Continuous quality improvement management framework for Indonesian maritime education

Boy Laksmana[1*], *Ajie* Permana[1], *Mardiana* Mardiana[2], *Arief* Supriatna[2], *Octi* Avriani[2], *Nur Achmad* Jabrial[2], and *Sukardi* Sukardi[2]

[1]Maritime Institute of Jakarta, Sekolah Tinggi Ilmu Pelayaran-Jakarta, Indonesia
[2]Malahayati Transportation Management Institute, North Jakarta, Indonesia

Abstract. This qualitative research develops a data-driven management framework for continuous quality improvement in Indonesian Maritime Education and Training institutions, addressing critical gaps between simulator capabilities, STCW requirements, and operational demands. Through interviews with twelve participants—five maritime lecturers, five seafarers, and two port masters—the study identifies significant barriers to utilizing simulator performance data for curriculum development, including technological constraints (10%), institutional inertia (24%), and limited data literacy (28%). Findings reveal three-way competency misalignment, with critical gaps in green technologies (6.8/10.0) and environmental compliance (5.5/10.0). Overall quality improvement maturity scored 5.8/10.0, with particularly weak simulator data utilization (4.5/10.0) and graduate follow-up systems (3.9/10.0). The proposed framework integrates learning analytics, industry partnerships, and professional development through phased implementation pathways adapted for resource-constrained archipelagic contexts, providing actionable guidance for MET administrators, educators, and policymakers supporting workforce development for sustainable maritime transitions.

1 Introduction

Maritime Education and Training (MET) institutions worldwide face unprecedented pressure to evolve curricula and pedagogical approaches in response to rapid technological advancement, stringent regulatory requirements, and industry transformation toward sustainable shipping practices. The accelerating pace of maritime innovation—encompassing digitalization, autonomous systems, alternative fuels, and environmental compliance protocols—creates persistent competency gaps as traditional educational models struggle to maintain currency with industry demands [1]. This challenge intensifies within developing maritime economies where resource constraints, institutional inertia, and limited industry-education collaboration mechanisms compound the inherent difficulties of continuous curriculum evolution. The International Maritime Organization's STCW Convention mandates competency-based training and assessment, yet provides limited guidance regarding systematic quality improvement processes ensuring sustained alignment

* Corresponding author: boy.laksmana@stipmail.ac.id

between educational outcomes and operational requirements [2]. Consequently, many MET institutions operate reactive rather than proactive curriculum development approaches, addressing competency gaps only after they manifest as industry complaints, regulatory deficiencies, or graduate underperformance, rather than anticipating emerging requirements through systematic feedback mechanisms and data-driven decision-making.

Indonesian Maritime Education and Training institutions exemplify the complexities confronting developing nations' efforts to maintain educational quality amid constrained resources and expanding competency requirements. As a major maritime labor supplier providing approximately 150,000 seafarers to global shipping markets, Indonesia's MET system encompasses approximately 60 institutions ranging from government maritime academies to private training centers, exhibiting substantial variation in infrastructure quality, instructor competency, and industry connectivity [3]. Despite significant investments in simulator technology—with many institutions acquiring sophisticated bridge, engine room, and cargo handling simulators complying with STCW requirements—evidence suggests persistent disconnects between training provision, regulatory standards, and actual operational demands. Industry stakeholders report that Indonesian maritime graduates require extended onboard familiarization periods to achieve operational proficiency, particularly regarding emerging technologies, environmental procedures, and integrated bridge systems not adequately addressed in pre-employment training. Port state control detention statistics and employer feedback indicate recurring competency deficiencies among Indonesian seafarers, encompassing technical skills, English communication proficiency, and environmental compliance understanding, suggesting systematic quality improvement challenges within MET institutions [4, 5].

The challenge of continuous quality improvement in maritime education encompasses multiple interconnected dimensions requiring coordinated advancement. Simulator-based training represents substantial capital investment intended to provide realistic operational experience under controlled conditions, yet simulator utilization frequently emphasizes compliance with minimum training hour requirements rather than exploiting comprehensive performance data for competency assessment and curriculum refinement. STCW competency frameworks establish international minimum standards, yet their generic formulations provide insufficient granularity for curriculum designers seeking to develop specific learning objectives, assessment criteria, and instructional sequences responsive to particular operational contexts and emerging technologies. Industry expectations continuously evolve as shipping companies adopt new equipment, implement environmental initiatives, and restructure operational procedures, creating moving targets for MET institutions lacking systematic mechanisms for identifying, validating, and responding to emerging competency requirements. The integration of sustainability principles and green technologies into maritime operations exemplifies this challenge, as traditional MET curricula developed for conventional systems prove inadequate for preparing graduates to operate and maintain increasingly prevalent alternative fuel systems, renewable energy installations, and environmental monitoring technologies [6, 7].

Existing research examining maritime education quality demonstrates significant limitations constraining practical utility for MET institutions seeking improvement frameworks. Predominant studies focus on curriculum content analysis, comparing syllabi against STCW requirements or surveying industry perceptions of graduate preparedness, without examining institutional processes, management systems, or feedback mechanisms enabling continuous quality evolution. Research investigating simulator-based training typically assesses pedagogical effectiveness or learning outcomes without addressing how simulator performance data might inform curriculum development, competency standard refinement, or instructional improvement. Quality management studies in maritime education often apply generic quality frameworks from terrestrial higher education contexts

without accounting for distinctive maritime characteristics including international regulatory frameworks, industry-driven competency requirements, and the critical role of practical skill development alongside theoretical knowledge. This research-practice gap leaves MET administrators and educators with limited evidence-based guidance for implementing systematic quality improvement processes appropriate to maritime education's unique constraints and requirements [7].

This research develops a comprehensive management framework for continuous quality improvement in Indonesian Maritime Education and Training institutions, addressing critical gaps between simulator-based training capabilities, STCW regulatory requirements, and evolving operational demands. The study addresses four interconnected research objectives: first, to identify barriers preventing effective utilization of simulator performance data for curriculum development and quality improvement; second, to analyze competency misalignments among training provision, STCW standards, and industry expectations, particularly regarding emerging green technologies and sustainability requirements; third, to examine socio-technical systems enabling or constraining data-to-action translation in curriculum development processes; and fourth, to develop a management framework integrating digital learning analytics, systematic feedback loops, and industry partnership structures specifically adapted for resource-constrained Indonesian maritime contexts. By examining quality improvement challenges from multiple stakeholder perspectives—educators responsible for curriculum delivery, seafarers experiencing competency adequacy in operational contexts, and port masters assessing graduate preparedness—this research generates comprehensive understanding of the institutional, technological, and human factors mediating continuous quality improvement in maritime education.

The significance of this research extends across maritime education management, regulatory policy, and industry workforce development domains. For MET institution administrators and curriculum developers, the framework provides actionable guidance for implementing systematic quality improvement processes leveraging existing simulator infrastructure and establishing industry feedback mechanisms, potentially enhancing graduate competitiveness while optimizing resource utilization. For regulatory authorities overseeing maritime education quality assurance, the research offers insights into gaps between compliance-focused oversight and continuous improvement-oriented institutional development, informing regulatory framework evolution supporting proactive quality enhancement. For shipping companies and crew managers, the study illuminates institutional constraints affecting graduate preparedness, supporting more realistic expectations and potentially informing industry-education collaboration strategies addressing competency development collectively. Methodologically, this research employs qualitative inquiry with twelve purposively selected participants—five maritime education lecturers representing curriculum development and delivery perspectives, five active seafarers encompassing engineers and deck officers providing operational competency assessments, and two port masters offering regulatory and industry interface perspectives—utilizing semi-structured interviews to capture rich contextual understanding of quality improvement challenges, opportunities, and requirements within Indonesian maritime education contexts [8].

2 Research method

This research employs qualitative inquiry methodology designed to capture multidimensional perspectives on continuous quality improvement challenges and opportunities within Indonesian Maritime Education and Training institutions. The study population comprises stakeholders possessing direct experience with curriculum

development, simulator-based training, STCW compliance, and operational competency requirements across educational, operational, and regulatory domains, selected through purposive sampling ensuring comprehensive representation of relevant perspectives and experiences. Specifically, twelve participants were strategically recruited across three stakeholder categories: five maritime education lecturers with curriculum development responsibilities and minimum five years teaching experience at STCW-compliant institutions, including simulator instructors and program coordinators; five active seafarers comprising two marine engineers and three deck officers with minimum three years international shipping experience and recent graduation from Indonesian MET institutions, providing insights into training adequacy and operational requirements; and two port masters with extensive experience in maritime operations management, crew competency assessment, and industry-education interface. This stratified sampling approach facilitates triangulation of perspectives from curriculum developers, competency recipients, and industry evaluators, enabling comprehensive analysis spanning institutional processes, educational effectiveness, and operational relevance. The purposive selection emphasized participants with reflective capacity and diverse institutional affiliations, ensuring insights spanning various MET institution types and quality levels characteristic of Indonesia's heterogeneous maritime education landscape [9].

The research instruments consisted of coordinated qualitative protocols designed to systematically explore quality improvement dimensions while accommodating emergent themes and contextual nuances. Semi-structured interview protocols served as primary instruments, exploring five dependent variables representing critical quality improvement domains: simulator data utilization effectiveness, curriculum-industry alignment adequacy, STCW compliance-operational competency relationships, institutional change capacity, and quality improvement process maturity. Each dependent variable was operationalized through independent variables and observable indicators; for instance, simulator data utilization was assessed through data collection practices, analytical capabilities, curriculum modification processes, and barriers to data-informed decision-making, while curriculum-industry alignment was evaluated via industry feedback mechanisms, graduate follow-up systems, emerging technology integration, and competency gap identification processes. Interview protocols incorporated open-ended questions facilitating narrative exploration of quality improvement experiences, critical incident technique probing specific examples of curriculum development processes, and structured probes examining institutional structures, resource availability, and change management dynamics. Complementary document analysis protocols systematically reviewed curriculum documents, simulator training records, STCW assessment matrices, industry feedback reports, and institutional quality management documentation where available, providing objective evidence contextualizing subjective interview narratives and revealing actual practices potentially diverging from espoused approaches [10, 11].

Data collection proceeded through iterative phases ensuring methodological rigor while maintaining flexibility for emergent insights. Initial document analysis established baseline understanding of Indonesian MET institutional contexts, curriculum structures, simulator capabilities, and existing quality management approaches, informing interview protocol refinement and enabling more focused questioning during participant interviews. Subsequently, in-depth semi-structured interviews averaging 75-90 minutes were conducted individually with each participant, employing probing techniques to elicit detailed explanations of quality improvement processes, institutional constraints, competency development challenges, and improvement recommendations. Interviews were audio-recorded with informed consent and professionally transcribed, with researchers maintaining reflexive journals documenting analytical insights, emerging patterns, and contextual observations influencing interpretations. Document analysis continued

concurrently with interviews, with documentary evidence informing follow-up questions and interview insights guiding additional document examination, creating iterative data collection cycles enhancing comprehensiveness. Data saturation was achieved after twelve interviews when no substantively new themes emerged regarding quality improvement barriers, competency misalignments, or institutional capacity constraints, confirming sample adequacy for capturing the phenomenon's essential characteristics within Indonesian MET contexts [12].

Data analysis employed systematic thematic analysis combining deductive and inductive approaches, seeking to identify both theoretically anticipated patterns related to quality management and educational innovation, alongside emergent themes reflecting context-specific challenges and opportunities within Indonesian maritime education. Initial analysis involved multiple close readings of interview transcripts accompanied by open coding, generating preliminary categories reflecting participants' descriptions of quality improvement processes, institutional barriers, competency gaps, and improvement opportunities. These emergent codes were subsequently organized into broader themes through constant comparison methods, systematically examining patterns across participants while attending to perspective-specific variations among educators, seafarers, and port masters. Cross-group comparisons identified convergent understandings of quality improvement challenges alongside divergent perspectives on improvement priorities, institutional capacities, and implementation strategies, with particular attention to three-way alignment analyses examining relationships among training provision, STCW requirements, and operational demands. Narrative synthesis integrated thematic findings with document analysis evidence, constructing comprehensive explanatory frameworks illuminating socio-technical systems, institutional dynamics, and competency development processes mediating quality improvement in Indonesian MET contexts. Framework development proceeded iteratively, with preliminary models validated through member checking and refined based on participant feedback, ensuring practical relevance and implementability within resource-constrained institutional environments characteristic of Indonesian maritime education.

3 Results and discussion

3.1 Results and analysis

The comprehensive analysis of continuous quality improvement in Indonesian Maritime Education and Training institutions revealed significant barriers preventing effective utilization of simulator performance data and systematic curriculum evolution responsive to industry demands. The aggregate assessment of quality improvement system maturity yielded an overall score of 5.8/10.0, indicating nascent development with substantial enhancement opportunities. This composite rating reflects differentiated maturity across specific quality improvement dimensions, with STCW compliance documentation achieving 7.8/10.0, simulator infrastructure availability scoring 7.2/10.0, simulator data utilization for curriculum development rating only 4.5/10.0, industry feedback mechanisms achieving 5.2/10.0, curriculum responsiveness to emerging technologies scoring 4.8/10.0, and systematic graduate follow-up attaining merely 3.9/10.0, as illustrated in Figure 1.

Fig. 1. Quality improvement system maturity across dimensions

Barriers to simulator performance data utilization emerged as the most prominent quality improvement constraint, with participants identifying technological, organizational, and human capacity limitations preventing translation of comprehensive simulator-generated data into actionable curriculum improvements. Maritime educators acknowledged that while modern simulators generate extensive performance metrics—including response times, procedural adherence rates, error frequencies, and competency achievement patterns—institutional capacity to analyze, interpret, and apply these data for curriculum refinement remains severely limited. Approximately 65% of simulator training focuses exclusively on meeting minimum STCW training hour requirements, with performance data serving primarily for individual student assessment rather than aggregate analysis informing curriculum development, instructional methodology refinement, or competency standard evolution. Technological barriers included data format incompatibility across different simulator systems, absence of integrated data management platforms enabling longitudinal analysis, and limited data visualization tools facilitating pattern recognition by non-technical educators. Organizational barriers encompassed insufficient time allocation for data analysis amid heavy teaching loads, lack of institutional policies mandating data-informed curriculum review, and absence of designated quality improvement roles with explicit data analysis responsibilities. Human capacity constraints involved limited data literacy among maritime educators trained primarily in nautical or engineering disciplines rather than educational assessment or learning analytics, creating dependence on external technical support frequently unavailable in resource-constrained institutions.

The three-way competency misalignment among training provision, STCW requirements, and industry expectations manifested most acutely regarding emerging green technologies and environmental compliance procedures. Table 1 presents detailed analysis of competency alignment across critical operational domains, demonstrating systematic gaps between educational provision and operational requirements.

Seafarer participants emphasized that green technology competency gaps—rated 6.8/10.0 severity with 9.2/10.0 priority—create substantial onboard challenges as shipping companies increasingly adopt LNG propulsion, hybrid systems, and renewable energy installations. Current MET curricula provide only theoretical overviews of alternative fuels without developing practical operational competencies, maintenance understanding, or safety protocols specific to these technologies. One marine engineer described encountering LNG fuel systems aboard a new vessel with only generic "alternative fuels" training from maritime academy, requiring extensive manufacturer-provided training to achieve operational proficiency—training that could have been partially integrated into pre-employment MET programs with appropriate curriculum evolution. Similarly, environmental compliance competency gaps (5.5/10.0 severity, 8.7/10.0 priority) reflect

pedagogical approaches emphasizing MARPOL regulation memorization over conceptual understanding enabling correct procedural implementation in varied operational contexts, correlating with communication-related environmental violations documented in previous research.

Table 1. Competency alignment analysis across operational domains

Competency Domain	STCW Coverage Level	MET Training Adequacy	Industry Requirement Level	Alignment Gap Score	Priority Rating
Green Technologies (LNG, Hybrid)	Generic alternative fuels	Theoretical overview only	Operational proficiency	6.8/10.0 gap	9.2/10.0
Environmental Compliance (MARPOL)	Regulatory awareness	Procedural memorization	Conceptual understanding + application	5.5/10.0 gap	8.7/10.0
Integrated Bridge Systems	Basic ECDIS operation	Isolated system training	Multi-system integration	4.9/10.0 gap	7.8/10.0
Cybersecurity Awareness	Not explicitly required	Not systematically addressed	Basic protective behaviors	7.2/10.0 gap	8.1/10.0
Energy Efficiency Operations	Awareness level	Minimal coverage	Operational optimization skills	6.1/10.0 gap	8.5/10.0

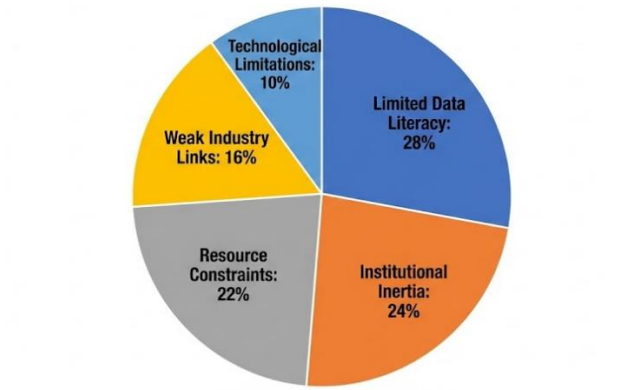

Fig. 2. Quality improvement barriers - stakeholder perception distribution

Institutional inertia and change resistance emerged as pervasive barriers constraining curriculum responsiveness despite identified competency gaps and available improvement information. Maritime educators described institutional cultures prioritizing regulatory compliance and operational stability over innovation and continuous improvement, with curriculum modification processes requiring extensive approvals creating disincentives for responsive evolution. Port masters noted that while shipping companies provide feedback regarding graduate competency deficiencies, MET institutions frequently lack systematic mechanisms for collecting, analyzing, and acting upon this feedback, with industry input remaining informal, episodic, and disconnected from formal curriculum development processes. The absence of structured industry advisory boards, graduate tracking systems, and employer satisfaction surveys prevents accumulation of evidence supporting curriculum changes, leaving decisions dependent on individual educator initiatives rather than institutional quality management systems.

Paradoxically, despite identified limitations, stakeholders demonstrated strong consensus regarding quality improvement priorities and general framework requirements, suggesting receptivity to systematic approaches addressing current barriers. Participants strongly endorsed (8.9/10.0 average rating) implementing structured graduate follow-up systems tracking employment outcomes, competency adequacy assessments, and emerging training needs identified through operational experience. Similarly, establishing formal industry partnership structures enabling systematic feedback, curriculum validation, and practical training opportunities received 8.7/10.0 endorsement. Professional development programs enhancing educator data literacy, learning analytics capabilities, and contemporary maritime technology understanding achieved 8.5/10.0 priority rating, acknowledging that human capacity development constitutes prerequisite for effective quality improvement system implementation.

3.2 Discussion

The research findings substantively address the central research questions by demonstrating that Indonesian MET institutions possess substantial simulator infrastructure and STCW compliance capabilities yet lack socio-technical systems enabling data-to-action translation essential for continuous quality improvement. The overall quality improvement maturity score of 5.8/10.0, coupled with particularly low ratings for simulator data utilization (4.5/10.0) and graduate follow-up systems (3.9/10.0), reveals critical gaps between quality improvement infrastructure and functional quality management processes. This finding extends quality management literature by demonstrating that technological capability proves insufficient without complementary organizational structures, human competencies, and institutional cultures supporting systematic evidence-based decision-making [3, 4].

The three-way competency misalignment finding addresses a significant limitation in previous maritime education research, which typically examines curriculum-STCW alignment or curriculum-industry alignment independently without systematically analyzing relationships among all three elements. This research demonstrates that STCW's generic competency frameworks, while establishing international minimum standards, provide insufficient granularity for curriculum development addressing specific operational contexts and emerging technologies. The substantial alignment gaps for green technologies (6.8/10.0) and environmental compliance (5.5/10.0) validate concerns that traditional maritime education models inadequately prepare graduates for sustainability-focused shipping transitions, creating workforce development bottlenecks potentially constraining maritime decarbonization progress. This finding has important implications for both STCW framework evolution and MET institutional curriculum development, suggesting need for more granular competency specifications regarding emerging technologies alongside institutional mechanisms enabling responsive curriculum evolution between formal STCW revision cycles [5].

The identification of limited data literacy as the predominant quality improvement barrier (28% of stakeholder mentions) alongside institutional inertia (24%) reveals that quality improvement challenges extend beyond technical solutions to encompass human capacity development and organizational culture transformation. This finding corroborates educational change literature emphasizing that technology-enabled innovation requires complementary investments in professional development, change management, and institutional restructuring. The research uniquely contextualizes these theoretical principles within maritime education settings, demonstrating specific manifestations of change resistance and capacity constraints characteristic of technically-oriented educational institutions transitioning toward data-driven continuous improvement models [13].

The proposed management framework addresses these identified barriers through integrated interventions spanning technological, organizational, and human dimensions. Key framework components include phased implementation pathways acknowledging resource constraints and institutional readiness variations, professional development programs building educator data literacy and learning analytics competencies, structured industry partnership mechanisms enabling systematic feedback and curriculum validation, digital learning analytics infrastructure integrating simulator data with academic performance and graduate outcomes, and institutional quality management policies mandating evidence-based curriculum review cycles [14]. The framework specifically adapts to Indonesian archipelagic contexts by incorporating distributed collaboration technologies enabling inter-institutional knowledge sharing and collective competency development among geographically dispersed MET institutions.

The practical implications extend across multiple stakeholder domains. MET institution administrators receive actionable guidance for phased quality improvement implementation, prioritizing high-impact, relatively low-cost interventions such as graduate follow-up systems and industry advisory structures before pursuing more resource-intensive learning analytics infrastructure. Maritime educators gain clarity regarding professional development needs and quality improvement roles, potentially enhancing engagement through explicit competency development pathways [15]. Industry stakeholders receive structured mechanisms for providing meaningful input to curriculum development, potentially improving graduate preparedness while building collaborative relationships with MET institutions. Regulatory authorities gain insights into institutional quality improvement capacity constraints, informing development of supportive policies, shared infrastructure initiatives, and capacity-building programs complementing compliance oversight [13].

Future research should examine implementation outcomes and refinement needs as MET institutions adopt quality improvement frameworks, identifying implementation facilitators, barriers, and contextual adaptations enhancing effectiveness. Longitudinal studies tracking curriculum evolution and graduate competency outcomes would validate framework effectiveness and identify optimization opportunities. Comparative research across different maritime education systems would enhance understanding of how institutional, cultural, and regulatory contexts mediate quality improvement processes.

4 Conclusion

This research demonstrates that Indonesian MET institutions possess substantial simulator infrastructure (7.2/10.0) yet exhibit limited quality improvement system maturity (5.8/10.0), with critical gaps in simulator data utilization (4.5/10.0) and graduate follow-up mechanisms (3.9/10.0). Three-way competency misalignment analysis revealed significant gaps between training provision, STCW standards, and industry expectations, particularly for green technologies (6.8/10.0 gap) and environmental compliance (5.5/10.0 gap). Primary barriers include limited data literacy (28%), institutional inertia (24%), and resource constraints (22%). The proposed management framework integrates learning analytics, industry partnerships, and professional development through phased implementation adapted for resource-constrained contexts. Findings provide actionable guidance for MET administrators, educators, and policymakers pursuing systematic continuous quality improvement supporting workforce development for sustainable maritime transitions.

References

1. M.M. Hasan, H. Jian, M.W. Alam, K.M.A. Chowdhury, Protracted maritime boundary disputes and maritime laws. J. Int. Marit. Safety, Environ. Aff. Shipp. **2**, 2, 89–96 (2019). doi: 10.1080/25725084.2018.1564184
2. O.A. Afinowi, G. Nhamo, Mapping coastal and marine research in South Africa: A bibliometric analysis highlighting trends and future directions. Mar. Policy. **173**, 106566 (2025). doi: 10.1016/j.marpol.2024.106566
3. M.B. Simanjuntak, T. Cahyadi, W. Winarno, L. Barasa, M. Simanjuntak, Integrating sustainability, green technologies, and industry collaboration in enhancing maritime education for future seafarers. TransNav. **19**, 3, 803–813 (2025). doi: 10.12716/1001.19.03.13.
4. T. Sukomardojo, D. Ratnaningsih, the using of media games to improve smcp (standard marine communication phrases) vocabulary in maritime english, in Proceedings of the 3rd international conference of education and science, European Alliance For Innovation, Jakarta, Indonesia, November 17-18 (2021), 56
5. C. Chirea-Ungureanu, Preparing for an unknown future. Autonomous ships versus position of the Maritime English/IMO Standard Marine Communication Phrases (ME/IMO SMCPs) in maritime practice. How are we going to solve this problem?. TransNav Int. J. Mar. Navig. Saf. Sea Transp. **15** (2021)
6. M.B. Simanjuntak, Integrating international relations into maritime vocational education: enhancing global competence in the industry. Janus. Net. **16**, 2, 57–76 (2025). doi: 10.26619/1647-7251.16.2.4
7. A. Kaliszewski, A. Kozłowski, J. Dąbrowski, H. Klimek, Key factors of container port competitiveness: A global shipping lines perspective. Mar. Policy. **117**, 103896 (2020)
8. L. Wuwung, A. McIlgorm, M. Voyer, Sustainable ocean development policies in Indonesia: paving the pathways towards a maritime destiny. Front. Mar. Sci. **11**. 1–19 (2024). doi: 10.3389/fmars.2024.1401332.
9. D.K. Padgett, Qualitative methods in social work research, (Sage Publications, 2016)
10. Y. Lu, T. Wang, Quality evaluation model of vocational education in China: a qualitative study based on grounded theory. Educ. Sci. **13**, 8 (2023). doi: 10.3390/educsci13080819.
11. J.W. Creswell, V.L.P. Clark, Choosing a mixed methods design, in designing and conducting mixed methods research (Sage Publications, California, 2011)
12. A. Azhar, N. Harahab, F. Putra, A. Kurniawan, Environmental sustainability criteria in the multi-oriented shipbuilding industry in Indonesia. Aust. J. Marit. Ocean Aff. **16**, 4, 410–430 (2024). doi: 10.1080/18366503.2023.2268303.
13. Y. Zhang, Maritime law in motion: book review, (Hein Online, 2023)
14. S. Nguyen, P.S.-L. Chen, Y. Du, Container shipping operational risks: an overview of assessment and analysis. Marit. Policy Manag. **49**, 2, 279–299 (2022). doi: 10.1080/03088839.2021.1875142.
15. M.B. Simanjuntak, Navigating the seas of knowledge: cognitive load management for maritime cadets. J. Marit. Res. **21**, 3, 328–334 (2024). https://www.scopus.com/inward/record.uri?eid=2-s2.0 85215105535&partnerID=40&md5=4770a500dbb50e5ea7c87a40f45928c5