Implementation of Safety and Security Management Systems in Maritime Transportation (Professional Perspectives and Implementation Challenges)

Giovanni Battista Puteri[1*], Abdul Rochman[2]
[1,2]Maritime Institute, Sekolah Tinggi Ilmu Pelayaran Jakarta, North Jakarta, Indonesia
Email: [1]giotista92@gmail.com, [2]rochman.abdul.stip@gmail.com

ABSTRACT

This qualitative study examines the implementation of safety and security management systems in maritime transportation through professional perspectives of 20 maritime industry stakeholders. The research analyzes implementation experiences with International Safety Management (ISM) Code and International Ship and Port Facility Security (ISPS) Code frameworks, identifying critical challenges, adaptive strategies, and competency development needs. Using thematic analysis of semi-structured interviews with maritime professionals, recent graduates, and educators, the study reveals significant gaps between theoretical frameworks and practical implementation realities. Findings indicate that professionals develop informal adaptation strategies to navigate conflicts between safety and security priorities, while educational preparation inadequately addresses real-world implementation complexities. The research contributes evidence-based implementation guidance for maritime organizations and recommendations for educational enhancement in maritime safety and security management competency development.

***Keyword**: Maritime Safety Management, Safety-Security Conflicts, Implementation Competency.*

1. INTRODUCTION

The maritime transportation sector stands at the nexus of global trade facilitation and complex safety-security management challenges, where the implementation of comprehensive management systems has become increasingly critical for operational sustainability and regulatory compliance (Zhang et al., 2024). As maritime activities account for approximately 90% of global trade volume, the effective implementation of safety and security management systems represents not merely a regulatory obligation but a fundamental requirement for protecting lives, environmental integrity, and economic stability across international supply chains (Cicek et al., 2019). The contemporary maritime environment presents unprecedented challenges that extend far beyond traditional safety considerations, encompassing cybersecurity

threats, drone-based attacks, GPS spoofing vulnerabilities, and evolving regulatory frameworks that demand sophisticated implementation approaches (Acanfora et al., 2024).

The foundation of modern maritime safety and security management rests primarily upon two critical regulatory frameworks: the International Safety Management (ISM) Code and the International Ship and Port Facility Security (ISPS) Code, both mandated under the International Convention for the Safety of Life at Sea (SOLAS) and administered by the International Maritime Organization (IMO). The ISM Code, implemented in 1998, established international standards for safe ship management and operation while emphasizing pollution prevention through systematic safety management systems (SMS) implementation (International Maritime Organization, 2024). Concurrently, the ISPS Code, introduced in 2004 following the September 11 attacks, created comprehensive security frameworks for ships and port facilities engaged in international trade, establishing three-tiered security levels and mandatory security planning requirements (Anderson et al., 2023). However, the simultaneous implementation of these frameworks has created complex operational challenges that research suggests are inadequately addressed by current implementation guidance and professional preparation programs (Uflaz et al., 2022).

Current maritime safety and security management faces several critical implementation challenges that extend beyond conventional regulatory compliance. The maritime safety system market, valued at USD 31.5 billion in 2023 and projected to reach USD 57.9 billion by 2032, reflects growing recognition of implementation complexities and technological integration requirements (Market Research Future, 2024). Contemporary threats including cybersecurity vulnerabilities, with 65% of maritime organizations reporting cyber incidents in 2024, demonstrate how traditional safety and security frameworks struggle to address rapidly evolving technological challenges (Voyager Portal, 2024). Moreover, emerging threats such as GPS spoofing, which affected over 20 vessels in the Black Sea in 2017, and drone-based attacks targeting maritime infrastructure highlight the inadequacy of current implementation approaches in addressing non-traditional security challenges (International Security Journal, 2023).

The implementation effectiveness of maritime safety and security management systems has been questioned through multiple research perspectives, revealing significant gaps between intended outcomes and practical results. Hetherington et al. (2012) conducted qualitative research demonstrating considerable disparity between managers' and seafarers' understanding of ISM Code implementation, resulting in substantial gaps between intended purpose and practice. Similarly, implementation studies indicate that the critical factor limiting effectiveness is the lack of seafarers' participation in workplace health and safety management, suggesting fundamental flaws in current implementation approaches (Hetherington et al., 2012). Furthermore, recent analysis of maritime transportation safety management reveals that while quantitative evaluation methods have become more sophisticated, incorporating Bayesian networks and fuzzy theory applications, the qualitative understanding of implementation challenges remains significantly underdeveloped (Zhang et al., 2023).

The intersection of safety and security management implementation presents particularly complex challenges that current research has inadequately addressed. Industry reports consistently identify conflicts between ISM Code safety requirements and ISPS Code security mandates, where "safety prevails to security as per ISPS code," yet practical guidance for navigating these conflicts remains limited (Safety4Sea, 2024). Professional practitioners report developing informal prioritization systems and adaptive protocols that deviate from standard implementation guidance while attempting to maintain both safety and security objectives, suggesting a critical gap between regulatory framework design and operational reality (International Register of Shipping, 2019). Additionally, the absence of official monitoring procedures for security implementation, unlike ISM audits, creates inconsistent implementation standards and reduced attention to security practices across maritime operations (Safety4Sea, 2024).

Maritime education and professional development programs have been identified as inadequately preparing graduates for real-world implementation challenges, particularly regarding integrated safety and security management systems. Research examining maritime education effectiveness indicates significant gaps between educational preparation and industry requirements, with particular deficiencies in implementation competency development (Pesigan et al., 2019). Studies of maritime higher education institutions reveal that while technical knowledge transmission occurs effectively, the development of practical implementation skills, adaptive problem-solving capabilities, and integrated system management competencies remains insufficient for contemporary maritime operational demands (Estimo, 2020). Moreover, the rapid evolution of maritime technology, including digitalization, automation, and cybersecurity requirements, creates additional implementation challenges that current educational frameworks struggle to address effectively (Baum-Talmor & Kitada, 2022).

The urgency of addressing implementation challenges in maritime safety and security management systems has been amplified by recent global events and technological developments that expose vulnerabilities in current approaches. The COVID-19 pandemic revealed significant weaknesses in maritime supply chain resilience and emergency response capabilities, highlighting the need for more adaptive and integrated safety and security management implementation strategies (Zhang et al., 2024). Additionally, geopolitical tensions and increasing maritime security threats, including state-sponsored cyberattacks and sophisticated piracy operations, demonstrate the critical importance of effective implementation strategies that can adapt to rapidly changing threat environments while maintaining operational efficiency and regulatory compliance (Maritime Security Market Analysis, 2023).

2. RESEARCH PROBLEM AND OBJECTIVES

Despite the critical importance of effective safety and security management system implementation in maritime transportation, current research provides insufficient understanding of how maritime professionals navigate the complex challenges of implementing integrated ISM and ISPS frameworks in real-world operational contexts. The primary research problem centers on the significant gap between theoretical regulatory frameworks and practical

implementation realities, where professionals must develop adaptive strategies to address conflicts between safety and security requirements, technological integration challenges, and resource constraints while maintaining regulatory compliance and operational effectiveness.

The specific research objectives guiding this investigation include: First, to analyze how maritime professionals experience and navigate the practical challenges of implementing integrated safety and security management systems across different operational contexts, with particular focus on identifying adaptation strategies developed when standard implementation protocols encounter operational, technological, or resource constraints. Second, to examine the specific competency gaps that exist between educational preparation and real-world implementation requirements, particularly regarding the integration of emerging security threats such as cybersecurity, drone attacks, and GPS spoofing into traditional safety management frameworks. Third, to evaluate the effectiveness of current implementation approaches in addressing the complex relationships between ISM Code safety requirements and ISPS Code security mandates, identifying critical implementation failure points and successful resolution strategies developed by experienced practitioners. Finally, to develop evidence-based recommendations for improving implementation effectiveness through enhanced professional preparation, organizational support systems, and regulatory framework adaptation that better align with operational realities and emerging threat environments.

3. RESEARCH METHOD

This research employed a comprehensive qualitative methodology designed to capture the complex experiences and perspectives of maritime professionals regarding safety and security management system implementation, utilizing a phenomenological approach that emphasizes understanding lived experiences and practical challenges within real-world maritime operational contexts (Creswell & Poth, 2018). The methodological framework was specifically designed to address the multifaceted nature of implementation challenges while ensuring rigorous data collection and analysis procedures that could capture both explicit knowledge and tacit understanding developed through professional practice (Saldaña, 2021).

3.1 Population and Samples

The study employed purposive sampling to select 20 maritime professionals with direct experience in safety and security management system implementation, representing diverse sectors of the maritime industry to ensure comprehensive perspective coverage (Patton, 2015). The target population was strategically selected to include three distinct professional categories that could provide complementary insights into implementation challenges and competency development needs. Eight senior implementation professionals were selected based on their extensive experience with ISM and ISPS Code implementation, including three Company Security Officers (CSOs) with minimum seven years implementation experience, two Ship Security Officers (SSOs) with multi-vessel implementation backgrounds, two Port Facility Security Officers (PFSOs) with large port implementation experience, and one maritime cybersecurity implementation specialist with expertise in integrating emerging security threats into traditional management frameworks (Hetherington et al., 2012). Eight implementation-focused graduates from maritime institutes were selected from 2021-2024 graduation cohorts,

comprising four Nautical Deck Engineering graduates with vessel-based SMS implementation experience and four Port and Shipping Engineering graduates with port facility security implementation experience, ensuring representation of recent educational preparation and early career implementation challenges (Estimo, 2020). Additionally, four implementation-specialized educators were included, representing maritime academics with dual academic-industry implementation expertise who could provide insights into educational preparation adequacy and professional development needs (Cicek et al., 2019).

The selection criteria required that all participants have minimum one year of direct implementation experience with either ISM or ISPS frameworks, possess English language proficiency sufficient for detailed interview participation, and demonstrate willingness to discuss specific implementation challenges and adaptive strategies. The urgency of obtaining data from these specific respondents stems from their unique position as practitioners who navigate daily implementation challenges while developing informal solutions that are rarely documented in formal research or regulatory guidance, making their experiential knowledge critical for understanding implementation realities (Zhang et al., 2023).

3.2 Research Instrument

The research instrument comprised a comprehensive semi-structured interview guide developed through extensive literature review and pilot testing with two maritime professionals to ensure question clarity and relevance to implementation experiences (Braun & Clarke, 2022). The interview framework incorporated multiple components designed to capture different aspects of implementation experience, including an Implementation Journey Mapping Tool that enabled participants to visually document their implementation experiences across different systems and contexts, and Critical Implementation Incident Analysis Forms that provided structured capture of specific challenging implementation scenarios and resolution strategies developed through practice (Uflaz et al., 2022). The dependent variables focused on implementation effectiveness outcomes, including regulatory compliance achievement, operational efficiency maintenance, and safety-security objective integration, while independent variables encompassed professional experience levels, organizational support systems, educational preparation adequacy, and resource availability for implementation activities.

Key indicators for implementation effectiveness included participant-reported success in navigating ISM-ISPS integration conflicts, development of adaptive strategies for addressing implementation obstacles, demonstration of competency in emerging threat integration, and evidence of successful knowledge transfer to colleagues or subordinates. Supporting instruments included a System Integration Conflict Assessment framework for analyzing how professionals resolve conflicts between safety and security requirements, an Implementation Cost-Benefit Decision Matrix for understanding resource allocation and prioritization approaches, and Technology Integration Challenge Documentation specifically designed to capture experiences with cybersecurity, AIS, GPS, and emerging technology implementation challenges (Acanfora et al., 2024).

3.3 Collection of Data

Data collection followed a systematic three-phase approach designed to ensure comprehensive capture of implementation experiences while maintaining methodological rigor and participant confidentiality (Saldaña, 2021). Phase one involved initial implementation experience exploration through 90-minute semi-structured interviews conducted via secure video conferencing platforms, with sessions recorded using encrypted recording software and transcribed verbatim by professional transcription services. The interview protocol systematically addressed implementation experience mapping for 20 minutes, system integration challenges for 25 minutes, adaptive strategy development for 20 minutes, technology integration experiences for 15 minutes, and cost-benefit implementation decisions for 10 minutes, ensuring comprehensive coverage of critical implementation aspects while maintaining participant engagement (Braun & Clarke, 2022).

Phase two incorporated deep-dive system-specific implementation analysis through follow-up interviews focused on particular implementation challenges identified during initial interviews, allowing for detailed exploration of specific adaptation strategies and their effectiveness in addressing implementation obstacles. Phase three involved verification and additional insight gathering through brief follow-up communications designed to clarify interpretation accuracy and gather additional insights that emerged from preliminary analysis (Creswell & Poth, 2018). Additional data collection included anonymized implementation document analysis where participants voluntarily provided examples of their implementation documentation, such as security plans, SMS procedures, and implementation guidelines, and implementation observation protocols where possible observation of implementation training sessions and system integration processes provided contextual understanding of implementation challenges.

3.4 Data Analysis

The data analysis employed a comprehensive thematic analysis approach following Braun and Clarke's (2022) six-phase framework, adapted specifically for implementation-focused research in maritime contexts. The analysis process began with data familiarization through multiple transcript readings combined with note-taking to identify preliminary patterns and potential themes related to implementation challenges and adaptive strategies. Initial code generation utilized an inductive approach that allowed themes to emerge from data rather than imposing predetermined categories, with particular attention to implementation-specific experiences and professional adaptation strategies (Saldaña, 2021). Theme identification and clustering focused on categorizing data into competency development themes, implementation challenge patterns, and adaptive strategy classifications, while theme review and refinement involved systematic examination of theme coherence and distinctiveness to ensure analytical rigor.

Cross-group comparisons were conducted to identify commonalities and distinctions among experts, lecturers, and graduates, revealing different perspectives on implementation challenges and competency development needs across professional experience levels and educational backgrounds (Hetherington et al., 2012). The analysis specifically examined

implementation effectiveness patterns, adaptive strategy variations, and competency gap identification across participant categories to understand how experience level and educational preparation influence implementation approaches and outcomes. Narrative synthesis development created a cohesive narrative explaining findings that connected individual experiences to broader implementation patterns and challenges, while maintaining participant voice and experiential authenticity throughout the analytical process (Creswell & Poth, 2018). The analytical framework incorporated specialized coding for implementation processes, system integration approaches, adaptive strategy development, and competency requirements to ensure comprehensive understanding of implementation realities and professional development needs in maritime safety and security management contexts.

4. RESULTS & ANALYSIS AND DISCUSSION

The comprehensive analysis of qualitative data from 20 maritime professionals revealed significant insights into the implementation of safety and security management systems in maritime transportation, demonstrating both the complexity of real-world implementation challenges and the adaptive capacity of maritime professionals in developing practical solutions to navigate regulatory and operational constraints.

4.1 Thematic Analysis Results

The thematic analysis identified five primary themes that characterize the implementation experience of safety and security management systems in maritime contexts. Theme 1: Implementation Reality vs. Regulatory Framework Design emerged as the most prominent finding, with 18 of 20 participants (90%) reporting significant gaps between how safety and security management systems are designed in regulatory frameworks versus their functional application in operational maritime environments. Participants consistently described conflicts between ISM Code safety priorities and ISPS Code security requirements, with one experienced CSO noting: "The regulations assume perfect conditions and unlimited resources, but in reality, we're constantly making decisions about whether safety or security takes priority in specific situations, and there's no clear guidance for these trade-offs."

Theme 2: Technology Integration Implementation Challenges was identified by 16 participants (80%), who described complex difficulties in integrating cybersecurity protocols, AIS security measures, GPS spoofing mitigation, and drone threat countermeasures into existing safety and security management frameworks. A maritime cybersecurity specialist explained: "Traditional SMS frameworks weren't designed for cyber threats. We're essentially building new implementation approaches while trying to maintain compliance with systems that don't recognize these threats exist." This theme reveals how rapidly evolving technological threats create implementation challenges that existing frameworks struggle to address effectively.

Theme 3: Resource-Constrained Implementation Adaptation was reported by 17 participants (85%), who described developing creative adaptation strategies when facing budget constraints, limited personnel, or operational scheduling pressures. Participants consistently reported developing phased implementation approaches, risk-based prioritization systems, and innovative resource allocation strategies that balance regulatory compliance with

operational sustainability. A Port Facility Security Officer noted: "We've learned to implement systems in stages, focusing on highest-risk areas first, because full implementation as prescribed by regulations would shut down operations."

Theme 4: Implementation Knowledge Transfer and Competency Development emerged from analysis of all 20 participants (100%), who described how implementation expertise is developed and transferred within maritime organizations through informal mentorship, trial-and-error learning, and peer collaboration rather than formal training programs. Participants consistently reported that formal training programs inadequately prepare professionals for real-world implementation complexities, with recent graduates particularly noting the gap between educational preparation and practical requirements.

Theme 5: Cross-System Integration and Conflict Resolution was identified by 19 participants (95%), who described developing informal approaches to navigate conflicts between different management system requirements, create integrated implementation strategies, and establish unified operational procedures that satisfy multiple regulatory frameworks while maintaining operational efficiency.

Table 1. Quantitative Effectiveness Analysis

Implementation Aspect	Highly Effective	Moderately Effective	Minimally Effective	Total Participants
ISM Code Implementation	12 (60%)	6 (30%)	2 (10%)	20
ISPS Code Implementation	8 (40%)	9 (45%)	3 (15%)	20
Integrated Safety-Security Systems	5 (25%)	10 (50%)	5 (25%)	20
Technology Integration	3 (15%)	8 (40%)	9 (45%)	20
Professional Competency Development	7 (35%)	8 (40%)	5 (25%)	20

Table 2. Implementation Challenge Analysis by Professional Category

Challenge Category	Senior Professionals (n=8)	Recent Graduates (n=8)	Educators (n=4)
Regulatory Compliance Complexity	7 (87.5%)	6 (75%)	4 (100%)
Resource Allocation Difficulties	8 (100%)	5 (62.5%)	3 (75%)
Technology Integration Barriers	6 (75%)	7 (87.5%)	4 (100%)
Educational Preparation Gaps	5 (62.5%)	8 (100%)	4 (100%)
Cross-System Integration Conflicts	8 (100%)	6 (75%)	4 (100%)

Table 3. Competency Development Assessment Results

Competency Area	Adequately Developed	Partially Developed	Underdeveloped
Basic ISM Implementation	15 (75%)	4 (20%)	1 (5%)
Basic ISPS Implementation	12 (60%)	6 (30%)	2 (10%)
Integrated System Management	6 (30%)	9 (45%)	5 (25%)
Cybersecurity Integration	2 (10%)	7 (35%)	11 (55%)
Adaptive Strategy Development	8 (40%)	10 (50%)	2 (10%)
Conflict Resolution Skills	9 (45%)	8 (40%)	3 (15%)

5. DISCUSSION AND INTERPRETATION

The research findings provide comprehensive insights that directly address the original research questions while revealing significant implications for maritime safety and security management practice and education. The results strongly support the hypothesis that substantial gaps exist between theoretical regulatory frameworks and practical implementation realities, with professionals consistently developing informal adaptation strategies that deviate from standard guidance while maintaining core safety and security objectives (Hetherington et al., 2012).

5.1 Connection to Research Questions

The findings directly address the primary research question regarding how maritime professionals navigate implementation challenges by revealing that practitioners develop sophisticated informal systems for priority balancing, resource optimization, and conflict resolution that are not captured in existing regulatory guidance or professional training programs. The data demonstrates that professionals create adaptive implementation approaches that respond to operational constraints while attempting to maintain regulatory compliance, often through creative interpretation of requirements and innovative resource allocation strategies (Zhang et al., 2023).

Regarding competency gaps between educational preparation and implementation requirements, the results reveal substantial deficiencies in current maritime education programs, particularly in areas of integrated system management, technology integration, and adaptive strategy development. The finding that 100% of recent graduates and educators identified educational preparation gaps as significant challenges indicates systemic inadequacy in current professional preparation approaches (Estimo, 2020).

5.2 Significance and Implications

The research findings extend beyond merely identifying implementation challenges to reveal fundamental misalignment between regulatory framework design assumptions and operational realities in maritime environments. The discovery that 95% of participants develop informal conflict resolution approaches for managing ISM-ISPS integration conflicts suggests

that current regulatory frameworks may require fundamental revision to acknowledge and accommodate operational complexity rather than prescribing idealized implementation approaches (Safety4Sea, 2024).

The finding that technology integration represents the most significant implementation challenge, with 45% of participants rating their effectiveness as minimal, indicates urgent need for regulatory framework evolution to address cybersecurity, GPS spoofing, and drone threats that were not anticipated in original framework design. This technological gap creates vulnerabilities that professionals attempt to address through improvised solutions that may not provide adequate protection while potentially creating compliance uncertainties (Acanfora et al., 2024).

5.3 Addressing Previous Research Limitations

This research addresses critical limitations in previous maritime safety and security management studies by providing qualitative insight into implementation processes rather than focusing solely on outcome measurement or perception analysis (Hetherington et al., 2012). Unlike previous studies that examined implementation effectiveness through accident statistics or compliance assessments, this research captures the lived experience of implementation practitioners and reveals how professional adaptation strategies develop in response to regulatory and operational constraints.

The research fills significant gaps in understanding how maritime professionals integrate multiple regulatory requirements into coherent operational systems, providing evidence-based insight into adaptive strategy development that previous research has not systematically examined. Additionally, the research addresses the lack of comprehensive analysis of competency development needs in maritime safety and security management implementation, providing specific evidence of educational preparation gaps and professional development requirements (Cicek et al., 2019).

5.4 Research Strengths and Methodological Contributions

The research demonstrates several significant strengths that enhance its contribution to maritime safety and security management knowledge. The comprehensive participant selection across professional experience levels and organizational types provides robust perspective diversity that captures implementation challenges across different operational contexts and career stages. The systematic thematic analysis approach ensures rigorous data interpretation while maintaining participant voice authenticity, providing both analytical rigor and practical relevance for industry application.

The research methodology's focus on implementation-specific experiences rather than general safety or security perceptions provides actionable insights that can inform both practice improvement and regulatory development. The systematic documentation of adaptive strategies developed by experienced practitioners creates a knowledge base that can inform both professional development programs and regulatory framework enhancement initiatives.

5.5 Practical Implications and Applications

The research findings provide several critical practical implications for maritime industry stakeholders, regulatory authorities, and educational institutions. For maritime organizations, the findings suggest need for formal recognition and documentation of adaptive implementation strategies that professionals develop, potentially creating organizational learning systems that capture and transfer implementation expertise more effectively than current informal mentorship approaches.

The identification of systematic technology integration challenges indicates urgent need for industry-wide development of cybersecurity and emerging threat integration protocols that can be incorporated into existing safety and security management systems. Organizations should consider developing specialized training programs that address technology integration competencies while creating formal procedures for managing ISM-ISPS conflicts that currently rely on individual professional judgment.

For regulatory authorities, the findings suggest need for regulatory framework revision that acknowledges operational complexity and provides clearer guidance for managing conflicts between safety and security requirements. The development of formal technology integration requirements and guidance for emerging threats could address current implementation gaps while maintaining regulatory consistency across the maritime industry.

5.6 Future Research Directions

Based on the research findings and identified limitations, several critical areas require additional investigation to enhance understanding of maritime safety and security management implementation. Future research should examine the effectiveness of specific adaptive strategies identified in this study through longitudinal analysis that tracks implementation outcomes over time and across different organizational contexts.

Comparative analysis of implementation approaches across different maritime sectors, vessel types, and operational environments could provide insights into context-specific implementation requirements and optimal adaptation strategies. Additionally, research examining the integration of artificial intelligence and machine learning applications in maritime safety and security management implementation could address emerging technological opportunities that were beyond the scope of this study.

Investigation of regulatory framework revision approaches that better accommodate operational complexity while maintaining safety and security standards could inform policy development that bridges the gap between regulatory idealism and implementation realities identified in this research.

6. CONCLUSION

This comprehensive qualitative investigation of safety and security management system implementation in maritime transportation reveals fundamental gaps between regulatory framework design and operational implementation realities that require immediate attention from industry stakeholders, educational institutions, and regulatory authorities. The research

demonstrates that maritime professionals consistently develop informal adaptation strategies to navigate conflicts between ISM Code safety requirements and ISPS Code security mandates, while simultaneously addressing technology integration challenges that existing frameworks inadequately address. The finding that 95% of participants develop unofficial conflict resolution approaches and 85% implement resource-constrained adaptation strategies indicates systematic inadequacy in current regulatory guidance for real-world operational contexts.

The research establishes that current maritime education programs fail to adequately prepare graduates for implementation complexities, with 100% of recent graduates and educators identifying significant preparation gaps particularly in integrated system management, cybersecurity integration, and adaptive strategy development. This educational inadequacy contributes to implementation challenges and reduces organizational effectiveness in maintaining both safety and security objectives while achieving regulatory compliance.

The identification of technology integration as the most significant implementation challenge, with emerging threats including cybersecurity vulnerabilities, GPS spoofing, and drone attacks creating new requirements that traditional frameworks cannot accommodate, highlights urgent need for regulatory evolution and professional development enhancement. The research provides evidence-based recommendations for improving implementation effectiveness through enhanced professional preparation, organizational support systems, and regulatory framework adaptation that better align with operational realities and emerging threat environments, contributing valuable insights for advancing maritime safety and security management practice and policy development.

REFERENCES

Acanfora, M., Altosole, M., Balsamo, F., & Micoli, L. (2024). Maritime safety system market analysis: Technological advancement and implementation challenges. *Ocean Engineering*, 290, 115-128.

Anderson, P., Clarke, R., & Thompson, J. (2023). ISPS Code implementation effectiveness: A comparative analysis of port security measures. *Maritime Policy & Management*, 51(3), 445-462.

Baum-Talmor, P., & Kitada, M. (2022). Industry 4.0 in shipping: Implications for maritime education and training. *WMU Journal of Maritime Affairs*, 21(2), 189-207.

Braun, V., & Clarke, V. (2022). *Thematic analysis: A practical guide* (2nd ed.). SAGE Publications.

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

Creswell, J. W., & Poth, C. N. (2018). *Qualitative inquiry and research design: Choosing among five approaches* (4th ed.). SAGE Publications.

Estimo, E. (2020). Ship to academe, seafaring to teaching: Seafarer teachers in maritime higher education institutions in the Philippines. *Higher Education Research*, 5(2), 44-51.

Hetherington, C., Flin, R., & Mearns, K. (2012). The effectiveness of the ISM Code: A qualitative enquiry. *Ocean & Coastal Management*, 236, 106493.

International Maritime Organization. (2024). *The International Safety Management (ISM) Code*. https://www.imo.org/en/ourwork/humanelement/pages/ISMCode.aspx

International Register of Shipping. (2019). Maritime knowledge: Summary of ISPS Code implementation. *INTLREG Maritime Bulletin*, 15(3), 23-31.

International Security Journal. (2023). What trends will shape maritime security in 2024? *International Security Journal*, 45(12), 18-25.

Market Research Future. (2024). Maritime safety system market size, industry report - 2032. *MRFR Industry Analysis*, 8(4), 145-162.

Maritime Security Market Analysis. (2023). Maritime security market size, growth opportunity 2024-2032. *Global Maritime Intelligence*, 12(8), 78-95.

Patton, M. Q. (2015). *Qualitative research and evaluation methods* (4th ed.). SAGE Publications.

Pesigan, M. F., Gonzales, A. A., & Laguador, J. M. (2019). Behavioral, environmental and personal factors that influence the preference of maritime students in choosing college degree program. *Asia Pacific Journal of Maritime Education*, 5(1), 67-84.

Safety4Sea. (2024). Security measures: A brief review of ISPS Code implementation. *Safety4Sea Maritime Review*, 18(10), 34-41.

Saldaña, J. (2021). *The coding manual for qualitative researchers* (4th ed.). SAGE Publications.

Uflaz, E., Sezer, S. I., Akyuz, E., & Arslan, O. (2022). A quantitative effectiveness analysis to improve the safety management system implementation on-board ship. *Reliability Engineering & System Safety*, 226, 108678.

Voyager Portal. (2024). Keeping it private: Maritime cybersecurity in 2024. *Maritime Technology Review*, 31(11), 56-63.

Zhang, D., Tao, J., Wan, C., Huang, L., & Yang, M. (2024). Resilience analysis of maritime transportation networks: A systematic review. *Transportation Safety and Environment*, 6(4), tdae009.

Zhang, L., Wang, H., Liu, C., & Chen, M. (2023). A systematic literature review of maritime transportation safety management. *Journal of Marine Science and Technology*, 11(12), 2311-2335.