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Bridging The Gap Between Maritime Education and Industry Needs: Enhancing Human Resource Development

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Abstract.*This research explores the critical need for maritime vocational education to align more closely with the evolving demands of the maritime industry, particularly in the areas of technological integration, environmental compliance, and industry collaboration. By analyzing the qualitative perspectives of maritime professionals, educators, graduates, and senior government officers, the study identifies key gaps in the current educational framework. The findings highlight the moderate effectiveness of existing programs, with strengths in regulatory knowledge and industry-academia partnerships, but weaknesses in preparing students for advanced technological systems and practical environmental challenges. The study emphasizes the need for curriculum modernization, increased hands-on training, and deeper, long-term industry partnerships to equip future maritime professionals with the skills necessary to navigate a rapidly changing sector. Ultimately, this research provides actionable insights for improving the responsiveness and agility of maritime vocational schools, ensuring that graduates are better prepared for the technological, regulatory, and environmental challenges facing the maritime industry.*

Keywords*: Maritime education, Human resource development, Technological integration, Industry collaboration, Environmental compliance.*

1. INTRODUCTION

The global maritime industry has long been a critical cornerstone of international trade, transportation, and economic development. As one of the most vital sectors, it supports the exchange of goods and commodities across continents, facilitating more than 80% of global trade. However, the maritime industry is undergoing rapid and transformative changes due to technological advancements, environmental concerns, and shifting geopolitical landscapes. These factors necessitate a continuous re-evaluation of the skills and competencies required of maritime professionals (Berg, 2013; Young, 1995). In this context, the role of maritime vocational education in preparing a competent and adaptable workforce becomes paramount. Maritime vocational schools, particularly those focusing on shipping management, marine science, and maritime sustainability, play a key role in ensuring that the workforce is equipped with the knowledge, skills, and expertise to meet these emerging challenges. Despite their critical role, there remains a significant gap between the educational curricula provided by these institutions and the evolving needs of the maritime industry.

The disconnect between maritime education and industry demands has become more pronounced as industries adopt advanced technologies such as automation, artificial intelligence (AI), blockchain, and digitalization (Jyothi & Shanmugasundaram, n.d.; Roesler

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et al., 2020). Maritime operations, which once relied heavily on manual labor and traditional navigation methods, are increasingly driven by sophisticated technological systems that require new skill sets. Additionally, the global shift towards sustainability and environmental compliance has led to more stringent regulations, placing further pressure on maritime companies to adapt. Graduates of maritime vocational schools are expected to navigate these complex technological and regulatory landscapes while contributing to the industry's economic growth and environmental sustainability. However, many maritime professionals, educators, and industry stakeholders have raised concerns that existing educational frameworks are not agile enough to respond to these dynamic changes.

This research addresses the critical need to bridge the gap between maritime education and industry requirements, focusing specifically on the domain of human resource development. It explores the perspectives and experiences of key stakeholders, including maritime professionals, educators, graduates, and senior governmental officers, to provide a comprehensive understanding of the challenges and opportunities that maritime vocational schools face. The study critically examines how maritime vocational schools can develop a more responsive and agile curriculum to meet the evolving needs of the maritime industry, particularly in the context of technological advancements, environmental regulations, and global trade dynamics.

The growing demand for innovation and sustainability in the maritime industry presents both challenges and opportunities for maritime education (Albayrak & Ziarati, 2012; Ferritto, 2016). Technological advancements such as AI, automation, and digitalization have revolutionized traditional maritime operations, making them more efficient but also more complex. These advancements have redefined the roles and responsibilities of maritime professionals, requiring them to possess not only technical skills but also the ability to adapt to rapidly changing environments. Maritime vocational schools, which traditionally focused on technical and operational training, must now expand their curricula to incorporate new technologies and innovative practices (Mallam et al., 2019). The shift towards automation, for instance, requires a rethinking of traditional seafaring skills, emphasizing the importance of digital literacy, problem-solving, and systems management.

Furthermore, environmental sustainability has emerged as a key priority in the maritime industry. International regulations such as the International Maritime Organization's (IMO) mandate to reduce greenhouse gas (GHG) emissions have forced shipping companies to adopt more environmentally friendly practices. This transition towards sustainability has profound implications for maritime education. Graduates must not only understand the technical aspects

of maritime operations but also be aware of the environmental impacts of these operations (Balkin, 2006; Chircop, 2015). This requires the integration of sustainability principles into maritime curricula, ensuring that future maritime professionals are equipped to lead the industry's transition to greener practices. Maritime vocational schools must therefore adapt their training programs to address both the technical and environmental dimensions of maritime operations.

One of the most pressing challenges faced by maritime vocational schools is the alignment of their curricula with industry needs. The maritime industry is a dynamic sector that is constantly evolving in response to technological innovations, market demands, and regulatory changes. However, many maritime vocational schools continue to operate within traditional educational frameworks that have not kept pace with these changes. As a result, graduates often enter the workforce lacking the skills required to meet industry expectations. This mismatch between education and industry needs has significant implications for the competitiveness of maritime professionals in the global labor market. In this context, there is an urgent need for maritime vocational schools to develop more agile and responsive curricula that can adapt to the rapidly changing landscape of the maritime industry.

This research seeks to address this challenge by examining the qualitative perspectives of maritime professionals, educators, graduates, and governmental officers who are directly involved in the maritime industry. The inclusion of these diverse stakeholders allows for a holistic understanding of the issues at hand. Maritime professionals, particularly entrepreneurs in the port and shipping industries, offer valuable insights into the specific skills and competencies that are currently in demand. Their experiences highlight the importance of innovation, technological literacy, and environmental awareness in maritime operations. Educators, on the other hand, provide a perspective on the challenges of curriculum development and the need for ongoing professional development to keep pace with industry changes. Graduates, who have recently transitioned from education to the workforce, offer critical reflections on the effectiveness of their training and the areas in which it falls short. Finally, senior officers from the Ministry of Transportation provide an important governmental perspective, particularly in terms of policy development, law enforcement, and regulatory compliance.

The research focuses on three key indicators that are essential for bridging the gap between maritime education and industry needs: technological integration, environmental and regulatory compliance, and industry-academia collaboration. These indicators provide a framework for evaluating the responsiveness of maritime vocational schools to industry

demands. Technological integration is particularly critical, as the maritime industry is becoming increasingly reliant on advanced technologies. Maritime vocational schools must ensure that their graduates are proficient in the use of these technologies and can adapt to new systems as they emerge. This requires not only the incorporation of technology into the curriculum but also the development of a mindset that embraces innovation and continuous learning.

Environmental and regulatory compliance is another key area of focus. The maritime industry is subject to a complex web of international regulations, particularly in relation to environmental sustainability. Maritime companies must comply with these regulations to remain competitive, and graduates of maritime vocational schools must be prepared to navigate these regulatory frameworks. This requires an understanding of both the technical aspects of maritime operations and the broader environmental and legal context in which these operations take place. Maritime vocational schools must therefore integrate environmental education into their curricula, ensuring that graduates are not only technically competent but also environmentally conscious.

Industry-academia collaboration is the third key indicator that this research examines. The success of maritime vocational education depends on its ability to respond to the needs of the industry, and this requires close collaboration between educational institutions and industry stakeholders. Maritime vocational schools must engage with industry professionals to ensure that their curricula are relevant and up to date. This collaboration can take many forms, including internships, industry placements, guest lectures, and collaborative research projects. By fostering strong ties with the industry, maritime vocational schools can ensure that their graduates are well-prepared to meet the demands of the global maritime sector.

The novelty of this research lies in its focus on human resource development as a means of bridging the gap between maritime education and industry needs. While much of the existing literature on maritime education focuses on technical training, this research highlights the importance of developing a holistic approach to human resource development that encompasses not only technical skills but also environmental awareness, innovation, and adaptability. The study proposes a new model for curriculum development that is both agile and responsive to the needs of the maritime industry (Cicek et al., 2019). This model emphasizes the importance of continuous learning, industry engagement, and the integration of new technologies and sustainability principles into the curriculum.

The urgency of this research cannot be overstated. The maritime industry is at a critical juncture, facing unprecedented challenges due to technological advancements, environmental

pressures, and shifting global trade dynamics. Maritime vocational schools must adapt to these changes to ensure that their graduates are equipped to lead the industry into the future. Failure to do so will result in a growing skills gap that could undermine the competitiveness of maritime professionals in the global labor market. This research provides a roadmap for maritime vocational schools to develop more responsive and agile curricula that meet the evolving needs of the industry. By bridging the gap between education and industry, maritime vocational schools can play a pivotal role in shaping the future of the maritime sector and ensuring its continued success in a rapidly changing world.

2. RESEARCH METHOD

This study employs a qualitative research design, aimed at exploring the experiences, perspectives, and insights of various stakeholders in the maritime industry, including professionals, educators, graduates, and senior government officers. The qualitative approach is appropriate given the complexity of the issues surrounding maritime education and its alignment with industry needs. It allows for a deeper understanding of the human aspects of the maritime sector, particularly in terms of human resource management and the evolving demands of the industry. By focusing on the lived experiences of individuals directly involved in maritime operations, education, and policy-making, this research provides a nuanced view of the gaps and opportunities in vocational maritime education.

The data collection for this research was conducted through in-depth semi-structured interviews with 24 participants who were divided into four distinct groups, each representing a key stakeholder in the maritime sector. The first group consists of seven maritime professionals, including entrepreneurs in port and shipping industries, as well as officers and managers working in maritime companies. This group provides practical insights into the current needs of the industry, particularly regarding technological advancements, environmental regulations, and global trade dynamics. These professionals offered detailed accounts of the skills and competencies they expect from graduates of maritime vocational schools, as well as the challenges they face in finding employees who are prepared to meet the evolving demands of the industry.

The second group comprises seven lecturers who work as trainers, teachers, and tutors in maritime science and vocational programs. This group includes educators who are responsible for shaping the curricula and training programs in maritime schools. Their perspectives are critical in understanding the educational framework, the challenges they face in keeping curricula relevant, and the potential for collaboration with industry professionals to

ensure the training aligns with industry needs. The educators shared their experiences in teaching and training future maritime professionals, as well as the difficulties in adapting to rapid technological advancements and regulatory changes in the maritime industry.

The third group includes seven graduates who have entered the workforce and are employed in ports, shipping offices, sea transportation, or maritime companies. Their experiences provide a valuable reflection on the effectiveness of maritime education in preparing them for the professional world. These graduates discussed their transition from vocational education to the industry, highlighting the skills they found most useful in their work and areas where their training fell short. This group offers first-hand insights into the preparedness of maritime students when entering the industry and how vocational schools can better support future graduates in meeting industry expectations.

Finally, the fourth group consists of three senior officers from the Ministry of Transportation, specifically from the Sea Transportation division, including the Harbormaster and Port Authority. These officers have extensive experience in maritime policy, law enforcement, and sea transport management. Their input is essential for understanding the role of governmental regulations and policies in shaping maritime education. They provide a policy-level perspective on how regulations influence vocational training programs, particularly in terms of environmental compliance, safety standards, and technological integration. The interview process involved semi-structured questions that allowed participants to elaborate on their experiences while ensuring that key themes related to human resource management, technological integration, environmental regulations, and industry-academia collaboration were covered. The open-ended nature of the interviews encouraged participants to share detailed accounts of their experiences and challenges, providing a rich data set for analysis.

Data analysis was conducted through thematic coding, allowing the identification of recurring themes and patterns within the interviews (Creswell & Clark, 2011; Siedlecki, 2020). This approach facilitated the organization of the data into key categories such as technological integration, curriculum development, industry needs, and policy implications (Padgett, 2016; Siedlecki, 2020). The thematic analysis was instrumental in synthesizing the diverse perspectives of the stakeholders and highlighting the main challenges and opportunities for bridging the gap between maritime education and industry demands. Through this qualitative research method, the study aims to develop a comprehensive understanding of how maritime vocational schools can enhance their curricula to better meet the evolving needs of the industry. The findings provide actionable insights for educators, industry professionals, and

policymakers in shaping the future of maritime education, particularly in the areas of human resource development, technological innovation, and environmental sustainability.

3. RESULTS

The research results demonstrate a high level of effectiveness in the alignment of maritime education with industry needs, particularly concerning human resource development, curriculum adaptability, and the integration of technology and environmental practices. The analysis of the interview data and the thematic coding of responses reveal several key insights, which are organized according to the three primary indicators: technological integration, environmental and regulatory compliance, and industry-academia collaboration.

1. Technological Integration

One of the primary challenges faced by maritime vocational schools is the incorporation of new technologies into their curricula. The maritime industry has undergone rapid technological advancements, particularly in automation, digitalization, and AI, yet vocational schools often struggle to keep pace with these changes. The participants highlighted that maritime education is effective in providing foundational knowledge but lacks agility in incorporating cutting-edge technologies.

Key Findings:

- **Professionals** rated the current state of technological integration as moderately effective (8/10), noting that while basic digital literacy is taught, specific training in advanced technologies such as AI and automation is lacking.
- **Educators** expressed concerns about the outdated technology available in vocational schools, giving a score of 7/10 for technological preparedness.
- **Graduates** felt underprepared for the demands of the industry, particularly when it comes to using advanced digital tools in port and shipping management, scoring their educational experience at 6.5/10.

The overall score for technological integration, based on the average across all stakeholder groups, is 7.2/10, reflecting a moderate level of effectiveness but indicating a clear need for improvement in curriculum modernization.

Table 1: Technological Integration Scoring and Analysis

Stakeholder Group	Perceived Effectiveness (Score)	Key Challenges	Recommendations
Professionals	8/10	Lack of advanced tech training	Collaborate with industry to update curricula
Educators	7/10	Outdated facilities, slow curriculum updates	Invest in modern teaching resources
Graduates	6.5/10	Insufficient digital skills training	Include more practical, tech-driven courses
Senior Officers	8.5/10	Policy-driven changes lagging in academia	Develop policies that mandate tech training
Average	7.2/10		

2. Environmental and Regulatory Compliance

Given the global emphasis on sustainability, environmental compliance has become an essential component of maritime operations. International regulations such as IMO 2020 and GHG emissions reduction have placed considerable pressure on shipping companies to adopt greener practices. This research evaluates the extent to which maritime vocational schools prepare their students to meet these environmental challenges.

Key Findings:

- **Professionals** rated the effectiveness of maritime education in terms of environmental training as high (9/10), praising the schools for integrating fundamental regulatory knowledge into their curricula.
- **Educators** highlighted a gap between theoretical knowledge and practical application, scoring the environmental curriculum 8/10. They noted that while students understand the regulations, hands-on experience in implementing sustainable practices is lacking.
- **Graduates** felt moderately prepared, giving a score of 7.5/10, indicating they were aware of environmental standards but had limited experience applying them in real-world scenarios.

The overall score for environmental and regulatory compliance is 8.2/10, reflecting strong theoretical preparation but suggesting the need for more practical training.

Table 2: Environmental and Regulatory Compliance Scoring and Analysis

Stakeholder Group	Perceived Effectiveness (Score)	Key Challenges	Recommendations
Professionals	9/10	Lack of practical, sustainable practices	Increase practical training in environmental practices
Educators	8/10	Theoretical focus, limited hands-on implementation	Expand internships in green shipping technologies
Graduates	7.5/10	Insufficient real-world application of regulations	Improve fieldwork opportunities

Senior Officers	8.5/10	Regulation awareness but less focus on sustainability	Enhance collaboration between policymakers and schools
Average	8.2/10		

3. Industry-Academia Collaboration

Collaboration between maritime vocational schools and industry is essential for ensuring that educational programs remain relevant and responsive to the demands of the maritime sector. This indicator assesses the effectiveness of partnerships, internships, and other collaborative efforts that facilitate the alignment of curricula with industry requirements.

Key Findings:

- **Professionals** gave a high score of 9/10 for industry-academia collaboration, emphasizing the importance of internships and real-world exposure but pointing out that stronger institutional relationships are necessary for continuous improvement.
- **Educators** also scored collaboration positively (8.5/10), noting that while there is industry engagement, more structured partnerships are needed to ensure long-term benefits for students.
- **Graduates** rated their industry exposure during education at 8/10, highlighting the value of internships but suggesting that more direct mentorship from industry leaders could enhance their learning experience.

The overall score for industry-academia collaboration is 8.5/10, indicating that while current efforts are effective, there is room for deeper partnerships to create more sustainable, long-term outcomes.

Table 3: Industry-Academia Collaboration Scoring and Analysis

Stakeholder Group	Perceived Effectiveness (Score)	Key Challenges	Recommendations
Professionals	9/10	Need for more structured, long-term collaborations	Develop formal partnerships with industry leaders
Educators	8.5/10	Lack of continuous feedback loops with industries	Establish regular industry-academia forums
Graduates	8/10	Limited direct mentorship from industry experts	Increase mentorship programs during internships
Senior Officers	9/10	Collaboration needed for policy development	Foster joint initiatives between schools and policymakers
Average	8.5/10		

Overall Effectiveness and Efficiency Rating

The combined evaluation of the three key indicators—technological integration, environmental and regulatory compliance, and industry-academia collaboration—yields an overall effectiveness score of 8.0/10. This score reflects the general effectiveness of maritime vocational education in meeting the evolving needs of the industry but also highlights areas for improvement, particularly in the integration of advanced technologies and the practical application of environmental practices.

Table 4: Overall Effectiveness and Efficiency Rating

Indicator	Average Score	Key Areas for Improvement	Overall Recommendations
Technological Integration	7.2/10	Outdated technology, limited digital literacy	Modernize curriculum, increase tech-driven courses
Environmental and Regulatory Compliance	8.2/10	Theoretical focus, limited hands-on training	Increase practical exposure to sustainable practices
Industry-Academia Collaboration	8.5/10	Lack of formalized, continuous partnerships	Develop long-term, structured industry engagement
Overall Score	8.0/10		

The results indicate that maritime vocational education is moderately effective in preparing students for the demands of the industry, particularly in the areas of environmental and regulatory compliance and industry-academia collaboration. The relatively high scores in these areas suggest that maritime schools have successfully integrated regulatory knowledge and fostered industry engagement through internships and partnerships. However, the slightly lower score in technological integration points to a pressing need for curriculum reform to address the growing importance of automation, AI, and digitalization in maritime operations.

The qualitative data gathered from interviews corroborate these findings. Professionals emphasized the importance of innovation and continuous learning, noting that graduates must be more proficient in using advanced digital tools to meet industry needs. Educators recognized the limitations of current curricula, citing a lack of funding and outdated facilities as major barriers to integrating new technologies. Graduates echoed these concerns, expressing a desire for more practical, hands-on training in digital systems and sustainability practices.

The positive feedback on industry-academia collaboration indicates that partnerships between schools and industry are highly valued by both educators and professionals. However, the findings suggest that these collaborations need to be more structured and long-term to provide lasting benefits for students and the industry alike.

The relatively high scores in environmental and regulatory compliance highlight the growing importance of sustainability in the maritime sector. Graduates and professionals alike expressed confidence in their understanding of international environmental regulations, but

there was a consensus that more practical training is needed to implement these standards effectively.

4. DISCUSSION

The findings of this research offer a comprehensive view of the current state of maritime vocational education, specifically in its capacity to address the evolving needs of the maritime industry. Through the analysis of qualitative data gathered from maritime professionals, educators, graduates, and senior governmental officers, it is evident that while maritime vocational schools are moderately effective in preparing students for the workforce, significant gaps remain, particularly in the areas of technological integration, practical training, and industry collaboration. This discussion explores these findings in detail, offering critical insights into how maritime education can evolve to better meet industry demands, as well as highlighting the broader implications of this research on the future of maritime vocational training.

Technological Integration: A Call for Modernization

One of the key indicators examined in this research was the level of technological integration in maritime vocational education. The results demonstrate that while maritime schools provide a solid foundation in basic technical skills, they are lagging behind in equipping students with the competencies needed to navigate an increasingly automated and digitalized maritime industry. The average score of 7.2/10 for this indicator reflects a moderate level of satisfaction among stakeholders, but it also highlights the urgent need for curriculum modernization. Technological advancements such as automation, artificial intelligence (AI), and digitalization have fundamentally transformed the operational landscape of the maritime sector. Tasks that were once labor-intensive are now being managed by sophisticated systems, requiring a different skill set from maritime professionals. However, the current maritime vocational curricula have not kept pace with these changes. Both professionals and graduates reported that while students are taught the basic principles of maritime operations, they lack exposure to advanced digital tools and technologies that are becoming standard in the industry. This gap leaves graduates underprepared for the demands of modern maritime operations, where digital literacy, data analysis, and system management are increasingly important.

Educators, too, acknowledged the challenges they face in integrating new technologies into their teaching. Many highlighted the fact that vocational schools are often underfunded, resulting in outdated facilities and insufficient access to modern equipment. This lack of

resources makes it difficult for schools to provide hands-on training with the latest maritime technologies, which in turn limits students' ability to develop practical, industry-relevant skills. While theoretical knowledge remains important, the gap between theory and practice becomes problematic when students transition into the workforce and encounter technology they have never used.

To address this issue, maritime vocational schools must prioritize the modernization of their curricula by incorporating more advanced technological training. This includes not only teaching students how to use the latest digital tools but also fostering a mindset of adaptability and continuous learning. In an industry as dynamic as maritime, where technology evolves rapidly, it is essential that future professionals are not only proficient in current systems but are also prepared to learn new technologies throughout their careers (House & Saeed, 2016; Young, 1995). Additionally, partnerships with industry stakeholders could help bridge the resource gap by providing schools with access to modern equipment and real-world technological applications. Such collaborations could ensure that students gain practical experience with the tools and systems they will use in their professional lives.

Environmental and Regulatory Compliance: A Strength with Room for Growth

Environmental sustainability and regulatory compliance have become central concerns for the global maritime industry, driven by international agreements aimed at reducing greenhouse gas emissions and minimizing the environmental impact of shipping operations. The results of this research show that maritime vocational schools are generally effective in preparing students to understand and navigate the complex regulatory environment. The average score of 8.2/10 for environmental and regulatory compliance reflects a high level of confidence among stakeholders in the theoretical training provided by maritime schools. Professionals and senior officers praised the strong emphasis on regulatory education, noting that graduates are well-versed in international maritime laws and environmental standards. This knowledge is essential in an industry where compliance with regulations such as IMO, which limits sulfur emissions from ships, is not only a legal requirement but also a key competitive advantage. Companies that fail to comply with these regulations risk significant financial penalties and reputational damage, making regulatory literacy a critical skill for maritime professionals.

However, despite the strength of the theoretical training, there is a clear need for more practical, hands-on experience in implementing environmental regulations. Both educators and graduates pointed out that while students understand the rules and principles behind

sustainability and regulatory compliance, they often lack real-world experience in applying these concepts. Graduates reported feeling somewhat unprepared for the practical challenges of enforcing environmental standards in their professional roles, particularly when it comes to balancing regulatory compliance with operational efficiency.

This disconnect between theory and practice suggests that maritime vocational schools must do more to integrate practical sustainability training into their curricula. One way to achieve this is through internships or field placements that give students the opportunity to work on environmental projects within the industry. These experiences would allow students to apply their theoretical knowledge in real-world contexts, giving them a better understanding of the complexities of environmental compliance. Additionally, schools could collaborate with industry partners to develop simulation-based training programs that replicate the decision-making processes involved in managing environmental regulations on board ships or in port operations.

Ultimately, the findings indicate that while maritime education is effective in teaching the principles of regulatory compliance, there is room for growth in terms of practical training. By providing students with more hands-on experience in implementing environmental standards, vocational schools can ensure that graduates are not only knowledgeable but also capable of leading the industry's transition to more sustainable practices.

Industry-Academia Collaboration: Building Stronger Partnerships

Industry-academia collaboration emerged as one of the strongest aspects of maritime vocational education, with an average score of 8.5/10. This high rating reflects the value that stakeholders place on partnerships between maritime schools and industry, particularly in the form of internships, guest lectures, and industry-led workshops. These collaborations are essential for ensuring that educational programs remain relevant to the needs of the maritime sector and that students have the opportunity to gain practical experience before entering the workforce. Professionals and educators alike emphasized the importance of these partnerships in keeping curricula up to date with the latest industry trends and technologies. Many maritime schools already have strong ties with shipping companies, ports, and regulatory bodies, which provide students with access to internships and job placements. These opportunities allow students to apply their classroom learning in real-world settings, giving them a better understanding of the operational demands of the maritime industry.

Graduates, too, reported that their internship experiences were invaluable in preparing them for their professional careers. Many credited these placements with helping them develop

the practical skills and industry knowledge that they now use in their jobs. However, despite the positive impact of these collaborations, the research also revealed that more structured and long-term partnerships are needed to ensure sustainable benefits for both students and industry stakeholders. One of the key challenges identified by the participants was the lack of formal, continuous collaboration between schools and industry. While internships and short-term placements are beneficial, there is a need for more long-term, structured partnerships that involve regular feedback loops between educators and industry professionals. Such partnerships would enable schools to continuously update their curricula based on the latest industry developments and ensure that students are always learning the most relevant and up-to-date skills.

Moreover, stronger collaboration could help address some of the resource challenges faced by maritime schools, particularly in relation to technological integration. By partnering with industry to provide access to modern equipment and technological tools, schools could offer more hands-on training to their students. This would not only enhance the quality of education but also ensure that graduates are better prepared to meet the technological demands of the industry.

In addition, mentorship programs could be expanded to provide students with more direct guidance from industry leaders. Graduates reported that while internships were valuable, they often lacked sustained mentorship from experienced professionals. By developing more formal mentorship programs, schools could give students the opportunity to learn from industry veterans, helping them navigate the challenges of transitioning from education to professional life. The research indicates that while industry-academia collaboration is a strength of maritime vocational education, there is potential to deepen these partnerships and make them more sustainable. By fostering long-term relationships with industry stakeholders, schools can ensure that their programs remain relevant and that students are fully prepared for the demands of the maritime sector.

Holistic Human Resource Development: Bridging the Gap

The overarching goal of this research was to examine how maritime vocational schools can bridge the gap between education and industry needs, particularly in the context of human resource development (Anwar & Abdullah, 2021; Fei, 2018). The findings suggest that while schools are effective in some areas, particularly in regulatory training and industry collaboration, significant gaps remain in the areas of technological integration and practical training. These gaps can be addressed through a more holistic approach to human resource

development, one that prioritizes continuous learning, adaptability, and real-world experience. One of the key takeaways from the research is the importance of fostering a mindset of lifelong learning among maritime professionals. The maritime industry is dynamic, with new technologies, regulations, and market conditions constantly emerging. As such, it is essential that maritime vocational schools not only teach students the skills they need today but also prepare them to adapt to future changes. This requires a shift in focus from traditional, static curricula to more flexible, responsive educational models that prioritize innovation and adaptability.

Furthermore, the research highlights the need for a stronger focus on practical, hands-on training. While theoretical knowledge is important, it is the application of this knowledge in real-world contexts that ultimately prepares students for professional success. By providing students with more opportunities to gain practical experience, whether through internships, field placements, or simulation-based training, maritime schools can ensure that their graduates are well-equipped to meet the operational and environmental challenges of the modern maritime industry. The research underscores the importance of strong, sustainable partnerships between maritime schools and industry. These partnerships are essential for ensuring that educational programs remain relevant and that students have access to the resources and mentorship they need to succeed. By building stronger, long-term collaborations with industry stakeholders, maritime vocational schools can bridge the gap between education and industry needs, ensuring that their graduates are not only knowledgeable but also capable of leading the industry into the future.

5. CONCLUSION

This research highlights the critical need for maritime vocational schools to evolve in response to the dynamic demands of the maritime industry, particularly in the areas of technological integration, environmental sustainability, and industry collaboration. While maritime education is moderately effective, particularly in regulatory compliance and fostering industry-academia partnerships, there are significant gaps in preparing students for the advanced technological landscape and practical implementation of environmental standards. The findings suggest that vocational schools need to modernize their curricula, incorporating cutting-edge digital tools and fostering a mindset of continuous learning. Additionally, practical, hands-on training in both technological systems and sustainability practices must be prioritized to better equip students for real-world maritime challenges. Industry-academia collaboration, though a strength, requires more structured and long-term partnerships to ensure

continuous relevance and resource sharing between educational institutions and industry stakeholders. By addressing these gaps and fostering closer ties with the industry, maritime vocational schools can bridge the gap between education and industry needs, ensuring that graduates are well-prepared to meet the evolving technological, regulatory, and environmental challenges of the modern maritime sector. This will empower the next generation of maritime professionals to lead the industry towards greater innovation and sustainability.

6. REFERENCES

Albayrak, T., & Ziarati, R. (2012). Encouraging research in maritime education & training. Journal of Maritime Transport and Engineering, 1(1), 4–9.

Anwar, G., & Abdullah, N. N. (2021). The impact of human resource management practice on organizational performance. International Journal of Engineering, Business and Management (IJEBM), 5, 1–9.

Balkin, R. (2006). The international maritime organization and maritime security. Tulane Maritime Law Journal, 30, 1–10.

Berg, H. P. (2013). Human factors and safety culture in maritime safety. In Marine Navigation and Safety of Sea Transportation: STCW, Maritime Education and Training (MET), Human Resources and Crew Manning, Maritime Policy, Logistics and Economic Matters (pp. 107–115). CRC Press.

Chircop, A. (2015). The international maritime organization. Journal of International Maritime Law, 21(5), 481–490.

Cicek, K., Akyuz, E., & Celik, M. (2019). Future skills requirements analysis in maritime industry. Procedia Computer Science, 158, 270–274.

Creswell, J. W., & Clark, V. L. P. (2011). Choosing a mixed methods design. In Designing and Conducting Mixed Methods Research (pp. 53–106). Sage Publications.

Fei, J. (2018). Managing human resources in the shipping industry. Routledge.

Ferritto, V. R. (2016). Maritime education factors and presenteeism: A comparative quantitative study. WMU Journal of Maritime Affairs, 15, 353–380.

House, D., & Saeed, F. (2016). The seamanship examiner: For STCW certification examinations. Taylor & Francis.

Jyothi, M. L., & Shanmugasundaram, R. S. (n.d.). Applications of IoT technology and computer vision in higher education–A literature review.

Mallam, S. C., Nazir, S., & Renganayagalu, S. K. (2019). Rethinking maritime education, training, and operations in the digital era: Applications for emerging immersive technologies. Journal of Marine Science and Engineering, 7(12), 428.

Padgett, D. K. (2016). Qualitative methods in social work research (Vol. 36). Sage Publications.

Roesler, V., Barrére, E., & Willrich, R. (2020). Special topics in multimedia, IoT and web technologies. Springer.

Siedlecki, S. L. (2020). Understanding descriptive research designs and methods. Clinical Nurse Specialist, 34(1), 8–12.

Young, C. (1995). Comprehensive revision of the STCW convention: An overview. Journal of Maritime Law and Commerce, 26, 1–9.