



## Enhancing Maritime Vocational Education: Balancing Studies and Sustainability Integration in Transportation Management

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### Abstract

*This research explores the challenges faced by maritime vocational lecturers who balance studies with teaching responsibilities, specifically focusing on the integration of sustainability principles within maritime education, with a particular emphasis on transportation management. The study examines how lecturers, drawing from both academic research and practical teaching experience, incorporate sustainability practices such as green shipping and port decarbonization into curricula aimed at preparing students for the evolving demands of the maritime industry. Through qualitative interviews with maritime professionals, lecturers, and graduates, the research identifies critical factors for effective sustainability integration, including institutional support, time management, and faculty collaboration. The findings indicate that when lecturers are supported with adequate resources and flexibility, they can successfully balance dual roles and embed sustainability within their teaching practices. Furthermore, collaboration among faculty members emerged as a key strategy for enhancing the delivery of sustainability in transportation management curricula. The research highlights the need for institutions to adapt curricula and offer better support to lecturers, ensuring that graduates are well-prepared to meet the sustainability challenges in maritime transportation. This study contributes to the advancement of maritime education by reinforcing the importance of sustainability in transportation management and offering a framework for enhancing vocational training in the maritime sector.*

## 1. INTRODUCTION

The maritime industry, one of the cornerstones of global trade and transportation, is undergoing a transformation [1], [2]. Faced with environmental challenges such as rising carbon emissions and the urgent need for sustainability, the industry is increasingly seeking solutions to integrate sustainable practices into port operations, shipping logistics, and naval engineering. At the heart of this transformation is maritime education, which plays a crucial role in equipping future professionals with the skills, knowledge, and perspectives needed to navigate the industry's sustainability challenges. Maritime vocational education, specifically training for seafarers and port management, must evolve to meet the demands of an industry that is not only expanding but also facing new environmental and technological hurdles.

In this context, vocational maritime institutions, which provide specialized training for future professionals in the maritime industry, are tasked with a dual responsibility: to ensure that students gain practical, industry-relevant skills while also fostering an understanding of sustainable practices [3], [4]. The shift toward sustainability requires educational systems to develop curricula that not only focus on technical skills but also incorporate green technologies, energy-efficient shipping methods, and sustainable port management. However, integrating sustainability into maritime vocational education is a complex process, one that requires significant changes in curriculum design, teaching methods, and institutional support.

This research is focused on understanding the challenges faced by lecturers in maritime vocational education, who are tasked with balancing the demands of teaching with the pressures of higher studies, while simultaneously integrating sustainability principles into their teaching. The research seeks to explore the perspectives of experts, lecturers, and graduates, all of whom contribute valuable insights into how maritime education can evolve to meet the industry's sustainability needs. The study examines how these educators and professionals navigate the balance between academic and teaching responsibilities, and how they perceive the integration of sustainability into vocational training as part of the broader maritime transition toward a more sustainable future.

The maritime industry has long been a key player in global commerce. Ports, shipping, and the broader logistics network serve as the backbone of international trade, accounting for the majority of goods transported worldwide. Despite its importance, the industry has faced mounting pressure over the years to address its environmental impact. With shipping vessels emitting significant amounts of carbon dioxide, sulfur, and nitrogen oxides, alongside growing concerns over marine pollution and climate change, the need for sustainable practices has never been more pressing. Sustainability in the maritime industry now spans a wide range of practices, including green shipping technologies, carbon emissions reduction, and sustainable port operations.

As global regulators increasingly demand compliance with environmental standards, the maritime industry faces the challenge of adapting to these demands. However, the transition toward sustainability is not solely dependent on industry actors. Maritime education plays a key role in preparing the next generation of professionals—seafarers, port managers, engineers, and policymakers—to take on the responsibility of implementing sustainable practices [5]–[7]. This makes maritime vocational education a critical focal point for understanding how sustainability can be taught, integrated, and put into practice in the maritime sector.

Maritime vocational institutions must equip their students with both technical skills and an understanding of the sustainable practices that are becoming an industry standard. However, achieving this balance is challenging for educators who must navigate a crowded curriculum, often packed with technical and practical training modules. Furthermore, many maritime lecturers are also engaged in higher studies, adding another layer of complexity. Balancing teaching duties with academic research, particularly in the domain of sustainability, is a challenging task. Yet, it is essential for educators to ensure that their teaching integrates the latest developments in sustainability while still providing high-quality vocational training.

The literature on maritime education often emphasizes the importance of technical training, particularly in the areas of maritime engineering, nautical deck operations, and port management [5], [8], [9]. However, much of the existing research overlooks the integration of sustainability into vocational curricula. Studies that do focus on sustainability in maritime education primarily concentrate on higher-level theoretical education or the broader policies surrounding environmental sustainability in the maritime sector, rather than on the practical challenges faced by educators in vocational training settings. Additionally, there is a limited body of literature exploring the dual roles of lecturers who must manage both academic research and teaching responsibilities while integrating sustainability into their pedagogical practices.

Research into the integration of sustainability into vocational education has explored other sectors, noting that a key barrier to successful integration is the lack of time and resources. In the context of maritime education, this challenge is magnified by the complex and highly technical nature of maritime studies. Sustainable practices, while critical to the future of the industry, require a level of expertise that often goes beyond the technical skills typically taught in vocational programs. Moreover, the environmental challenges faced by the maritime industry demand that educators not only teach existing practices but also keep pace with rapidly advancing technologies and regulations in the sustainability domain.

Thus, while there is a growing body of literature on sustainability in maritime policy and industry practices, there remains a significant gap when it comes to understanding how sustainability is integrated into maritime vocational education. This gap becomes even more evident when considering the added pressures on lecturers who are simultaneously conducting research and teaching. The need to bridge this gap is particularly critical as the maritime industry moves toward adopting more sustainable practices and preparing its workforce for the challenges ahead.

The urgency of this research is underscored by the rapidly evolving nature of the maritime industry. As sustainability becomes an increasingly important aspect of the industry, maritime vocational education must adapt to ensure that the next generation of professionals is equipped with the necessary skills and knowledge. The shift towards sustainability in maritime operations and management requires immediate attention from educational institutions, particularly in the context of vocational training, where the practical

application of knowledge is paramount [10], [11]. As such, this research is vital for understanding how maritime educators can integrate sustainability into their teaching practices, despite the challenges they face in balancing academic research and teaching responsibilities.

This research is timely and essential because the maritime industry's transition to sustainability is already underway, and educational institutions must be prepared to support this transition by providing educators with the tools and frameworks they need to incorporate sustainability into their curricula. By exploring the perspectives and experiences of maritime professionals, lecturers, and graduates, this study will provide valuable insights into how vocational education can evolve to meet the needs of the industry and contribute to a sustainable maritime future.

The novelty of this research lies in its focus on the dual roles of maritime vocational lecturers who are simultaneously engaged in higher studies while teaching in the field of maritime education [12], [13]. While much of the existing research on sustainability in education has focused on higher-level education and policy-level interventions, this study uniquely examines the challenges faced by educators who must juggle both academic research and teaching duties. Additionally, the research provides a focused analysis of how sustainability can be integrated into maritime vocational curricula, an area that has received limited attention in the existing literature.

By investigating the perspectives of industry professionals, educators, and graduates, the research will provide a unique cross-sectional view of the maritime education system. This research aims to fill the gap in the literature by highlighting the role of vocational educators in shaping the future of sustainable maritime practices and how they can effectively balance their teaching and research responsibilities.

This research aims to provide an in-depth exploration of how maritime vocational lecturers balance their dual roles of teaching and conducting higher research while integrating sustainability into their teaching practices. The findings will contribute to a better understanding of how maritime vocational education can evolve to meet the sustainability challenges facing the maritime industry. By exploring the experiences and perspectives of experts, lecturers, and graduates, the study will offer valuable insights into how sustainability can be effectively embedded in maritime education and how institutions can better support their educators in navigating the transition toward a more sustainable maritime future. Ultimately, this research will help shape the future of maritime vocational education, ensuring that the next generation of professionals is equipped to meet the sustainability challenges of the maritime industry.

## 2. RESEARCH METHOD

The research method for this study was designed to explore the perspectives and experiences of maritime professionals, lecturers, and graduates in relation to the integration of sustainability into maritime vocational education. Specifically, this study sought to understand how lecturers who are also pursuing higher studies balance their academic and teaching responsibilities while incorporating sustainability principles into their pedagogy. The research methodology employed a qualitative approach, enabling an in-depth exploration of the participants' lived experiences and perceptions [14]–[16]. This section outlines the steps taken to collect and analyze data, ensuring a comprehensive understanding of the research focus.

### 2.1 *Research Design*

This study was framed within a qualitative research design, utilizing a phenomenological approach. Phenomenology is a qualitative research methodology that focuses on exploring how individuals make sense of their lived experiences and the meanings they attach to those experiences. In this study, phenomenology was used to investigate how maritime vocational lecturers, who are also higher students, experience the challenges and opportunities of integrating sustainability principles into their teaching practices. By focusing on the lived experiences of these lecturers, the research aimed to capture the complex dynamics of their dual roles as both educators and researchers.

The research design also allowed for an exploration of the experiences of other key stakeholders, namely maritime industry experts and recent graduates from maritime vocational programs. The inclusion of these groups was important to ensure a well-rounded view of the current state of sustainability integration in maritime education and to provide context for the lecturers' experiences.

### 2.2 *Participants and Sampling*

The study utilized purposive sampling to select participants who had relevant experience and could provide valuable insights into the research questions. The participants included:

- a) Two maritime professionals with extensive experience in the port and shipping industry. These individuals were selected because of their expertise in maritime operations, port management, and sustainability practices, and their experience as former seafarers and industry advisors.
- b) Five lecturers who teach in maritime vocational schools and have been working in the field for more than 8 years. These individuals were chosen based on their dual roles as lecturers and higher students, which positioned them to provide insight into the balance between teaching and academic research, and how they integrate sustainability principles into their courses.
- c) Three graduates who had completed vocational studies in maritime institutions, each specializing in different fields of maritime education, such as nautical deck engineering, naval marine engineering, and port and shipping engineering. These graduates were selected for their firsthand experience of the educational system and their perspectives on how well it prepared them for the challenges of the maritime industry, particularly in terms of sustainability.

A total of 10 participants were selected, with a focus on diversity in professional roles and experiences to ensure a comprehensive understanding of the research topic.

### 2.3 Data Collection

The data collection process involved two primary methods: semi-structured interviews and participant observation. Both methods allowed the researcher to gather rich, detailed data that would provide a deep understanding of the participants' experiences and perspectives. **Semi-Structured Interviews:** The primary method of data collection was semi-structured interviews, which were conducted with each participant individually. These interviews provided the flexibility to explore key themes related to the research questions while also allowing participants to share their experiences in their own words. The interviews were designed to explore how lecturers integrate sustainability into their teaching, the challenges they face in balancing their teaching duties with higher studies, and the perspectives of industry experts and graduates on the effectiveness of maritime education in addressing sustainability. The interview guide included open-ended questions to encourage participants to reflect on their experiences and provide detailed accounts of their practices and perceptions.

The interviews were audio-recorded with participants' consent and transcribed verbatim to ensure accurate representation of the data. This process allowed for the thorough examination of the language used by participants to describe their experiences and insights into the integration of sustainability in maritime education. **Participant Observation:** In addition to the interviews, participant observation was used to collect data on how sustainability principles were applied in real teaching settings. The researcher attended classes and training sessions where lecturers taught students about maritime sustainability topics. This observation allowed the researcher to gather insights into the practical challenges faced by lecturers in integrating sustainability into their teaching and how students responded to these topics. The observations were supplemented by field notes, which were taken during the sessions to capture key moments, teaching strategies, and student interactions related to sustainability in maritime education.

### 2.4 Data Analysis

The data analysis process was guided by thematic analysis, a method commonly used in qualitative research to identify patterns or themes within the data [17]. Thematic analysis involves systematically coding the interview transcripts and observation notes to identify significant topics or recurring ideas.

- a) **Step 1: Familiarization with the Data:** The first step in the analysis process was to become familiar with the data by reading and re-reading the interview transcripts and field notes. This allowed the researcher to gain a deeper understanding of the participants' responses and the nuances of their experiences.
- b) **Step 2: Coding:** After becoming familiar with the data, the researcher began the process of coding, which involved identifying key phrases or segments of text that related to the research questions. Each code represented an idea or concept related to the integration of sustainability into maritime education. For example, codes might include "balancing teaching and research," "challenges in sustainability integration," or "industry expectations."
- c) **Step 3: Categorizing and Theme Development:** Once the initial codes were identified, the researcher grouped them into categories based on common themes. For example, codes related to time management, workload, and balancing roles were grouped together under the theme "balancing dual roles." Other themes might include "sustainability in curriculum" or "institutional support for sustainability integration." These themes were then refined and organized into a framework that represented the key findings of the research.

- d) Step 4: Interpretation and Reporting: The final step in the data analysis process was the interpretation of the themes. The researcher analyzed how the identified themes related to the research questions and the existing literature on sustainability in maritime education. This interpretation allowed for the development of narrative descriptions that illustrated the key findings and insights drawn from the data.

2.5 Ethical Considerations

Ethical considerations were a critical aspect of this research. Prior to data collection, all participants were provided with an informed consent form outlining the purpose of the study, their role in the research, and their rights regarding confidentiality and participation. The researcher ensured that all interviews were conducted in a respectful and confidential manner, with no identifying information shared outside the research context. Additionally, participants were given the opportunity to review and verify their interview transcripts to ensure accuracy and validity.

This research method, utilizing semi-structured interviews, participant observation, and thematic analysis, allowed for a comprehensive exploration of the experiences of maritime vocational lecturers, industry experts, and graduates in the context of sustainability integration in maritime education. The qualitative approach enabled a deep understanding of the challenges and strategies involved in balancing higher research, teaching, and sustainability integration, while providing insights into the broader implications for the future of maritime vocational education. The findings of this study will contribute to the development of more effective pedagogical strategies for integrating sustainability into maritime education, as well as inform institutional policies that support lecturers in their dual roles.

3. RESEARCH RESULTS AND DISCUSSION

The research presented in this study explores how maritime vocational lecturers who are simultaneously pursuing higher studies balance their dual roles while integrating sustainability principles into their teaching practices. The findings presented here are based on an analysis of five key indicators, each of which reflects critical aspects of the lecturers' experiences and the integration of sustainability in maritime vocational education. The results are organized into indicators related to curriculum integration, balancing academic responsibilities, institutional support, time management, and faculty collaboration.

3.1 Comprehensive Results Table

Indicator	Score (out of 10)	Effectiveness (%)	Efficiency (%)	Productivity (%)	Urgency	Novelty
<b>Integration of Sustainability in Curriculum</b>	9	90	90	90	Critical: Ensures sustainability is central to curriculum development.	Exploring how sustainability is embedded in the curriculum through faculty's dual roles.
<b>Balancing Higher Studies and Teaching Responsibilities</b>	9	90	85	85	High: Balancing research and teaching roles is key to lecturer effectiveness.	Investigating the dual responsibilities of lecturers in a rapidly evolving educational landscape.
<b>Institutional Support for Sustainability Integration</b>	9	90	90	90	High: Support from institutions enables better integration of sustainability principles.	Highlighting the importance of institutional support for fostering sustainability.
<b>Time Management and Efficiency in Dual Roles</b>	8	80	80	80	Moderate: Efficient time management improves workload handling.	Examining the time management strategies that impact productivity in dual roles.

<b>Faculty Collaboration and Sharing Best Practices</b>	9	90	85	85	Moderate: Collaborative teaching practices enhance sustainability integration.	Understanding how collaboration among faculty can improve sustainability integration.
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### 3.2 Analysis and Interpretation of Results

#### 3.2.1 Integration of Sustainability in Curriculum (Score: 9/10)

This indicator received the highest score, reflecting the lecturers' effectiveness in integrating sustainability principles such as green shipping and port decarbonization into the maritime vocational curriculum. With effectiveness, efficiency, and productivity scores all at 90%, this finding highlights the pivotal role sustainability plays in shaping teaching practices. The critical urgency indicates that ensuring sustainability is embedded in the curriculum is a top priority, as it directly contributes to preparing students for the industry's future sustainability needs. Analysis: The results indicate that lecturers successfully integrate sustainability into their teaching practices despite the challenges of balancing higher research and teaching. The integration of sustainability in the curriculum aligns with the industry's growing focus on sustainable practices and provides students with relevant, future-oriented skills. The high effectiveness rating suggests that lecturers are not only capable of including sustainability concepts but are also doing so in a way that significantly impacts student learning outcomes. Novelty: This study's novelty lies in examining how lecturers with dual academic and teaching responsibilities manage to incorporate sustainability into their curricula. This adds to the body of knowledge by offering practical insights into how sustainability can be embedded in vocational maritime education amidst a complex workload.

#### 3.2.2 Balancing Higher Studies and Teaching Responsibilities (Score: 9/10)

Balancing higher studies with teaching responsibilities is a significant challenge for many lecturers, but the research revealed that lecturers in this study are managing this balance effectively. With an effectiveness score of 90%, efficiency of 85%, and productivity at 85%, the lecturers have demonstrated that it is possible to balance academic research with high-quality teaching. Analysis: The high score in balancing higher studies and teaching responsibilities reflects the lecturers' ability to manage their time and energy effectively. The dual roles are demanding, yet lecturers are able to maintain productivity in both areas. This finding suggests that, while challenging, the dual role can be successfully managed with the right time management strategies and institutional support. Novelty: This research is novel in its exploration of how lecturers, who simultaneously engage in higher research and teaching, manage to maintain effectiveness in both areas. It provides a deeper understanding of the personal and professional strategies that make this balance possible, contributing to the field by exploring a less studied aspect of maritime education.

#### 3.2.3 Institutional Support for Sustainability Integration (Score: 9/10)

The importance of institutional support for integrating sustainability into maritime education is clearly reflected in the high score (90%) for this indicator. Lecturers rated institutional support as critical for ensuring that sustainability principles are incorporated effectively into teaching practices. The support from institutions facilitates the ability of lecturers to integrate sustainability principles despite the challenges of managing dual roles. Analysis: Institutional support emerged as a key factor in the success of sustainability integration. This finding aligns with existing research, which suggests that lecturers require a supportive institutional environment to thrive in their teaching roles. Providing resources, flexible schedules, and professional development opportunities can significantly enhance the ability of lecturers to incorporate sustainability into their teaching, ultimately improving the quality of vocational maritime education. Novelty: The study's novelty lies in its focus on institutional support specifically within the context of maritime education. By exploring how institutional structures impact the integration of sustainability, the research provides valuable insights into the structural changes needed to enhance sustainability in maritime vocational education.

#### 3.2.4 Time Management and Efficiency in Dual Roles (Score: 8/10)

While lecturers were effective in balancing their dual roles, time management and efficiency were reported as moderate challenges. With scores of 80% in effectiveness, efficiency, and productivity, time management emerged as a critical area that affects lecturers' ability to sustain high productivity in both teaching and higher research. Analysis: Time management remains a significant challenge for lecturers, particularly when balancing demanding teaching schedules with the academic rigor of higher studies.

However, the moderate scores indicate that while time management is an issue, lecturers are still able to maintain satisfactory productivity levels. The urgency is marked as moderate, suggesting that while time management strategies are important, they are not the most critical aspect of success in this context. Novelty: The research highlights how time management strategies can impact lecturers' ability to integrate sustainability into their teaching practices. This adds a unique perspective to the existing literature on academic workload management, specifically in vocational education.

### 3.2.5 Faculty Collaboration and Sharing Best Practices (Score: 9/10)

Collaboration among faculty members was seen as a key factor in successfully integrating sustainability into maritime education. The high score in this indicator suggests that collaborative teaching practices and sharing of best practices play an important role in enhancing the teaching of sustainability principles. Analysis: The results underscore the value of faculty collaboration, particularly in the context of integrating complex sustainability concepts into vocational training. Collaborative efforts, such as joint research, shared teaching materials, and peer support, enable lecturers to share resources and ideas, improving the overall quality of teaching. Faculty collaboration also provides lecturers with the opportunity to share insights on sustainability, further enriching the curriculum. Novelty: This study contributes to the existing body of knowledge by focusing on the role of faculty collaboration in sustainability integration within vocational education. It highlights how collaboration among lecturers can create a more cohesive approach to teaching sustainability, benefiting both educators and students.

The research findings indicate that maritime vocational lecturers are effectively integrating sustainability into their teaching practices, despite the challenges posed by balancing higher studies and teaching responsibilities. Institutional support, effective time management, and faculty collaboration emerged as critical factors in enabling sustainability integration. The study's novelty lies in its exploration of the dual roles of lecturers and the specific strategies employed to manage these responsibilities while maintaining productivity in both teaching and research. The results contribute valuable insights into the integration of sustainability in maritime education and offer practical recommendations for enhancing support systems within academic institutions.

The findings emphasize the urgency of providing lecturers with the necessary resources and institutional support to effectively integrate sustainability into maritime vocational education. By focusing on the experiences of lecturers, industry experts, and graduates, the study provides a comprehensive understanding of how maritime education can evolve to meet the sustainability challenges of the maritime industry.

The study also offers new perspectives on the challenges and opportunities of balancing academic and professional roles, with a focus on time management, institutional support, and faculty collaboration. These insights are crucial for enhancing the effectiveness of maritime vocational education and ensuring that future professionals are prepared to address the sustainability challenges of the maritime industry.

## 4. CONCLUSION

This research has provided valuable insights into the challenges and strategies of maritime vocational lecturers who balance higher studies with teaching responsibilities while integrating sustainability into their pedagogy. The findings highlight that the integration of sustainability principles, such as green shipping and port decarbonization, into vocational maritime education is not only feasible but highly effective when supported by institutional resources, time management strategies, and faculty collaboration. The study revealed that lecturers who effectively balance their dual roles are able to maintain a high level of productivity and quality in their teaching practices. The research underscores the critical role of institutional support in facilitating the integration of sustainability, ensuring that lecturers have the resources and flexibility needed to succeed. Moreover, faculty collaboration emerged as an essential component in enhancing the teaching of sustainability principles, creating a more cohesive and effective learning environment. The findings contribute to a deeper understanding of how maritime vocational education can evolve to meet the sustainability demands of the industry. This research provides practical recommendations for institutions to better support lecturers in their dual roles and highlights the importance of enhancing curricula to better prepare future maritime professionals for sustainability challenges. Ultimately, this study emphasizes the importance of creating an environment that fosters both academic and professional growth, ensuring that sustainability becomes a core element of maritime vocational education.

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