



## Integrating Financial Literacy, Sustainability, and Industry Collaboration in Curriculum Development (Enhancing Maritime Education)

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Submitted on : 06/05/2024   Revised : 12/11/2024   Accepted : 20/12/2024

### ABSTRACT

*This research investigates the effectiveness of maritime education in addressing the evolving needs of the maritime industry, with a particular focus on shipping management, maritime business, financial literacy, and sustainability. The study employs qualitative methods, including semi-structured interviews with maritime professionals, educators, and graduates, to assess the alignment of current curricula with industry requirements. Results indicate that while maritime education provides a solid technical foundation, it falls short in integrating modern financial practices and sustainability principles. Stakeholder collaboration between industry professionals, educators, and students was found to be valuable but underdeveloped, highlighting the need for more structured partnerships. With an overall score of 9/10 across all indicators, the research suggests that incorporating financial decision-making and sustainability into the curriculum is essential for preparing graduates for future industry challenges. The study emphasizes the importance of adapting maritime education to equip students with the skills necessary to thrive in an increasingly complex and environmentally-conscious global maritime sector.*

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**Keywords:** maritime education, curriculum development, financial literacy, sustainability, industry collaboration

### INTRODUCTION

As one of the largest sectors contributing to the world's economy, it drives the movement of goods and materials across continents, shaping international commerce and influencing national economies. However, despite its economic importance, the maritime industry faces significant challenges, especially in the areas of sustainability, financial management, and human resource development [1], [2]. For countries and

organizations to maintain a competitive edge, there is an urgent need for well-trained professionals who not only understand the complexities of shipping management and port operations but also have the financial acumen and sustainable practices required to thrive in an increasingly volatile, interconnected world [3], [4].

At the heart of these challenges is maritime education, which must evolve to meet the demands of the modern maritime sector. The traditional

approach to maritime training has largely been technical, with an emphasis on operational skills and seafaring expertise. However, as the industry becomes more complex, driven by financial intricacies and sustainability imperatives, there is an increasing need for maritime educational frameworks that integrate knowledge of financial management, sustainable practices, and innovative business strategies into the curriculum [5], [6]. This presents a significant gap in current maritime education, where traditional curricula may not sufficiently equip students with the skills required to address the financial, environmental, and managerial challenges of the modern maritime world.

The primary aim of this research is to critically examine how maritime education can be enhanced to better align with the evolving needs of the maritime industry, particularly in the fields of port and shipping management, maritime business, financial monetary practices, and sustainability. This study specifically focuses on the development of a financially grounded maritime curriculum—one that incorporates the perspectives of educators, industry professionals, and graduates in a comprehensive, interdisciplinary manner. By exploring these perspectives, this research aims to bridge the gap between the theoretical aspects of maritime education and the practical, financial, and sustainable challenges professionals face in the industry.

The maritime industry is characterized by its immense financial implications. From port operations to shipping companies, financial decisions underpin every facet of the industry [7], [8]. As such, the curriculum taught at maritime vocational schools should not only cover traditional aspects of maritime management, such as navigation, cargo handling, and logistics, but also emphasize the importance of financial literacy, risk management, and monetary decision-making in shipping and port operations. Understanding the financial landscape of the maritime industry is paramount, as fluctuations in fuel prices, labor costs, regulatory changes, and market demand can all impact the bottom line of a maritime business. Professionals in the industry must be equipped with a comprehensive understanding of the economic forces at play, as well as the financial tools and strategies needed to make informed decisions in an ever-changing global market.

Moreover, the issue of sustainability has become a driving force in the global maritime sector. With growing concerns over climate change and the environmental impact of shipping operations, there is a significant push within the industry to adopt greener, more sustainable

practices. International regulations, such as the International Maritime Organization's (IMO) greenhouse gas reduction targets, are pushing the industry toward more energy-efficient technologies, renewable fuel options, and eco-friendly shipping practices [9]–[12]. The integration of sustainability into maritime education is therefore critical, as it enables future professionals to not only comply with regulatory requirements but also lead initiatives that balance environmental responsibility with business viability. Sustainability in maritime operations is not limited to environmental considerations alone but also includes social responsibility and economic resilience, making it a multifaceted challenge that necessitates a forward-thinking educational approach.

This research adopts a qualitative, descriptive analysis methodology to explore the perspectives and experiences of key stakeholders within the maritime education and industry sectors. The research engages three main groups: maritime professionals who are entrepreneurs in the port and shipping industries, maritime officers and managers working within companies, and educators involved in teaching and researching maritime science. Additionally, the study includes insights from graduates who have completed their studies in maritime institutes, providing a comprehensive understanding of the challenges and gaps that exist between what is taught in maritime schools and the realities of the maritime business environment [13], [14].

The significance of the study lies in its potential to propose a more financially and environmentally grounded curriculum for maritime education. Through its focus on industry relevance, financial literacy, and sustainability, the research aims to propose a new approach that aligns maritime education with the needs of the modern workforce. The maritime professionals who were interviewed for this research have extensive experience in the industry and bring invaluable insights into the skills, knowledge, and expertise needed by future maritime professionals [15], [16]. Their input will inform the development of a curriculum that is not only relevant to the industry's current needs but also anticipates future trends, ensuring that graduates are equipped with the skills needed for long-term success.

The study will also explore the challenges faced by maritime educators in adapting their teaching methods and curricula to address the financial and sustainability demands of the industry. Maritime lecturers and researchers often find themselves at the intersection of theoretical knowledge and practical industry requirements.

Balancing academic rigor with the need for practical, real-world skills is a constant challenge. Furthermore, this research will examine how the perspectives of maritime graduates can offer valuable feedback on the gaps they encountered during their education, providing a critical evaluation of how well current maritime curricula prepare students for the realities of the industry.

In terms of urgency, this research is timely and necessary, as the maritime industry faces rapidly evolving challenges. The shift toward greener shipping practices, along with the increasing financial complexities of global maritime trade, requires a workforce that is not only technically skilled but also proficient in financial decision-making and sustainability practices. Maritime education must evolve to meet these challenges and equip future generations with the knowledge and skills to navigate the industry's changing landscape [14]. As such, this research will contribute to the development of a curriculum that empowers future maritime professionals to make informed financial decisions, adopt sustainable practices, and lead the way in innovative port and shipping management.

The findings of this research will have wide-reaching implications for maritime education. By offering practical recommendations for enhancing the curriculum, the research will help maritime vocational schools, universities, and training institutes develop more comprehensive programs that better prepare students for the multifaceted demands of the maritime industry. This will contribute not only to the competitiveness and sustainability of the maritime sector but also to the broader goal of fostering responsible, forward-thinking professionals capable of navigating the challenges of a globalized, environmentally-conscious economy.

Ultimately, this research aims to empower educators, industry professionals, and students alike to contribute to the development of a maritime industry that is both financially sound and environmentally sustainable. By integrating financial, business, and sustainability principles into maritime education, this study seeks to foster a new generation of professionals who are not only proficient in traditional maritime operations but also equipped to lead the industry in a rapidly changing world. The findings will be instrumental in shaping the future of maritime education and ensuring that the next generation of maritime leaders is prepared to meet the challenges of an increasingly complex, interconnected, and sustainable world.

## METHOD

This research adopts a qualitative research methodology to explore the perspectives and experiences of key stakeholders in the maritime industry, specifically focusing on the development and enhancement of maritime education [17], [18]. The methodology was chosen because it enables an in-depth understanding of the nuances within the maritime sector, where quantitative data alone may not fully capture the complex relationships, practices, and insights that shape the maritime business, financial, and sustainability sectors. A qualitative approach facilitates rich, descriptive insights into how stakeholders perceive the current state of maritime education and how it can be restructured to address the evolving needs of the industry.

The primary focus of this study is to examine the views of three distinct groups involved in maritime education and the maritime industry. These groups consist of maritime professionals, including entrepreneurs, officers, and managers working in port and shipping industries; maritime educators, who serve as lecturers, trainers, and researchers in maritime science and vocational programs; and graduates of maritime institutes. By engaging these three groups, the research aims to gather comprehensive insights into the strengths and weaknesses of the current maritime education system, particularly in areas of port and shipping management, maritime business, financial management, and sustainability.

To achieve the objectives of this study, a descriptive analysis was employed, which involves systematically analyzing the data collected from interviews and other qualitative data sources to uncover common themes, patterns, and emerging trends. Descriptive analysis allows the researcher to synthesize the experiences and perspectives of the participants, providing a thorough understanding of how maritime education can be restructured to better align with industry demands. This method does not aim to test hypotheses or provide statistical validation but focuses on capturing the lived experiences and subjective insights of the participants in their own words.

The data collection process involved semi-structured interviews with key participants from each of the three groups [19], [20]. The semi-structured interview format was selected because it provides flexibility to probe deeper into participants' responses while ensuring that specific themes critical to the research—such as financial literacy, sustainability practices, and the integration of industry needs into curricula—are adequately explored. This method allows for a more organic flow of conversation, where

participants can freely share their perspectives, and the interviewer can follow up with probing questions to gain further insights into complex issues. The interviews were conducted either in person or through virtual platforms, depending on the geographical location of the participants, ensuring that the data collection process was as inclusive and comprehensive as possible.

The maritime professionals interviewed for this study included entrepreneurs involved in the shipping industry, officers and managers from maritime companies, and individuals with extensive experience in port and shipping operations. Their insights provided valuable information on the real-world demands of the maritime industry, particularly with respect to financial decision-making, the management of maritime businesses, and the growing emphasis on sustainability within maritime operations. These professionals were able to highlight the skills and knowledge they deem most critical for the next generation of maritime professionals, helping to identify gaps between current educational offerings and industry expectations.

In addition to the maritime professionals, interviews were conducted with maritime educators who work as lecturers, trainers, and tutors in vocational programs for seafarers and maritime studies. These educators are well-positioned to provide an in-depth perspective on the challenges of integrating financial and sustainability topics into existing maritime curricula [21], [22]. Their experience in both teaching and researching in maritime science allows them to assess the effectiveness of current programs and suggest improvements or changes that could better prepare students for the demands of the maritime business world.

Furthermore, interviews with graduates who have completed their studies at maritime institutes were conducted to gather feedback on their educational experiences and how well their training prepared them for the realities of the maritime industry. The graduate interviews offered a reflective perspective on the curriculum, helping to highlight the gaps or areas that may require further attention. These participants, having recently entered the industry, can speak to the immediate applicability of the knowledge and skills they gained during their education, providing an important evaluative component to the research.

Data collected through these semi-structured interviews were transcribed and analyzed using thematic analysis. This involved carefully reading through the transcriptions, identifying key themes and patterns that emerged from the data, and categorizing these themes into overarching topics

that aligned with the research focus. The themes were then analyzed in relation to the three main indicators of the study: curriculum alignment with industry needs, stakeholder collaboration in curriculum development, and financial and sustainability awareness in education. By analyzing the responses from the three groups of participants, the research aimed to identify common threads and divergent views that would provide actionable insights for enhancing maritime education.

The ethical considerations for this research were also carefully addressed. All participants were informed about the purpose of the study and their consent was obtained before conducting interviews. Confidentiality was ensured throughout the research process, and participants were assured that their responses would only be used for academic purposes. This approach not only guaranteed the integrity of the research but also fostered an environment in which participants felt comfortable sharing their candid thoughts and experiences.

## **RESULTS AND DISCUSSION**

The research aimed to explore the enhancement of maritime education in the areas of port and shipping management, maritime business, financial monetary practices, and maritime sustainability. The study utilized qualitative methods, including semi-structured interviews with maritime professionals, educators, and graduates, to assess the effectiveness and alignment of maritime curricula with industry needs. Based on the findings, the research identified key indicators for improvement and development, scoring the efficacy of these indicators on a scale from 1 to 10, where 10 represents the highest level of effectiveness and efficiency.

The results indicate a high level of effectiveness across the key areas of shipping management, maritime business, financial monetary management, and maritime sustainability, with an overall average score of 9/10 across all three indicators. This demonstrates that, while improvements are still needed, the research participants agree that the current frameworks and suggestions for maritime education reforms are highly effective and can significantly enhance the maritime industry.

### **Indicator 1: Curriculum Alignment with Industry Needs**

The first indicator measured the alignment of maritime education curricula with the current and

future needs of the maritime industry. This aspect is crucial for ensuring that students are not only prepared for the technical and operational demands of the industry but are also equipped with the financial acumen and sustainability practices required for success in the global maritime sector.

The results showed that maritime professionals, including entrepreneurs, officers, and managers, expressed a high level of satisfaction with the integration of industry needs into the curriculum. They emphasized that while the basic operational knowledge required for maritime business is well-covered, there is a growing need for curricula to incorporate more financial decision-making, market analysis, and sustainability strategies. Many professionals indicated that maritime education should adapt more rapidly to changes in the industry, particularly concerning financial risks and environmental regulations.

Maritime educators shared similar views, noting that while the foundational aspects of maritime education are strong, there is a lack of emphasis on integrating modern financial practices and sustainability principles into course content. Several educators reported that although they recognize the importance of these topics, the current curricula often fail to offer the necessary depth, particularly in areas like green shipping technologies and carbon pricing in maritime operations.

Graduates, reflecting on their educational experience, pointed out that while the training in technical skills and logistics management was valuable, they found limited exposure to financial decision-making tools and eco-friendly shipping practices in their coursework. Graduates, especially those who transitioned into managerial roles, noted that they had to learn many of these skills on the job, highlighting the need for better integration of business and sustainability modules into the curriculum.

The curriculum alignment with industry needs received a score of 9/10, with feedback suggesting that the curriculum generally covers the basic operational aspects of maritime education effectively. However, there remains significant room for further integration of financial literacy and sustainability into the program.

Indicator	Rating	Comments
Curriculum alignment with industry needs	9/10	High alignment, but financial literacy and sustainability integration require further development to meet modern industry demands.

## Indicator 2: Stakeholder Collaboration in Curriculum Development

The second indicator assessed the extent to which **industry professionals**, **educators**, and **graduates** collaborate in the development of maritime curricula. The goal was to understand how well these groups work together to ensure that educational programs are both academically rigorous and highly applicable to real-world challenges in maritime management.

Stakeholders, particularly **maritime professionals**, were generally optimistic about the collaborative efforts in curriculum development but highlighted the need for stronger **direct involvement** in educational design. Many noted that while some industry collaborations exist, they are often **sporadic** and **insufficient** to make a significant impact on the curriculum. Professionals suggested that **more structured collaboration** between industry players and academic institutions could lead to a more effective and comprehensive program. **Regular feedback loops** and **industry workshops** were proposed as mechanisms to ensure that curricula remain up-to-date with the rapidly changing maritime landscape.

**Maritime educators** acknowledged the importance of collaboration with industry professionals but pointed out the challenges in establishing ongoing partnerships. They suggested that formal channels for industry-academic collaboration, such as joint research initiatives, internships, and **consultation committees**, could significantly improve curriculum relevance. Additionally, they indicated that collaboration was often limited by logistical and financial constraints, which made it difficult to implement industry feedback systematically into the curriculum.

**Graduates** provided insights into their experiences with the curriculum, stating that while many of the technical aspects were covered well, there was little exposure to the industry's financial or sustainability-related practices during their studies. They indicated that industry collaboration was somewhat **theoretical** rather than **practical**, and greater emphasis on real-world application could improve their post-graduation transition into the workforce.

Stakeholder collaboration in curriculum development received a score of **8/10**. While there is a recognized effort to engage industry professionals in the development of maritime curricula, the collaboration is not yet sufficiently institutionalized or continuous enough to make a significant impact on shaping modern education practices in the maritime sector.

Indicator	Rating	Comments
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<b>Stakeholder collaboration in curriculum development</b>	8/10	Valuable but inconsistent; more structured and continuous collaboration with industry professionals is required.
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### Indicator 3: Financial and Sustainability Awareness in Education

The third indicator focused on assessing the level of **financial literacy** and **sustainability awareness** incorporated into the maritime curriculum. This is essential in ensuring that students are prepared for the growing importance of **environmentally sustainable operations** and **financial risk management** in the maritime sector.

**Maritime professionals** expressed a high demand for integrating more comprehensive **financial decision-making** and **sustainability** modules into maritime education. They highlighted that financial skills, particularly in risk assessment, **global market analysis**, and **supply chain financing**, are critical for professionals in the maritime business. Additionally, they stressed that sustainability is a key issue, with growing pressure from international regulations and public scrutiny pushing for greener operations. Professionals indicated that a lack of training in these areas could lead to **short-term inefficiencies** and **regulatory challenges**.

**Maritime educators** pointed to the increasing **global shift towards sustainability** and agreed that there is a need to **embed sustainability principles** deeper into the curriculum. Many educators acknowledged that **green shipping technologies**, **energy efficiency**, and **carbon footprint management** are areas that need stronger academic focus, especially given the increasing importance of these issues in both the **regulatory landscape** and **market demand**. Financial literacy, though not widely integrated into all programs, was seen as another area that requires stronger inclusion in the curriculum. Educators noted that students need to understand **financial viability** and **profitability models**, not just operational efficiency.

**Graduates** confirmed that sustainability was addressed, but often in a **peripheral manner**, with much of the curriculum centered on operational or technical skills. While some graduates acknowledged the importance of these aspects, they noted that they did not receive sufficient training in how to apply these principles in real-world scenarios. Financial literacy, too, was seen as underdeveloped, with graduates reporting that they had to learn about financial decision-making and sustainability on the job rather than during their studies.

Financial and sustainability awareness in education received a score of **9/10**. The need for improvement in embedding these principles into the curriculum was acknowledged, but the foundational work has already been laid, and a high level of awareness exists within the academic and professional spheres.

Indicator	Rating	Comments
<b>Financial and sustainability awareness in education</b>	9/10	Good awareness and recognition of importance; however, practical implementation and deeper integration into courses needed.

The research results indicate a strong, positive perception of the current state of maritime education, with particular emphasis on the alignment with industry needs, stakeholder collaboration, and financial and sustainability awareness. With an average score of 9/10 across all indicators, the findings suggest that while there is substantial effectiveness and efficiency in current maritime curricula, significant opportunities for improvement remain. The most notable areas for development include increasing the integration of financial literacy, market analysis, and sustainability practices into the curriculum to ensure that future maritime professionals are fully equipped to meet the evolving challenges of the industry.

The results also highlight the importance of fostering deeper and more structured collaboration between industry professionals and academic institutions to ensure that curricula remain relevant and reflective of the industry's needs. This collaboration can be facilitated through feedback loops, industry seminars, and real-world case studies, which can provide students with practical experience and insights.

The research underscores the critical importance of financial literacy and sustainability in maritime education and the need for an educational framework that fosters holistic development of maritime professionals—equipping them not only with technical skills but also with the financial acumen and sustainability knowledge necessary to navigate the challenges of the modern maritime industry.

The primary aim of this research was to assess how maritime education can be enhanced to better meet the demands of the evolving maritime industry, particularly in the areas of port and shipping management, maritime business, financial management, and sustainability. The results have demonstrated a high level of effectiveness and efficiency in the current maritime educational frameworks, with an overall score of

9/10 across all indicators. These findings suggest that maritime education is largely on track in addressing some of the core competencies required by the industry, but significant opportunities remain for improvement in several key areas. This discussion will delve into the implications of these findings, analyze the broader context of maritime education, and reflect on the possible next steps for enhancing the curriculum to better prepare students for future challenges in the maritime sector.

### **1. Curriculum Alignment with Industry Needs**

One of the central focuses of this research was to examine how well the maritime curricula align with the dynamic needs of the maritime industry. The study revealed that while the existing curriculum is well-designed to equip students with the fundamental technical knowledge required for maritime operations, there is a noticeable gap when it comes to the integration of modern financial practices and sustainability principles. Both maritime professionals and educators highlighted the growing importance of incorporating financial literacy, risk management, and green shipping technologies into the curriculum. These areas are no longer peripheral to the maritime business world but are central to the success of maritime companies in a globalized, environmentally-conscious economy.

The maritime industry is increasingly shaped by global market dynamics, regulatory frameworks, and environmental concerns. To thrive, maritime professionals need to be equipped not just with technical skills such as navigation, cargo handling, and port operations, but also with a robust understanding of financial decision-making and the financial complexities of shipping. This includes understanding cost structures, financial forecasting, and market dynamics that influence shipping operations. The findings of this study suggest that while students may receive a solid grounding in operational knowledge, they may not be sufficiently prepared to handle the financial and economic realities of managing a maritime business, particularly in the context of economic fluctuations, price volatility, and global trade disruptions.

Similarly, sustainability is an area where the maritime industry is under increasing pressure from both government regulations and public expectations. Maritime professionals must increasingly navigate complex environmental regulations, manage the costs associated with green technologies, and adapt to a market that is progressively prioritizing environmental sustainability. The integration of sustainability into the curriculum is thus crucial, as it ensures that future maritime leaders are well-versed in eco-

efficient practices, emission reduction technologies, and circular economy models. The research has highlighted that although sustainability is mentioned in many maritime education programs, it is often treated as an afterthought rather than a core aspect of the curriculum. To address this, maritime education must expand its focus to include eco-friendly shipping practices, sustainable port operations, and climate-change mitigation strategies.

The overall score of 9/10 for this indicator suggests that the maritime curriculum already includes many of the foundational concepts needed to align with industry needs. However, the gap in financial education and sustainability practices needs urgent attention. Updating the curriculum to include more relevant financial and environmental content, while maintaining the strong operational base, is essential for ensuring that maritime professionals are fully equipped to thrive in the changing industry landscape.

### **2. Stakeholder Collaboration in Curriculum Development**

The second key indicator explored the level of collaboration between industry professionals, educators, and graduates in the development of maritime curricula. Stakeholder collaboration is widely recognized as an important factor in ensuring that educational programs remain relevant and practical. The results revealed a high level of awareness of the importance of industry-academic collaboration but also pointed out that current collaborative efforts are often insufficient and sporadic. Both educators and maritime professionals stressed the need for more structured and ongoing collaboration.

While there are examples of collaboration, such as internships, joint research initiatives, and guest lectures by industry experts, these efforts are not systematically incorporated into the curriculum development process. Industry professionals expressed a desire for a more structured approach to collaboration, one that includes regular feedback loops and formal partnerships between maritime schools and the shipping industry. The professionals noted that more consistent collaboration would help bridge the gap between academic theory and the practical challenges faced by maritime businesses. By including real-world case studies, hands-on training programs, and industry-based research, the curriculum could be made more dynamic and aligned with the needs of the maritime sector.

Educators, on their part, acknowledged the value of collaboration but pointed out several challenges in implementing it. Many educators emphasized the lack of sufficient resources, time,

and infrastructure to establish deep industry partnerships. There are also significant barriers in terms of logistical coordination between academic institutions and the fast-paced, geographically diverse maritime industry. As a result, the integration of industry input into the curriculum is often delayed or only partially implemented, which limits the potential benefits of stakeholder collaboration.

The feedback from graduates reinforced the need for more substantial industry engagement. Graduates, particularly those who have entered management positions, often found that their education had not fully prepared them for the financial and strategic decisions they had to make on the job. They mentioned that the academic program could have benefited from more direct exposure to industry practices and business decision-making processes, which could have been facilitated through stronger partnerships between the academic and professional sectors.

The 8/10 score for this indicator suggests that while there is recognition of the importance of collaboration, its implementation is inconsistent and requires further institutionalization. More formalized collaboration between industry stakeholders and educational institutions, through joint curriculum design, mentorship programs, and consultation committees, could help bridge this gap. Such collaboration would not only enhance the relevance of the curriculum but also help students build professional networks that could be invaluable when transitioning into the workforce.

### **3. Financial and Sustainability Awareness in Education**

The third indicator, which examined the level of financial literacy and sustainability awareness embedded in maritime education, is perhaps the most pressing area for reform. The maritime industry is facing unprecedented financial challenges, from fluctuating fuel prices to the economic impacts of the COVID-19 pandemic. At the same time, environmental sustainability has become a central issue in global shipping, with companies and governments working together to address the sector's contribution to climate change. To meet these challenges, maritime professionals must not only be technically proficient but also adept at making informed financial decisions and leading sustainable operations.

The research findings indicate that while there is some focus on sustainability and financial management within the maritime curriculum, it is often treated as a secondary or optional topic. The 9/10 score for this indicator reflects the recognition of financial and sustainability issues within maritime education, but it also highlights the gap

between awareness and comprehensive implementation. Maritime professionals and educators emphasized that sustainability is increasingly central to the future of the industry, yet many curricula still lag behind in terms of integrating carbon management, green port practices, and sustainable shipping technologies into the core modules [6], [23], [24].

From the perspective of graduates, the lack of in-depth financial training was particularly concerning. Many felt that their education had not sufficiently prepared them for the financial challenges they encountered once they entered the workforce, particularly in relation to cost management, market analysis, and the financial risks associated with global shipping operations. As the maritime industry becomes more financially complex, it is essential that future professionals are equipped with the necessary tools to understand and navigate this landscape. This includes understanding the financial implications of decisions related to fleet management, capital investment, and cost-benefit analysis for environmental upgrades.

The growing importance of sustainability within maritime operations is another area that requires more focus in the curriculum. As maritime businesses increasingly face regulatory pressures, consumer expectations, and reputational risks related to environmental sustainability, there is a pressing need for professionals to be well-versed in green technologies, energy-efficient shipping solutions, and environmental compliance. The integration of sustainability into maritime education should go beyond regulatory compliance and encourage innovative solutions to reduce the environmental impact of the sector.

The results of this research provide a comprehensive picture of the current state of maritime education and its alignment with the evolving needs of the maritime industry. While the research found that maritime education is largely effective in providing foundational technical skills and knowledge, there is significant room for improvement in integrating financial literacy, business management, and sustainability into the curriculum [25]–[27]. The findings emphasize the critical need for a more financially grounded and sustainability-oriented maritime education, one that prepares students for the complex, global, and environmentally-conscious maritime landscape. The high scores for alignment with industry needs, stakeholder collaboration, and financial and sustainability awareness indicate that maritime education is on the right track but needs to be adapted to better prepare students for the future. By embedding financial decision-making,



sustainability practices, and stronger industry partnerships into the curriculum, maritime education can help create a new generation of professionals who are not only proficient in technical skills but also capable of leading the maritime industry into a sustainable and financially viable future.

## CONCLUSION

This research underscores the growing need for a revised maritime curriculum that effectively addresses the evolving demands of the maritime industry, particularly in shipping management, maritime business, financial literacy, and sustainability. The study reveals that while current maritime education provides a solid foundation in operational skills, there are significant gaps in the integration of financial decision-making and sustainability practices. These areas are critical for preparing future professionals to navigate the complex and rapidly changing maritime landscape. The research indicates a high level of effectiveness in the alignment of maritime education with industry needs, receiving an overall score of 9/10, but highlights the importance of further incorporating modern financial strategies and environmental sustainability into the curriculum. Additionally, the study emphasizes the need for more structured and ongoing collaboration between industry stakeholders and academic institutions to ensure that curricula remain relevant and responsive to real-world challenges. While maritime education has made progress in preparing students for traditional operational roles, it must evolve to equip graduates with the financial acumen and sustainability awareness required to lead the maritime sector in the 21st century. The findings suggest that by strengthening these areas, maritime education can better serve industry needs, foster innovative practices, and prepare students to contribute to the sustainable growth and financial viability of the global maritime industry.

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