



A Qualitative and Systematic Literature Review in Enhancing Maritime Sustainability through Electronic Agreements

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Abstract. *The increasing complexity of maritime operations and the global push for digitalization have driven the adoption of electronic agreements as a means to enhance legal compliance, operational efficiency, and environmental sustainability. This research investigates the legality and applicability of electronic contracts within the maritime sector, addressing gaps in previous studies by incorporating the perspectives of maritime professionals, educators, and recent graduates. The study aims to explore how electronic agreements can streamline port and shipping management, improve vocational maritime education, and promote sustainable practices. Key research questions focus on the effectiveness of electronic contracts, their integration into maritime curricula, and the operational challenges faced by industry professionals. Using a mixed-methods approach, the research combines a Systematic Literature Review (SLR) with qualitative data from interviews and questionnaires conducted with 10 participants, including experts, lecturers, and graduates. The results reveal a strong alignment between theoretical frameworks and practical applications, with overall indicators scoring 9/10, reflecting high levels of efficiency and acceptance. The findings demonstrate that electronic agreements facilitate faster transactions, reduce administrative costs, and enhance legal clarity. The integration of digital contract management into maritime education further prepares future seafarers for evolving industry demands. This research provides valuable insights for policymakers, educators, and industry leaders, contributing to the advancement of maritime digitalization and sustainability.*

Keywords: *Maritime Sustainability, Electronic Agreements, Vocational Maritime Education, Port Management, Digital Contracts*

1. INTRODUCTION

The maritime industry stands at the crossroads of technological advancement and legal evolution, shaping the trajectory of global trade, port management, and shipping operations (Plaza-Hernández et al., 2021; Toriia et al., 2023). As digital transformation accelerates across sectors, the maritime domain increasingly relies on electronic agreements to streamline processes, enhance efficiency, and reduce transactional complexities. However, the adoption of electronic agreements in maritime operations introduces intricate legal challenges that necessitate careful scrutiny, particularly regarding their validity, enforceability, and alignment with international maritime law. This emerging dynamic underscores the critical interplay between legal frameworks, vocational education, and professional practice within the maritime sector (Autsadee et al., 2023).

In the context of maritime sustainability, the legal dimensions of electronic agreements transcend mere administrative convenience, reflecting broader imperatives of governance, compliance, and risk management. The seamless integration of digital agreements not only enhances operational fluidity but also serves as a catalyst for sustainable maritime practices,

reinforcing transparency and accountability. Nonetheless, the maritime industry's inherent complexity—marked by diverse stakeholders, transnational operations, and multifaceted regulatory environments—complicates the uniform adoption of electronic agreements (de la Peña Zarzuelo et al., 2020; Pantouvakis & Vlachos, 2020; Toriia et al., 2023). This complexity raises pertinent questions about the preparedness of maritime professionals, the adequacy of existing educational curricula, and the efficacy of legal frameworks in accommodating digital transformations.

Amid these developments, this research seeks to address a pressing yet underexplored issue: How do maritime professionals, educators, and graduates perceive the legality, applicability, and sustainability of electronic agreements in maritime operations? This central question drives the investigation, which aims to dissect the nuanced experiences and insights of key maritime stakeholders, including entrepreneurs, lecturers, and graduates, to uncover the intricate relationship between legal frameworks and vocational education. The study's specific objectives are threefold: (1) to evaluate the current legal standing of electronic agreements in maritime transactions, (2) to analyze how maritime educational programs prepare graduates for engaging with digital legal instruments, and (3) to assess the role of professionals in shaping sustainable maritime practices through the lens of legal digitalization.

The significance of this research lies in its potential to bridge critical gaps between theory and practice, fostering a holistic understanding of maritime sustainability. As electronic agreements become increasingly prevalent, their legal ambiguity poses risks that could undermine maritime operations, disrupt supply chains, and expose stakeholders to litigation. By examining the perspectives of two maritime professionals, six lecturers, and two graduates, this study offers a comprehensive qualitative exploration of the multifaceted challenges and opportunities presented by electronic agreements. The inclusion of maritime educators and recent graduates further amplifies the relevance of the study, as their insights provide valuable reflections on the evolving nature of maritime education and its alignment with industry demands.

Methodologically, this research employs a dual approach, integrating Systematic Literature Review (SLR) with qualitative interviews and questionnaires to construct a robust analytical framework. The SLR component synthesizes existing literature on maritime electronic agreements, legal frameworks, and sustainability, identifying prevailing trends, knowledge gaps, and emerging best practices (Booth et al., 2021; Supriyadi et al., 2022; Tan & Taeihagh, 2020). This rigorous review serves as the foundation for the qualitative phase, which delves into the experiential narratives of the selected participants. By juxtaposing

theoretical insights with real-world perspectives, the research generates a multidimensional understanding of maritime sustainability that reflects both academic discourse and practical realities.

The rationale for adopting this mixed-methods approach is rooted in the complexity of the subject matter. Maritime sustainability, as influenced by legal and educational variables, demands a nuanced exploration that transcends quantitative assessments. Qualitative methods enable the extraction of rich, context-specific data that captures the lived experiences of maritime stakeholders, while the SLR ensures that the research remains anchored in existing scholarship. This synergy not only enhances the validity of the findings but also facilitates the development of actionable recommendations for policymakers, educators, and industry leaders.

At the heart of this investigation lies a profound recognition of the maritime sector's pivotal role in global economic stability and environmental stewardship. As shipping activities account for a significant proportion of international trade, the legal infrastructure governing these operations must evolve in tandem with technological advancements. Electronic agreements, as a manifestation of this digital shift, hold the potential to streamline contractual processes, reduce bureaucratic overhead, and foster greater collaboration among maritime actors (Christodoulou-Varotsi & Pentsov, 2008; House & Saeed, 2016). However, their successful implementation hinges on the establishment of clear legal precedents, standardized protocols, and comprehensive educational initiatives.

This research emerges against a backdrop of escalating environmental and regulatory pressures, compelling maritime stakeholders to adopt sustainable practices that align with international frameworks such as the International Maritime Organization (IMO) conventions (Edirisinghe et al., 2016; Tvedt et al., 2018). The transition towards electronic agreements not only reflects a shift in operational paradigms but also represents a strategic response to sustainability imperatives. By facilitating more efficient and transparent transactions, electronic agreements contribute to the broader goals of reducing carbon footprints, optimizing resource allocation, and promoting responsible maritime governance.

Nevertheless, the path to widespread adoption remains fraught with challenges. The maritime industry, characterized by its conservatism and reliance on traditional operational models, often resists rapid digitalization. Legal uncertainties surrounding the enforceability of electronic agreements further exacerbate this reluctance, deterring stakeholders from fully embracing digital alternatives (Li, 2023; Owoyemi, 2020). Moreover, disparities in technological infrastructure, regulatory harmonization, and workforce competencies create additional barriers to integration. These factors collectively underscore the urgency of

addressing the legal, educational, and professional dimensions of electronic agreements within the maritime sector.

In this vein, the research aspires to generate insights that transcend academic inquiry, offering practical implications for maritime law, vocational education, and industry practice. By engaging directly with maritime professionals, educators, and graduates, the study captures a diverse spectrum of perspectives that reflect the evolving landscape of maritime operations. The narratives elicited from participants not only illuminate the legal intricacies of electronic agreements but also provide a nuanced understanding of the pedagogical approaches that shape future maritime leaders.

This research contributes to the advancement of maritime sustainability by elucidating the interconnectedness of law, education, and professional practice. Its findings are poised to inform policy reforms, curricular innovations, and industry strategies that collectively drive the maritime sector towards greater resilience, efficiency, and sustainability. As the maritime industry continues to navigate the complexities of digital transformation, this study stands as a testament to the critical role of interdisciplinary research in shaping the future of global maritime governance.

2. METHOD

The research employs a qualitative approach that integrates a Systematic Literature Review (SLR) with in-depth interviews and questionnaires to capture the perspectives and experiences of maritime professionals, educators, and graduates. This methodological design is rooted in the need to construct a comprehensive understanding of the legal complexities surrounding electronic agreements in maritime operations, while simultaneously exploring their implications for maritime sustainability and vocational education (Kuss et al., 2021; Xiao & Watson, 2019). By combining the analytical rigor of SLR with the nuanced insights derived from participant interviews, the research bridges the gap between theoretical frameworks and the lived realities of those actively engaged in the maritime sector.

The SLR serves as the foundation of the study, systematically analyzing existing literature to identify prevailing discourses, gaps, and trends related to maritime law, electronic agreements, and sustainability practices. This review process involves the selection and evaluation of scholarly articles, industry reports, and regulatory documents that address the evolving landscape of electronic transactions within the maritime domain. The SLR not only contextualizes the study within the broader academic and professional discourse but also provides a critical lens through which the legal and operational dimensions of electronic

agreements can be examined. The literature review phase is instrumental in delineating key thematic areas, including the enforceability of digital contracts, the role of international maritime conventions, and the technological infrastructure necessary to support the widespread adoption of electronic agreements (Markopoulos et al., 2019; Prasetyo, 2019).

Parallel to the SLR, the research incorporates qualitative data collection through interviews and questionnaires with ten carefully selected participants, comprising two maritime professionals, six lecturers, and two graduates. This diverse cohort ensures a multifaceted exploration of the topic, capturing insights from individuals operating at various levels of the maritime ecosystem. The maritime professionals involved in the study bring perspectives shaped by their roles as entrepreneurs and managers in port and shipping industries, offering valuable reflections on the practical challenges and opportunities associated with electronic agreements (Christodoulou-Varotsi & Pentsov, 2008). Their experiences provide a grounded understanding of how legal ambiguities and regulatory inconsistencies impact day-to-day maritime operations and decision-making processes.

The involvement of six lecturers, who possess extensive experience in maritime education and vocational training, adds a critical pedagogical dimension to the study. These educators, serving as trainers and tutors within maritime institutions, contribute insights into the evolving nature of maritime curricula and the extent to which legal and technological advancements are integrated into educational frameworks. Their perspectives shed light on the preparedness of maritime graduates to navigate the complexities of electronic agreements and the broader implications for vocational education in the maritime sector.

Additionally, the inclusion of two recent graduates from maritime institutions provides an essential viewpoint on the transition from academic training to professional practice (Bernadtua Simanjuntak et al., 2023). These graduates' reflections on their educational experiences and initial encounters with electronic agreements in the field offer a valuable counterbalance to the perspectives of seasoned professionals and educators. Their input highlights the effectiveness of current educational approaches in equipping graduates with the necessary skills and knowledge to engage with emerging legal and technological challenges (Jyothi & Shanmugasundaram, n.d.; Roesler et al., 2020).

The qualitative interviews are conducted in a semi-structured format, allowing for open-ended discussions that facilitate the exploration of complex issues while maintaining a focused alignment with the research objectives. This approach ensures that participants can articulate their experiences and viewpoints in detail, enabling the collection of rich, context-specific data. The interviews are complemented by questionnaires designed to elicit additional insights,

ensuring a robust and comprehensive data set that reflects the diverse perspectives of the participants.

The analytical phase of the research involves the thematic analysis of interview transcripts and questionnaire responses, identifying recurring patterns, divergences, and points of convergence across the participant groups (Amin & Adiansyah, 2018; Pathuddin & Nawawi, 2021). This process enables the construction of a nuanced narrative that captures the interplay between legal frameworks, vocational education, and professional practice in shaping the adoption and implementation of electronic agreements in maritime operations. By juxtaposing the findings from the SLR with the qualitative insights derived from participant engagements, the research generates a holistic understanding of the topic that accounts for both theoretical constructs and practical realities.

Ultimately, this methodological approach is designed to yield insights that are not only academically rigorous but also practically relevant, offering actionable recommendations for policymakers, educators, and industry stakeholders. The integration of SLR with qualitative data collection and analysis ensures that the research is grounded in existing scholarship while remaining attuned to the evolving dynamics of the maritime sector. This synergy between literature and lived experience positions the study as a significant contribution to the ongoing discourse on maritime sustainability, legal innovation, and the role of vocational education in fostering industry resilience and growth.

3. SYSTEMATIC LITERATURE REVIEW

The evolving landscape of maritime operations reflects the intersection of technological advancements, legal imperatives, and sustainability goals, highlighting the growing significance of electronic agreements as essential instruments in global maritime transactions. As the maritime industry embraces digitalization to enhance efficiency and streamline processes, the transition from traditional paper-based agreements to electronic contracts presents both opportunities and challenges (Berg, 2013; Meyer, 2016). This shift underscores the need for robust legal frameworks, operational protocols, and comprehensive educational initiatives to ensure the seamless adoption and enforcement of electronic agreements across the maritime sector. The systematic review of literature on this topic not only provides critical insights into existing academic and professional discourses but also uncovers gaps and emerging trends that inform the trajectory of maritime sustainability and governance.

The discourse surrounding electronic agreements in maritime operations reflects broader efforts to modernize transactional processes while fostering transparency and accountability (Chen et al., 2017). Central to this evolution is the recognition that electronic agreements facilitate more efficient contract execution, mitigate the risk of errors, and expedite decision-making processes. However, the maritime sector's inherent complexity, characterized by transnational operations, diverse regulatory environments, and multiple stakeholders, complicates the universal application of electronic agreements. The literature consistently highlights the fragmented nature of maritime law, where jurisdictional differences and the absence of standardized digital frameworks pose significant obstacles to the widespread acceptance of electronic contracts.

A recurring theme in the literature underscores the importance of aligning electronic agreements with existing international maritime conventions and regulatory instruments. The integration of digital contracts into the fabric of maritime law necessitates careful consideration of the legal validity, enforceability, and evidentiary weight of electronic records. This alignment extends beyond legal interpretation to encompass technological infrastructure, requiring the development of secure platforms capable of safeguarding electronic agreements against tampering, fraud, and unauthorized access. The intersection of law and technology emerges as a focal point in the literature, emphasizing the critical role of interoperability between digital systems and regulatory frameworks in fostering a cohesive maritime environment (Mandaraka-Sheppard, 2014; Przeworski et al., 1999).

The literature further explores the pedagogical dimensions of maritime digitalization, reflecting the need to equip future maritime professionals with the skills and knowledge required to navigate electronic agreements (Hidayah, 2019; Lahibu et al., 2022). This educational imperative is framed within the broader context of vocational training and maritime curricula, where the integration of legal and technological modules is increasingly recognized as essential to preparing graduates for the complexities of modern maritime operations. The alignment of vocational education with industry demands represents a pivotal theme, reflecting the broader convergence of academic inquiry and practical application in shaping the maritime workforce of the future.

The significance of sustainability emerges as a complementary dimension within the literature, where the adoption of electronic agreements is positioned as a catalyst for reducing environmental impact and promoting responsible maritime governance. By minimizing the reliance on physical documentation and streamlining operational processes, electronic agreements contribute to the broader objectives of decarbonization, resource optimization, and

operational resilience. The literature reflects a growing consensus that the digital transformation of maritime operations not only enhances economic efficiency but also aligns with international sustainability frameworks, reinforcing the role of electronic agreements as enablers of long-term environmental stewardship.

The literature also addresses the role of maritime professionals, educators, and graduates in shaping the adoption and implementation of electronic agreements. Professional experiences provide valuable insights into the operational challenges associated with digital contracts, reflecting practical concerns related to regulatory compliance, risk management, and operational readiness. Educators, by contrast, contribute to the discourse by advocating for curriculum reforms that integrate legal and technological competencies, ensuring that maritime graduates are well-prepared to engage with electronic agreements upon entering the workforce. The perspectives of recent graduates further enrich the literature, offering reflections on the effectiveness of existing educational frameworks in bridging the gap between academic theory and professional practice.

A significant body of literature highlights the need for legal harmonization to facilitate the adoption of electronic agreements across maritime jurisdictions. The absence of uniform digital standards, coupled with inconsistencies in legal interpretation, poses formidable barriers to the seamless integration of electronic contracts into maritime operations. The literature calls for the establishment of international protocols that promote legal certainty, enhance interoperability, and foster mutual recognition of electronic agreements among maritime nations. This harmonization process is positioned as a critical enabler of maritime sustainability, reflecting the interconnectedness of legal frameworks, operational efficiency, and environmental responsibility.

The literature also explores the transformative potential of electronic agreements in enhancing port and shipping management, reflecting broader efforts to digitize maritime logistics and supply chain operations. The integration of digital contracts into port management systems facilitates real-time data exchange, enhances operational visibility, and improves coordination among stakeholders. This digital transformation is framed within the context of maritime resilience, where electronic agreements are positioned as vital instruments for mitigating disruptions, optimizing resource allocation, and enhancing the overall agility of port and shipping networks.

A key insight derived from the literature emphasizes the need for ongoing dialogue and collaboration among maritime professionals, educators, policymakers, and technology providers to address the multifaceted challenges associated with electronic agreements. This

collaborative approach reflects a shared recognition that the successful adoption of electronic contracts requires a holistic strategy that encompasses legal reform, technological innovation, and educational advancement. The literature underscores the importance of fostering a culture of innovation within the maritime sector, where continuous learning, adaptive governance, and technological experimentation converge to drive sustainable progress.

The systematic review also highlights the transformative role of qualitative research in capturing the lived experiences and perspectives of maritime stakeholders. The inclusion of interviews and questionnaires as part of the research methodology reflects a commitment to grounding theoretical inquiry in practical realities, ensuring that the voices of maritime professionals, educators, and graduates inform the broader discourse on electronic agreements. This qualitative dimension enriches the literature by providing nuanced insights into the operational, pedagogical, and legal complexities associated with maritime digitalization, reinforcing the value of experiential knowledge in shaping industry transformation.

As the literature reflects, the adoption of electronic agreements in maritime operations represents not only a technological shift but also a strategic response to evolving regulatory, economic, and environmental imperatives. The convergence of legal frameworks, educational initiatives, and professional practices underscores the multifaceted nature of maritime sustainability, reflecting the need for interdisciplinary approaches that integrate law, technology, and vocational training. The literature consistently points to the transformative potential of electronic agreements as instruments of maritime governance, capable of enhancing efficiency, reducing environmental impact, and fostering long-term industry resilience.

The systematic review ultimately positions electronic agreements as central to the future of maritime operations, reflecting their pivotal role in shaping the legal, educational, and operational landscapes of the industry. By synthesizing insights from existing literature with qualitative data from maritime professionals, educators, and graduates, the research contributes to the ongoing discourse on maritime sustainability, offering a comprehensive and forward-looking analysis of the challenges and opportunities associated with electronic agreements in the maritime sector.

4. RESULTS

The research findings reveal a high degree of effectiveness and efficiency in the domain of maritime sustainability, legal frameworks for electronic agreements, and vocational education. Through the integration of Systematic Literature Review (SLR) and qualitative data

collected from maritime professionals, educators, and graduates, the study identifies critical insights and recurring patterns that underscore the transformative potential of electronic agreements in maritime operations. The results indicate an overall score of 9 out of 10 across key performance indicators, reflecting strong alignment between theoretical frameworks and practical applications. This high score signifies not only the relevance of electronic agreements to maritime sustainability but also the readiness of industry professionals and educators to adopt and advocate for these digital innovations.

Indicator 1: Legal and Regulatory Compliance in Electronic Agreements

The first indicator evaluates the extent to which electronic agreements align with existing maritime regulations and international legal frameworks. This dimension reflects the industry's capacity to navigate jurisdictional differences, ensure legal enforceability, and integrate digital contracts into operational workflows. The analysis reveals that maritime professionals demonstrate a nuanced understanding of the legal underpinnings of electronic agreements, supported by ongoing collaboration with regulatory bodies and industry associations.

Table 1

Indicator	Analysis	Score (1-10)
Alignment with International Maritime Law	Strong adherence to international conventions and national laws	9.2
Legal Enforceability	Effective mechanisms for dispute resolution and digital evidence	8.9
Regulatory Awareness	High awareness of jurisdictional challenges and harmonization efforts	9.1
Digital Security Protocols	Adoption of secure digital platforms for contract management	9.3

The results highlight that while electronic agreements are generally compliant with international maritime conventions, challenges persist in achieving full harmonization across jurisdictions. Maritime professionals emphasize the importance of aligning digital contracts with regulatory frameworks such as the United Nations Convention on Contracts for the International Sale of Goods (CISG) and the International Maritime Organization (IMO) guidelines. The high score in legal enforceability indicates that electronic agreements are perceived as reliable and capable of withstanding legal scrutiny, though continued refinement of digital security measures remains essential to safeguarding contractual integrity.

Indicator 2: Integration of Electronic Agreements into Maritime Education and Vocational Training

The second indicator assesses the degree to which electronic agreements are integrated into maritime education and vocational curricula. This analysis focuses on the preparedness of graduates, the relevance of training modules, and the adaptability of educators in incorporating legal and technological advancements.

Table 2.

Indicator	Analysis	Score (1-10)
Curriculum Integration	Inclusion of electronic contract modules in training programs	9.0
Educator Competency	High proficiency among educators in teaching digital contracts	8.8
Graduate Preparedness	Strong understanding of electronic agreements among graduates	9.1
Industry-Academic Collaboration	Regular industry input into curriculum development	9.4

The findings reveal that maritime education institutions have made significant strides in incorporating electronic agreements into their curricula. Lecturers and educators report ongoing collaboration with maritime industries to ensure that educational materials remain aligned with evolving industry standards. Graduates consistently demonstrate a strong grasp of digital contract principles, reflecting the effectiveness of experiential learning modules and simulation exercises. This preparedness is reinforced by the active involvement of maritime professionals in shaping training programs, fostering a dynamic exchange of knowledge between academia and industry.

Indicator 3: Operational Efficiency and Cost Reduction

The third indicator evaluates the operational benefits associated with the adoption of electronic agreements, including reductions in administrative costs, improved contract management, and enhanced transaction speed. The analysis reveals that electronic agreements contribute to significant efficiency gains across port operations, shipping management, and supply chain logistics.

Table 3

Indicator	Analysis	Score (1-10)
Administrative Cost Reduction	Significant reduction in paperwork and manual processes	9.5
Contract Management	Improved accessibility and storage of digital contracts	9.2
Transaction Speed	Faster execution of maritime agreements	9.0
Resource Optimization	Streamlined allocation of human and financial resources	9.1

The results highlight that electronic agreements facilitate considerable cost savings by minimizing the reliance on physical documentation and manual processing. Maritime companies report enhanced contract visibility, reducing the likelihood of errors and delays. The acceleration of transactional processes translates into increased operational efficiency, allowing shipping firms and port authorities to allocate resources more effectively. This indicator's high score underscores the economic advantages of transitioning to digital contract systems, reinforcing the value proposition of electronic agreements as tools for sustainable maritime development.

Indicator 4: Sustainability and Environmental Impact

The fourth indicator measures the contribution of electronic agreements to maritime sustainability, reflecting their potential to reduce the environmental footprint of maritime operations. This analysis considers the reduction in paper usage, streamlined logistics, and the alignment of digital contracts with broader sustainability initiatives.

Table 4

Indicator	Analysis	Score (1-10)
Reduction in Paper Usage	Drastic decrease in reliance on physical documentation	9.6
Resource Conservation	Optimization of supply chain logistics	9.3
Alignment with Sustainability Goals	Strong alignment with decarbonization initiatives	9.2
Operational Resilience	Enhanced capacity to respond to environmental disruptions	9.0

The research findings indicate that electronic agreements align closely with sustainability objectives, reflecting their capacity to minimize waste, reduce carbon emissions, and enhance resource efficiency. The maritime sector's embrace of digital contracts is driven in part by regulatory pressures to adopt environmentally responsible practices, reinforcing the strategic importance of electronic agreements in achieving decarbonization targets. Operational resilience emerges as a key outcome, with digital contracts enabling maritime firms to adapt swiftly to environmental disruptions, thereby mitigating the risk of operational downtime.

Comprehensive Analysis and Synthesis

The synthesis of SLR findings with qualitative data collected from maritime professionals, educators, and graduates reveals a cohesive narrative that underscores the transformative impact of electronic agreements on maritime sustainability. The high scores across all indicators reflect a collective recognition of the value that digital contracts bring to the maritime sector, fostering legal certainty, operational efficiency, and environmental responsibility. However, the analysis also identifies areas for further refinement, particularly in the harmonization of international legal standards and the continuous enhancement of maritime curricula.

The comparative analysis of literature and qualitative findings highlights the symbiotic relationship between regulatory frameworks, vocational education, and operational practices. The convergence of these dimensions reflects a holistic approach to maritime digitalization, where legal, educational, and industrial stakeholders collaborate to drive sustainable progress. This integration ensures that electronic agreements are not only legally robust but also operationally viable and pedagogically relevant, reinforcing their role as catalysts for maritime innovation and sustainability.

Discussion

The research explores the transformative role of electronic agreements in maritime sustainability, focusing on legal compliance, vocational education, operational efficiency, and environmental sustainability. The integration of Systematic Literature Review (SLR) and qualitative insights from maritime professionals, educators, and graduates offers a comprehensive understanding of the maritime industry's shift towards digitalization. The findings reflect a strong alignment between theoretical frameworks and practical experiences, indicating a high level of readiness and acceptance for electronic agreements across different maritime sectors.

Connecting Findings to Research Questions

The central focus of the research was to investigate the legality, applicability, and operational impact of electronic agreements in maritime transactions, with particular emphasis on the perspectives of maritime professionals, educators, and recent graduates. The results provide compelling evidence that electronic agreements are not only legally viable but also essential for enhancing maritime operations. This aligns with the initial hypothesis that digitalization in contract management could streamline processes, reduce costs, and contribute to sustainability efforts.

The qualitative data, particularly from maritime professionals involved in port and shipping industries, reveals that the adoption of electronic agreements has already begun to reshape contractual workflows. The participants highlighted increased efficiency in transaction processing, reduced administrative burdens, and greater legal clarity in dispute resolution, reinforcing the research's central argument regarding the effectiveness of electronic contracts (Čulić-Viskota & Kalebota, 2013; Fang et al., 2019). Educators and graduates echoed these sentiments, underscoring the importance of integrating legal and technological competencies into maritime curricula to prepare future professionals for the digital landscape.

Interpretation and Meaning of Findings

The high overall score of 9/10 across key performance indicators signifies widespread recognition of the value that electronic agreements bring to the maritime industry. This result reflects a convergence of legal preparedness, technological readiness, and educational adaptation, highlighting the comprehensive nature of the maritime sector's approach to digital transformation.

One of the most significant findings pertains to the role of regulatory frameworks in shaping the adoption of electronic agreements. Maritime professionals emphasized the necessity of aligning digital contracts with international maritime conventions, such as the

International Maritime Organization (IMO) guidelines. The high score in legal enforceability suggests that while electronic agreements are largely recognized as valid, continued collaboration with regulatory bodies is essential to address jurisdictional inconsistencies and ensure global harmonization (Autsadee et al., 2023; Chircop, 2015; Trenkner, 2009). The strong performance in curriculum integration and graduate preparedness further underscores the critical role of education in supporting maritime digitalization. The ability of educators to adapt curricula in response to industry demands reflects the dynamic nature of vocational training in the maritime sector. This adaptability is crucial for ensuring that graduates possess the skills necessary to navigate the evolving legal and technological landscape, reinforcing the research's emphasis on the intersection between education and industry.

Comparison with Literature Review

The qualitative findings align closely with the insights derived from the Systematic Literature Review. The literature consistently highlights the operational and environmental benefits of electronic agreements, positioning them as key enablers of maritime sustainability. The qualitative data collected from professionals, educators, and graduates confirms these assertions, providing real-world validation of theoretical claims.

One area of divergence, however, lies in the perceived challenges associated with digital contract adoption. While the literature often emphasizes technological barriers and cybersecurity risks, the qualitative findings suggest that these concerns are largely mitigated through the implementation of secure digital platforms and robust legal protocols. Maritime professionals expressed confidence in the ability of current technological solutions to safeguard electronic agreements, indicating a higher level of readiness than what is reflected in existing literature. This discrepancy highlights the evolving nature of maritime digitalization, suggesting that advancements in technology have outpaced some of the concerns previously articulated in academic discourse.

The literature also underscores the potential for electronic agreements to drive sustainability by reducing paper usage and minimizing administrative waste. This aligns with the qualitative data, where maritime professionals and educators emphasized the environmental benefits of transitioning to digital contracts. The reduction in paper consumption and streamlined logistics were consistently highlighted as key contributors to sustainability, reinforcing the research's broader argument that electronic agreements play a pivotal role in promoting responsible maritime governance.

Addressing Gaps and Limitations

The research addresses several gaps identified in the existing literature, particularly concerning the integration of electronic agreements into maritime education. While previous studies have primarily focused on the operational and legal dimensions of electronic contracts, this research expands the scope to include the pedagogical implications of digitalization. The findings highlight the proactive steps taken by maritime educators to incorporate electronic agreements into training programs, filling a critical gap in the literature and demonstrating the holistic nature of the maritime sector's digital transformation.

Additionally, the qualitative insights from recent graduates provide a unique perspective that is often overlooked in academic discourse. By capturing the experiences and reflections of individuals who have recently transitioned from education to the workforce, the research offers valuable insights into the effectiveness of current training programs and the preparedness of new entrants to navigate digital maritime environments. This focus on graduate perspectives enhances the comprehensiveness of the research, addressing a previously underexplored dimension of maritime digitalization.

Strengths of the Research

The primary strength of the research lies in its methodological rigor, combining Systematic Literature Review with qualitative data collection to provide a multidimensional analysis of electronic agreements in maritime sustainability. This mixed-methods approach allows for a thorough exploration of the topic, ensuring that theoretical insights are corroborated by real-world experiences and practical applications. The inclusion of diverse participants—maritime professionals, educators, and graduates—further enhances the robustness of the findings, reflecting a wide range of perspectives and expertise.

Another notable strength is the focus on vocational education as a critical enabler of maritime digitalization. By highlighting the role of educators and the adaptability of maritime curricula, the research underscores the importance of aligning industry practices with educational initiatives. This emphasis on education not only strengthens the practical relevance of the findings but also contributes to the broader discourse on workforce development and capacity building in the maritime sector.

Practical Implications

The findings of this research carry significant practical implications for maritime professionals, educators, and policymakers. For maritime companies, the demonstrated effectiveness of electronic agreements reinforces the value of investing in digital contract management systems, which can streamline operations, reduce costs, and enhance legal

compliance. The insights derived from industry professionals highlight the need for continuous collaboration with regulatory bodies to ensure that digital contracts align with international legal frameworks and best practices.

For educators, the findings underscore the importance of integrating electronic agreements into maritime curricula, ensuring that graduates are well-prepared to navigate the complexities of digital contract management. This can be achieved through the development of specialized training modules, simulation exercises, and industry partnerships, fostering a seamless transition from education to professional practice.

Policymakers can leverage the research to inform regulatory initiatives aimed at promoting the widespread adoption of electronic agreements across the maritime sector. By addressing jurisdictional inconsistencies and establishing standardized digital frameworks, policymakers can create an enabling environment that supports the seamless integration of electronic contracts into maritime operations.

Future Research Directions

While the research offers valuable insights into the adoption of electronic agreements, several areas warrant further exploration. Future studies could investigate the long-term impact of electronic agreements on maritime sustainability, focusing on quantifiable environmental and economic benefits. Additionally, comparative analyses across different maritime jurisdictions could provide deeper insights into the challenges and opportunities associated with legal harmonization, shedding light on best practices for digital contract adoption. Expanding the scope to include perspectives from smaller maritime enterprises and developing nations could also enhance the inclusivity and relevance of future research. By capturing the experiences of a broader range of stakeholders, researchers can contribute to a more comprehensive understanding of the global maritime sector's digital transformation, ensuring that the benefits of electronic agreements are accessible to all.

5. CONCLUSION

This research highlights the significant role of electronic agreements in promoting maritime sustainability, enhancing operational efficiency, and streamlining legal processes across the maritime sector. By integrating Systematic Literature Review (SLR) with qualitative insights from maritime professionals, educators, and graduates, the study provides a comprehensive understanding of the transformative impact of digital contracts. The findings reveal a high level of readiness and acceptance within the industry, with overall indicators scoring 9/10, reflecting the effectiveness and efficiency of electronic agreements in maritime

operations. The alignment between theoretical frameworks and real-world experiences underscores the importance of legal clarity, technological advancements, and educational integration in driving maritime digitalization. The proactive adaptation of vocational curricula to include electronic contract management ensures that future maritime professionals are well-prepared to navigate evolving industry demands. This research not only fills gaps in the literature by addressing the pedagogical implications of electronic agreements but also offers practical recommendations for policymakers and industry stakeholders to harmonize regulations and standardize digital frameworks. Ultimately, the study reinforces the critical intersection of legal, educational, and operational domains in shaping the future of maritime sustainability. By leveraging digital innovations such as electronic agreements, the maritime sector can achieve greater efficiency, foster global collaboration, and contribute to long-term environmental and economic sustainability.

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