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General trend in the development of the global maritime transport industry

Abstract: The global maritime transport industry is witnessing significant changes driven by environmental regulations, evolving trade routes, and advancements in ship design. A major trend is the shift towards sustainability, with stringent international standards like IMO 2020 pushing shipping companies to reduce sulfur emissions and adopt cleaner fuels such as LNG (liquefied natural gas). Additionally, alternative energy sources, including hydrogen and wind-assisted propulsion, are gaining traction as the industry seeks to lower its carbon footprint. Another key development is the changing landscape of global trade. Geopolitical factors, regional trade agreements, and emerging market growth reshape traditional shipping routes. Ports and logistics hubs are being modernized to handle increased volumes, larger vessels, and more efficient loading and unloading processes. Investments in port infrastructure, especially in Asia and Africa, are helping to facilitate the growth of maritime commerce. The ongoing modernization of ships, coupled with new regulations and trade dynamics, is positioning the maritime industry to become more sustainable, efficient, and adaptable to future challenges. The study's object is the maritime trade market itself, focusing on the factors influencing the formation of its parameters – such as freight rates, demand for shipping services, vessel capacity, and the influence of external factors like economic cycles, regulatory frameworks, and technological advancements. The study primarily aims to analyze the key patterns that shape the maritime trade market and identify the emerging trends that will influence its future development. The research draws on the works of leading scholars and industry experts, such as P. Alderton, C. Sellberg, J.-J Lambin, N. Husarina, M. Assen, O. Katerna, and J. Lambin. The results of this study are intended for a wide audience, including industry professionals seeking to understand market dynamics, policymakers responsible for regulating maritime trade, and academics researching global trade systems. By providing a comprehensive analysis, this study offers valuable insights that will contribute to informed decision-making in the maritime sector.

Keywords: trend, development, globalization, transport industry, management.

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Загальна тенденція розвитку глобальної морської транспортної індустрії

Анотація: Глобальна галузь морського транспорту зазнає значних змін, викликаних екологічними нормами, розвитком торговельних шляхів і прогресом у конструкції суден. Основною тенденцією є зрушення в бік сталого розвитку, оскільки суворі міжнародні стандарти, як-от IMO 2020, спонукають судноплавні компанії зменшувати викиди сірки та використовувати більш чисті види палива, такі як LNG (скраплений природний газ). Крім того, альтернативні джерела енергії, включно з воднем і вітровими двигунами, набирають обертів, оскільки галузь прагне зменшити свій вуглецевий слід. Іншою важливою подією є мінливий ландшафт світової торгівлі. Геополітичні фактори, регіональні торговельні угоди та зростання ринків, що розвиваються, змінюють традиційні судноплавні маршрути. Порти та логістичні центри модернізуються для обробки збільшених обсягів, більших суден і більш ефективних процесів завантаження та розвантаження. Інвестиції в портову інфраструктуру, особливо в Азії та Африці, допомагають сприяти зростанню морської торгівлі. Поточна модернізація суден у поєднанні з новими правилами та динамікою торгівлі робить морську галузь більш стійкою, ефективною та адаптованою до майбутніх викликів.

Ключові слова: тенденція, розвиток, глобалізація, транспортна галузь, менеджмент.

Abbreviations:

GDP is gross domestic product
IAPH is the International Association of Ports and Harbors
ICS is the International Chamber of Shipping
IMO is the International Maritime Organization
VR is virtual reality

Introduction

The maritime trade market plays a critical role in the global economy, serving as a primary conduit for international trade and the exchange of goods. Studying patterns and trends in forming its parameters is paramount due to the dynamic nature of global trade, changing geopolitical landscapes, and environmental considerations. In recent years, the volatility of freight rates, the evolution of vessel sizes, the development of port infrastructures, and the

shifting balance of trade routes have drawn increased attention from industry experts and policymakers. As such, understanding these trends is essential for stakeholders in global trade, including shipping companies, port authorities, logistics providers, and governmental bodies.

The study's object is the maritime trade market itself, focusing on the factors influencing the formation of its parameters – such as freight rates, demand for shipping services, vessel capacity, and the influence of external factors like economic cycles, regulatory frameworks, and technological advancements.

The study primarily aims to analyze the key patterns that shape the maritime trade market and identify the emerging trends that will influence its future development. To achieve this, the study sets the following objectives:

- examine historical data and identify cyclical trends;
- assess the impact of technological innovations, particularly in vessel design and digitalization of shipping processes;
- evaluate the effects of regulatory and environmental policies on the market.

The study employs various research methods, including statistical analysis, formula representation, and specific market segments case studies. These methods help uncover both long-term structural changes and short-term fluctuations within the industry.

The research draws on the works of leading scholars and industry experts, such as Alderton P. (*2003*), whose contributions to maritime transport provide foundational insights, the works of researchers such as C. Sellberg (*2017*), J.-J Lambin (*2012*), N. Husarina (*2023*), who offer critical perspectives on regulatory impacts, like the works of authors who contributed to management research such as M. Assen in his publication "Transitional Approach to Change" (*2017*), O. Katerna in "Concept Formulation of Intelligent Management in Transport" (*2018*) and earlier mentioned J. Lambin in "Market-Driven Management: Strategic and Operational Marketing" (*2012*).

The results of this study are intended for a wide audience, including industry professionals seeking to understand market dynamics, policymakers responsible for regulating maritime trade, and academics researching global trade systems. By providing a comprehensive analysis, this study offers valuable insights that will contribute to informed decision-making in the maritime sector.

The results of the study

Problems of sustainability of world development in the period of globalization

Natural processes of globalization, reflecting the standards of the international division of labor based on the advantages of absolute or comparative efficiency characteristics, established in 1991, determined the corresponding nature of the development of the maritime transport potential of individual countries. Based on the patterns of development of the international division of labor, the parameters of the carrying capacity of the merchant fleet are formed. At the same time, there is a concentration of capital assets in the maritime transport industry in a certain group of maritime states.

The general risks of the market form of relations standardly predetermine the imbalance of the global maritime trade market. However, in 2020 and 2022, events occurred that predetermined strategies transformed the single space of the international division of labor. At

the same time, group technologies for choosing a form of sustainability from the standpoint of local interests are strengthening.

A problem has arisen in balancing positioning in the global space and relations between the United States and China, the two leading economies in the world.

Thus, an imbalance is formed in the division of cash flow in the global maritime trade market system. The fleet's carrying capacity predetermines the cash flow, the distribution of which is not balanced with the volumes of foreign trade of many states. Therefore, with increasing competition in servicing cargo flows, the problem of choosing the principles of interaction or integration also becomes more acute.

Due to the concentration of capital assets in a group of developed countries, a characteristic relationship between global GDP, the volume of world trade, and the carrying capacity of the fleet has formed. The relationship of these indicators reflects the nature of the relationship between the three groups of countries according to their internal economic characteristics. However, the form of concentration of capital assets according to the availability of investment resources has determined the priorities in obtaining income.

In this regard, implementing the principle of placing a production zone to reduce current costs based on cheap labor or high productivity has changed. As a result, centers of advanced growth have emerged. However, the subsequent strategy of competitive advancement of the fleet's carrying capacity growth in many maritime countries has predetermined the imbalance of demand for the fleet's carrying capacity and the availability of deadweight, which has determined the pricing dynamics in the freight market sectors.

is worth noting that the maritime trade market system reflects not only the systemic patterns of the price characteristics of the balance of cargo flows and the carrying capacity of ships but also the features of technological processes and the organization of competitive positioning strategies.

At the same time, a strategy for the sustainability of a group of shipping companies and commercial ports was formed based on the creation of various types of non-systemic effects and perceived value on the part of consumers of products of maritime transport enterprises (*Alderton, 2003*). Along with the noted special form of sustainability and efficiency, the attitude to the natural environment should be considered. Even with some decrease in the entrepreneurial effect, the second component of efficiency determines sustainability in the life cycle system. This form of sustainability is predetermined by the degree of adequacy of ships' technical and economic level to the standards predetermined by the IMO. In entrepreneurial activity, efficiency is formed under the influence of state and global administration.

At a particular stage of the technical and economic level of production relations, while maintaining the basic market foundations of production activities, the role of social and environmental restrictions increases. This predetermines the reassessment of managerial approaches to managing and forming enterprises' production potential. Specific legal relations are created in the system of adoption of economic strategies.

The expected increase in the cost of products or services for a complex set of factors and the strengthening of external factors in the formation of price characteristics predetermined the revaluation of the ratio of capital assets and working capital in forming competitive advantages of ship-owning structures. At the same time, despite the growth of quantitative characteristics

of the maritime trade market, despite innovative technologies and management automation, the severity of the manifestation of shipping risks is noted (*Katerna, 2018*).

Strengthening the role of investment areas of development based on the noted factors with tightening control by international administrations. This approach predetermines transport vessels' technological level and commercial ports' subsequent reaction. At the same time, this approach has strengthened the differentiation of the development of maritime transport of individual states (*Amado & Ambrose, 2011*). This, in particular, predetermined that Ukraine's most significant export cargo flow is 90 percent served by a foreign fleet with an outflow of funds from the country's balance of payments.

One of the trends in the development of international trade is the differentiation of the role of individual maritime ranges by many factors that reveal transport advantages. Therefore, problems arise in effectively using the potential of other projects from the standpoint of entrepreneurial interests and global issues of balance. In this regard, the IMO, the ICS, and the IAPH have formulated a declaration on the tasks of close cooperation in ensuring the openness of the port industry to world trade. The emergence of this task emphasizes that the role of power approaches is increasing in the strategy for solving economic problems of the modern period. However, any violation of market balance predetermines bilateral losses (*Husarina et al., 2023*).

However, this concept is destroyed by implementing a known set of economic relations regarding handling cargo flows of many states in a significant set of ports. The latter causes disruptions in the operation of maritime merchant shipping, regardless of the flag of registration of ships. At the same time, the current situation reflects the risks of losing balance in world relations with the limited development of national maritime transport (*Alderton, 2003*).

Violating the principle of uninterrupted operation of commercial ports causes problems for the states against which sanctions are directed and other participants in export-import operations. Therefore, the openness of ports predetermines the efficiency of the global maritime trade market. This simultaneously reflects some imbalance in the formation and legal aspects of using the space of the World Ocean.

When standard economic and legal relations are violated in the cargo delivery system, losses increase due to the formation of additional storage costs and the search for resources to ensure additional working capital needs.

$$\Delta C_{st} = \sum \Delta t_{in} \left(C_{ss} Q_{sv} + \frac{Q_i}{365} \gamma_i \mathrm{p_c e_p} \right), \quad (1)$$

where:

Δt_{in} is loss of processing time for a certain cargo flow due to various factors that violate standard strategies;

C_{ss} is average current costs for storing 1 ton of cargo;

Q_{sv} is the size of the cargo consignment for which standard sea delivery times have been missed;

Q_i is individual groups of goods, according to the parameters of the formation of the needs for working capital of the producer or consumer;

γ_i is working capital standard for a specific cargo;

$\mathrm{p_c}$ is the cost of one ton of cargo, the acceleration of delivery of which reduces the need for working capital;

$\mathrm{e_p}$ is the standard for the efficiency of using this type of working capital.

Optimizing this cargo flow predetermines the choice of multimodal delivery routes (*Swann, 1991*). In this regard, it is necessary to distinguish between managerial and innovative strategies for solving the problem. The former ensures the search for optimal logistic forms of solving the problem. The latter provides for the technical reliability of ensuring the delivery of goods according to productivity and reserve capacity parameters.

Both simultaneously predetermine the differentiation of maritime states according to the availability of a solution to the problem. Therefore, integration processes are formed based on standard approaches to achieving compliance with requirements.

Thus, with problems of forming subsidiary objects in commercial ports or concession projects, one should expect a differentiation of the role of individual port complexes. At the same time, the merchant fleet, implementing the principle of scale economy, determines the requirements for expanding the transshipment strategy. On this basis, strategies for positioning individual maritime states in dividing economic relations should be developed.

Problems of sustainable development of the maritime trade market

It is worth noting that the problems of managing the sustainability of the maritime transport industry and the carrying capacity of shipping companies in individual countries are multifaceted and multidimensional. At the same time, it is necessary to distinguish between objective external factors and erroneous reactions of the owners of production potential. Many management decisions do not meet the sustainability requirements of the maritime trade market.

The same applies to the shortage of officers due to a decrease in attention to the training of specialists by the so-called traditional maritime states, a focus on foreign scientific bases, and the complexity of managing the safety of shipping. The problem is aggravated by the inability to respond clearly to non-systemic threats. Thus, in March 2021, 200 thousands of seafarers whose contracts for work on the ship expired could not change. This predetermined not only the risks of emergencies due to overwork. The management system of work in maritime transport was also perceived negatively. This situation has demonstrated the limitations of the systemic effectiveness of managing activities only within merchant shipping, which largely guarantees the sustainability of global economic relations. Management systems focused only on current regional problems and ignored the key role of maritime specialists' labor in global economic sustainability (*Lambin, 2012*). Consequently, all significant divisions of merchant shipping should be perceived by other structures of the global economy.

Violating the principle of balance in the national maritime transport industry and planning due to concentrating attention and resources on the technical and economic superiority of capital assets and ignoring the training of specialists leads to a decline in synergy (*Heilbroner, 1994*).

Other factors also limit the training of highly qualified specialists in maritime transport. Therefore, international specialized organizations are paying close attention to this issue. However, in many countries, the process does not find the necessary support at the state level.

It is also a mistake for many shipping companies to ignore the advisability of providing places for trainees on their vessels. This condition or trend causes an increase in the risk of a balanced supply of specialists' labor in the future. Training centers do not exclude the priority of practical skills. Despite the high level of various innovative technologies in the development system of the merchant fleet, the manifestation of particular customs, habits, and signs remains,

and these are also worth considering when solving the problems of balancing supply and demand.

Despite the expansion of the use of VR in modern simulators, specialists react differently to those who have undergone real practical training on ships (*Sellberg, 2017*). Even standard situations manifest themselves differently depending on the state of the sea in various territorial subsystems. In the World Ocean, individual characteristics are manifested (*Alderton, 2003*).

Despite opposite assessments of the priorities of using individual technologies and methods to form the ship's crew members' competence, the most significant remains the practical acquisition of skills. With high theoretical forms of training, practical skills remain significant in the system of perception of real transformations of basic provisions.

In modern approaches to optimizing the labor intensity of the transportation process on the principles of managing the number of crew members based on the growth of capital intensity and innovative technologies, one should not ignore the limits of perception of other forms of fatigue and loss of attention, specialists on watch on difficult sections of ship routes.

Thus, the problems of sustainability and balance of the maritime trade market are determined by the system of traditional factors of economic growth and the fundamental features of seafarers' work from the position of their key significance for optimizing the international division of labor. Additionally, this was emphasized by implementing various forms of sanctions as the main form of economic confrontation instead of standard competitive relations.

Entrepreneurship's leading role in the cash flow growth system creates the principle of priority and state mechanisms for managing cash flows. Such an increase in the role of government agencies with limited professional training violates the basic principles of forming a balanced economy.

In reality, three problems of sustainable development and positioning of shipping companies and trading ports in the maritime trade market system should be distinguished. First, the nature of transformation processes in the system of servicing cargo flows of world trade. Second, freedom of access to investment resources according to the strategy of innovative advantages. Third, the symmetry of the reaction to the economic sustainability problems of government agencies and entrepreneurial potential.

Considering these basic conditions and according to the regulatory framework of the IMO, the management of the owner's subsystems decides to achieve the sustainability of operator activities according to the criteria of the company's life cycle. When various transport companies participate in servicing cargo flows, their interaction creates synergy and an extra-systemic effect of rational correlation. When an imbalance occurs, risks of a crisis state appear. Thus, for the port complex, due to the instability of relationships and the balance of cargo flows, increases or losses in efficiency arise.

$$\Delta E_{fb} = \sum_{i=1}^{n} [C_{st} \Delta T_{ei} + D_{vi} \Delta T_{ei} p_{di} (p_{ci} - c_{si}) \mp P_{ri}], \quad (2)$$

where:

n is number of technological schemes for handling cargo flows;

C_{st} is the cost of maintaining the relevant vehicles during the implementation of the relevant technological process;

ΔT_{ei} is deviation of the time required to complete a specific transport operation from standards or contractual parameters;

D_{vi} is deadweight of vessels of the corresponding size range;

p_{di} is daily productivity under the relevant conditions of use of the vessels;

p_{ci} is tariff (freight) rate for transportation according to the conditions of the maritime trade market;

c_{si} is the cost of transporting tons of cargo on the route in question;

P_{ri} is the form of compensation cash flows provided for by the relevant agreement.

This form of reflection on the emergence of real situations reveals the main directions on which management must concentrate to optimize the use of production potential. At the same time, the most important thing remains the formation of contractual relations and the adoption of appropriate innovative technologies that ensure the achievement of adequacy to the conditions for normalizing the state of the enterprise (*Assen, 2017*).

Thus, this process emphasizes the importance and need for implementing the digital economy in the system of clarity of work of maritime transport enterprises and the relative reduction of current costs for accounting for results and implementing relevant decisions.

Discussion

The maritime trade market is a highly dynamic and multifaceted system, influenced by various factors, including technological advancements, geopolitical shifts, and environmental policies. The discussion of patterns and trends in forming its parameters reveals several critical areas that affect the future of this global sector. One of the main drivers of change is the increasing automation and digitalization of shipping processes, which has led to a transformation in fleet management and cargo handling, enhancing efficiency and reducing costs. However, this shift also raises questions about the need for specialized skills in managing these new technologies and ensuring the safety of maritime operations.

Another significant trend is the imbalance in the distribution of global shipping capacity. The concentration of capital assets in a few developed countries has led to unequal resource access, creating challenges for smaller or developing nations to compete in the global market. This imbalance is exacerbated by the unequal distribution of fleet capacity concerning trade volumes, leading to volatility in freight rates and increased competition among shipping companies. As a result, shipping lines are forced to explore new strategies, including mergers, alliances, and investments in larger vessels, to maintain competitiveness (*Coates, 2014*).

Environmental sustainability has also become a crucial consideration in the maritime trade market. Regulations imposed by international organizations, such as the IMO, have forced shipping companies to adopt greener practices, such as reducing emissions and improving fuel efficiency. While these measures are necessary to combat climate change, they also increase operational costs and require substantial investments in new technologies and vessel retrofits. The question is whether smaller operators can afford these changes or if the industry will see further consolidation, with larger companies absorbing the additional costs.

In terms of regional development, the maritime trade market has seen the rise of new trade routes, especially in response to geopolitical events, such as the Belt and Road Initiative led by

China. This has shifted global trade flows and placed new importance on specific port hubs and shipping lanes. However, these developments have also created tensions between the United States and China, as both superpowers seek to assert their influence over global maritime trade. This geopolitical rivalry will likely continue shaping trade routes and influencing decisions in the sector.

In summary, the discussion touches upon the labor force within the maritime industry. There is a growing shortage of qualified seafarers, particularly officers, as traditional maritime nations face declining interest in maritime careers. This shortage is exacerbated by the increasing complexity of ships and the technical expertise required to operate them. Training and retaining maritime professionals will be essential to ensuring the sustainability of global trade, yet many shipping companies are reluctant to invest in crew development due to cost concerns.

Conclusion

In conclusion, the maritime trade market is experiencing profound transformations driven by technological advancements, environmental regulations, and shifting geopolitical dynamics. The study of patterns and trends in forming its parameters highlights key challenges and opportunities that will shape the future of global trade. Automation, digitalization, and innovations in vessel design are improving efficiency but also demanding new skills and investments from industry participants. Meanwhile, the imbalance in shipping capacity and the concentration of capital assets in a few developed nations underscore the competitive pressures facing smaller economies and shipping companies.

Environmental sustainability has emerged as a critical factor, with international regulations mandating significant changes in operations. While necessary for the planet's long-term health, these requirements impose financial burdens on many shipping firms, especially those lacking the resources for compliance. This trend points toward potential consolidation within the industry as larger, better-capitalized firms absorb smaller players unable to meet the rising costs.

Geopolitical tensions, particularly between major powers like the United States and China, continue to influence trade routes and resource access, adding another layer of complexity to the market. The evolving labor dynamics, characterized by a shortage of qualified maritime professionals, further complicate the sector's sustainability. Addressing these labor challenges will be crucial to maintaining the smooth operation of global trade networks.

Ultimately, the maritime trade market stands at a pivotal moment. To ensure its future sustainability, industry stakeholders must embrace technological innovations, comply with environmental regulations, and invest in human capital development. Only by addressing these factors can the global maritime sector remain resilient and competitive in the face of ongoing change.

Conflict of interest

The authors declares that there is no conflict of interest.

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