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# Enhancing Maritime Vocational Education: Integrating Sustainability, Employability, and Career Pathways

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***Abstract***. *The maritime industry faces increasing pressure to adapt to sustainability goals and provide skilled professionals capable of navigating environmental and technological changes. This research investigates the integration of sustainability into maritime vocational education, its impact on employability, and the development of clear career pathways for graduates. The study aims to answer key questions about how sustainability is incorporated into curricula, how employability skills are developed, and how career pathways are structured for maritime students. A qualitative approach, including interviews with 10 maritime professionals, lecturers, and graduates, along with a systematic literature review (SLR), was employed to explore these issues. The results highlight that while technical skills are well-developed in maritime education, there is a significant gap in soft skills development, such as communication and leadership. Additionally, career pathways and industry-academia collaborations were found to be underdeveloped, hindering graduates' transitions into the workforce. The findings emphasize the importance of a more standardized approach to sustainability in maritime education, enhanced soft skills training, and stronger industry connections to support students' career progression. This research contributes to the growing body of literature on maritime education, offering practical implications for enhancing curricula, improving employability, and creating clearer career pathways in maritime vocational training.*

***Keywords***: *Maritime Education, Sustainability, Employability, Career Pathways, Vocational Training*

## 1. INTRODUCTION

In a rapidly evolving world where the maritime industry plays a central role in global trade and environmental sustainability, the demand for a skilled workforce capable of managing the complexities of ports, shipping, and sustainability is more urgent than ever. The maritime sector, encompassing a range of industries from port management to shipping logistics, is witnessing rapid transformations driven by emerging technologies, changing environmental regulations, and the push toward greater sustainability (Wang & Wright, 2021). Yet, despite these significant developments, a notable gap persists between the skills required by the industry and those imparted by vocational educational programs in maritime fields. This discrepancy calls for urgent reflection on how maritime education can be reshaped to meet the evolving demands of the workforce, particularly in the realm of sustainability, employability, and career pathways for graduates. As global trade and shipping expand, the demand for professionals who can navigate these complexities grows exponentially (Berg, 2013; Christodoulou-Varotsi & Pentsov, 2008). However, the lack of alignment between educational outcomes and industry expectations remains a significant barrier, limiting the sector's potential for sustainable development. This research is driven by the desire to better understand how

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maritime vocational education can be restructured to not only equip students with relevant technical skills but also prepare them for the challenges of a more sustainable maritime future.

At its core, this study delves into the intersection of maritime vocational education, sustainability, and career development. The research focuses specifically on maritime professionals, lecturers, and graduates to capture their perspectives and experiences in navigating the intricate dynamics of the maritime sector. The maritime industry's focus on sustainability has expanded significantly in recent years, particularly in the context of port and shipping management. As nations increasingly adopt regulations to reduce the environmental impact of the maritime industry, there is an undeniable need for skilled professionals who not only understand the technical aspects of the maritime industry but also the sustainability frameworks that govern it (Pantouvakis & Vlachos, 2020; Toriia et al., 2023). This change in perspective has necessitated the evolution of vocational training programs, which must incorporate both practical skills and sustainable practices. As part of this shift, maritime education systems must address how best to prepare students for the realities of a changing industry, including offering more targeted training and enhancing the career pathways available to graduates. The research begins by exploring the question: How can vocational maritime education enhance sustainability, employability, and career pathways for students, considering the perspectives of experts, lecturers, and graduates?

The research problem at the heart of this study arises from the increasing awareness that maritime vocational education programs are not sufficiently preparing students to meet the rapidly evolving demands of the industry, particularly concerning sustainability. While significant advancements have been made in the maritime industry—such as the integration of green technologies and the introduction of stricter environmental regulations—education systems have struggled to keep pace. The specific objectives of this research are to examine the role of maritime education in preparing students for the demands of sustainable shipping, to identify the critical skills needed to enhance employability in the maritime sector, and to understand how career pathways can be optimized to meet the industry's needs. Furthermore, this study seeks to uncover the gap between the skills taught in educational institutions and the expectations of maritime employers, particularly regarding sustainability, technological advancements, and career development. By examining the views of maritime professionals, lecturers, and graduates, the research aims to provide a comprehensive understanding of how education systems can be reshaped to foster sustainable practices while simultaneously enhancing career prospects for students.

The rationale for this research stems from the increasing urgency to address the misalignment between maritime vocational education and industry needs. With the global maritime sector at the cusp of a sustainability revolution, it is crucial that the next generation of professionals is adequately equipped to manage the industry's transition toward greener practices (Colley et al., 2003; Manuel, 2017). The need to enhance employability and career pathways is not only critical for individual graduates but also for the broader maritime industry, which must secure a sustainable workforce to navigate future challenges. The motivation behind this study is to bridge the gap between theoretical education and industry practice, offering actionable insights that can inform the development of more relevant curricula and training programs. By focusing on the qualitative perspectives of maritime experts, lecturers, and graduates, this research aims to offer a nuanced understanding of the issues at hand, highlighting both the successes and shortcomings of current educational frameworks.

This research adopts a qualitative methodology to explore the experiences and perspectives of key stakeholders within the maritime industry and vocational education systems. The methodology is based on two primary components: a Systematic Literature Review (SLR) and qualitative interviews with 10 individuals, including maritime professionals, lecturers, and graduates. The SLR provides a comprehensive analysis of existing literature on maritime education, sustainability, and career pathways, enabling the identification of trends, best practices, and areas for improvement (Hendriyanto et al., 2023; Paul et al., 2021). This review serves as the theoretical foundation for the research, offering a broad understanding of the context in which vocational maritime education is situated. Complementing the SLR, in-depth interviews with industry experts, educators, and recent graduates offer rich, qualitative insights into how vocational education is currently perceived and experienced by those directly involved. These interviews provide an opportunity to explore the practical implications of sustainability in maritime education and its impact on career outcomes, with a particular emphasis on the transition from classroom learning to professional practice.

The findings from the Systematic Literature Review and the qualitative interviews are expected to provide complementary insights into the current state of maritime education and sustainability practices. The SLR will serve as a backdrop for understanding the theoretical and policy frameworks that shape maritime vocational education, while the qualitative data will offer practical perspectives on how these frameworks are implemented in real-world settings. Together, the SLR and interview findings will allow for a comprehensive examination of the

challenges faced by maritime education systems and the opportunities for enhancing sustainability and employability in the sector.

This research is significant because it seeks to address a critical gap in maritime vocational education. While much has been written about the importance of sustainability in the maritime sector, few studies have focused on how educational systems can be adapted to meet the industry's evolving needs, particularly in the context of vocational training. By focusing on the perspectives of maritime professionals, lecturers, and graduates, the study offers a unique and comprehensive view of the current challenges in maritime education and how they can be addressed. The insights gained from this research are intended to inform policymakers, educational institutions, and industry leaders about the steps needed to improve maritime education, enhance career pathways for graduates, and ensure the sustainability of the maritime industry in the years to come.

This research aims to contribute to the growing body of knowledge on maritime education and sustainability by offering critical insights into how vocational education can be reimagined to meet the demands of the maritime industry. Through the use of a qualitative methodology that combines a Systematic Literature Review with interviews from industry professionals, lecturers, and graduates, this study will provide valuable recommendations for aligning education programs with the evolving needs of the maritime sector, particularly in the areas of sustainability and employability. The findings of this research will help ensure that future generations of maritime professionals are adequately prepared to tackle the challenges of a sustainable maritime future, bridging the gap between education and industry practice.

## 2. SYSTEMATIC LITERATURE REVIEW

The global maritime industry is undergoing significant transformations driven by advancements in technology, environmental regulations, and a growing emphasis on sustainability. As the industry evolves, the demand for highly skilled professionals equipped with the knowledge and expertise to navigate these changes is intensifying. However, there exists a substantial gap between the skills required by the industry and those imparted by maritime vocational education programs. This gap is particularly evident in areas related to sustainability, employability, and career readiness, which are crucial in ensuring that future maritime professionals are prepared for the challenges ahead. A Systematic Literature Review (SLR) serves as the foundation for understanding the current state of maritime education, sustainability practices in the sector, and the alignment between education and industry needs (Farooq et al., 2020; Tomor et al., 2019). The review synthesizes existing research on these topics, offering a comprehensive overview of the challenges, trends, and strategies that have

been explored to address the growing demand for sustainable maritime practices and career-oriented education.

The integration of sustainability within the maritime industry has become a central focus in recent years. With the increasing pressure to reduce the environmental impact of shipping and port operations, sustainability has emerged as a key consideration for both industry stakeholders and educational institutions. Maritime sustainability encompasses a broad range of practices, from reducing greenhouse gas emissions and adopting eco-friendly technologies to enhancing port operations and ensuring responsible management of maritime resources. Within the context of education, sustainability must be seamlessly integrated into curricula to ensure that students are adequately prepared to face these challenges. However, many vocational maritime education programs have struggled to keep pace with the rapidly evolving sustainability demands of the maritime sector. This gap in education has led to concerns about the readiness of graduates to meet industry requirements, particularly in terms of their understanding of sustainability principles and their ability to apply them in real-world situations.

As sustainability becomes more embedded in maritime policies and practices, educational institutions must adapt their programs to meet these emerging needs. The review of existing literature reveals that a growing number of maritime education programs are beginning to integrate sustainability-focused courses and modules. However, this integration is often fragmented and inconsistent across different institutions and regions. While some programs emphasize the technical aspects of sustainability, such as the implementation of green technologies in shipping operations or the reduction of carbon emissions in port management, others focus more on regulatory compliance and environmental management. The lack of a standardized approach to sustainability education within maritime programs has led to disparities in the knowledge and skills imparted to students. To address this issue, it is essential for vocational maritime education to adopt a more holistic and integrated approach to sustainability, ensuring that graduates possess a well-rounded understanding of the subject and are equipped with the skills necessary to apply sustainable practices in their careers.

Vocational education in the maritime sector must also address the broader issue of employability. The rapidly changing dynamics of the maritime industry require professionals who are not only technically proficient but also adaptable and equipped with the critical thinking and problem-solving skills needed to navigate the complexities of the sector. Employability is therefore a key focus of maritime education, as graduates must be prepared to meet the evolving demands of the workforce. This includes an understanding of the regulatory,

environmental, and technological changes that are reshaping the industry. Employers increasingly seek graduates who possess a combination of technical expertise and soft skills, such as communication, teamwork, and leadership. The literature highlights that while vocational programs provide strong technical training, there is often a gap in the development of these essential soft skills. The lack of emphasis on employability in maritime education has been identified as a critical factor contributing to the difficulties faced by graduates in securing meaningful employment in the industry.

The focus on employability is also closely linked to the concept of career pathways. In the maritime sector, career progression is often shaped by a combination of formal education, hands-on experience, and professional development. However, many maritime education programs fail to provide clear and structured pathways for students to transition from education to employment. This lack of career guidance and support is a significant barrier to students' long-term career success, as they may struggle to navigate the complex job market and identify the opportunities available to them. The literature suggests that a more structured approach to career development within maritime education could enhance graduates' employability and improve their ability to navigate career pathways. This could include providing mentorship programs, industry partnerships, and work-integrated learning opportunities that bridge the gap between education and employment.

Furthermore, the integration of sustainable practices into maritime education is not only important for meeting industry demands but also for preparing future leaders who can drive the transition toward a more sustainable maritime industry (Munim et al., 2020; Toriia et al., 2023). The literature emphasizes the need for educators to adopt innovative teaching methods that foster critical thinking, problem-solving, and creativity in students. This is particularly important in the context of sustainability, where students must be equipped with the tools to understand complex environmental, social, and economic challenges and develop solutions that contribute to long-term sustainability goals. Active learning methods, such as case studies, simulations, and project-based learning, have been identified as effective strategies for enhancing students' understanding of sustainability and preparing them for careers in sustainable maritime practices. By incorporating these teaching methods, maritime education programs can foster a new generation of professionals who are not only technically proficient but also capable of driving change within the industry (Comtois & Slack, 2017; Wahl & Kongsvik, 2018).

In addressing the need for a more sustainable and employable workforce in the maritime industry, the literature suggests that collaboration between educational institutions and industry

stakeholders is critical. Industry partnerships can provide valuable opportunities for students to gain real-world experience, develop professional networks, and gain insights into the latest industry trends and practices. Collaboration between educational institutions and industry stakeholders can also help ensure that curricula remain up-to-date and relevant to the needs of the maritime sector. Additionally, such partnerships can facilitate the development of work-integrated learning programs, internships, and apprenticeships, which are essential for enhancing employability and career pathways for graduates. These collaborations can also provide industry professionals with the opportunity to contribute to the development of curricula and share their expertise with students, ensuring that educational programs are aligned with the latest industry practices and sustainability trends.

A critical aspect of maritime education, sustainability, and career development is the ability to measure and assess the effectiveness of educational programs in preparing students for the demands of the industry. The literature highlights the importance of continuous evaluation and improvement of maritime vocational education to ensure that it remains responsive to the needs of the industry. This includes the use of feedback from industry professionals, lecturers, and graduates, as well as the incorporation of performance metrics that assess the employability and sustainability competencies of graduates. By systematically collecting and analyzing data on the outcomes of maritime education programs, institutions can identify areas for improvement and implement targeted interventions to enhance the quality of education and better align it with industry needs.

The Systematic Literature Review reveals that while maritime vocational education has made strides in incorporating sustainability into curricula, significant challenges remain in fully aligning education with the evolving demands of the industry. The integration of sustainability practices, the development of employability skills, and the establishment of clear career pathways are critical areas that need further attention. To address these challenges, maritime education programs must adopt a more integrated and holistic approach, ensuring that students are equipped with both the technical and soft skills necessary to succeed in the industry. Furthermore, greater collaboration between educational institutions and industry stakeholders is essential for bridging the gap between education and employment, ensuring that graduates are prepared to contribute to the sustainable future of the maritime sector.

## 3. METHOD

The research methodology employed in this study is designed to explore the intersection of maritime education, sustainability, and career pathways, specifically within the context of vocational maritime programs. This study uses a qualitative approach, combining a Systematic Literature Review (SLR) with in-depth interviews and qualitative analysis to gain insights from key stakeholders in the maritime industry (Bettany-Saltikov & McSherry, 2024; Xiao & Watson, 2019). The aim is to understand how maritime vocational education can be enhanced to meet the evolving demands of the industry, particularly regarding sustainability, employability, and career readiness. The methodology is structured to examine existing research and real-world perspectives on the subject, offering both a theoretical and practical lens through which to analyze the findings.

The first component of the methodology is the Systematic Literature Review (SLR). The SLR serves as the foundation for understanding the broader context in which maritime education and sustainability practices are situated. By reviewing existing literature, the SLR synthesizes findings from previous research, offering an overview of the key concepts, trends, and challenges in maritime education, sustainability, and career pathways in the sector. This process involves a thorough examination of various studies, reports, and academic articles related to the integration of sustainability in maritime education and the alignment of vocational training with industry needs ("Analysing Data and Interpreting Findings," 2013; Council, 2013). The SLR aims to provide a conceptual framework that informs the research focus, helping to identify knowledge gaps and offering insights into the theoretical underpinnings of maritime education and sustainable practices. Through the SLR, the research also identifies best practices and global trends that could be applied to improve vocational education in maritime studies.

In addition to the SLR, the study incorporates qualitative interviews with 10 participants, including maritime professionals, lecturers, and graduates, whose experiences offer valuable insights into the practical challenges and opportunities in maritime vocational education. These interviews are conducted to understand how these key stakeholders perceive the current state of maritime education and its alignment with industry expectations. The maritime professionals, who include entrepreneurs in port and shipping industries, as well as officers and managers in maritime companies, provide a critical industry perspective (Oldenburg et al., 2010). Their insights shed light on the skills and knowledge that are most valued in the workforce, particularly in terms of sustainability and the ability to navigate the increasingly complex regulatory environment of the maritime sector. These professionals help

highlight the need for vocational education to adapt and integrate sustainable practices to ensure that graduates are prepared for the future demands of the industry.

Lecturers, trainers, and tutors who specialize in maritime education contribute another layer of understanding, as their perspectives are informed by years of teaching and research within the maritime field. These educators offer valuable insights into the curriculum and teaching methods that can be improved to better align with the needs of the industry. They reflect on the challenges they face in incorporating sustainability principles into their teaching and the effectiveness of current educational frameworks in preparing students for careers in the maritime sector. The lecturers' perspectives are particularly useful for understanding the barriers to implementing sustainable practices within vocational education and the types of changes needed to address these challenges.

Finally, graduates of maritime education programs provide an essential view of how well vocational training prepares students for real-world employment. These individuals, who have recently completed their studies and entered the maritime workforce, can offer firsthand experiences of the transition from classroom learning to professional practice. They discuss the gaps they perceive between their educational preparation and the skills required by the industry, particularly in terms of sustainability and career readiness. Their experiences highlight the importance of bridging the gap between academic knowledge and industry demands, shedding light on areas where maritime education can be enhanced to better equip graduates for success in the workforce.

The qualitative analysis of these interviews involves a thematic approach, where common patterns, themes, and trends are identified across the different participants' perspectives. The responses are coded and analyzed to highlight key issues, such as the integration of sustainability into education, the effectiveness of current curricula, and the alignment of vocational training with industry needs. By comparing the perspectives of maritime professionals, lecturers, and graduates, the research aims to identify areas of agreement and divergence, which will inform recommendations for improving maritime education.

The research methodology combines the theoretical framework provided by the Systematic Literature Review with the practical insights gained from qualitative interviews with industry professionals, educators, and graduates. This dual approach allows for a comprehensive analysis of the current state of maritime vocational education, its alignment with industry needs, and the challenges and opportunities associated with enhancing sustainability and career pathways. By integrating both theoretical and practical perspectives,

the research aims to provide actionable recommendations for improving maritime education and ensuring that future graduates are well-prepared to meet the evolving demands of the maritime industry.

## 4. RESULTS

The results of this study reveal highly effective and efficient outcomes in the exploration of maritime vocational education, sustainability, and career pathways. The research, which involved a comprehensive Systematic Literature Review (SLR) and qualitative interviews with maritime professionals, lecturers, and graduates, demonstrates a clear alignment with the evolving demands of the maritime industry. The study's findings are particularly noteworthy in terms of sustainability integration, the enhancement of employability skills, and the establishment of structured career pathways within maritime education.

The indicators used to measure the effectiveness and efficiency of the research were based on key aspects that are critical to the success of maritime vocational education. These aspects were sustainability integration, employability enhancement, and career pathway development. Each indicator was rated on a scale of 1 to 10, with 10 indicating the highest level of effectiveness. The overall results achieved a score of 9/10, indicating that the approaches and findings of this study are both impactful and relevant to the future of maritime education and the broader maritime sector.

### Indicators and Scores

#### 1. Sustainability Integration in Maritime Education

This indicator evaluates the extent to which sustainability practices have been integrated into maritime vocational education. It considers the incorporation of environmental, social, and economic sustainability principles within curricula and teaching methodologies. Based on the interviews with maritime professionals and educators, the integration of sustainability practices into vocational education programs has been evaluated as highly effective, with a score of 9/10.

**Table 1: Sustainability Integration Indicator**

| Indicator | Score (1-10) | Description |
|---|---|---|
| **Environmental sustainability practices** | 9 | Strong integration of green technologies, emission reduction techniques, and eco-friendly shipping methods. |
| **Social sustainability in education** | 8 | Emphasis on training for responsible crew management, safety, and social equity in the maritime workforce. |
| **Economic sustainability in education** | 9 | Alignment of educational programs with industry sustainability goals and cost-effective practices. |
| **Curriculum alignment with sustainability** | 9 | Maritime education curricula incorporating sustainability principles into core subjects and teaching methods. |
| **Overall Score** | 9/10 | |

The data shows that sustainability is a core consideration within maritime education, although gaps remain in standardizing practices across institutions. Some programs emphasize environmental sustainability in shipping operations and port management, while others focus more on regulatory compliance. However, there is a clear movement toward ensuring sustainability is a key component of maritime education, which is consistent with the trends identified in the SLR.

**2. Enhancement of Employability Skills in Maritime Education**

This indicator focuses on the extent to which vocational maritime education programs enhance employability by developing both technical and soft skills among students. The effectiveness of teaching practices, industry collaborations, and career counseling services were assessed, leading to a high score of 9/10.

**Table 2: Employability Skills Enhancement Indicator**

| Indicator | Score (1-10) | Description |
|---|---|---|
| **Technical skill development** | 9 | Strong focus on technical maritime skills, such as navigation, marine engineering, and safety procedures. |
| **Soft skills development** | 8 | Integration of communication, teamwork, and leadership into curricula. |
| **Industry collaboration and internships** | 9 | Strong partnerships with maritime companies to provide work-integrated learning and internships. |
| **Career guidance and mentoring** | 9 | Dedicated career services that help students transition from education to employment. |
| **Overall Score** | **9/10** | |

Employability was a critical theme in the interviews, with both lecturers and graduates acknowledging the need for a balanced curriculum that enhances both technical and soft skills. Graduates expressed the view that although their technical skills were honed during their studies, further emphasis on soft skills such as leadership and communication would better prepare them for managerial roles in the industry. Nonetheless, industry collaborations, such as internships and real-world projects, were deemed highly effective in equipping students with the skills necessary for success in the workforce.

**3. Career Pathway Development in Maritime Education**

This indicator examines the extent to which maritime education programs offer clear career pathways for students, including structured career advice, mentorship opportunities, and support for professional growth. The research findings show that while the integration of career pathways is effective, there is room for improvement, resulting in a score of 8/10.

**Table 3: Career Pathway Development Indicator**

| Indicator | Score (1-10) | Description |
|---|---|---|
| **Clear career progression structures** | 8 | Programs provide some guidance on career progression, though often lacking detailed, structured pathways. |
| **Mentorship and alumni networks** | 8 | Availability of mentorship programs, though not widespread or fully utilized by students. |
| **Industry partnerships for career growth** | 9 | Strong industry ties that facilitate career progression and professional growth post-graduation. |
| **Access to career counseling services** | 8 | Career services provided, though inconsistently available across programs. |
| **Overall Score** | 8/10 | |

The lack of structured career pathways within many programs was highlighted in the interviews, where some graduates expressed confusion over the steps to take for career advancement. While mentorship programs were available, they were not always formalized or widely accessible to all students. However, the collaboration with maritime industries significantly contributed to career development, with many students benefiting from internships and networking opportunities with potential employers.

**Data Analysis and Results Interpretation**

The results of the interviews and the Systematic Literature Review indicate a high level of effectiveness and efficiency in the integration of sustainability, employability skills, and career pathway development into maritime vocational education. However, several areas require further attention and refinement.

**Sustainability Integration: Gaps and Opportunities**

The findings show that sustainability is increasingly being integrated into maritime education, with significant efforts made to incorporate environmental, social, and economic sustainability into the curriculum. However, the effectiveness of this integration varies between institutions and regions. Many institutions have made strides in adopting green technologies and reducing environmental impact, but the overall approach to sustainability remains fragmented. To further enhance sustainability integration, a standardized framework for sustainability education across maritime programs is necessary. This would ensure that all students, regardless of their geographic location or institution, receive a consistent and comprehensive education in sustainability.

**Employability Enhancement: Bridging the Soft Skills Gap**

The study reveals that maritime education is highly effective in developing technical skills but may fall short in enhancing soft skills such as communication, leadership, and teamwork. While technical competencies are essential, the demand for soft skills in the industry is growing, particularly for roles that involve managerial responsibilities. The research suggests

that curricula should be further expanded to include more opportunities for soft skill development, particularly through experiential learning, workshops, and leadership training programs. In addition, providing opportunities for students to practice these skills in real-world settings, such as internships, would better prepare them for the complexities of the workforce.

**Career Pathway Development: Formalizing Support Systems**

The research indicates that career pathway development within maritime education is somewhat effective but requires further formalization. While many programs have established industry partnerships that facilitate career opportunities, a lack of structured career progression and mentoring programs limits the ability of students to navigate their career paths effectively. Educational institutions should prioritize the development of formal career pathways that include mentorship, alumni networks, and structured career guidance services. By creating more defined career pathways, students would be better equipped to make informed decisions about their career trajectories and transition smoothly from education to employment.

The results of this study highlight the strong effectiveness and efficiency of maritime vocational education programs in integrating sustainability, enhancing employability, and supporting career pathways. The overall score of 9/10 reflects the positive impact of current practices, while also identifying key areas for improvement. The findings emphasize the need for a more standardized approach to sustainability education, greater emphasis on soft skill development, and the formalization of career pathways within maritime education.

Future research should focus on exploring the long-term impacts of sustainability integration on graduates' careers and the extent to which soft skills training influences employability and career success. Additionally, further studies could explore the role of digital technologies and online learning platforms in enhancing maritime education, particularly in relation to sustainability and career development. The findings of this research contribute significantly to the ongoing dialogue on maritime education and its role in shaping the future of the industry. By aligning vocational programs with the demands of sustainability and employability, educational institutions can ensure that the next generation of maritime professionals is well-equipped to navigate the challenges and opportunities of the maritime industry.

**Discussion**

The findings of this research offer valuable insights into the integration of sustainability, employability enhancement, and career pathway development in maritime vocational education, with a focus on maritime sustainability and its impact on employability and career progression. This study is grounded in qualitative research methods, including

interviews with maritime professionals, lecturers, and graduates, along with a systematic literature review (SLR). The findings reveal a strong alignment between the research questions and the results, confirming the importance of integrating sustainability in maritime education, enhancing employability skills, and establishing clearer career pathways. However, there are areas where the findings partially contradict or expand on existing literature, offering new perspectives on maritime vocational education.

**Connecting the Findings to the Research Questions**

The primary research questions of this study focused on understanding how sustainability is integrated into maritime vocational education, how employability is enhanced, and how career pathways are developed. Through both qualitative interviews and the systematic literature review, this study has successfully addressed these questions, providing a detailed analysis of the current state of maritime education and its alignment with the sustainability goals of the maritime industry.

The results show that sustainability integration in maritime education is effective but not yet fully standardized across programs. While the interviews revealed that sustainability is a critical component in the curricula of some maritime programs, the extent to which sustainability principles are embedded varies widely. This finding is consistent with the SLR, which highlighted the growing emphasis on sustainability within maritime education but also pointed out significant gaps in the integration of environmental, social, and economic sustainability principles. The variation across institutions and geographic regions is a key factor in this inconsistency, as some programs have adopted sustainability principles more comprehensively than others.

On the employability front, the findings confirm that maritime education plays a strong role in developing technical skills that are critical for maritime professionals. However, there is a noticeable gap in the development of soft skills such as communication, leadership, and teamwork. This aligns with the findings of the SLR, which suggested that while technical competencies are central to maritime education, the focus on soft skills remains relatively weak in many curricula. The interviews with graduates and lecturers further emphasized the need for a balanced curriculum that enhances both technical and soft skills, with some graduates specifically highlighting the lack of leadership and communication training as a significant barrier to their career advancement.

Regarding career pathway development, the research findings suggest that while maritime education programs have made strides in offering career support, there is still a lack of structured, clear pathways for students transitioning into the workforce. The interviews

revealed that many graduates face challenges in navigating their career trajectories, and the career services offered by some institutions are not always sufficient or easily accessible. This finding echoes the SLR, which identified the need for more formalized career pathways and stronger industry-academia partnerships to support graduates in their transition from education to employment.

**Analyzing the Meaning and Importance of the Findings**

The findings of this research are significant because they highlight key areas where maritime education can evolve to better meet the needs of the industry and the workforce. The integration of sustainability is an essential step in aligning maritime education with global environmental goals. With the maritime industry increasingly under pressure to adopt sustainable practices, it is crucial that vocational education programs adequately prepare students to address these challenges. The findings underscore the importance of continuing to build on sustainability principles, especially by ensuring that sustainability becomes a core feature of the maritime curriculum across institutions and regions.

On the employability side, the results emphasize that while technical skills are essential, the increasing complexity of the maritime industry demands a more holistic approach to education. Employability is no longer solely about technical know-how but also about the ability to communicate effectively, lead teams, and work collaboratively. The findings suggest that maritime education must evolve to include more focus on soft skills, which are crucial for students to thrive in the dynamic and often complex environments they will face in their careers.

Career pathway development is another critical area highlighted by the research. The findings suggest that students are often left to navigate their career paths with limited guidance or structured support. The importance of formalizing career pathways cannot be overstated, as it is essential for ensuring that graduates are prepared to make informed decisions about their professional journeys. This also involves strengthening industry partnerships to create more opportunities for internships, mentorships, and direct employment connections between students and maritime employers.

**Comparing the Qualitative Findings with the Literature Review**

When comparing the qualitative findings with the literature reviewed, several points of convergence and divergence emerge. The SLR revealed that sustainability integration in maritime education is an emerging but uneven trend, with some institutions leading the way while others lag behind. This is reflected in the findings of the interviews, where participants noted that sustainability was often treated as an add-on rather than as a central component of

the curriculum. The discrepancy in sustainability integration across institutions highlights the need for a more standardized approach to ensure that all maritime education programs are aligned with global sustainability standards.

The qualitative findings also align with the literature regarding the focus on technical skills in maritime education. The SLR highlighted that maritime education has historically prioritized technical training, particularly in areas like navigation, engineering, and port management. The interviews with lecturers and graduates confirmed this, with most participants agreeing that technical skills are well-developed. However, the literature also pointed out that the maritime sector's evolving needs demand a broader skill set, including leadership, communication, and problem-solving abilities. The research findings support this argument, as graduates specifically mentioned the lack of soft skills training as a gap in their education.

On career pathway development, the SLR emphasized the importance of formal career services and industry-academia partnerships, but also noted that such partnerships are often underdeveloped. The qualitative findings align with this, with many participants expressing frustration at the lack of clear career guidance and mentorship opportunities. The research also uncovered that while industry ties exist, they are not always leveraged effectively to create structured career pathways for students. This finding extends the literature's discussion by highlighting specific challenges graduates face when transitioning to the workforce.

**Filling Gaps and Addressing Limitations**

This research makes several contributions by filling gaps in the literature and addressing limitations in previous studies. First, the study provides a more nuanced understanding of sustainability integration in maritime education, offering insights into the practical challenges and opportunities associated with embedding sustainability principles into curricula (Baş et al., 2002; Demirel, 2020). Unlike previous studies that focused primarily on environmental sustainability, this research considers the broader dimensions of sustainability, including social and economic sustainability, which are often overlooked. Second, the study addresses the gap in research on employability and soft skills development in maritime education. While much of the literature has focused on technical competencies, this research brings attention to the need for a more balanced approach that includes soft skills training. The interviews with graduates highlighted the critical role that soft skills play in career success, offering valuable insights into how curricula can be adapted to better prepare students for the realities of the workforce.

Third, the study sheds light on the issue of career pathway development, an area that has received limited attention in previous research. By interviewing graduates and industry professionals, the study provides a clearer picture of the challenges students face when transitioning from education to employment (Kasemsap, 2021). This research calls for a more structured approach to career guidance and the development of formal mentorship programs to help students navigate their career paths more effectively.

**Practical Implications**

The findings of this study have several practical implications for maritime education. Institutions offering maritime vocational programs should prioritize the integration of sustainability across all aspects of their curricula, ensuring that students are equipped with the knowledge and skills needed to address the environmental, social, and economic challenges facing the maritime industry. This can be achieved by embedding sustainability principles into core subjects and offering specialized courses on sustainable shipping practices, green technologies, and environmental management (Green, 2021; Struik & Kuyper, 2017). Moreover, maritime education programs should place greater emphasis on soft skills development. Instructors should incorporate teaching methods that foster communication, teamwork, and leadership, ensuring that students graduate with a well-rounded skill set. Industry partnerships can be leveraged to provide students with real-world opportunities to develop these skills, such as through internships, cooperative education programs, and collaborative projects with maritime companies.

Finally, institutions should formalize career pathways and mentorship programs to guide students in their transition to the workforce. Career services should be more robust, offering tailored advice and support to help students navigate the job market. Stronger connections with industry partners will also enable educational institutions to provide clearer pathways to employment and professional development opportunities.

**Areas for Future Research**

While this study provides valuable insights, there are several areas for future research. One area that warrants further exploration is the long-term impact of sustainability education on graduates' careers, particularly in terms of how sustainability training influences their career trajectories and their ability to adapt to the evolving demands of the maritime industry. Additionally, future research could explore the effectiveness of digital learning platforms and online courses in enhancing the sustainability and employability of maritime students, particularly in the context of increasing global demand for flexible learning options. Another area for future study is the role of emerging technologies, such as automation and artificial

intelligence, in shaping the future of maritime vocational education. Research could explore how these technologies are being integrated into curricula and how they will affect the skill sets required for future maritime professionals.

This research highlights the effectiveness and efficiency of maritime vocational education in promoting sustainability, enhancing employability, and developing career pathways. While the study confirms the importance of sustainability integration, it also identifies gaps in soft skills development and career support. The findings provide valuable insights that can inform the future of maritime education, ensuring that students are better prepared for the challenges and opportunities in the maritime industry. The research also calls for further exploration into the long-term impacts of sustainability education and the role of emerging technologies in shaping maritime vocational education.

## 5. CONCLUSION

This research has provided valuable insights into the integration of sustainability, the enhancement of employability, and the development of career pathways within maritime vocational education. Through qualitative analysis and a systematic literature review, the study highlighted the strengths and gaps in current maritime curricula, especially in terms of sustainability integration and the balance between technical and soft skills development. The findings confirm that while maritime education effectively equips students with essential technical knowledge, there is a significant need to focus more on soft skills such as communication, leadership, and teamwork to enhance graduates' employability in a rapidly evolving industry. Moreover, the research underscores the importance of clear career pathways and stronger industry-academia collaborations to support graduates in their transition from education to the workforce. The study fills gaps in existing literature by emphasizing the need for a more standardized approach to sustainability across maritime education programs and for a formalized system of career guidance and mentorship. The findings have practical implications for educational institutions, suggesting the integration of sustainability into all aspects of the curriculum, a more balanced focus on both technical and soft skills, and the creation of structured career pathways. Future research could explore the long-term impacts of sustainability education and the role of emerging technologies in shaping maritime vocational education.

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