability of the SC is a key condition for achieving the reliability of the operator's activities. The requirements for selecting the priority market segment in maritime trade are emphasized. To solve this task, it is essential to provide a clear description of the trends for the subsequent stage of development.

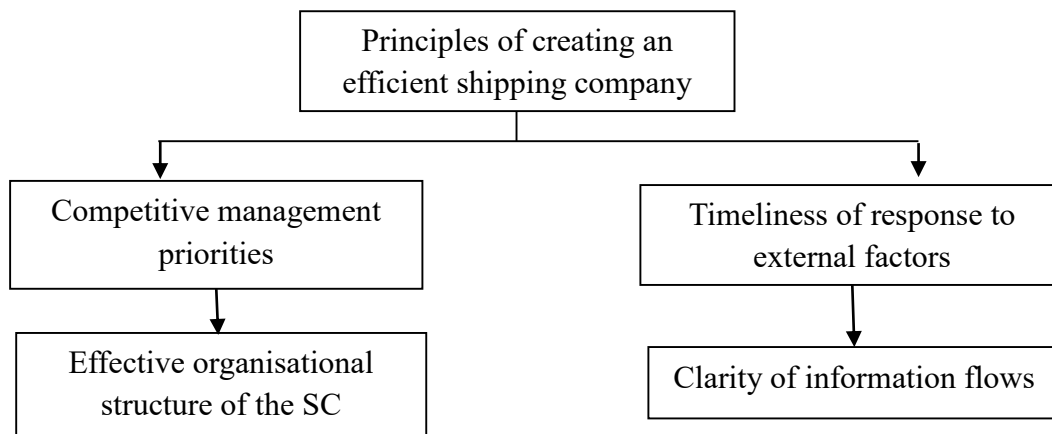


Figure 13.1. Principles of establishing a shipping company based on sustainable positioning criteria

Crisis management strategies include projects for the prioritized development of specific maritime regions. In this regard, attention should be focused on promoting the Black Sea as one of the local alternatives for trade routes. This can be achieved through an active marketing strategy and accessible information. Even with limited development resources, there is an observed increase in the investment component for the expansion of the merchant fleet in countries that pursue a strategy of active participation in international labor division. This approach confirms the potential for future expansion of the regional segment.

The modern maritime trade market is characterized by a high degree of short-term instability. This, in turn, complicates the formation of long-term functional plans for both manufacturers and transport companies. One of the main sources of instability is the ambition of business structures to expand their influence within the international economy, while the global economic growth rate remains relatively slow.

At the same time, many states are addressing the issue of protecting their national markets through quota systems and anti-dumping investigations. As a result, cargo owners primarily rely on short-term charter agreements as a strategic approach. This minimizes the risks of higher long-term losses.

13.2. Calculation of Vessel Requirements for Coastal Shipping

Factors that determine the challenges of reducing the energy intensity of the transportation process and enhancing environmental safety are driving the expansion of coastal shipping. The calculations are based on data regarding cargo flows and the main characteristics of the cargo transport route.

$$N_s = \frac{Q \cdot t_r}{T_w D_{vi} \alpha \beta}, \quad 13.1$$

where Q – annual cargo transport volume, tons;

t_r – time for a round trip, days;

T_w – operating time of the vessel for transportation during the operational period, days;

D_{vi} – net cargo capacity of the vessel, tons;

α – coefficient of vessel capacity utilization;

β – coefficient of cargo turnover on the route.

$$\beta = \frac{L}{l_{md}} \quad 13.2$$

L – total length of the round trip, miles;

l_{md} – average distance for transporting one ton of cargo on the route, miles.

The coefficients α and β are calculated based on the informational data from the previous period, reflecting subsequent changes in transportation directions.

The calculation basis for planning the replenishment of the merchant fleet is the balancing method. The balance reflects the unity and movement of the fleet composition over the calculation period regarding write-offs (W_{io}), replenishment, and availability on a specific date. It allows for an accurate assessment of the active fleet's contribution to achieving the set goals and selecting new vessels for replenishment in line with the growth of cargo volumes and the replacement of retiring tonnage (W_{in}).

The balance formula is:

$$W_{i+1} = W_{i-1} - W_{io} + W_{in} \quad 13.3$$

where i – index of the year or period.

Based on the analysis of the development of the maritime trade market, the transport fleet, and the characteristics of shipbuilding, a matrix of ship types is developed that best corresponds to the implementation of the replenishment program for the considered prospective period.

The selection of optimal ship types from the matrix of alternative solutions is carried out based on comparative technical and economic calculations and construction costs at alternative shipyards.

The main method for the technical and economic justification of the ship type consists of a variant comparison of several vessels of the same purpose.

The primary principle of justification is the comparability of the ships being compared and the calculation results, which is achieved through a unified regulatory framework adopted for justifying development parameters and calculating net present value.

Variant research of any operational or technical characteristic of a vessel is performed according to a specific scheme:

- ranges (intervals) and calculated variants of the optimized characteristic are established
- economic indicators for each variant are determined based on calculated dependencies
- the best value of the analyzed characteristic is chosen based on the extreme value of the economic indicator

The main economic indicators that should serve as criteria for selecting the calculated vessel are:

- cost per unit of transport work
- capital intensity per unit of carrying capacity or deadweight
- net present value and the period required to achieve a positive state

The last indicator is considered the main criterion for solving the project task.

In the practice of justifying a specific type of vessel for certain functional conditions, alternatives may arise where the decisive factor of the project is not a cost parameter but rather operational limitations such as draft and others.

13.3. Seafarers' Labor Productivity in the Fleet Management System

As the cost of a unit of fleet transport capacity increases, the role of seafarers and fleet management specialists becomes more significant. According to several studies, 85% of seafarers expect to spend most of their professional careers at sea. However, at some point, all of them consider transitioning to shore-based positions.

This group forms both entrepreneurial subsystems and the quality of subsequent management of the functional activities of transport and other types of fleets.

Among the professions related to managing various fleet service processes, key roles include: operation managers, fleet managers, surveyors, trainers, technical superintendents, port captains, marine equipment sales specialists, insurance professionals, and maritime lawyers.

According to Faststream, both deck officers and marine engineers have equal opportunities to acquire shore-based specialties. The main challenge of this transition is the significant initial loss of income when starting a new type of work. However, as management skills are developed, specialists with 10–15 years of seafaring experience can achieve salaries in insurance, brokerage, surveying, and fleet management that are comparable to those earned at sea.

For many companies, having seafarers on staff is considered essential. The Asian region of the maritime industry market is preferable for career growth in the maritime business due to higher wages and better prospects for advancement in management structures. Singapore, Northern Europe, and the USA are viewed as priority locations.

However, due to the asymmetry in the development of the maritime trade market, managing any shipping company is subject to risks associated with unsystematic fluctuations. This makes it crucial to have experience in perceiving real market shifts and responding appropriately to changes. This was particularly evident during the 2009 crisis and the subsequent stagnation of cargo flows.

13.4. Sanitation and Financial Recovery of Maritime Transport Divisions

The law "On Restoring the Debtor's Solvency or Declaring Bankruptcy" provides methods for overcoming crisis situations. The decision to change the economic and legal status of an enterprise is made by the economic court. The ultimate measure is the issuance of a ruling recognizing the debtor as bankrupt.

As the first stage of problem resolution, a strategy for saving the enterprise within its functional designation is considered. The primary goal is to strengthen stability and balance the further functioning of socio-economic subsystems. The criterion for development is the growth of resource productivity and the efficiency of production potential realization. In relation to market and competition parameters, development results in the improvement of technological processes.

The methodological principles for a shipping company to escape an extreme risk level include:

- Timely diagnosis of parameters and conditions of bankruptcy.
- Identification of all factors influencing the crisis state of the fleet.

- Development of anti-crisis financial management mechanisms for the shipping company.

Operating in a competitive market or a monopolistic competition market does not eliminate the risk of bankruptcy. The primary characteristic of bankruptcy for a shipping company (SC) is insufficient liquid assets. Under these conditions, the SC is unable to meet creditors' demands and fulfill its budgetary obligations within the established timeframe. It effectively loses its ability to function based on perceived market value in maritime transport.



Fig. 13 Container ship “JOLLY ARGENTO”

The length and width of the vessel are 184 m x 27.4 m. The ship was put into operation to enhance maritime logistics and optimize container transportation. The use of such vessels ensures the stability of cargo flow and strengthens connectivity between key trade routes. The vessel's flag – Portugal confirms the country's presence in the global shipping industry. The total deadweight – 21,021 Gross Tonn (GT). The design speed (Max/Average): 19.5 / 15.0 knots ensures effective fulfillment of the vessel's functional purpose.

Figure 13.2 presents the risk factors for bankruptcy in enterprises operating within the global maritime trade market.

Bankruptcy ultimately represents the extreme stage of crisis, posing a direct survival threat to the fleet or port. During this period, resource depletion and division of capital shares among participants occur.

Constant analysis of bankruptcy cases in the core operational sector is necessary. It is important to track bankruptcy frequency not only among small shipping companies and ports but also within large transport enterprises. This process affects stock market stability and must be monitored closely, especially in analysing capital outflow trends from the national economy.

Methods for financially rehabilitating a shipping company depend on the depth of its crisis. Based on a comprehensive assessment of financial results and the prospects for utilizing production potential, the stage of insolvency of a ship-owning or operating company is determined.

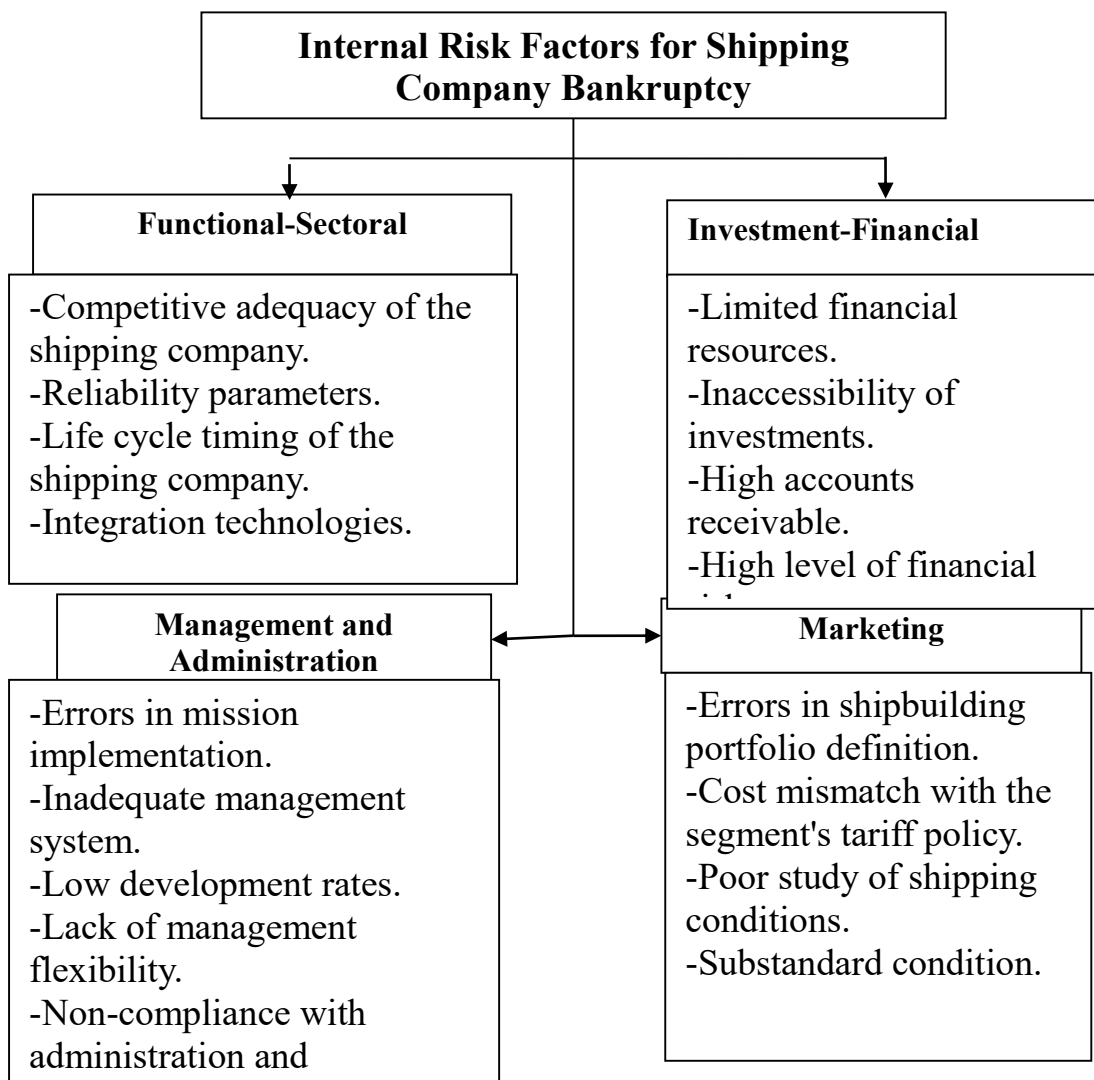


Fig. 13.2. Structuring Sources and Forms of Financial Risk in Maritime Transport Enterprises

The crisis state of certain industries and national economies influences the expansion of the shadow sector, serving as a means of maintaining employment. In maritime transport, the shadow sector arises from substandard fleets and the use of open registry flags in states that do not adhere to strict international regulations on maritime safety and crew wage conditions.

It is important to differentiate between specific crisis characteristics:

- The hidden stage of bankruptcy due to increasing obligations and business structure deterioration.

- The stage of financial instability, characterized by financial flow misalignment and potential chronic insolvency formation. This leads to a decline in market and production potential for the SC or trade port.

Insolvent SCs share common indicators but also have unique crisis movement features. These include errors in operational strategy selection, work organization, and fleet chartering.

The degree of SC insolvency is determined by financial-economic condition indicators. These indicators reflect financial performance effectiveness and are used to assess production potential utilization.

Key Financial condition indicators

1) Indicators reflecting external signs of insolvency:

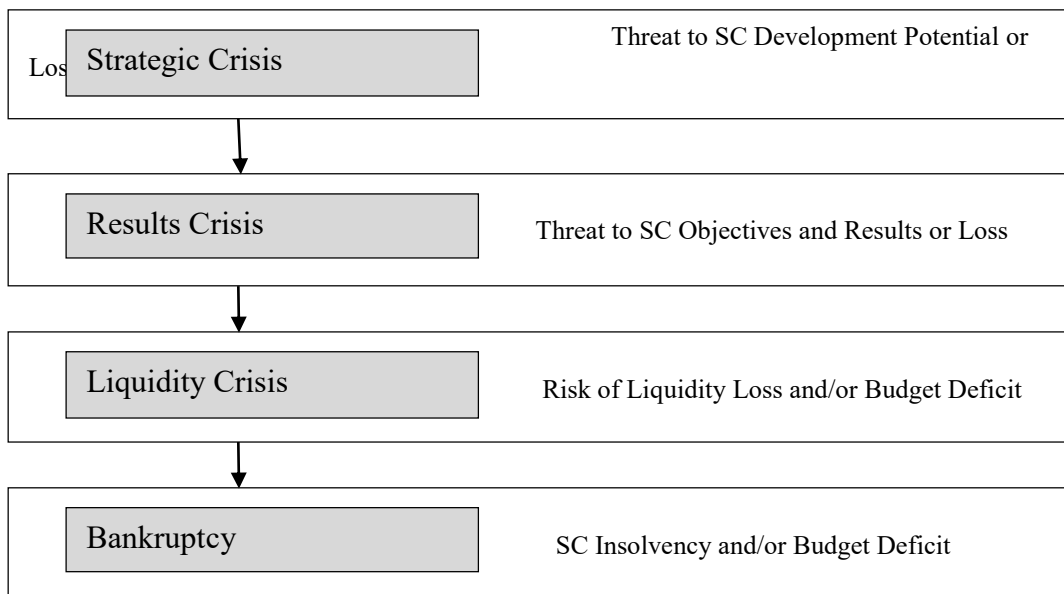
- Current liquidity ratio.
- Self-financing ratio.
- Severity of overdue obligations.

Based on their level, measures are formed that correspond to general methods of financial recovery and restoration of solvency.

2) Indicators reflecting enterprise management effectiveness:

- Growth rates of the shipping company's production potential.
- Competitive positioning parameters.
- Cost-per-transport deviation from the limit value.
- Stability of cash flow formation based on self-sufficiency criteria.

It is necessary to distinguish the differentiation of the goals of the SC, which is under threat of a crisis state (Fig. 13.3).



It is necessary to distinguish between two aspects of the problematic state of a shipping company – external and internal.

The external aspect involves the company's ability to mobilize working capital to meet creditor obligations, including debt servicing and payments.

The internal aspect relates to the ability to ensure working capital sufficient for standard business operations.

A state of perpetual development crisis characterizes the domestic commercial fleet. In Ukraine's modern conditions, no comprehensive strategies have been developed or implemented for the iterative formation of a competitive maritime transport industry.

The economic growth potential based on innovative technologies was utilized in the past, but no new significant competitive reserves were created. The causes of strategic crisis include institutional failures, technological development setbacks, and ignorance of shipping market dynamics and requirements.

A results crisis represents a crisis in operational success. It is characterized by negative capital growth, provoking an imbalance between assets and liabilities. This results from limited development potential based on innovative technologies, insufficient functional efficiency, and ineffective management, leading to declining operational profitability in the maritime trade market.

A liquidity crisis threatens the company's solvency due to increasing losses. This, in turn, raises the risk of budget deficits and financial imbalance.

13.5. Container Terminal Capacity Planning

Containerized cargo delivery technologies belong to the segment of sustainable development. However, due to the high cost of this technology, global problems can lead to severe crisis situations. The key factor is the precise management of container technology potential parameters. This calculation is performed in two stages, considering management specifics based on ownership conditions.

1. The terminal and its infrastructure belong to a shipping company.
2. The terminal and its infrastructure are oriented towards balanced development regardless of capital ownership. That is, the terminal is a free participant in the stevedoring market.

The planning of the throughput capacity (performance) of a container terminal, considering design standards and competitive positioning, must ensure the following condition:

$$q_{KT} = \frac{30M_B\delta_L Y_M^n T_M}{b_{np}} \quad 13.4$$

Where M_B – gross average daily intensity of container ship processing, containers/day.

δ_3 – terminal occupancy coefficient over time (technological design standard for terminals).

γ_M – potential utilization coefficient due to meteorological reasons.

b_{np} – coefficient of shipment unevenness.

n_{TM} - duration of the navigation period, months.

Thus, the required number of terminals can be calculated based on the obtained data.

$$n_{TER} = \frac{Q_{KN}}{q_{KT}} \quad 13.5$$

In real conditions, container carrying capacity, terminal throughput capacity, and container ship carrying capacity do not coincide. Therefore, to achieve the primary objective (transportation) while optimizing functional activities, efficiency, and urgency of operations, the issue of investment planning arises, and consequently, the search for financial resources. In planning calculations, the maximum possible result among three production potential constraints is considered.

The decision on investment directions can be based on the development of a decision-making algorithm (Fig. 13.4).

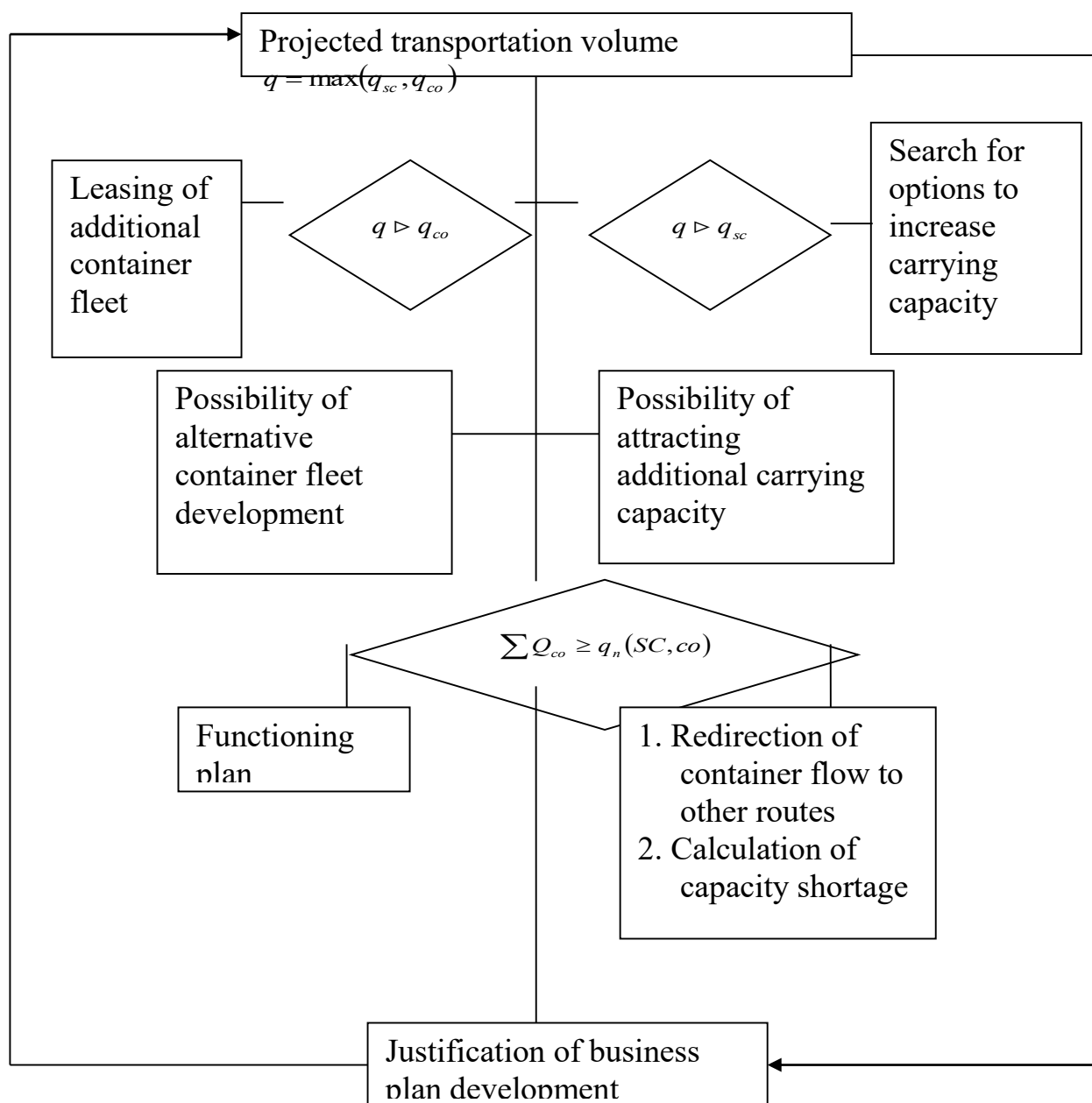


Figure 13.4. Sequence of justification for container terminal parameters

For long-term planning of container transport development, three methods are used:

- Expert assessments.
- Mathematical-statistical (extrapolation).
- Computational-analytical (balance, normative).

The choice of method is based on achieving accuracy in transportation development planning. The fundamental condition is ensuring a comprehensive solution to the main tasks.

Under relatively stable economic growth rates within an economic cycle, the mathematical-statistical method can be used for freight volume planning.

The basis for calculations is container-appropriate cargo transportation in the base period, included in the assessment based on statistical data. This requires analyzing the nomenclature of maritime transport cargoes and performing a techno-economic feasibility study for shifting new cargo categories to containerized transportation, thereby forming the corresponding cargo flow.

After refining the nomenclature of container-appropriate cargo and determining the total transportation volume in the base period, extrapolation is performed for the future using dynamic series smoothing.

Based on statistical data, container transportation volumes in the base period are determined. Then, using the dependency between container-appropriate cargo transportation parameters and actual containerization, a regression equation is derived. This allows for refining the feasibility and possibilities of containerization expansion in the projected period.

Within a relatively stable maritime transport period, forecasting prospective cargo flows is based on average annual growth rates. This effectively forms the growth rate indicators of the world tonnage deadweight:

$$Q_{pi} = (1 \pm x)^{t-1} Q_{bi}, \quad 13.6$$

where

Q_{pi} – projected cargo volume in the selected fleet operation direction.

Q_{bi} - cargo volume in the base period;

x – average annual cargo growth rates characterized by stability.

Property relations based on investment flow require strict time guarantees for the use and disposal of assets. Therefore, the transport property may be leased or granted under concession for no less than 49 years. This enables investors to develop long-term business plans and implement investment projects with a well-founded expectation of capital return.

Control Questions

1. How can the company achieve that the staff members act as to the conditions of performance outlined above?
2. Formulate the basic principles of stability management in SC positioning within operator activity segments.
3. Explain the specifics of calculating fleet carrying capacity in niche maritime segments.
4. Highlight the role and ways to improve seafarers' labor productivity considering the modern intensity of onboard work.
Reasons for financial losses and factors for financial recovery in SC.
5. Describe the forms of financial sustainability risk for maritime transport enterprises.
6. List the key factors for normalizing container terminal capacity.
7. Explain the rationale for determining container terminal capacity.

Chapter 14:

A COMPREHENSIVE APPROACH TO MARITIME SAFETY

14.1 Regulation and International Safety Standards

International maritime safety is regulated by a number of conventions and codes developed and implemented under the auspices of the International Maritime Organization (IMO). Among the key documents are the International Convention for the Safety of Life at Sea (SOLAS), the International Safety Management Code (ISM Code), and the International Ship and Port Facility Security Code (ISPS Code).

1. SOLAS Convention (Safety of Life at Sea)

The SOLAS Convention is one of the oldest and most important international instruments in maritime safety. It was first adopted in 1914 following the Titanic disaster, but the modern version has been in force since 1974 with subsequent amendments.

The convention covers a wide range of requirements for:

- Ship design and equipment (watertight compartments, lifesaving appliances, fire protection systems).
- Navigational safety (use of radar, Automatic Identification Systems (AIS), mandatory shipping routes).
- Crew and passenger safety (evacuation drills, training, emergency procedures).
- Cargo operations and prevention of flooding (ship stability, cargo securing, ballast systems).

SOLAS requires shipowners to ensure the technical condition of their vessels and undergo regular inspections. Non-compliance may result in a ship being detained in port or banned from operation.

2. ISM Code (International Safety Management Code)

The ISM Code was adopted in 1993 and has been mandatory for all commercial ships since 1998. It establishes a safety management system (SMS) aimed at preventing accidents and reducing human error in maritime operations.

Key principles of the ISM Code:

- Shipowner and company responsibilities – Every shipping company must develop and implement a safety management system (SMS) to oversee all onboard operations.

- Designation of a responsible person (DPA) – Each company must appoint a designated person ashore (DPA) responsible for communication between the vessel and shore management, ensuring compliance with safety standards.

- Emergency preparedness procedures – Companies must have clearly documented procedures for preventing accidents, responding to incidents, and protecting the environment.

- Regular audits and inspections – Ships and companies undergo compliance audits with the ISM Code, and violations may result in operational restrictions.

The ISM Code aims to foster a safety culture and promote a systematic approach to risk management within the shipping industry.

3. ISPS Code (International Ship and Port Facility Security Code)

The ISPS Code was developed following the terrorist attacks of September 11, 2001, and came into force on July 1, 2004. It establishes measures to prevent security threats to ships and ports, including terrorism, piracy, and illegal activities.

Key provisions of the ISPS Code:

- Security level classification – The code defines three security levels (normal, heightened, and critical), each requiring specific measures.

- Responsibilities of ship security officers (SSO) and company security officers (CSO) – Each vessel must have an appointed security officer, while shipping companies must designate a fleet security officer.

- Ship Security Plan (SSP) – Shipping companies must develop and implement an individual security plan for each vessel.

- Access control to ports and ships – Strict requirements are enforced for identifying individuals on board, cargo inspections, and monitoring vessel areas.

The ISPS Code has enhanced maritime security against illegal activities; however, compliance imposes additional security costs, increasing operational expenses for companies.

These three international documents form the foundation of maritime safety and are mandatory for all vessels operating in international waters. Compliance not only mitigates accident risks and security threats but also ensures the sustainable and efficient operation of shipping companies.

Maritime safety largely depends on global regulation and oversight. Two key entities play a leading role in this process: the International Maritime Organization (IMO) and classification societies. They establish standards, conduct inspections, and ensure vessel compliance with safety requirements.

The International Maritime Organization (IMO) is a specialized United Nations agency responsible for maritime safety, prevention of marine pollution, and international fleet operational standards.

Founded in 1948, IMO began operations in London in 1959. Today, it has 175 member states, including major maritime nations.

Key Functions of IMO:

1. Development of International Conventions and Codes
 - 1.1 IMO serves as the primary legislative body in maritime affairs, creating mandatory rules for industry stakeholders.
 - 1.2 Key documents include:
 - 1.1.1 SOLAS – Safety of Life at Sea
 - 1.1.2 MARPOL – Prevention of Pollution
 - 1.1.3 STCW – Seafarer Training Standards
 - 1.1.4 ISM Code – Safety Management System
 - 1.1.5 ISPS Code – Ship and Port Security
2. Monitoring Compliance with International Regulations
 - 2.1 IMO does not directly inspect ships but mandates that member states implement enforcement mechanisms.
 - 2.2 It operates through the Flag State system and Port State Control (PSC) inspections.
3. Accident Analysis and Regulatory Updates
 - 3.1 Following major incidents, IMO conducts investigations and amends regulations accordingly.
 - 3.2 For example, the Exxon Valdez oil spill (1989) led to stricter double-hull tanker requirements.
4. Establishment of Global Safety Initiatives
 - 4.1 Safety enhancement programs for developing countries.
 - 4.2 Implementation of digital technologies for maritime monitoring.

IMO sets global standards, compelling shipping companies to invest in safety and environmental technology. However, compliance with new regulations increases costs for fleet modernization and crew training.

Classification societies are independent organizations that verify vessel compliance with international safety, structural integrity, and seaworthiness standards.

The largest classification societies are members of the International Association of Classification Societies (IACS), established in 1968. It includes 11 leading organizations:

- Lloyd's Register (LR, UK)
- Bureau Veritas (BV, France)
- DNV (Norway)
- American Bureau of Shipping (ABS, USA)
- ClassNK (Japan)

- RINA (Italy), among others.

Key Functions of Classification Societies:

1. Ship Certification
 - 1.1 Classification societies assign vessels a class status, confirming their compliance with IMO safety standards.
 - 1.2 Loss of class status results in a vessel being uninsurable and ineligible for operation.
2. Technical Inspections and Surveys
 - 2.1 Shipowners must undergo regular inspections (annual and intermediate).
 - 2.2 Checks include hull integrity, engine performance, and navigation equipment.
3. Consulting and Expertise
 - 3.1 Societies develop new structural standards for shipbuilding.
 - 3.2 They assist shipowners in adopting innovative technologies such as alternative fuels.
4. Environmental Standards Compliance
 - 4.1 Development of emission reduction requirements (EEXI, CII).
 - 4.2 Control of ballast water management systems.

Shipping companies require classification because, without it, vessels cannot be insured or operate on international routes. Cargo owners and ports refuse to work with unclassified vessels due to increased risks. Classification societies help maintain fleet reputation and technical integrity.

Thus, IMO establishes global safety standards, while classification societies ensure their practical implementation. Together, they uphold high reliability in global shipping, preventing accidents and enforcing fleet compliance.

For shipping companies, this means strict adherence to regulatory requirements, continuous fleet renewal, and investments in safety, which, in turn, impact business efficiency and competitiveness.

14.2 Responsibility of shipping companies for safety

The safety responsibility of shipping companies is not just a legal obligation, but a crucial part of operating in the maritime industry. Maritime trips and cargo transport are always associated with risks and the safety of the crew, passengers and the environment depends not only on how strictly a shipping company deals with the issue of safety, but also on the success of its business.

The main responsibility of shipping companies is to ensure safety at all stages of shipping - from ship design to operation and maintenance. This requires an effective safety management system that includes strict rules for shipmasters, crew and all personnel. First and foremost, a company must provide that its ships comply with international standards that regulate safety and environmental issues.

In addition, shipping companies are responsible not only for monitoring the technical condition of their vessels, but also for regular crew training. Each vessel must have detailed safety instructions and the crew must be prepared for various emergencies, whether it is a fire, accidental damage to the vessel or spillage of oil products. The shipowner is responsible for safety not only at the time of inspection, but also throughout the life of a vessel. By carrying out regular technical inspections and repairs, the company minimises the risks of accidents and incidents.

Also, the most important part of responsibility is compliance with environmental standards. Shipping companies are required to take measures to prevent pollution of the marine environment, which includes proper waste management, prevention of emissions and oil spills. These actions not only satisfy international requirements, but also contribute to improving the company's image as a responsible player in the international arena.

We should not forget about social responsibility. Shipping companies are obliged to create safe working conditions for their employees. This includes providing the crew with all necessary equipment for safe work, organising medical check-ups and providing timely assistance in case of injury or illness. Failure to ensure the safety of its employees can lead not only to legal consequences, but also to loss of reputation and financial loss.

In addition, shipping companies' responsibility for safety extends to their interactions with other market participants such as port authorities, shippers and insurance companies. All these parties must work together to ensure that the vessel is safely delivered to its destination. In the event of an incident, the company is responsible not only for the safety of its vessel, but also for the consequences for other stakeholders, including possible environmental damage.

One of the most famous cases was the *Costa Concordia* incident in 2012. The ship, owned by Costa Crociere (part of Carnival Corporation), struck a reef off the coast of Italy because the captain changed the route without approval. This resulted in the death of 32 people, the evacuation of more than 4,000 passengers and a full-scale rescue operation. The company lost significant profits, paying millions of dollars in compensation to the passengers and families of the victims. This case has led to stricter international standards for crew training and improved evacuation procedures on cruise ships.

Another example is the fire on the container ship *Maersk Honam* in 2018 that killed 5 crew members. The fire started in the cargo compartments, which raised questions about the safety of transporting dangerous goods. Following the incident, Maersk strengthened controls over the classification, packaging and storage of such cargoes on its vessels, and implemented additional fire protection measures.

No less significant was the environmental accident associated with the oil spill from the *Prestige* tanker in 2002. The ship, carrying more than 60,000 tonnes of oil, sank off the coast of Spain, causing widespread pollution. This resulted in multi-million dollar fines for ship owners and operators, as well as a review of international requirements for oil tanker design. As a result, the transition to double-hulled tankers under the MARPOL convention was accelerated.

These examples clearly demonstrate that shipping companies must strictly comply with international safety standards, otherwise the consequences could be catastrophic for both people and the environment.

Therefore, the responsibility of shipping companies for safety is a multifaceted task that requires a comprehensive approach and constant monitoring. It is not only a matter of compliance with norms and standards, but also of safety culture, which should penetrate all the company's activities. Shipping companies that understand the importance of these obligations and timely implement modern risk management methods gain not only competitive advantages, but also guarantee the safety of all participants in the shipping process.

14.3 Protection Against Piracy and Cyber Threats

Modern threats to shipping are complex and multifaceted risks faced by shipping companies, crews, and all participants in the maritime industry. These threats range from technological and environmental risks to security threats and political instability. The maritime industry is constantly searching for solutions to minimize these risks, but each year, threats become more sophisticated and require new approaches.

One of the most significant threats to shipping in recent years is cybersecurity. Shipping companies increasingly face cyberattacks aimed at hacking information systems, manipulating navigation and vessel control systems, and stealing confidential data. Hackers can gain access to a ship's control systems, potentially leading to hijacking or accidents. This issue is particularly relevant as automation and digital technologies, such as GPS and automated control systems, become more widespread.

Environmental threats are becoming an increasingly serious issue for the shipping industry. Marine pollution, carbon dioxide emissions, and other pollutants from ships have a destructive impact on the planet's ecosystem. Modern environmental

regulations, such as the International MARPOL Convention, require shipping companies to adopt new technologies to reduce pollution. However, much work remains to be done to achieve sustainability. Additionally, climate change is creating new challenges, including more frequent and intense storms, rising sea levels, and shifting ocean currents, which can significantly affect shipping routes and safety.

Piracy and security threats remain critical risks for maritime transportation. This is especially true in regions such as the Gulf of Aden, Somalia, Malaysia, and Nigeria, where pirate attacks can result in cargo loss, vessel hijacking, or even crew casualties. Modern security measures, such as armed guards on board and the use of advanced tracking and protection technologies, help mitigate these threats. However, completely eliminating piracy is still impossible.

Political instability in various regions of the world also poses a serious threat to shipping. Conflicts, sanctions, and legislative changes can complicate or completely block access to key maritime routes. For example, the blockage of the Suez Canal in 2021 demonstrated how vulnerable the world's major trade arteries can be, leading to billions of dollars in losses and significant supply chain delays.

Economic threats also play a crucial role. Fluctuations in oil prices, economic crises, and trade wars can impact the demand for maritime transport. Shipping companies must adapt to changing market conditions by optimizing their routes and expenses to remain competitive.

Moreover, the human factor remains one of the most complex and unpredictable threats to shipping. Crew errors, lack of qualifications, fatigue, or failure to follow safety procedures can lead to accidents and disasters. While modern technologies and automation systems help mitigate these risks, the human element still plays a crucial role in ensuring safety.

Thus, modern threats to shipping represent a multi-layered challenge that requires a comprehensive approach to solutions. Shipping companies must be prepared for these challenges by implementing new technologies, improving crew training and closely cooperating with international organizations to ensure the safety and sustainability of maritime transport in the future.

Protection strategies and incident response in shipping are a critical part of risk management systems aimed at ensuring the safety of vessels, crews, and the environment. Modern threats, such as cyberattacks, piracy, environmental disasters, and accidents, require shipping companies not only to minimize risks but also to be prepared for rapid responses when incidents occur. Developing effective protection and response strategies helps reduce consequences, minimize financial and reputational losses, and ensure safety at sea.

The primary task of shipping companies is to prevent incidents. To achieve this, it is essential to implement a comprehensive protection system that includes both physical and technological security measures.

Cybersecurity: with the advancement of digital technologies, vessels have become vulnerable not only to physical threats but also to cyberattacks. Cyber incidents can result in the loss of control over navigation systems, communication shutdowns, or even the hijacking of a vessel's operational systems.

One of the fundamental methods of protection is encryption of shipboard systems. For example, in 2017, one of the largest container operators, Maersk, fell victim to the *NotPetya* virus, which infected its corporate networks and caused an estimated \$300 million in losses. Following the attack, the company implemented stricter encryption and data protection measures to prevent similar incidents in the future.

Network segmentation (OT and IT) is another crucial cybersecurity measure. Operational Technology (OT) covers ship management systems, navigation, and life-support mechanisms, whereas Information Technology (IT) is responsible for administrative processes and communication. In 2020, several attacks were recorded where hackers used phishing emails to infiltrate IT networks and then attempted to access ship control systems. To prevent such breaches, companies began implementing strict network segmentation policies to isolate operational systems from administrative networks.

Network traffic monitoring and protection against «Man-in-the-Middle» (MITM) attacks have also become critical. In 2019, cybersecurity experts detected attempts to interfere with ship satellite communications, where attackers manipulated GPS coordinates, generating false navigation data. In response, shipping companies started deploying technologies to verify GPS signal authenticity and detect anomalies in data transmission.

Thus, while the maritime industry faces numerous threats, a combination of physical security, cybersecurity measures, and crew training is making ships increasingly resistant to both pirates and hackers.

Physical Security: the physical protection of ships from piracy includes a range of measures aimed at preventing attacks and ensuring the safety of crew and passengers.

One of the most effective methods is the deployment of armed security personnel (Privately Contracted Armed Security Personnel, PCASP). Statistics show that no commercial vessel carrying armed guards has ever been successfully hijacked by pirates. For example, in the 2010s, when Somali pirates were actively attacking ships

in the Gulf of Aden, most vessels with onboard armed guards successfully repelled attacks, forcing pirates to seek softer targets.

Another protective measure is the installation of barbed wire along the perimeter of the vessel, making it difficult for pirates to board. Many container ships and bulk carriers traveling through high-risk areas reinforce their hulls with barbed wire layers, making them less attractive targets.

Water cannons are also an effective defense tool. These systems create powerful jets of water capable of knocking pirates off ladders or preventing them from approaching the vessel. In 2011, the crew of a Maersk vessel successfully fended off a pirate attack using water cannons, buying time until a military convoy arrived.

Modern ships also employ acoustic deterrent systems such as LRAD (Long Range Acoustic Device). These devices generate a high-intensity sound wave that causes disorientation and pain, forcing attackers to retreat. In 2005, the cruise ship *Seabourn Spirit* successfully repelled a Somali pirate attack using an LRAD, compelling the attackers to withdraw.

If pirates manage to board the vessel, the crew can retreat to a *citadel* – a secure room equipped with reinforced doors, emergency supplies, and communication systems. In 2010, the crew of the container ship MV Taipan locked themselves in a citadel, and thanks to a timely distress call, the ship was rescued by Dutch special forces without any casualties among the crew.

Environmental Protection: to mitigate environmental risks, shipping companies are implementing modern pollution control technologies, including emission monitoring systems, wastewater treatment units, and oil spill prevention measures. Crew members undergo regular training on how to respond to oil spills and other ecological emergencies.

While it is impossible to eliminate all risks, preparing for rapid and effective emergency responses is a key part of environmental protection strategies.

Planning and Crew Training: every shipping operator must have a well-developed Emergency Response Plan (ERP) detailing necessary actions in the event of an incident. These plans must be regularly updated, and crews must be trained to handle various emergencies, such as fires, cyberattacks, piracy, and environmental disasters. The ability to remain calm under stress and work effectively as a team is essential in minimizing the impact of an incident.

Monitoring and Communication Systems: ships must be equipped with advanced monitoring and communication systems that enable real-time incident reporting and rapid response coordination. Modern satellite technologies and emergency alert systems significantly improve the speed and effectiveness of communication with shore-based authorities, enhancing overall maritime safety.

Response Equipment: every vessel must be equipped with essential tools for crew protection and incident mitigation, ranging from firefighting equipment to oil spill containment measures. Additionally, having medical supplies and first-aid kits is crucial to provide immediate medical assistance in emergencies.

International Cooperation: in the event of major incidents, such as environmental disasters or pirate attacks, coordination with international bodies like the International Maritime Organization (IMO), coast guards, and other shipping companies is critical. International cooperation enables a swift and effective response, minimizing the impact of incidents.

Once an incident occurs, the focus must not only be on damage control but also on initiating the recovery process, which includes both physical restoration and reputation management.

Damage Assessment: the first step after an incident is assessing the extent of the damage, including:

1. Structural damage to the vessel;
2. Environmental consequences (e.g., oil spills);
3. Cargo losses;
4. Crew health and safety.

Specialized inspectors and auditors may be brought in to conduct an independent assessment and ensure accurate reporting.

Insurance: most shipping companies have insurance policies covering damages from accidents and incidents. It is crucial to promptly file an insurance claim to initiate the compensation process and mitigate financial losses.

Reputation Recovery: following an incident, companies must take steps to restore their reputation, which may include:

- 1) Public apologies and transparency regarding the incident;
- 2) Sharing details of corrective measures taken to prevent future incidents;
- 3) Engaging with media to manage public perception and minimize reputational damage.

Feedback & Continuous Improvement: after an incident, a company must analyze its response, identify weaknesses in existing procedures, and enhance safety protocols. Conducting post-incident reviews helps prevent similar situations in the future and strengthens overall maritime security.

With the advancement of technology, new protection and response methods are becoming increasingly effective. The use of drones for monitoring, artificial intelligence (AI) for big data analysis and risk prediction, and blockchain technology for data security are examples of modern approaches that are already being integrated into the maritime industry.

Therefore, maritime security and incident response strategies require a comprehensive approach that combines prevention, crew training, technological advancements, and international cooperation. Systems that integrate these elements help minimize risks and ensure a swift response to unforeseen situations, guaranteeing the safety and stability of the maritime industry.

14.4 Occupational Safety and Accident Prevention

Managing human factors and conducting emergency procedure training are key elements in ensuring safety in shipping. While technology and automation play a significant role in modern maritime operations, the human factor remains a critical aspect that directly affects vessel performance and maritime safety. Recent studies have shown that most incidents at sea occur due to errors made by crew members. Therefore, attention to human factor management and regular training has become an integral part of the safety culture in the maritime industry.

Human factors management includes analyzing, understanding, and minimizing errors that may be made by humans during vessel operations. Crews often work under stressful conditions, long shifts, limited resources, and challenging weather, all of which increase the likelihood of mistakes. It is crucial for shipping company management and the ship's leadership to create conditions that promote effective crew performance, minimizing risks associated with fatigue, overload, and miscommunication. An example of this approach is the implementation of human-centered management systems that take into account the psychological and physiological characteristics of the crew. For instance, such systems can monitor crew members' fatigue levels and, when necessary, recommend breaks or adjustments to work schedules, reducing the likelihood of errors caused by exhaustion.

Another important aspect of human factors management is crew training and development. A system of regular drills and emergency simulations helps crew members not only improve their professional skills but also develop the right psychological responses in extreme situations. For example, ship crews operating in high-risk piracy areas undergo regular training on countering attacks, including actions during a hijacking and passenger evacuation. Such drills not only enhance practical skills but also strengthen team cohesion, which is crucial in stressful conditions.

Emergency procedure training, in turn, is an essential part of preparing the crew for potential incidents on board. These drills include both regular exercises for responding to man-made disasters and simulations of actions in the event of natural disasters such as storms or earthquakes. One of the most common types of such training is evacuation drills, which help both the crew and passengers practice evacuation

procedures in case of fire, flooding, or other threats. For example, the 2012 tragedy on the cruise ship Costa Concordia resulted from improperly conducted drills and crew errors during evacuation. This incident underscored the importance of not only theoretical knowledge but also the practical execution of emergency procedures.

In addition, emergency procedure drills include the use of modern simulators that allow for the most accurate reproduction of real emergency conditions. Simulators, for example, can mimic a fire on board or a collision with another object, which allows the crew to practice their actions in conditions that closely resemble reality. Such drills are conducted regularly in order to maintain a high level of crew readiness for any unexpected situations.

Another important component is the creation of psychological readiness for incidents. For example, training in stressful conditions helps the crew remain calm and confident in the event of an emergency. Teaching proper psychological techniques, such as stress management and rapid decision-making, is no less important than technical skills. On some vessels, training on managing psychological strain has been implemented, which helps the crew work effectively even under conditions of extreme fatigue or during long voyages.

In conclusion, it can be said that human factors management and regular emergency procedure training form the basis for ensuring maritime safety. Effective training, attention to the crew's condition, and preparedness for emergencies significantly reduce the risks of accidents and incidents at sea. This is an investment not only in safety but also in business stability, the reputation of the shipping company, and, most importantly, in people's lives.

14.5 Environmental Safety and Pollution Prevention

MARPOL (International Convention for the Prevention of Pollution from Ships) is an international convention that regulates the prevention of marine pollution by ships. It was adopted in 1973 and has since been significantly expanded, incorporating additional protocols and amendments aimed at protecting the environment from various types of pollution, such as oil spills, chemical substances, garbage, and emissions of polluting gases into the atmosphere. In recent decades, particular attention has been given to reducing carbon dioxide (CO₂) and other greenhouse gas emissions, which have become a crucial aspect of the fight against global climate change.

The primary goal of MARPOL is to minimize pollution associated with maritime transport and to increase the accountability of shipping companies for the environmental consequences of their activities. The convention consists of several parts, each addressing a specific type of pollution. However, in recent years, the

greatest focus has been on the requirements for reducing emissions of pollutants into the atmosphere, particularly carbon dioxide and other greenhouse gases, as well as sulfur and nitrogen oxides, which are the primary pollutants emitted by ships.

One of the most significant changes introduced under MARPOL was Annex VI, which regulates emissions of pollutants into the atmosphere. This regulation establishes requirements for reducing sulfur, nitrogen oxide, and greenhouse gas emissions. In particular, since 2020, new restrictions on the sulfur content in fuel have come into force, limiting it to no more than 0.5%. This has been a major step in combating air pollution, as sulfur emissions generated by fuel combustion on ships are a primary cause of acid rain and atmospheric pollution.

A successful example of implementing such requirements is the transition of shipping companies to the use of low-sulfur fuel or alternative types of fuel, such as liquefied natural gas (LNG). In recent years, many major shipping companies have been investing in new vessels powered by LNG, which significantly reduces carbon dioxide and other pollutant emissions. For instance, Maersk, one of the world's largest shipping companies, has announced plans to build new vessels using LNG to reduce its carbon footprint.

Additionally, MARPOL Annex VI includes requirements for exhaust gas cleaning systems, known as scrubbers. These systems are installed on ships and allow for the capture and purification of harmful substances from exhaust gases, such as sulfur and nitrogen oxides. Scrubber systems have gained popularity among shipping companies, as they enable the continued use of traditional high-sulfur fuel while reducing emissions to comply with MARPOL regulations. However, this approach is also controversial due to the potential for water pollution when open-loop scrubbers are used, as they discharge treated waste into the sea.

In recent years, significant attention has also been given to reducing carbon dioxide emissions. The International Maritime Organization (IMO) has set ambitious targets for reducing greenhouse gas emissions from ships. By 2030, shipping companies must reduce CO₂ emissions by 40% compared to 2008 levels, and by 2050, they aim to achieve a 50% reduction in total carbon emissions. To meet these targets, companies are exploring various technologies, such as advanced engines with higher fuel efficiency, wind and solar technologies for partial replacement of traditional energy sources, as well as the adoption of biofuels and other environmentally friendly alternatives.

An example of such an initiative is the "Wind Challenger" project, which is being developed by Japanese scientists and engineers. This vessel utilizes giant sails to harness wind power, partially reducing the need for traditional fuel, thereby decreasing carbon dioxide emissions. Although the technology is still in the development stage, it

demonstrates the potential for the sustainable advancement of maritime transport and its adaptation to stringent environmental requirements.

It is important to note that the necessary improvements are not limited to technical modifications alone. The implementation of environmentally friendly technologies also requires changes in corporate culture and crew training. Ship crews must be trained in the proper use of new technologies and compliance with environmental standards. This also includes emission monitoring and regular inspections of ships to ensure compliance with MARPOL requirements.

MARPOL and its emission reduction regulations play a key role in mitigating the negative environmental impact of shipping. The introduction of new technologies, the use of alternative energy sources, and the improvement of emission purification processes are all steps toward sustainable and environmentally friendly shipping. Moreover, these measures not only contribute to environmental protection but also help shipping companies reduce operational costs, enhancing their competitiveness in the market.

Shipowners' responsibility for environmental damage is a crucial element of international law and maritime safety. In recent decades, the protection of the marine ecosystem from pollution caused by shipping activities has gained particular importance. Shipowners are required not only to comply with international regulations and standards but also to take all necessary measures to prevent pollution, making them accountable for environmental protection.

One of the most striking examples of shipowners' responsibility is the case of the tanker *Exxon Valdez*, which ran aground in Alaskan waters in 1989, causing one of the largest oil spills in U.S. history. The environmental damage was catastrophic—millions of barrels of oil were released into the water, leading to the death of numerous marine animals, severe ecosystem disruption, and long-term consequences for the region. The shipowner, Exxon, suffered significant financial losses, including fines and compensation payments, and spent billions of dollars on cleanup efforts. This incident underscored the importance of adhering to environmental standards and clearly established shipowners' accountability for pollution incidents.

Additionally, in recent years, increasing attention has been given to carbon dioxide and other greenhouse gas emissions, as shipping remains a significant source of atmospheric pollution. Shipowners are required to comply with the International Maritime Organization's (IMO) regulations aimed at reducing CO₂ emissions from ships. Violations of these regulations can result in fines, sanctions, or even a ban on operating ships in certain regions. In 2020, new regulations limiting the sulfur content in marine fuel came into effect, further reinforcing shipowners' responsibility for

compliance. Those failing to meet these standards may face substantial fines and legal proceedings.

Shipowners are accountable not only for water pollution but also for the waste generated by their vessels. For instance, garbage and plastic waste discharged into the sea have a devastating impact on marine ecosystems. Under MARPOL and other international agreements, such as the Ballast Water Management (BWM) Convention, shipowners are obligated to ensure proper waste management on board and to dispose of waste appropriately in designated port facilities.

Another crucial aspect of shipowners' responsibility is ensuring that crew members receive proper training in environmental protection. The crew must be well-informed on how to prevent pollution, properly dispose of waste, and respond effectively in case of an emergency. For example, in the event of an oil or chemical spill, the crew must promptly deploy specialized containment measures to localize the pollution and minimize its impact. Untrained or inadequately prepared crews can exacerbate the consequences of an incident, thereby increasing the liability of the shipowner.

Thus, shipowners' responsibility for environmental damage is not only a legal obligation but also a key factor in their international reputation. They must comply with global environmental standards, invest in sustainable technologies, mitigate risks, and train their personnel to prevent pollution and manage its consequences. Violations of these obligations can result in severe financial and reputational losses, as well as irreversible damage to ecosystems. This underscores the importance of adhering to environmental regulations for the successful operation of shipping businesses.

14.6 Insurance and Risk Management

One of the forms of risk management is insurance. Shipowners may limit themselves to standard marine insurance or turn to Protection and Indemnity (P&I) Clubs, which cover risks not included in standard marine insurance.

P&I Clubs (Protection and Indemnity Clubs) are mutual insurance organizations that provide shipping companies with liability insurance for damages that may arise from their operations. P&I Clubs play a crucial role in the maritime industry, offering insurance protection against a wide range of risks, including property damage, environmental pollution, crew injuries or fatalities, as well as financial losses related to vessel or cargo delays. By joining these clubs, shipping companies safeguard themselves against the legal and financial consequences of various incidents that may occur during vessel operations.

P&I Clubs are often part of the International Group of P&I Clubs (IG P&I), which covers approximately 90% of the world's tonnage. Some of the leading clubs include UK P&I Club (United Kingdom), Skuld (Norway), Gard (Norway), The American Club (USA), Japan P&I Club (Japan).

The liability insurance provided by P&I Clubs covers a broad spectrum of risks. One of the most common is liability for environmental pollution, particularly in cases of oil or chemical spills—one of the most expensive types of damage a shipping company can incur. For example, in the case of the Exxon Valdez tanker accident in 1989, which caused one of the largest oil spills in history, the shipping company received financial compensation through its P&I Club to cover the costs of cleanup and environmental damage compensation.

However, insurance through P&I Clubs is not limited to environmental risks. These clubs also provide coverage for third-party claims, such as cargo owners' claims if the cargo is damaged or lost during transportation. A notable example is an incident involving a container vessel colliding with another ship, damaging containers carrying high-value goods. In such a situation, the P&I Club compensates the cargo owners, covering legal expenses and financial reimbursements.

Furthermore, P&I Clubs protect shipping companies from liability for crew injuries or fatalities. Shipowners are required to ensure the safety of their employees, but in the event of an accident where an injury or death occurs due to crew negligence or as a result of a maritime incident, liability may be imposed on the shipowner. The P&I Club covers compensation costs, allowing the shipping company to avoid significant financial losses.

Insurance through P&I Clubs also covers expenses related to vessel delays. For instance, if a vessel is delayed in port due to a mechanical failure or unforeseen circumstances, shipowners may incur losses from delayed cargo delivery. In such cases, the P&I Club may compensate for incurred losses, including reimbursement to cargo owners for delays. Additionally, in the event of vessel downtime due to mechanical failure or an accident, P&I Clubs may cover vessel repair expenses.

An equally important aspect of insurance through P&I Clubs is the provision of legal protection and assistance. If a shipowner or crew becomes involved in legal proceedings, such as being accused of violating international maritime conventions, the club provides necessary legal support. This may include not only legal representation in court but also assistance in negotiations, dispute resolution, and minimizing business consequences.

A relevant example involves the major shipping operator Maersk, which, in the event of incidents, can also rely on its P&I Club's protection to cover legal expenses and compensation for damages. In 2017, one of the company's vessels was involved

in an accident that resulted in significant damage to cargo containers. Maersk turned to its P&I Club for financial protection, which helped cover compensation costs for cargo owners and minimize potential penalties for contract breaches.

Thus, P&I Clubs provide invaluable support to shipping companies, ensuring their protection against various liabilities associated with maritime operations. These clubs help mitigate financial risks related to property damage, environmental incidents, crew injuries or fatalities, and also provide legal defense in disputes. For shipping companies, this is not only a way to reduce potential losses but also an opportunity to conduct their operations with confidence in risk protection.

14.7 Financial consequences of incidents and strategies for their minimization

The financial consequences of incidents in the shipping industry can be catastrophic for shipping companies. In addition to the costs of mitigating the aftermath of accidents, such incidents may lead to legal proceedings, fines, compensation payments to affected parties, and, most importantly, reputational damage. These consequences can significantly impact long-term financial stability, increase operating expenses, and even make it more difficult to secure financing or attract investments in the future. Therefore, strategic risk management and the implementation of effective measures to minimize financial losses have become crucial aspects of shipping companies' operations.

One of the first steps in minimizing financial risks is the implementation of liability insurance. These clubs provide shipping companies with essential protection in case of various incidents, such as pollution, cargo damage, crew injuries, or accidents. Insurance helps cover losses and reduce financial consequences related to compensation payments, legal expenses, and fines. For example, in the event of an oil spill, the shipowner can utilize insurance to cover the costs of water cleanup and compensation for environmental damage.

Another important strategy is incident prevention through proactive measures and training. Investments in ship safety and crew education can significantly reduce the likelihood of accidents and incidents, thereby helping to avoid substantial financial losses. For example, regular emergency drills such as evacuation procedures, firefighting, and collision response enable crew members to react quickly in critical situations and minimize damage. Shipping companies should also invest in modern monitoring and risk management systems that help prevent mechanical failures and enhance safety control.

Additionally, investments in environmentally friendly technologies help reduce pollution risks and associated costs. For example, switching to alternative

fuels such as liquefied natural gas (LNG) lowers pollutant emissions and minimizes the risk of non-compliance with environmental regulations. The implementation of scrubbers for emission control, as well as advanced filtration and pollution neutralization systems, can significantly decrease the likelihood of environmental contamination and, consequently, the expenses related to its remediation.

A crucial tool for minimizing financial consequences is timely response and crisis management. Shipping companies should develop detailed emergency and accident response plans to efficiently handle incident aftermaths. The faster assistance is organized, the less damage will be inflicted on ecosystems, cargo, and the vessel itself. An example of this approach is the case of the mv Costa Concordia: despite the tragic loss of the ship, Costa Crociere managed to minimize financial losses by implementing a crisis response plan and actively cooperating with authorities and various organizations to resolve the situation as quickly as possible.

An important aspect is managing reputational risks. The loss of reputation after an incident can have long-term financial consequences. For example, a shipping company may lose contracts, clients, or even the ability to operate in certain regions if the incident receives widespread media coverage. In such cases, it is crucial to communicate openly and promptly with the public and stakeholders about the actions being taken to resolve the situation and prevent similar incidents in the future.

A crucial step in managing the financial consequences of incidents is maintaining reserve funds or financial instruments that can be used to cover losses in emergencies. These may include an internal company reserve fund, credit lines, or specialized financial products to ensure liquidity during a crisis.

An example of the successful application of this strategy is Maersk, which, despite the impact of a cyberattack in 2017, was able to quickly restore its operations thanks to its reserve funds and an effective risk management system. The company managed to minimize its losses and continue its operations despite severe system disruptions.

Thus, minimizing the financial consequences of incidents in the shipping industry requires a comprehensive approach that includes insurance, prevention, technological innovations, effective crisis management, and transparent communication with stakeholders. Implementing these strategies helps shipping companies not only reduce risks but also maintain financial stability amid the constant challenges of the maritime industry.

Control questions

1. What are the key international conventions regulating maritime safety?

2. What safety measures does the ISM Code provide, and how does it affect the operation of shipping companies?
3. What is the primary purpose of the ISPS Code, and what threats does it help prevent?
4. What role does the International Maritime Organization (IMO) play in ensuring maritime safety?
5. How do classification societies help maintain the safety and seaworthiness of ships?
6. What mandatory responsibilities do shipping companies have for the safety of crew, passengers, and the environment?
7. Provide examples of major maritime accidents and their consequences for shipping companies.
8. What physical security measures are used to prevent pirate attacks on ships?
9. How do shipping companies protect their systems from cyberattacks and digital threats?
10. What role do P&I Clubs play in shipowners liability insurance, and what risks do they cover?

CONCLUSION

The development of global commercial shipping is determined by the nature of the current state of international economic relations. The tasks of achieving commercial efficiency in shipping activities and ensuring transport independence in national foreign trade shape the maritime policies of most industrially developed countries. The limited investment resources and the level of competition in the global transport services market restrict the opportunities for the even development of the merchant fleet. Therefore, constant changes in the balance of demand and supply of tonnage are observed in the chartering market.

The stability of shipping companies' operations in the transport services market is based on a combination of principles and patterns of cargo flow formation, the choice of the technico-economic level of the fleet, and the implementation of integration processes. In this regard, attention is paid to:

- the priority of demand for merchant fleet tonnage by main types;
- maintaining the necessary efficiency of commercial shipping;
- the freedom of operators' activities of shipowners of any ownership form;
- the increased role of the time factor in meeting the transportation needs of global economic relations;
- the priority of multifaceted competition in several sectors of the chartering market;
- observing the balance and complexity of the production potential of fleets and ports;
- the concentration of cargo flows, specialization, and interaction in the system of multimodal transport technologies;
- considering the nature of constant fluctuations in activity levels and depressions;
- strengthening technological competition among leading shipping companies;
- the potential for the development of the national fleet of Ukraine in the system of logistics supply chains.

Taking into account the aforementioned principles and patterns of the freight market's functioning allows for the implementation of a long-term development strategy for the national transport fleet, both on an initiative basis by shipowners and with state support for the fleet and ports.

In the modern system of labor division and cooperation, the adequate development of the merchant fleet and seaports becomes a crucial condition for the stability of global economic relations and an effective export potential for the country. Therefore, maintaining a balanced approach to stimulating free commercial activity through a fair taxation system is of paramount importance.

The effectiveness of the normalized development of the national merchant fleet can be ensured by having clear tools for implementing the core functional purpose of a shipping company in the ever-changing conditions of the global transport services market. To monitor the optimal condition of all subdivisions of the national maritime complex, the system of performance evaluation indicators must be continuously improved. The combination of such indicators enables the selection of a promising fleet development strategy.

The final results of shipping companies are created discretely, and the key issue is reducing the time gap between cost formation and obtaining results. To ensure comparability and balance between macroeconomic goals and the full utilization of economic resources, the principle of managing shipping companies' results is examined with consideration of integration patterns.

The requirements for managing competitive sustainability in the freight market system and the objectives of improving the efficiency of functional activities have necessitated refining aspects of managing the final results of the national shipping complex and individual enterprises. In the context of globalization, the economic and social effectiveness of integration processes in merchant shipping requires further study. The primary goal is to achieve unity between economic activities and capacity expansion concerning cargo flow parameters while simultaneously improving the quality of transport handling within multimodal transport technologies.

The intensification of transport services in global economic relations necessitates the improvement of methodological approaches to assessing development efficiency, planning results, and stimulating the utilization of the maritime merchant fleet's production potential. The mechanism for managing development and operational results is based on accounting for pricing processes and selecting priority forms of fleet development.

The increasing complexity of external conditions for the sustainable operation of shipping companies within the integration system necessitates the creation of various associations. Fleet development is associated with risks stemming from the probability of cargo flow formation and the competitive situation in cargo base distribution. The substantial size of shipping companies' capital assets highlights the growing importance of optimizing organizational structures based on efficiency criteria for managing results and costs.

The sustainability of national merchant shipping in the global transport services market should be monitored through projected return-on-assets indicators. Therefore, the primary task of any shipowner or investor is to assess the financial condition of the enterprise within the calculated period. The key factor becomes the return per unit of

investment, either in the form of profit margins or dividends and shareholder capital growth.

Given the limited carrying capacity of the national merchant fleet, the priority is to study the fundamental patterns and principles of managing the available potential to accumulate financial resources for further fleet development.

ABBREVIATION

AIS – Automatic Identification System
BINSa – Black Sea International Shipowners Association
FFC - Freight from Foreign Charterers
LC – Life Cycle
IMO – International Maritime Organization
IMC – Intermodal Communication
CMM – Code of Merchant Shipping
SC – Shipping Company
BFP – Transport Between Foreign Ports
ITF – International Transport Workers Federation
ITC - International Transport Corridors
STP - Scientific and Technological Progress
SEI – Ship's Energy Installation
TNC – Transnational Corporation
TTS – Transport-Technological Systems
TEL – Technico-Economic Level (of enterprises, vessels)
ULD – Unit Load Device
AFRA – Average Freight Rate Assessment
COFR – Certification of Financial Responsibility
FPC – Fair Practice Committee
GT – Gross Tonna
MOU – Paris Memorandum of Understanding
OECD – Organization for Economic Co-operation and Development
PSC – Port State Control
ROE – Return on Equity (reflects the reimbursement of previously realized investments to real owners)
ROI – Return on Investment (or Profit Margin)
SDARI – Shanghai Merchant Ship Design & Research Institute
Shipbreaking Platform – Analytical Company
TEU – Twenty-Foot Equivalent Unit
UNCTAD – United Nations Conference on Trade and Development

GLOSSARY

A

Agent – (1) generally, a representative of a company; (2) an organization acting on behalf of another organization, usually as an intermediary; an agent's services are typically paid through commissions.

Agency operation – the performance of factual and legal actions related to the provision of transport services within an agreed territory, carried out by one independent party (the agent) on behalf of and at the expense of another party (the principal).

American (short) ton – a unit used in bills of lading** – 907 kg.

Assets – economic resources of SC and ports that are expected to generate income through operational activities.

Attitude – the extent to which a real or potential cargo owner likes or dislikes the SC service technology.

B

Benefits – advantages that a cargo owner expects to gain when choosing a specific maritime transport technology.

Break-even analysis – determining the volume of transport operations required to cover gross costs.

Bill of lading – a document confirming the acceptance of cargo for transportation and obligating the carrier to deliver the cargo to the consignee.

C

Campaign objectives – the goals set by a SC to achieve specific transportation volumes, profit levels, or expansion within a priority market segment.

Cargo Handling services – managing of handling equipment, loading/discharging of ships, organization of port labour, storage, stuffing and stripping

Charter – a document certifying the existence and terms of a charter agreement. Depending on the type of charter arrangement, it can be a voyage charter, time charter, bareboat charter, or demise charter.

Collection of port charges – collection of dues and charges related to the use of a port by a ship and to the taxation of cargo, except the charges expressly due to services used

Commercial policy – marketing and tariffs policy of single port terminals, commercial relationships between terminals and users

Companies sphere of competence – functions that are strictly connected with operations involving private business forces offering means to produce services for ships and services for cargo through suitable port superstructures and supplying the same services to clients, acquired through an appropriate commercial policy

Competencies – the combination of a SC experience and resources.

Competitive advantage – a clear distinction of a SC from its competitors based on criteria most important to target charterers.

Competitive scope – the area (segment) of a SC competitive positioning, which can be broad or narrow.

Competitive strategy – the strategy a SC follows in relation to other FM operators.

Competitiveness – a relative characteristic of a SC that reflects its distinction from competing enterprises in terms of both meeting market demand and the costs of satisfying these demands.

Competition – rivalry between maritime transport enterprises for better and more economically advantageous conditions in operational activities.

Competitor analysis – a study of the nature of major competing SC, their key objectives, and strategies.

Competitor audit – a precise analysis of the strengths and weaknesses of competing SC, their goals, and strategy.

Conjuncture – the current economic situation in the market, characterized by the balance between supply and demand, tariff rate levels, available carrying capacity, and cargo flow volume.

Consulting – advising on a wide range of economic activities of enterprises, firms, and organizations.

Contract price – the price specified in a contract, expressed in the currency of the exporter's country (shipbuilding location), the importer's country, or a third country's currency.

Core competencies – the key distinctive positive characteristics of a SC, i.e., what sets it apart favorably from competitors.

Corporate goals – objectives shared by the entire shipping company (or association).

Corporate identity – the core principles, mission, and value system adopted by a SC, which shape its individuality and enable it to stand out in the MTM segment.

Corporate plan – a document outlining the overall strategy of a SC, typically for the current planning period.

Cost leadership – the position of a SC with the lowest costs, serving a large number of maritime trade market segments.

Cost focus strategy – a strategy in which a SC aims to achieve a cost advantage within a priority segment of operational activity.

Credit line – a legally formalized obligation of a bank or other credit institution to provide the borrower with loans within an agreed limit over a specified period.

Customer value – the perceived benefits a buyer gains from purchasing goods or services, minus the perceived costs of these transactions.

Customs union – an agreement between states on the regulation of customs duties among them.

D

Data – the primary form of knowledge, the result of observation and record-keeping.

Dealer – an individual or legal entity engaged in trade transactions with securities (or other goods), buying or selling them as a principal rather than an agent, meaning on their own behalf and at their own expense.

Decision-making unit – a group of employees responsible for making decisions regarding the principles of operational and investment activities.

Demurrage – monetary compensation paid to the shipowner for the detention of a vessel during cargo operations beyond the time stipulated in the charter party.

Differential advantage – a clear distinction of a SC from competitors based on criteria most important to target cargo owners.

Differentiation strategy – the selection of a criterion valued by maritime transport clients and the positioning of the company in the maritime trade market based on this criterion.

Distributor – an independent intermediary or part of a distribution chain specializing in delivering a manufacturer's goods or services to the consumer.

Diversification – the development of new cargo transportation service technologies or entry into other MTM segments.

Dominant position – market position of an undertaking that has exclusive right to provide certain services or, generally speaking, of an enterprise having a relevant market share.

E

Effectiveness – the ability to successfully implement the chosen strategy, ensuring competitiveness and generating net income.

Efficiency – the ability to conduct business “the right way.” A method of managing business processes according to the highest standards, typically aimed at reducing costs or optimizing resource use.

Engineering – a form of providing various engineering services on a commercial basis.

English (long) ton – a unit used in bills of lading ++ – 1,016 kg.

Entry barriers – factors preventing new SC from entering the FM segment, such as a high level of investment required for operational activities.

Entrepreneurship – the process of seeking new business opportunities, implementing new technologies, selecting new areas for capital investment, creating new jobs, and efficiently utilizing resources.

Equity capital – funds invested by the owners of a SC in its shares, along with the retained earnings from its functional activity.

Exit barriers – obstacles arising from exiting maritime transportation, such as costs associated with reducing a company's carrying capacity.

Expert power – opportunities arising from the implementation of a specialist's experience and good maritime practice.

F

Firm liquidity – a company's ability to timely meet its debt obligations, depending on the amount of debt and the availability of liquid assets.

Foreign direct investment (FDI) – investments in subsystems based in other countries, ensuring the subsequent generation of cash flows for the direct owner.

Franchising – a form of licensing in which one company (the franchisor) provides a package of services (including a product and brand name) to another company (the franchisee) for a specified monetary compensation.

Freight – payment to the owner of a transport vehicle for the transportation of cargo or passengers, including loading and unloading services.

Freight rate – the price of maritime transportation per unit of cargo. The freight rate depends on the cargo's characteristics, voyage conditions, and the freight market situation.

Full-cost pricing – setting a tariff rate that accounts for all costs and assumptions based on specific transportation volumes.

G

General promotion – general promotion of the port image, of the position towards the market and of the existing facilities

Going-rate pricing – pricing based on freight rate levels acceptable for a given market segment, with a primary focus on competitors' rates rather than the SC costs.

H

Hold – a strategy for managing operational activities aimed at generating profit and maintaining market share in maritime trade.

Holding company – a firm that owns a portion of the capital assets of another company.

I

Innovation – the commercialization of an invention by bringing it to market, ensuring scientific and technological superiority in operational activities. The terms “novelty” and “advancement” are also used.

Inseparability – a characteristic of cruise services, meaning that the production of a cruise product is inseparable from its consumption.

Investments – all forms of property and intellectual assets invested in business and other activities to generate profit or achieve a social effect.

Investment fund – a legal entity with the status of a joint-stock company engaged exclusively in collective investment activities.

Investment risk – the probability of unforeseen financial losses due to uncertainty in investment conditions.

J

Joint venture – a collaboration between two or more parties in executing a business project, sometimes involving the creation of a new company.

Just in time – a supply and delivery concept aimed at minimizing inventory by organizing a supply system in which goods and components are delivered precisely when needed.

L

Leasing – the rental of equipment, ships, vehicles, and other assets for a period of up to 15 years or more under special payment conditions.

Lifetime value – the total value of a transport service customer, representing the profit earned by the SC from utilizing its carrying capacity over the duration of servicing a particular cargo or passenger flow.

M

Margin – the difference between interest rates, security prices, commodity prices, revenues and expenses, and other indicators.

Market development – the transfer of already established transport technologies from one maritime trade market segment to another.

Marketing – a set of organizational, technical, and commercial functions of a company aimed at market research, product manufacturing, and service provision, considering supply, demand, and sales.

Marketing strategy – the approach a SC chooses to establish and maintain profitable relationships with cargo owners. This involves increasing TEU capacity and selecting vessel positioning segments.

Mobile defense – a process involving diversification or expansion of participation in the FM segment by altering the nature of operational activities.

N

Niche targeting – competition within a specific FM segment (operational niche), understood as positioning within a particular subsystem of the freight market.

O

Opportunity cost – costs incurred by the SC due to the inability to recognize the need for a strategy change.

Order – a commercial document in which the buyer-importer specifies the necessary conditions for the production of the ordered goods (vessel) and all essential elements required for concluding an export transaction.

Order portfolio – the total number of orders (shipbuilding) held by a manufacturer as of a specific date.

P

Panamax – ships' characteristics compatible with the dimensions of the Panama Channel.

Partnership – a voluntary commercial association in which ownership, management, and profit distribution are regulated by agreements signed between partners.

Port – a port is town with harbour and facilities for a ship/shore interface.

Positioning – the selection of a target market segment (i.e., determining where the SC intends to compete) and a distinctive advantage (defining how the company plans to compete).

Price – (1) the amount of money paid for a good or service; (2) the agreed-upon cost of a good or service between the seller and the buyer.

Product differentiation – the process of forming distinctive characteristics of the transportation process, considering factors that have the greatest impact on the stability of a SC in the FM segment.

R

Repositioning – changing the target segment of the cruise or other maritime trade market, the relative advantage, or both factors.

Reward power – influence providing certain advantages in accordance with the resulting opportunities.

Round-the-world – container liner services moving always in same direction eastbound or westbound and linking the most relevant shipping markets of the world (Far East, Middle East, Europe, northern America and Far East again).

Royalty – payments for the use of assets such as trademarks, patents, copyrights, or new types of expert documents, according to contracts known as licensing agreements. Royalties also cover franchise payments.

S

Seaports – are areas where there are facilities for berthing or anchoring ships and where is equipment for the transfer of goods from ship to shore or ship to ship.

Segment – a group of cargo owners and cruise consumers (including potential ones) with specific common characteristics.

Services for ships – piloting, towing, mooring, berthing bunkering, catering, supply of utilities such as water and power, shiprepair, etc.

Stevedore – a company responsible for loading and unloading vessels, hired by either the charterer or the shipowner.

Strategic alliance – cooperation between multiple SC through the development of joint strategies, signing of licensing agreements, and contracts for long-term operational projects.

Strategic degrees of freedom – an indicator reflecting a SC ability to respond to competitors' actions in the operational segment.

Strategic focus – various strategies that can be implemented to achieve a SC investment or operational goals.

Strategic issue analysis – the study of the degree of alignment of the SC positioning goals for diversification due to changes in the freight market.

Strategic planning – a managerial process of creating and maintaining strategic alignment between a company's goals, its potential capabilities, and positioning opportunities.

Subsidiary – a company owned by another company.

Subsidy – financial or in-kind assistance provided by the government using budgetary resources or special funds.

Synergy – a phenomenon in business practice where the overall result exceeds the sum of individual effects.

SWOT-analysis – a structured approach to assessing the strategic position of a maritime transport enterprise by identifying its strengths, weaknesses, opportunities, and threats. (SWOT stands for Strengths, Weaknesses, Opportunities, and Threats).

T

Targeting – the selection of a maritime trade segment for competitive positioning.

Technological distance – the differences between two SCs and their technologies for servicing cargo or passenger flows.

Technology or SC life cycle – consists of four stages in the life cycle of the considered object. It is represented as a curve reflecting market positioning. The stages include market entry, position growth, maturity, and decline.

Tenders – a form of trade in which a buyer announces a competition for goods with specific technical and economic parameters.

Threat – a situation or trend unfavorable to achieving a SC goals, such as competitor initiatives or rapid actions, unexpected obstacles (e.g., piracy), and government regulatory rulings.

V

Value – (1) the price paid for a good or service; (2) the consumer's subjective perception of a product or service's worth.

Value chain – a set of activities carried out by a SC for designing, operating, marketing, and servicing cargo owners.

Variability – a characteristic of transport services that depends on the provider, resulting in significant differences in service standards.

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Scholarly publication

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