

A THEMATIC ANALYSIS OF EXPERT INSIGHTS ON TRENDS INCLUDING TECHNOLOGICAL ADVANCEMENTS, SUSTAINABILITY - NAVIGATING THE FUTURE OF SHIPPING

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ABSTRACT

The study explores and identifies practices shaping the future of the shipping industry by conducting semi-structured and in-depth interviews with a purposive sample of twelve senior leaders from the shipping industry between Feb and March 2024. Interviews were audio-recorded, transcribed, and analyzed by using inductive methods. Interviewees shared insights into their personal career trajectories, the influence of stringent International Maritime Organization (IMO) regulations, and the integration of emerging technologies like real-time monitoring and automation within their operations. Findings led to a two-dimensional model representing how industry leaders navigate the evolving challenges in the global shipping landscape. The first dimension focuses on core processes, including regulatory compliance, technological integration, and sustainability transitions while the second dimension emphasizes contextual interactions, including the diversity factor and the broader global shipping dynamics, such as geopolitical shifts, market demands, and workforce diversity. Nine overarching themes were found: Career Evolution and Professional Growth, Technological advancements, Regulatory changes, Environmental Sustainability, Role of women, Ship building and scrapping, Global Shipping Dynamics, Challenges and Future Trends.

Implications *The findings offer a rich understanding of the current, future of shipping and the factors that will assist both policy and operational level decision making.*

Keywords: sustainability, workforce diversity, infrastructure development, operational efficiency, shipping

INTRODUCTION

The shipping industry is a vital component of the global economy, facilitating the transportation of approximately 90% of the world's goods by volume (Stopford, 2020). As such, it is heavily influenced by broader global trends, including sustainability initiatives and technological advancements. Sustainability has emerged as a major concern across the globe, with governments, businesses, and consumers increasingly prioritizing environmentally friendly practices. The push for sustainable development is reshaping various sectors, from manufacturing to energy, and is expected to permeate the shipping industry as well. As nations implement stricter regulations to meet international climate commitments, shipping companies may face increased pressure to reduce emissions and adopt more sustainable practices. This shift could lead to rising operational costs, necessitating changes in logistics strategies and potentially affecting shipping rates and competitiveness. In addition, technological advancements are transforming industries worldwide, impacting everything from supply chain management to consumer behavior. The rise of automation, artificial intelligence, and data analytics has revolutionized how businesses function and the shipping industry will need to adapt to remain relevant. Changes in consumer expectations for faster and more transparent

shipping services may require companies to invest in new technologies to improve efficiency. If shipping companies fail to keep pace with these advancements, they risk losing market share to more agile competitors.

Moreover, the global economy is also experiencing significant geopolitical shifts that influence trade dynamics like trade wars, tariffs, and changes in international relations which can disrupt established shipping routes and patterns. For example, tensions between major economies could lead to rerouted shipments and altered supply chains, creating uncertainties for shipping companies. Furthermore, the recent disruptions caused by global events, such as the COVID-19 pandemic, have highlighted the vulnerabilities within supply chains and the shipping sector. Such disruptions can lead to delays, increased costs, and shifts in consumer behavior, ultimately impacting shipping volumes and profitability. As the world continues to recover and adapt, it is essential to explore how these factors will influence the shipping industry in the coming years.

Thus, the need to explore the current state of the shipping industry is underscored by the global trends of sustainability, technological advancement, and geopolitical shifts. Understanding how these factors interact with the shipping sector will provide valuable insights for stakeholders seeking to navigate the evolving landscape of international trade and ensure long-term success. Besides studying recent trends can inform policy decisions and regulatory frameworks, ensuring they are responsive to the needs of the industry and its stakeholders. By investigating how industry leaders are adapting to these changes, researchers can contribute to a more resilient and sustainable shipping sector.

Objective

The objective of this study is to explore and identify practices shaping the future of the shipping industry by conducting in-depth interviews with industry experts. With a philosophy of realism, using an inductive approach and thematic analysis, the study aims to uncover key trends, patterns, and insights that offer a deeper understanding of how industry leaders perceive and navigate these changes, and to develop a conceptual framework that reflects the evolving landscape of the global shipping sector.

LITERATURE REVIEW

In recent years, the shipping industry has transformed due to economic, environmental, and technological changes across the globe. The current global competition demands greater efficiency and cost-effectiveness, while climate change drives the adoption of sustainable practices like alternative fuels and energy-efficient designs. These changes have asked for broader innovation trends, addressing market pressures and regulatory demands. Various shipping routes have been developed and potential new passages in the Arctic, helps the industry's adaptability to changing climatic and geopolitical landscapes, which significantly impact shipping dynamics Rovenskaya, (2024). The recent emphasis on sustainability often puts pressure on shipping companies, collaborative mechanisms emerging among ports and shipping lines represent a promising avenue for mutual investment in emission reduction technologies Jin (2024).

Use of Internet of Things (IoT) enhances operational visibility, enabling firms to optimize routes and reduce fuel consumption and also aligns with global sustainability goals. Research indicates that these innovations not only streamline processes but also reshape the competitive landscape by attracting capital and talent into the industry Jihong Chen, (2024). Studies were done to find out the relationship between pandemic-related shocks and maritime stocks and it was found that companies which were digitally advanced were responding more effectively to the disruption around evidencing a bidirectional causal association that

underscores the importance of digital readiness in navigating unforeseen challenges Wu, (2024).

The shipping industry is constantly under pressure to take up sustainable practices to combat climate change and also reduce ecological footprints. Global companies in the maritime sector have successfully employed electrification and decarbonization strategies, demonstrating that it is possible to enhance environmental performance while maintaining operational efficiency. I. Ermakov et al., (2024). Industries are looking at alternative fuels and it helps in addressing the environmental concerns and also gives new opportunities for businesses and jobs. Oluwakemi Betty Arowosegbe et al., (2024) The implementation of electrification and decarbonization strategies has been shown to substantially improve environmental performance within maritime operations I. Ermakov et al., (2024). The adoption of innovative practices, including the use of renewable energy sources and advanced monitoring systems, has emerged as vital countermeasures to combat pollution and mitigate the adverse effects of shipping activities Ioannis Filippopoulos et al., (2024). Studies underscore the urgent need for port-related industries to embrace digitalization, eco-friendliness, and automation—elements identified as critical for maintaining competitiveness in an evolving global market Dae-Hwan Jeong et al., (2024). The pandemics' detrimental effects, evidenced by significant declines in container volumes and international transport routes, illustrate how external shocks can rapidly disrupt industry operations Xiaolei Liu et al., (2020).

It can be observed that most of the literature do not take an Indian perspective. The predominant themes are on sustainability and operational efficiency

RESEARCH METHODOLOGY

A qualitative analysis is used to understand the themes, meanings, and patterns within textual data. This approach has been used to explore future phenomena as quantitative data falls short and the importance of coding and categorizing data to identify recurring themes and insights is emphasized Saldana (2015).

This study adopts the Realism Philosophy. Realism assumes that an objective reality exists, independent of individual beliefs or perceptions. Researchers can uncover this reality through systematic inquiry. Realist researchers believe that interviews can reveal actual trends as they exist in the world. They aim to identify patterns in industry behavior that exist independently of individual opinions but can be accessed through experts' insights. Interviews are seen as a tool to capture real-world data about market dynamics, which reflects an underlying objective reality. An Inductive Approach which involves gathering data (in this case, through interviews) and then deriving patterns, theories, or conclusions from that data is adopted. It moves from specific observations to broader generalizations.

Content Analysis

The study further intends to quantify specific elements of the interviews, such as how often certain words or phrases related to trends are mentioned through content analysis. This approach involves systematically counting the frequency of specific terms or categories. It is intended to measure and quantify the prominence of specific themes. Four criteria are used to ensure the quality of output - credibility, transferability, dependability, and confirmability (Lincoln and Guba, 1985). Credibility was ensured through careful planning during the interview process with four senior management professionals. The participants were selected based on their expertise and relevance to the study as they were the senior management members in the shipping industry. The interview was conducted face to face and were recorded.

Interview responses were transcribed. All the participants reviewed transcripts for accuracy, ensuring their perspectives were faithfully captured, thus enhancing the validity of the findings. Transferability is ensured by providing a detailed description of the research process. Transferability in the interviewing process is ensured by checking on participant backgrounds, and interview settings. Dependability and confirmability were addressed through research notes that documented decisions and developments. A standardized interview protocol was followed to maintain consistency across all interviews. Responses were recorded and transcribed verbatim, ensuring accuracy Figures 1 & 2.

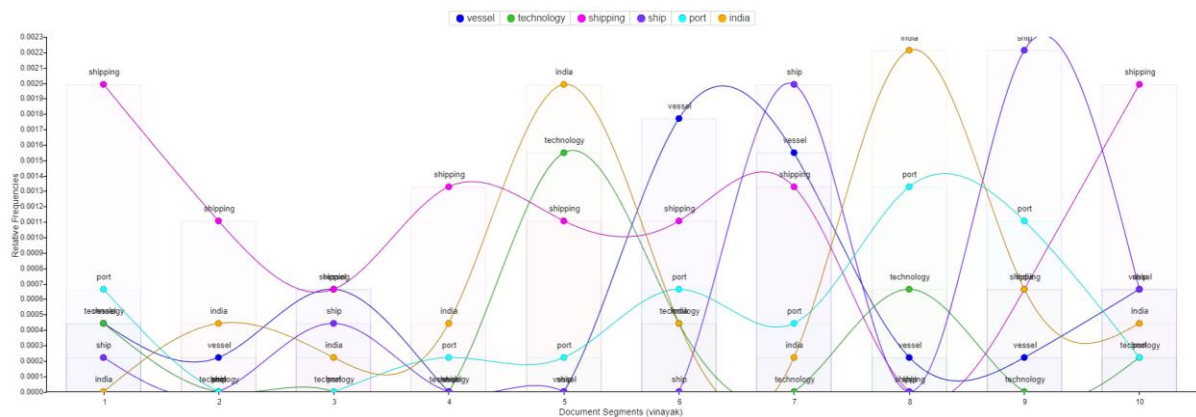


FIGURE 1
DIAGRAM SHOWS THE MOST FREQUENTLY USED WORDS IN THE INTERVIEW

This analysis provides a comprehensive understanding of the various factors impacting the shipping and logistics industry as derived from the interview.

Most Frequent Words in the Corpus

Shipping (157); india (110); ship (87); industry (79); ships (65); port (61); vessel (56); years (51); china (48); business (47); technology (46); logistics (40); vessels (37);

Distinctive Words (compared to the rest of the corpus):

Oil (8), emissions (8), sustainability (7), fuel (11), ship's (5), sewage (5), pollution (5), environment (18), regulations (21), water (8), rules (8), , hazardous (4), evolved (4), capital (11), terminal (10), policy (9), terminals (7), rupees (7), logistics (32), operators (6), labor (6), businesses (6), automobile (6), dock (5), class (7), society (3), offices (3), guidelines (3), classes (3), administration (3), maintenance (5), dry (5), thorough (2), shipyard (4), rules (4), regional rotterdam (8), automation (7), zurich (6), speed (6), series (6), container (12), catering (6), economy (11), spare (5), rice (5), metal (5), women (9), systems (9), transported (4)

Thematic Analysis

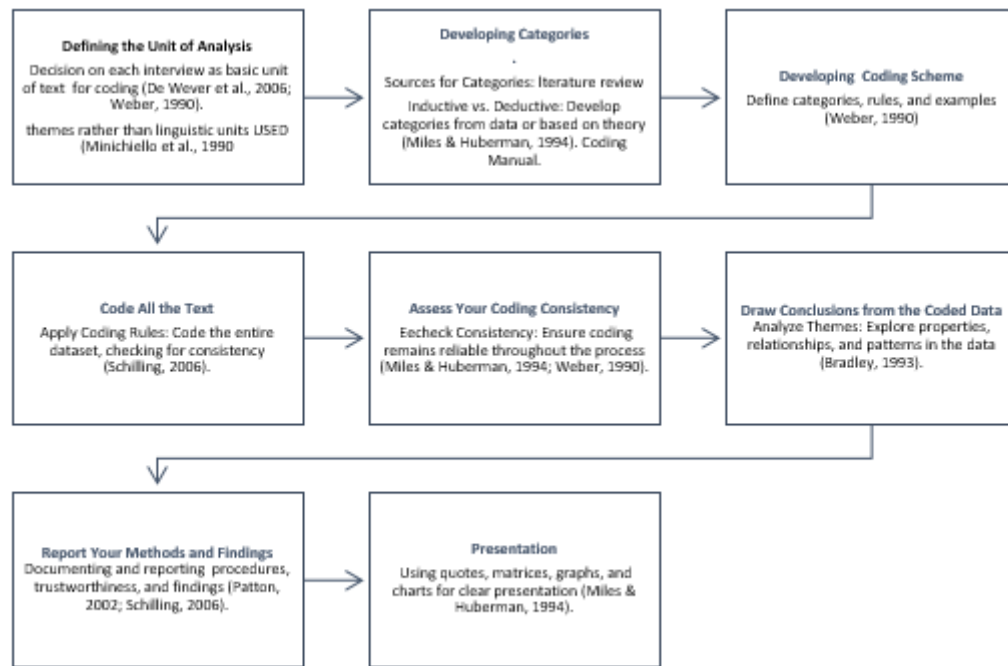


FIGURE 2
THE RESEARCH PROCESS ADOPTED DEPICTED

Below is a consolidated thematic codes table derived from the interview transcripts Table 1.

Table 1 INTERVIEW TRANSCRIPTS		
THEME	Code	Interview Extract
Technological Advancements and Automation	TAA01	<p>"Technology has played a major role, especially in communication, and now emissions are controlled with electronic fuel injection systems."</p> <p>"The most important and significant development has been the introduction of IT services in shipping automation processes...it's only after the introduction of basic email services..."</p> <p>"A lot of digitization is coming up in the industry... You build a tariff system and it can auto quote to the customers around the scene."</p> <p>"These primary documents get into other documents. For example, they become the shipping for the custom filing and then we're going to bill of lading."</p> <p>"Shipping lines having auto quote... now it's available online. You can book and rate compare, book and proceed."</p> <p>"Now with that, the machine has been learning. There are good known software in the US wherein you don't have to type the full details... it's all dropped down."</p> <p>"So, technology has helped to reduce the documentation aspect of it. We don't have to replicate the work."</p> <p>The digitalization... I definitely feel that digitalization has happened more in China and US of course, because both... even I would say it happened not in the Middle East."</p>

Operational Efficiency	OE01	<p>"Technology has played a major role in operating vessels more efficiently, reducing emissions and fuel consumption."</p> <p>The workflow and control of the processes have shifted from the vendor side to the client side...old processes were very much analog and paper-based."</p> <p>"The efficiency of the port depends on two factors... how quickly the containers will be evacuated from the port."</p> <p>"We stopped the service as it didn't work out well."</p> <p>"Adani port is much more efficient and showed profits."</p> <p>"Technology has played a major role... ships are monitored every second... communication has evolved so much that seafarers are always connected."</p>
Fuel and Environmental Concerns	FEC01	<p>"The shift to alternative fuels like ammonia, gas, and nuclear energy is crucial to minimizing carbon emissions."</p> <p>"Due to the increase in fuel prices, there is a lot of place for research and innovation in finding alternative fuels like hydrogen."</p> <p>"Technology has played a major role... ships are monitored every second... communication has evolved so much that seafarers are always connected."</p> <p>We need to shift towards alternative fuels... the market is moving towards ammonia, electrical propulsion, and eventually nuclear energy to reduce emissions to nearly zero."</p> <p>"We didn't get any subsidies or any incentives from the government as a policy sector to operate... the port charges full due, a full carbon handling."</p> <p>"We need to shift towards alternative fuels... the market is moving towards ammonia, electrical propulsion, and eventually nuclear energy to reduce emissions to nearly zero."</p>
Global Trade and Containerization	GTC01	<p>"Container ships like those owned by MAERSK and MSC handle massive global trade volumes, making them key players in international logistics."</p> <p>"The evolution of containerized cargo started in the 70s...containerized cargo takes care of more than 70 to 80% of the movement."</p> <p>"Benchmarking the ports are in China and Europe... Antwerp port is one of the most efficient."</p> <p>"One vessel takes a particular container... the final destination may be Ghana."</p>
Infrastructure Disparities	ID01	<p>"Ships built in China are much cheaper than those built in Japan or Europe, making Asia the new leader in ship production."</p> <p>"We are at least 20 to 30 years behind well-developed shipping infrastructure countries...the ports in China are far more bigger than even the shipping hubs in other parts of the world."</p> <p>"The terminal operators are private operators... we have met the port chairman of Chennai and Pondicherry... every time they say they will do but doesn't happen."</p> <p>"The port doesn't have any terminals."</p>
Economic Impact and Job Creation	EIJ01	<p>"The shipping industry is a major revenue generator globally, and countries like India are beginning to invest in inland waterways for further economic benefits."</p> <p>"Jobs have not been lost in this process but a lot of jobs also have been created due to automation and IT systems coming in especially in the back-end process."</p> <p>"The decision-making is not very futuristic... it is not very situational-based decision-making."</p> <p>"If the infrastructure should be there... policy would have helped."</p>
Workforce Diversity and Gender Inclusion	WDGI01	<p>"Women are now entering all ranks of the shipping industry, and this is a welcome change. One of our ships is completely manned by women."</p>
Strategic Global Hubs	SGH01	<p>"Strategic hubs like Europe, the U.S., and now Asia, are becoming key players in shipping logistics."</p> <p>"In Europe, we have Antwerp port... Hamburg port... these are big transshipment ports."</p> <p>"Hub and spoke concept-wise, certain ports in Europe and in China... in Hong</p>

		Kong, Singapore is the most efficient ports." "There's a lot of risk on the contingency and liability side of it."
Challenges in Compliance and Maintenance	CCM01	"MARPOL and other international regulations ensure that emissions, ballast water, and sewage are strictly monitored and compliant." "The introduction of automation processes in shipping has itself been a revolution...the volumes being catered to by the ports is unimaginable." "The regulations have become stringent over emissions... we have International conventions like MARPOL to prevent pollution and safeguard the environment." "The cargoes are not evacuated quickly from the port to the yard... so U.S. logistically is not so great in comparison to Europe and China." "Why would you operate a ship which is not efficient? Then you're losing money on a daily basis." "The regulations have become stringent over emissions... we have International conventions like MARPOL to prevent pollution and safeguard the environment."
Sustainability and Future of Shipping	SFS01	"Sustainability is now a hot topic, not just in shipping but across industries. The move to alternative fuels is key to making shipping more eco-friendly." "Sustainability is now one of the hot topics... shipping is the prime mover... majority of the cargo is transported by ships... we need to minimize environmental damage." "Sustainability is now a hot topic...the need for global trade comes into place, and that is when the need for transportation at a bigger level is required." "Sustainability is now one of the hot topics... shipping is the prime mover... majority of the cargo is transported by ships... we need to minimize environmental damage."
Ship Recycling , Environmental Impact	SREI01	"Ship recycling in India and Bangladesh is now highly regulated, ensuring minimal environmental harm when ships are scrapped."
Evolution of Maritime Regulations	EMR01	"Regulations governing shipping have become increasingly stringent, especially with the advent of MARPOL, which controls everything from emissions to sewage discharge."
Shipbuilding Lifecycles and Maintenance	SLM01	"Ship lifecycles are dependent on continuous maintenance, regulatory compliance, and machinery upgrades. Ships can be scrapped if they can't meet new standards."
Impact of Global Warming on Shipping	IGWS01	"If the shipping industry continues using hydrocarbon-heavy fuels, it will contribute significantly to global warming. Shifting to sustainable practices is essential." "If we continue using hydrocarbon-heavy fuels, we will significantly contribute to global warming... we are looking for sustainable solutions." "If the shipping industry continues using hydrocarbon-heavy fuels, it will contribute significantly to global warming." "If we continue using hydrocarbon-heavy fuels, we will significantly contribute to global warming... we are looking for sustainable solutions."
Global Leadership in Shipping Industry	GLSI01	"Shipping is now globally regulated by the IMO, which governs emissions and operational standards worldwide. Asia, Europe, and America are key players in the industry's future." "The shipping industry has to be responsible for future generations... we are at a stage where compliance is inspected and regulations are strictly followed by 99% of shipping companies." "We are at least 15 to 20 years behind...compared to the world's best port today, which is Singapore or Hong Kong."

		"The shipping industry has to be responsible for future generations... we are at a stage where compliance is inspected and regulations are strictly followed by 99% of shipping companies."
Technological Shifts in Seafaring Culture	TSSC01	"Seafarers no longer need to be as physically tough as before, thanks to machinery and technological assistance. However, this shift has also reduced the toughness required for the profession." "The introduction of automation processes has changed the volumes...it has opened doors for all small and medium scale enterprises." "The way we train seafarers has become less stringent... technology now allows for around-the-clock assistance... this has changed how seafarers operate at sea."

Inference

The thematic analysis of the shipping industry reveals several inferences that can be drawn about the current trends and challenges. Here are the key inferences based on the thematic codes and insights:

Adoption of technology is essential for competitiveness: Technological advancements are crucial in revolutionizing shipping operations, highlighting the need for continuous adaptation to technological changes for increased efficiency and job creation. All interviews emphasize the transition from traditional methods to advanced technologies that enhance efficiency and safety. The shipping industry is undergoing a technological revolution, with advancements in IT, automation, and AI significantly enhancing operational efficiency and creating new job roles. To remain competitive, companies and ports must continue to invest in and adapt to these technologies.

Operational efficiency is a key differentiator: Operational efficiency is a benchmark set by developed ports, encouraging the adoption of paperless processes and reduced turnaround times across the industry. Developed ports, particularly in Europe, demonstrate that operational efficiency, achieved through digitalization and streamlined processes, is crucial for maintaining a competitive edge in the global market. Other ports can benefit from adopting these best practices to improve their own operations.

Environmental sustainability is a growing priority: Environmental sustainability remains a significant challenge, with ongoing efforts to innovate alternative fuels and reduce the industry's carbon footprint. A shared theme across interviews is the industry's push towards sustainability, including alternative fuels and better waste management. The industry faces pressure to reduce its environmental footprint by exploring alternative fuels and sustainable practices. However, the challenge lies in implementing these innovations effectively, which requires investment and commitment from stakeholders.

Workforce diversity is progressing but needs more attention: Workforce diversity is improving, with increased roles for women in commercial sectors, though operational inclusivity remains a challenge. The growing role of women due to technological advancements is acknowledged as a positive shift in the industry. - There is a positive trend toward greater diversity and inclusion in commercial and IT roles within the shipping industry. However, more effort is needed to achieve gender balance, especially in operational roles on vessels.

Containerization is a cornerstone of modern shipping: Containerization has been transformative, enabling global trade and multimodal integration, underscoring its role as a key industry game-changer. The shift to containerized cargo has fundamentally transformed global trade, allowing for seamless integration across different modes of transport. This efficiency continues to be a major factor in the growth of international shipping.

Infrastructure development is crucial for emerging economies: Infrastructure disparities highlight the need for strategic improvements in regions like India, where bureaucratic red tape and infrastructural lag hinder potential economic growth. Countries like India face significant infrastructure challenges, often exacerbated by bureaucratic red tape. Addressing these disparities is essential for these economies to fully leverage the benefits of global trade and economic growth.

Shipping industry's economic impact is significant: Economic impact of the shipping industry is undeniable, contributing to global trade, economic development, and job creation across various sectors. The shipping industry plays a vital role in facilitating global trade and contributing to economic development. It generates numerous job opportunities, particularly in roles related to new technologies and automated systems.

Strategic global hubs drive trade efficiency: Strategic global hubs illustrate the significance of advanced infrastructure and strategic location in managing global trade, with China as a dominant leader. Ports like Singapore, Shanghai, and Rotterdam are crucial to global trade due to their advanced infrastructure and strategic locations. These hubs highlight the importance of positioning and infrastructure investment for maintaining and enhancing trade efficiency.

Regulatory changes: There is a consistent focus on increasingly stringent regulations aimed at improving environmental and operational standards.

Overall Inference

The analysis indicates that while the shipping industry is making strides in technology adoption and operational efficiency, significant challenges remain in environmental sustainability, infrastructure development, and workforce diversity. Strategic investment and policy reforms are needed to address these challenges and harness the full potential of the shipping sector in driving global economic growth. Additionally, countries lagging in infrastructure must prioritize development to benefit from the industry's advancements and opportunities.

Future Directions

While much attention has been paid to the technical aspects of automation, real-time monitoring, and digital shipping platforms, there is limited research on the human side of technological adoption. How these changes impact the workforce in terms of skill sets, job security, and productivity remains under-explored. Future studies should investigate the social and operational impacts of digitization, including how these technologies affect day-to-day operations, employee training needs, job redesign, and overall workforce adaptability in shipping.

Although the IMO's regulations are well-documented, there is a gap in understanding the operational challenges of complying with these regulations. How different segments of the industry—small versus large shipping companies, for example—cope with the increasing regulatory burden, and how this affects operational costs and efficiency, needs further exploration. Research should investigate best practices in regulatory compliance, with a focus on cost-effective solutions for companies to meet IMO emissions targets and waste

management standards. Comparative studies between regions with different regulatory enforcement could offer insights into more globalized compliance models.

While there is significant interest in alternative fuels, such as LNG, hydrogen, and biofuels, there is insufficient research on the long-term viability, environmental impacts, and cost-efficiency of these alternatives, particularly in emerging markets where infrastructure is underdeveloped. Research should focus on comparative lifecycle analyses of alternative fuels, assessing both the environmental and economic trade-offs. Future studies could also explore the infrastructure challenges for the global implementation of sustainable fuel technologies and identify which markets are most likely to benefit. While challenges such as regulatory compliance and sustainability are recognized, there is limited research on how shipping companies strategically integrate sustainability into their long-term business models. Specifically, how sustainability efforts are financed, monitored, and aligned with broader industry objectives is underexplored. Future research could examine innovative business models that successfully incorporate sustainability initiatives while remaining profitable. This could include exploring the role of public-private partnerships, green financing, and the integration of environmental, social, and governance (ESG) metrics into company strategies.

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