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ECONOMIC ASSESSMENT OF EXTERNAL ENVIRONMENTAL FACTORS OF MARITIME TRANSPORT ENTERPRISES IN STRATEGIC MANAGEMENT

Economic approaches to assessing external factors influencing the functioning of maritime transport enterprises are examined in the context of increasing regulatory pressure and market volatility. Using the PESTEL methodology, political, economic, social, technological, environmental, and legal factors are systematized with consideration of industry-specific characteristics. The analysis qualitatively outlines the channels through which these factors affect costs, revenues, and investment decisions of shipping companies (freight rates, fuel prices, carbon pricing, customs and tax policies, insurance premiums, IMO/EU requirements). A set of indicators and methodological guidelines is proposed for integrating the results of such analysis into strategic management, thereby enhancing the resilience and competitiveness of enterprises without the use of quantitative calculations.

Keywords: *strategic management, external environment, maritime transport enterprises, PESTEL analysis, port tariffs, freight rates, bunker fuel price, regulatory compliance.*

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ЕКОНОМІЧНА ОЦІНКА ФАКТОРІВ ЗОВНІШНЬОГО СЕРЕДОВИЩА ПІДПРИЄМСТВ МОРСЬКОГО ТРАНСПОРТУ У СТРАТЕГІЧНОМУ УПРАВЛІННІ

У статті розглядається економічна оцінка факторів зовнішнього середовища, які формують умови функціонування та стратегічні рішення підприємств морського транспорту. Спираючись на PESTEL-рамку, у дослідженні систематизовано політичні, економічні, соціальні, технологічні, екологічні та правові детермінанти з чітким урахуванням галузевих каналів впливу – таких як волатильність фрахтових ставок, ціни бункерного пального, вуглецеве ціноутворення та екологічні обмеження (IMO/EU), портові та стивідорні тарифи, митні й податкові режими, страхові премії та валютні ризики. На відміну від суто описових оглядів, запропонований підхід є свідомо якісним (без числових розрахунків), але економічно обґрунтованим: для кожної групи факторів визначено механізми, через які зовнішні шоки трансформуються у структуру витрат, параметри доходів та інвестиційні рішення, а також запропоновано компактний набір спостережуваних індикаторів, придатних для поточного моніторингу та для прив'язки зовнішніх умов до корпоративних правил прийняття рішень. У статті доведено, що екологічні витрати відповідності та ціни енергоносіїв є ключовими довгостроковими драйверами зростання собівартості, тоді як циклічність фрахтових ринків лишається основним джерелом нестабільності доходів; правові та інституційні умови визначають рівень ризику, структуру контрактів, а також доступ до ринків і капіталу. Здобуток статті має три компоненти: (і) адаптовану до галузевої специфіки таксономію PESTEL-факторів, релевантних для судноплавства та портових взаємодій; (іі) карту якісних каналів передачі впливу зовнішніх детермінант на результати діяльності підприємств (витрати, маржа, грошовий потік, інвестиційний горизонт); (ііі) практичний перелік індикаторів, який дає змогу стратегічним командам інтегрувати моніторинг зовнішнього середовища в цикл планування без негайного використання економетричного моделювання. Запропонований інструментарій підтримує сценарне мислення, пріоритизацію ризиків і ухвалення рішень на основі тригерів щодо модернізації флоту, паливної стратегії, маршрутизації та хеджування. У фіналі статті подано зауваги щодо впровадження та обмежень, а також окреслено напрями подальших досліджень, серед яких – економетрична верифікація зв'язків «фактор–результат» та кейсові оцінки для різних типів суден і торговельних ліній.

Ключові слова: *стратегічне управління, зовнішнє середовище, підприємства морського транспорту, PESTEL-аналіз, портові тарифи, фрахтові ставки, ціна бункерного пального, регуляторна відповідність.*

Statement of the problem. Maritime transport enterprises operate in a complex and dynamic external environment that is significantly influenced by political, economic, social, technological, environmental, and legal factors. The strengthening of international environmental requirements, fluctuations in energy prices, shifts in global logistics, and changes in regulatory policies create new challenges for strategic management. Under these conditions, traditional approaches to external environment analysis, which are predominantly descriptive, fail to provide an adequate level of justification for managerial decisions. There is a need to transition toward an economically measurable assessment of external factors, which would allow for a quantitative determination of their impact on enterprise competitiveness and the effectiveness of corporate strategies. This necessitates the improvement of methodological approaches to the strategic analysis of the external environment of maritime transport enterprises.

Analysis of recent research and publications. The issue of economic assessment of external factors in maritime transport is grounded in the developments of

market, institutional, and industry economics. Theoretical foundations for structuring macro-drivers and market barriers that translate into enterprise costs and revenues are presented in the works of F. Aguilar [1], M. Porter [2], G. Johnson, K. Scholes, R._Whittington [3], as well as in the strategic measurement approaches of R. Kaplan and D. Norton [4]. The industry-specific features of shipping – freight market cyclicality, tonnage supply, fleet and port investment – are systematized by M. Stopford [6]. Institutional and international economic effects are reflected in the classical works of R. Coase [5] and in studies of the "environmental regulation–competitiveness" relationship [7], complemented by N. Stern's macroeconomic assessment of climate policy [8].

Ukrainian scholarly discourse emphasizes port economics and pricing: the works of N. Smentyna on digitalization and smart ports, V. Zhykharyeva on methodologies for port tariffs and dues, and O. Sokolova's research on the "green" transformation of transport confirm the relevance of technological, price, and legal factors for the strategic decisions of shipping companies [10–12].

Formation of the objectives of the article (task statement). The purpose of the article is to systematize the external factors influencing the functioning of maritime transport enterprises based on the PESTEL methodology and to qualitatively substantiate the channels through which these factors affect costs, revenues, and investment decisions. The objectives are to identify industry-specific political, economic, social, technological, environmental, and legal factors; to summarize the typical manifestations and risks of their impact; and to propose methodological guidelines for integrating the results into strategic management.

Summary of the main research material. The concept of PEST analysis was first proposed by A. Aguilar and R. Smith, who noted that "the assessment of external factors helps companies identify opportunities and threats that they cannot control but which may significantly affect their activities" [1]. Later, the four basic factors (PEST) defined in the work of F. Aguilar [1] were expanded through the addition of environmental and legal components, which led to the formation of a more comprehensive tool – PESTEL [2].

Political factors are among the key components of the PESTEL framework, as they shape the regulatory environment and the level of market stability–both essential for strategic planning. Political stability, taxation policies, trade restrictions, and government regulatory actions may exert both direct and indirect influence on business operations.

For the maritime transport industry, political factors are particularly critical. Government decisions related to export and import controls, the introduction of sanctions, or changes in customs legislation can significantly alter the economic opportunities available to companies. Thus, political factors such as government stability, corruption levels, regulatory shifts, and security policies play a decisive role in shaping the strategies of maritime transport enterprises.

Economic factors play a crucial role in shaping the business environment, as they determine consumer purchasing power, price stability, access to credit resources, and other financial conditions that influence opportunities for growth. The economic situation within a country or in the global market can significantly affect corporate business strategies.

For maritime transport enterprises, economic downturns result in reduced cargo flows and lower fleet utilization, as declining household and business purchasing power directly decreases the volume of imports and exports[9]. Additionally, inflationary pressures increase the costs of fuel, vessel maintenance, and repairs, thereby reducing companies' profit margins. Currency fluctuations create further risks for firms that purchase fuel and equipment in foreign currencies, while revenues from transportation services are often generated in the national currency. This mismatch between revenues and expenses leads to financial imbalances and necessitates the use of currency hedging instruments.

Social factors encompass demographic characteristics, cultural features, and shifts in consumer behavior. They shape the demand for a company's products and influence its marketing strategies. The demographic structure of the population–such as age composition, birth and mortality rates–significantly affects market dynamics. For example, population ageing may lead to increased demand for healthcare services.

These trends require companies to adapt to changing societal preferences and to develop products that align with emerging values. Such tendencies are directly relevant to maritime transport enterprises, as cargo owners and end consumers increasingly expect "green" transportation services and transparent ESG reporting.

Technological innovations are transforming the business environment and creating new opportunities for improving efficiency and attracting customers. However, the rapid pace of technological adoption can also pose challenges, requiring companies to adapt their processes to new technologies. The introduction of automation and artificial intelligence reduces costs and increases productivity, yet these technologies may require substantial investment and restructuring of operational processes. In the maritime transport sector, this means that companies implement digital navigation systems, electronic document exchange, and automated port services, which help reduce operating costs and shorten cargo handling times[10].

Environmental factors – such as climate change, environmental regulations, and sustainability requirements – are becoming increasingly important for companies, especially in industries dependent on natural resources. Climate change creates new risks for businesses, particularly for firms operating in climate-sensitive sectors. As noted in [8], climate change represents the greatest market failure the world has ever faced. Emission reduction requirements directly affect the strategies of maritime transport enterprises, compelling them to integrate sustainability principles into their operational activities.

Legal (regulatory) aspects include the laws, regulations, and standards that companies are required to comply with. These factors shape the legal framework within which businesses operate and define the rights and obligations of enterprises. Labour legislation regulates the relationship between employers and employees, including issues such as wages, working hours, and occupational safety. Violations of labour law can lead to substantial fines, creating financial risks for companies. Consumer protection legislation sets requirements for the quality of goods and services, which

is an important factor in building customer trust. In the practice of maritime transport enterprises, consumer protection requirements manifest through quality control of services, adherence to delivery deadlines, and liability for damaged or lost cargo.

Thus, the economic substantiation of the influence of external factors within strategic analysis makes it possible not only to describe the operating environment of a maritime transport enterprise but also to build a logic of strategic decision-making based on the quantitative assessment of probable changes in the macro- and microeconomic environment. This, in turn, creates a foundation for developing an adaptive and well-grounded corporate development strategy for maritime transport enterprises.

In conducting a strategic analysis of the external environment, it is important to consider not only general macro-environmental trends but also the specific factors that directly affect operational activities. Accordingly, for the purposes of this study, the external factors have been systematized within the PESTEL framework, taking into account industry-specific characteristics and the current challenges faced by maritime transport enterprises in conditions of environmental instability.

The volatility of freight rates is one of the most significant risks for maritime transport enterprises. Its level is determined by global supply–demand dynamics, energy prices, and geopolitical factors. The COVID-19 pandemic, followed by the war in Ukraine, caused sharp fluctuations in rates, which in some cases exceeded pre-war levels several times over [13]. For maritime transport companies, this results in revenue unpredictability, difficulties in financing fleet and infrastructure projects, and an increased risk of insolvency. As noted by Ukrainian researchers [14], the disruption of stability in the Black Sea region has led to a drastic shift in cargo flows and higher financial risks for shipping companies.

The rise in fuel prices is a critical factor that directly affects the economic performance of shipping companies. According to research conducted within the framework of an international environmental conference [15], maritime transport has proved to be the most sensitive to fuel price fluctuations: increases in oil and gas prices lead to a substantial rise in operating costs compared to other modes of transport.

Another significant factor is the depreciation of the national currency. For maritime transport enterprises that purchase fuel and spare parts in foreign currencies, a decline in the exchange rate immediately translates into higher costs. According to the results of an economic analysis conducted in import-dependent countries [16], a 10% depreciation leads to an approximate 9% increase in import-related expenses, which in turn results in a loss of up to 4% of marginal profit. This underscores the need for currency hedging and flexible financial policies within corporate strategy management.

Equally important is the tightening of environmental regulation, which has become strategically significant in current conditions. The inclusion of maritime transport in the European Union Emissions Trading System (EU ETS) [17], as well as the implementation of FuelEU Maritime [18], imposes substantial financial pressure on shipping companies. According to expert assessments, new requirements concerning the use of "green" fuels and the installation of emission-control systems may increase transportation costs by 8–10% [19]. Since alternative fuels are currently much more expensive and limited in availability, companies are compelled to revise their investment programmes and incorporate environmental compliance costs into their long-term strategies.

Thus, the examples provided demonstrate that the key external factors (freight rate levels, fuel prices, exchange-rate fluctuations, environmental regulation, etc.) not only shape the main risks but also become decisive elements in strategic planning. They necessitate a shift from descriptive analysis to an economically oriented approach that enables quantitative assessment of development scenarios and the formation of resilient corporate strategies. The growing volatility of global markets, the emergence of new environmental requirements, and intensified competition further increase the need for forecasting models and quantitative analytical methods. Maritime transport enterprises are compelled to adapt their strategic decisions to rapidly changing conditions, responding promptly to price shocks and regulatory shifts. What becomes important is not only identifying the influencing factors but also assessing their intensity, temporal dynamics, and potential long-term effects.

Table 1 presents a system of indicators for assessing the impact of external factors on maritime transport enterprises in accordance with the components of PESTEL analysis.

The proposed system makes it possible to quantitatively interpret the external factors affecting maritime transport enterprises, thereby creating a foundation for further economic assessment and the development of corporate strategies.

Conclusions. The study of external determinants shaping the functioning of maritime transport enterprises has resulted in the substantiation of a methodological approach grounded in the PESTEL framework and characterized by a clear economic focus. This enables the alignment of analytical tools with the practical needs of strategic management and establishes a logical transition from environmental monitoring to the formulation of effective managerial decisions.

It has been shown that within the political and legal subsystems, the defining factors are the stringent requirements of international conventions and European regulatory initiatives concerning decarbonization and safety. For enterprises, this implies the need to assess the consequences of regulatory changes in advance, plan fleet modernization, adapt ship energy systems and documentation procedures, and develop internal compliance policies that minimize penalty-related and reputational risks.

The economic component of the external environment is manifested primarily through energy prices, freight rate volatility, customs and tax regimes, and exchange-rate fluctuations. Taken together, these factors determine voyage cost levels, transport margins, and the stability of cash flows.

Social factors manifest themselves through the availability and quality of maritime labour, labour-standard requirements, trade-union pressure, and the growing societal demand for "green" services. For strategic management, this implies the need to maintain workforce resilience, invest in crew training and certification, and shape a service offering with clearly defined ESG attributes.

Table 1

System of indicators for assessing the impact of external factors on maritime transport enterprises

PESTEL Group	PESTEL Factor	Indicator	Unit of Measurement
1	2	3	4
Political	Regulation of Maritime Transport	Enterprise expenditures for compliance with international conventions and PSC inspections	monetary units per year
			% of operating costs
	Climate Policy Commitments	Expenditures for purchasing emission quotas and environmental certification	monetary units per year
		Change in transportation cost due to alternative fuels	% of cost price
	Regional Development Policy	Number of days the vessel is delayed due to sanctions or route changes	days/year
		Additional insurance premiums (war risk)/ surcharges on freight due to risk zones	monetary units per year
	Tax Policy	Effective corporate income tax rate	%
		Scope/availability of tax incentives for “green” investments implemented by the enterprise	monetary units per year
		Level of expenditures related to taxation	monetary units per year
	Safety Policy	Expenditures related to mitigating security risks at maritime enterprises	monetary units per year
		Expenditures on vessel protection and security assurance	monetary units per year
Economic	Fuel Cost	Change in voyage cost due to fluctuations in fuel prices	monetary units per voyage
		Share of fuel expenses in total voyage cost	%
	Volatility of Freight Rates	Profit/loss caused by fluctuations in freight market rates	monetary units per year
		Share of loss-making voyages	%
	Cost of Second-Hand Vessels	Average market price for acquiring a vessel of a given type and class	monetary units
		Capital expenditures for fleet renewal	monetary units per year
	Customs Policy	Average customs clearance time	hours
		Financial consequences of downtime of vessels and cargo at ports due to customs procedures	monetary units per year
	Level of Infrastructure Development	Average vessel handling time at ports	hours
		Efficiency of port and terminal infrastructure	TEU/hour
	Economic Stability	Exchange-rate impact on expenditures	monetary units per year
		Share of foreign-currency expenses in total cost structure of the enterprise	%
	Port THC Tariffs (handling and logistics operations)	Average HPR tariff per voyage	monetary units per ton or per TEU
		Share of HPR costs in total transportation cost	%
	Cost of Labor Resources	Average wage level	monetary units per year
		Staff turnover rate	%
Social	Personnel Qualification	Number of certified crew members (STCW)	persons
		Average crew salary	monetary units per month/year
	Public Support for Environmental Initiatives	Share of contracts using “green” services	%
		Share of revenue from “green” services	monetary units per year
	Demographic Changes	Expenditures for recruitment and training	monetary units per year
		Average employee age	years
	Social Conflicts	Additional costs (demurrage, detention)	monetary units per year
		Loss of working time	days per year

Continue Table 1

1	2	3	4
Technological	Innovation in Shipbuilding	Fuel savings after modernization	% of revenue
		Capital expenditures for an energy-efficient fleet	% of revenue
	Logistics Technologies	Share of containers with digital tracking	%
		Number of PCS (Port Community System) terminals in ports	units
	Environmental Technologies	Expenditures on emission reduction	mon. un./CO_2-equivalent
		Number of vessels using alternative fuels	units
	Development of Information Systems	Share of cargo transported with e-documentation	%
		Use of artificial intelligence in route planning	% ships
Environmental	Climate Change	Number of days of delays due to storms	days per year
		Additional expenses for route deviations	monetary units per year
	Environmental Safety Requirements	Volume of CO_2, NO_x, SO_x emissions	tons per year
		Environmental protection expenditures	monetary units per year
	Biodiversity Protection	Volume of treated ballast water	%
		Number of protected marine zones passed	units
	Investment in Sustainable Development and Greening	Share of "green" investments in total capital expenditures	% of total investment
		Availability of ESG reporting	yes/no
		Waste treatment costs	monetary units per year
Legal	International Maritime Conventions	Number of changes in conventions	units
		Fines for non-compliance	monetary units per year
	Local Legislation	Size of port dues	monetary units per ton
		Storage/demurrage/detention charges	monetary units per day
		Administrative procedure duration	hours
		qualitative/quantitative assessment	yes/no
		Number of regulatory requirements	monetary units per year
	Labor Standards Compliance	Percentage of violations identified	%
		Number of labor condition inspections	units/year
	Insurance Requirements	Vessel insurance cost	monetary units per year
		Number of insurance incidents	units/year

Source: developed by the author

The technological block of factors–including logistics digitalization, e-documentation, fleet-monitoring systems, and intelligent routing–affects both productivity and cost structure. Innovations make it possible to reduce cargo-handling time, lower fuel consumption, improve schedule predictability, and decrease the share of ballast voyages.

Environmental factors–primarily externalities and emission-pricing mechanisms–are already shaping the new economics of maritime transport. The study provides methodological guidelines that help enterprises integrate environmental external effects into cost calculations and pricing policies, set investment priorities, and communicate "green value" to clients.

Based on the proposed systematization, a set of indicators has been outlined for each PESTEL group–from regulatory and price-related to technological and institutional. Although the article deliberately refrains from performing quantitative calculations, these indicators serve as reference points for further environmental monitoring and for translating qualitative observations into actionable decisions. This makes it possible to develop a risk map, identify threshold values for action triggers (fleet renewal, rerouting, adjustment of contractual terms), and align investment programmes with decarbonization and safety requirements.

In summary, environmental regulation and fuel prices act as the primary drivers of cost growth; freight-rate volatility remains the key source of revenue instability; while currency and insurance factors determine financial resilience. Integrating the qualitative insights of PESTEL into the strategic management framework creates the prerequisites for improving resource efficiency, enhancing flexibility in the selection of strategic alternatives, and strengthening competitiveness within global supply chains.

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