

DOI: <https://doi.org/10.38035/dijemss.v7i6><https://creativecommons.org/licenses/by/0/>

The Role of Digital Competence and Work Ethic in Improving Seafarer Performance in Indonesia

Indang Noerkajati¹, Edi Abdurachman², Olfebri³, Librita Arifiani⁴, Lira Agusinta⁵, Novita Widyaningrum⁶

¹Institute of Transportation and Logistics Trisakti, Jakarta, Indonesia, noerkajatiindang@gmail.com

²Institute of Transportation and Logistics Trisakti, Jakarta, Indonesia, edia@itltrisakti.ac.id

³Institute of Transportation and Logistics Trisakti, Jakarta, Indonesia, olfebri@yahoo.co.id

⁴Bina Nusantara University, Jakarta, Indonesia, librita.arifiani@binus.ac.id

⁵Institute of Transportation and Logistics Trisakti, Jakarta, Indonesia, lir4agusinta@gmail.com

⁶Indonesian State Maritime Polytechnic, Jakarta, Indonesia, novita@polimarin.ac.id

Corresponding Author: noerkajatiindang@gmail.com¹

Abstract: Seafarers' performance has a strategic role in ensuring the safety, operational efficiency, and sustainability of the maritime industry amid the acceleration of digital transformation. The application of digital-based ship technology requires seafarers not only to master technical skills, but also to have digital competencies and a strong work ethic. This study aims to systematically examine the influence of digital competence and work ethic on seafarers' performance through the Systematic Literature Review (SLR) approach combined with bibliometric analysis. Literature searches were conducted on Scopus, ScienceDirect, SpringerLink, PubMed, and Google Scholar databases for publications for the period 2015–2025, with reference to the PRISMA guidelines. Out of the initial 1,000 articles, 20 empirical articles were obtained that met the criteria for qualitative synthesis, while bibliometric analysis was carried out using the VOSviewer software. The results of the study show that digital competence contributes significantly to improving seafarers' performance through strengthening knowledge, skills, and the ability to implement ship technology. Meanwhile, work ethic plays an important role in shaping seafarers' discipline, motivation, and professionalism, which reinforces consistency of performance in high-risk maritime work environments. The study confirms that the integration of digital competencies and work ethic is a key prerequisite for sustainable seafarer performance development, as well as providing strategic implications for shipping companies, maritime education institutions, and policymakers.

Keywords: Digital Competence, Work Ethic, Seafarer Performance, Systematic Literature Review, Bibliometric Analysis.

INTRODUCTION

Seafarers' performance plays a critical role in ensuring maritime safety, operational efficiency, and the sustainability of global shipping activities. Although the maritime industry

continues to experience technological developments, human factors are still the dominant cause of maritime incidents, with a contribution of more than 70% to ship accidents worldwide (IMO, 2022). This condition shows that the improvement of ship technology alone is not adequate without being balanced with an increase in human resource competence and work behavior. Therefore, understanding the factors that determine seafarers' performance is becoming an increasingly important research agenda in the study of maritime management and human resource management.

In the context of a country with a developing maritime economy like Indonesia, the issue of seafarer performance is becoming increasingly crucial. Although Indonesia is one of the largest suppliers of seafarers in the world, most of its workforce is still at the operational level, with limited representation in officer and managerial positions (BPSDMP, 2023). This condition reflects ongoing challenges related to competency gaps, especially in the ability to adapt to digital-based ship systems and meet international performance standards. Previous studies have shown that inadequate professional competence of the ship's crew contributes to operational inefficiencies, sub-optimal decision-making, as well as increased safety risks on board ships (Sulistiana et al., 2025).

One of the most significant contemporary challenges affecting seafarers' performance is the rapid digital transformation in maritime operations. Modern ships are increasingly reliant on electronic navigation systems, automation, and integrated digital platforms. Nevertheless, empirical evidence suggests that many seafarers do not yet have adequate digital competencies to operate such systems effectively, thereby increasing cognitive burden and the potential for human error (Shi et al., 2024; Tijan & Jovi, 2021). Without adequate digital competencies, the potential benefits of maritime digitalization cannot be optimally utilized, ultimately weakening operational performance and shipping safety.

In addition to technological competence, work ethic is a very important behavioral factor in influencing seafarers' performance. The characteristics of maritime work that demand high discipline, responsibility, and adherence to safety procedures make work ethic a crucial aspect. Various studies show that a strong work ethic is positively related to performance consistency, safety compliance, and teamwork effectiveness in high-risk industries, including shipping (Bautista-Bernal et al., 2024). Conversely, a weak work ethic can reduce the effectiveness of technical and digital skills, resulting in suboptimal performance.

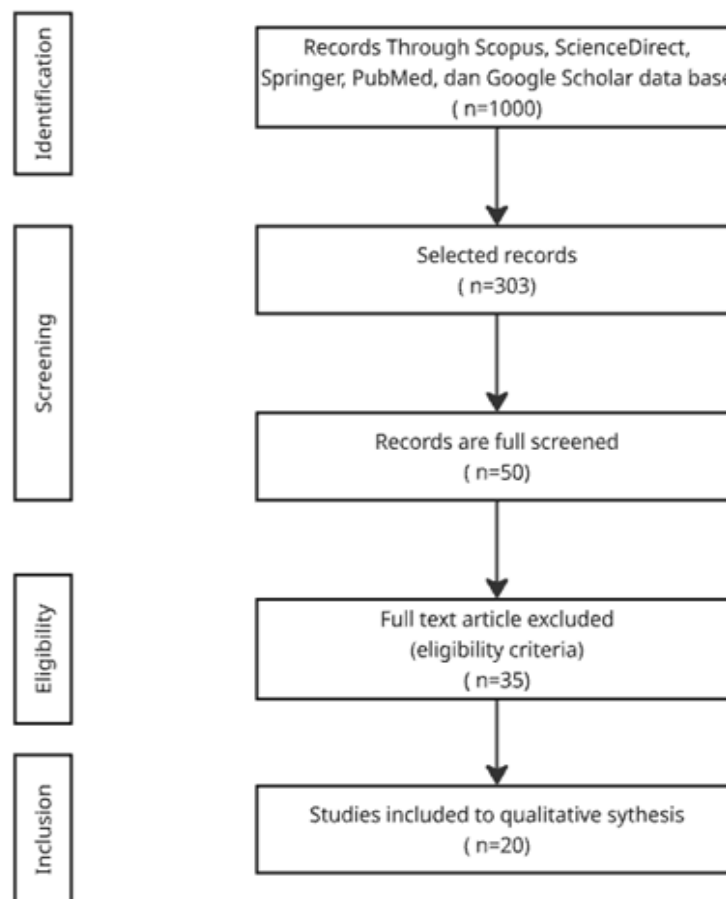
It's important to note that the influence of digital competencies and work ethic on performance doesn't happen in isolation. Crew competencies serve as a key mechanism that bridges individual abilities and behavioral attributes with actual job performance. Competency-based theory emphasizes that performance can be achieved when individual knowledge, skills, and attitudes are integrated in professional competencies that are aligned with operational standards (Janssens et al., 2023). However, the most empirical studies still examine these relationships in isolation, with limited attention to the mediating role of crew competence, particularly in the context of seafarers from countries with developing maritime economies.

Therefore, this study aims to analyze the influence of digital competence and work ethic on seafarers' performance with crew competence as a mediating variable. By filling the research gap, this study is expected to contribute to the maritime human capital literature through the presentation of a more comprehensive and integrated seafarer performance model. The findings of this study are expected to provide theoretical and practical implications for maritime education, training institutions, and shipping companies in an effort to improve global competitiveness and professional standards of seafarers.

METHOD

This study uses a bibliometric review design to map and quantitatively analyze research developments related to safety awareness in truck drivers in the context of freight

transportation. The bibliometric approach was chosen because it is able to provide a comprehensive and objective picture of the patterns of scientific publications, influential authors, and the tendency of research themes in a certain field of study, while minimizing the potential for subjective bias in the literature selection process. This study applies the PRISMA guidelines proposed by Moher et al. (2009) to ensure transparency, replicability, and methodological rigor in conducting the Systematic Literature Review (SLR). The identification stage involved a comprehensive keyword search related to digital competence, work ethic, and seafarers' performance, including synonymous and related terms, across reputable databases such as Scopus, ScienceDirect, SpringerLink, PubMed, and Google Scholar, resulting in approximately 1,000 initial records. The screening stage applied strict inclusion criteria, focusing on empirical studies in the maritime sector that examine digital competence, work ethic, professional competence, or seafarer performance, published between 2015 and 2025, while excluding non-empirical and irrelevant publications. Eligible articles were then assessed through detailed title, abstract, and full-text reviews to confirm relevance, eliminate duplicates, and ensure alignment with the research objectives. This rigorous selection process ultimately yielded 20 high-quality empirical studies, which were analyzed thematically to identify key patterns, theoretical approaches, and research gaps, with the overall selection process summarized in the PRISMA flow diagram.



Source: Research Results
Figure 1. PRISMA Flowchart

RESULTS AND DISCUSSION

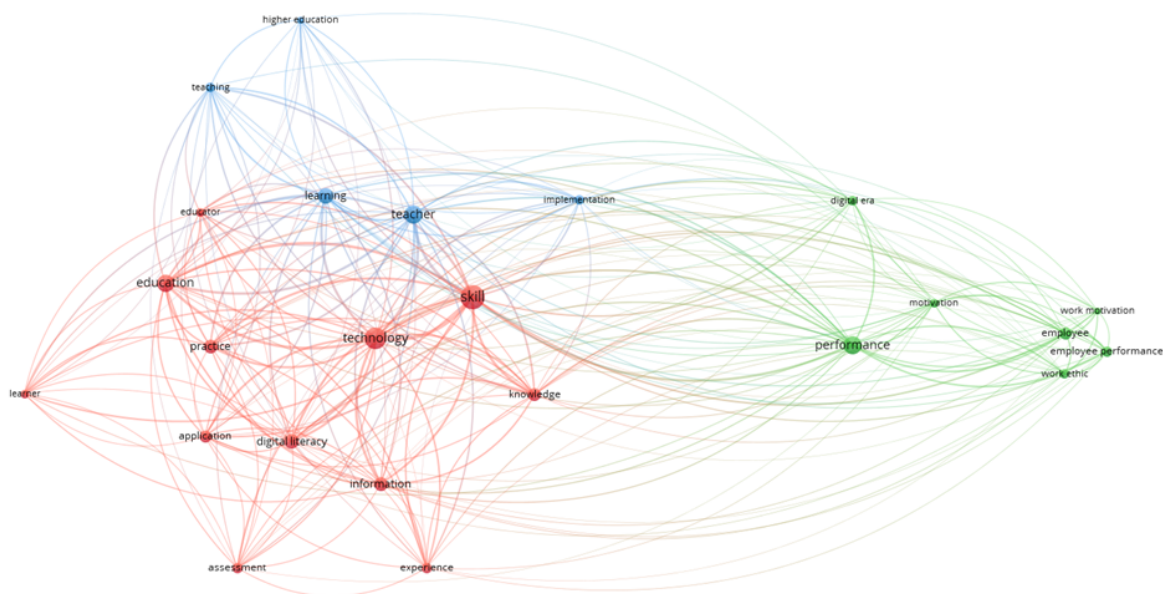
The first stage of selection is carried out through the screening of titles and abstracts to eliminate articles that clearly do not meet the inclusion criteria, such as research that discusses non-maritime modes of transportation, topics outside the context of seafarers or merchant ship

crews, as well as non-scientific publications in the form of popular editorials, opinions, or reports. At this stage, a total of 697 articles were eliminated, leaving 303 articles that were initially considered relevant. Furthermore, a complete text review stage was carried out on the 303 articles to ensure the suitability of the research context, clarity of methodology, and completeness of empirical data that support the analysis of the relationship between digital competence, work ethic, and seafarer performance. The results of this process showed that 253 articles did not meet the set criteria, so only 50 articles were proceeded to the feasibility evaluation stage.

The feasibility evaluation stage is carried out by examining in depth the methodological quality, clarity of the operational definition of variables, and the adequacy of the data presented in the article. Based on the rigorous selection process, 20 empirical articles were obtained that met all criteria and were used in qualitative synthesis through a thematic analysis approach. These articles are the main basis for mapping patterns of relationships between variables as well as in identifying key factors that influence seafarers' performance in the digital age.

In addition to qualitative synthesis, this study also conducted a bibliometric analysis of all initial search results ($n = 1,000$ articles) to map research trends, conceptual linkages, and dominant themes in maritime human resource studies. Bibliometric analysis is carried out using the VOSviewer software, which allows visualization of the co-occurrence relationship between keywords based on the frequency of occurrence and the strength of their correlation in scientific publications. The strategic keywords used in this mapping include digital competence, work ethic, seafarers' performance, crew competence, and maritime human resources.

The results of the bibliometric visualization show that digital competence and work ethic have a strong relationship with the themes of seafarer performance, crew professionalism, maritime safety, and operational effectiveness. The size of the nodes in the visualization represents the intensity of the study of a topic, while the connecting lines between nodes reflect the strength of the conceptual relationships between variables. These findings provide a comprehensive overview of the complexity of the determinants of seafarers' performance and provide a strong conceptual basis for further discussion in the results section and discussion of the study.



Source: Research Results
Figure 2. Bibliometric Analysis

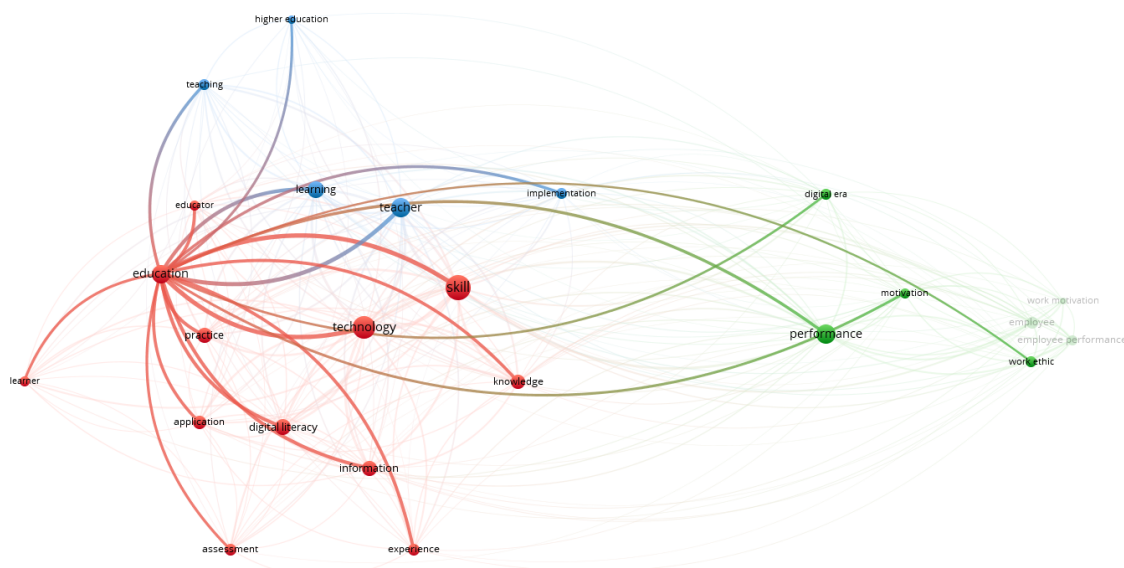
Based on Figure 2, the visualization presents the results of literature analysis using VOSviewer on 1,000 relevant scientific articles, where each node represents a keyword and its

performance, and leadership. This pattern suggests that attitudes, discipline, responsibility, and intrinsic motivation play a strategic role in shaping how effectively seafarers perform their duties. A strong work ethic reinforces the application of digital and technical competencies, leading to better operational performance, higher procedural compliance, and stronger teamwork. Overall, the bibliometric visualization confirms that digital competence, work ethic, and motivation are the main determinants of seafarers' performance in maritime human resource studies.

Overall, the results of this analysis confirm that seafarers' performance is shaped by the integration between digital competencies and work ethic, which is strengthened by education systems, learning, as well as motivational and leadership factors. However, the literature mapping also shows that most studies still examine these factors partially. Therefore, there is still a research gap in developing an integrated seafarer performance model, especially in the context of developing maritime countries such as Indonesia, which is able to explain how digital competence and work ethic simultaneously contribute to improving seafarer performance in the digital era.

Factors That Affect Work Ethics

Based on the results of the bibliometric analysis shown in Figure 4, work ethic emerges as one of the behavioral factors that has a direct and significant relationship with performance, and is closely related to the concepts of work motivation, individual performance, and leadership roles. The position of work ethic in the green cluster adjacent to the performance node suggests that the literature consistently views work ethic as an important determinant in shaping individual work effectiveness, including in the context of the seafarer profession.



Source: Research Results
Figure 4. Bibliometric Regulation

The mapping shows that work ethic forms the foundation of seafarers' attitudes and values, influencing how they perform their duties, follow procedures, and maintain consistent performance in a highly disciplined work environment. Its strong connection with work motivation indicates that work ethic is not only about normative values, but also about intrinsic drive to work responsibly, productively, and achieve optimal results. A positive work ethic reflected in commitment, diligence, integrity, and responsibility is essential for sustainable

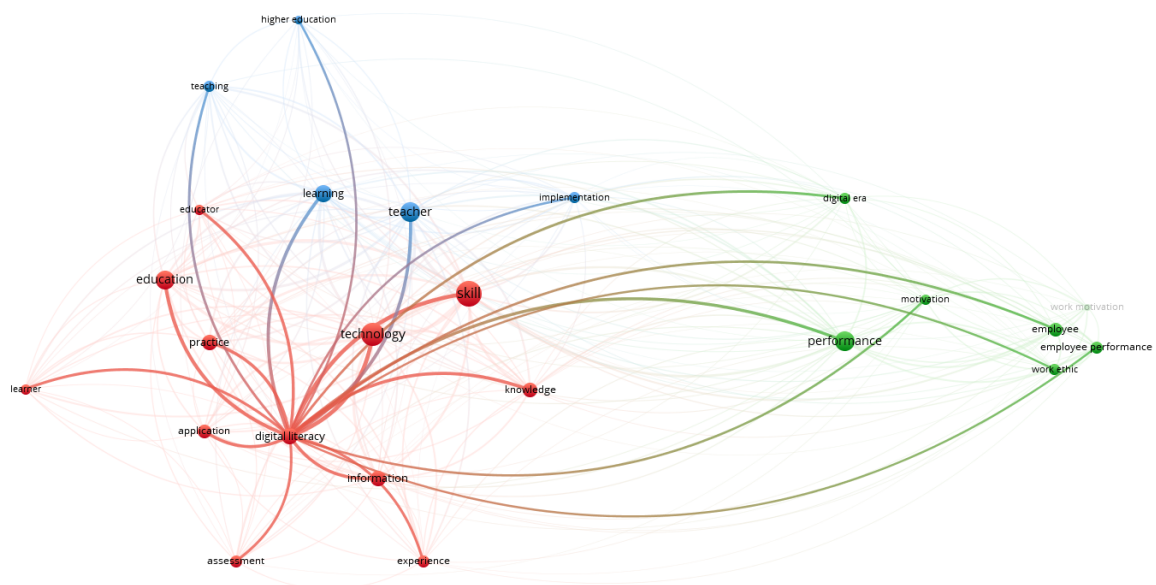
performance, especially in shipping, where seafarers face high pressure, long working hours, limited conditions, and strict safety standards.

The visualization also highlights the link between work ethic and leadership, showing that strong leadership on board and within shipping companies plays a key role in shaping professional values, discipline, and collective responsibility. Therefore, work ethic is not merely an individual trait, but a result of the interaction between personal values and organizational management systems.

Overall, the results of this analysis confirm that work ethic is a key factor that influences seafarers' performance, both directly and through strengthening work motivation and professional behavior. However, literature mapping also shows that studies of work ethic in the context of seafarers are still relatively limited and are often treated as a supporting variable, rather than a key determinant of performance. Therefore, a more integrated research approach is needed to understand the strategic role of work ethic in improving seafarers' performance, especially in the era of maritime digitalization and in the context of developing maritime countries such as Indonesia.

Factors Influencing Digital Competence

Based on the results of the bibliometric analysis shown in Figure 5, digital *literacy* emerged as one of the key factors that has a strong and direct relationship with performance.



Source: Research Results
Figure 4. Bibliometric SOP

This is reflected in the relatively large and central position of the digital literacy node, as well as its intense relationship with other keywords such as technology, information, knowledge, skills, and implementation. This pattern of interconnectedness shows that the literature consistently places digital competencies as the main foundation in improving individual performance in an increasingly digitized work environment, including in the maritime sector.

The strong link between digital literacy and technology shows that seafarers' digital competence goes beyond basic device usage and includes understanding ship operational

systems, digital-based information and navigation technologies, and the ability to adapt to automation and integrated maritime technologies. In this sense, digital competence is a critical prerequisite for seafarers to perform their duties effectively, accurately, and in line with modern operational standards. The close relationship between digital literacy, knowledge, and skills further confirms that digital competence is formed through the integration of conceptual understanding and practical abilities, and functions as a bridge between education, training, and workplace application.

The relationship between digital competence and performance indicates that seafarers with higher digital literacy tend to demonstrate better efficiency, more accurate decision-making, and stronger adaptability to technological change. Adequate digital competence enables effective information management, reduces operational errors, and enhances coordination and communication on board, whereas limited digital skills may increase cognitive workload and error risk, ultimately lowering individual and team performance. Moreover, the linkage between digital competence and the education–teaching cluster highlights the strategic role of maritime education and training institutions in developing relevant digital skills and ensuring continuous learning in accordance with ongoing technological advancements in the maritime sector.

Overall, the results of this bibliometric analysis confirm that digital competence is an important determinant of seafarers' performance, which works through strengthening knowledge, skills, and technology implementation capabilities in the maritime work environment. However, the literature mapping also shows that most research still focuses digital competencies on purely technical aspects, without comprehensively integrating them with behavioral factors such as work ethic. Therefore, a more integrated research approach is needed to understand how digital competencies and work ethic simultaneously contribute to improving seafarers' performance, especially in facing the challenges of digitalization of the maritime industry in developing countries such as Indonesia.

Bibliometric Review

No	Title & Researcher	Research Variables	Research Methods	Discussion
1	Challenges of maritime human resource management for the transition to shipping digitalization (Theotokas et al., 2024)	1. Maritime Human Resource Management 2. Digitization 3. Skills and Training 4. Organizational Culture	Descriptive Qualitative	The journal discusses the challenges in human resource management in the maritime industry due to digitalization, with an emphasis on the need for training and changes in management practices to support the digital transition.
Research Equations Second, the research emphasizes the importance of managing and improving the quality of human resources in the maritime sector.				
Research Differences This journal focuses more on the challenges and transitions due to digitalization without measuring the quality of seafarers directly, while the research being studied specifically measures the influence of competence on the quality of seafarers and uses quality improvement as a mediator variable.				
2	Digital wind of changes: navigating competitiveness in the maritime sector through the transformation in human resource development (Autsadee et al., 2024)	1. Human Resource Development (HR) 2. Digitization 3. Competitive in the Maritime Sector	Qualitative	This journal discusses how digitalization affects human resource development in the maritime sector and how this can improve the competitiveness of companies. Emphasis on the importance of adapting HR development strategies to face changing industry challenges.
Research Equations Both studies emphasize the importance of human resource development in the context of the maritime industry.				
Research Differences This journal is more general in discussing human resource development and digitalization, while the research being studied is more specifically related to individual competencies and their impact on the quality of seafarers.				
3	Impact of english language proficiency on maritime safety and environmental protection (Simanjuntak et al., 2024)	1. English language skills 2. Maritime safety 3. Environmental protection	Quantitative	This journal discusses the importance of English language proficiency in the context of maritime safety and environmental protection. Research shows that seafarers who have English language skills Both are better able to understand safety instructions and environmental regulations, which in turn improves the safety and sustainability of maritime operations.
Research Equations Both use quantitative survey methods to collect data and analyze relationships between variables.				
Research Differences The journal focuses more on the influence of English language skills on environmental safety and protection, while the research being studied more broadly covers the influence of various competencies (language, digital, soft skills, work ethic) on the quality of seafarers.				
4	The impact of digitalization on the maritime sector: Analyzing technostress among officer seafarers (Bayrak & Muslu, 2025)	1. Digitalisasi 2. Technostress 3. Kesejahteraan mental	Quantitative Survey	This journal discusses how digitalization in the maritime sector can cause technostress among seafarers, especially officers on ships. Research shows that the pressures generated by the use of technology can negatively impact mental well-being and, ultimately, on the operational performance of seafarers. Emphasis is placed on the importance of stress management and support to address the challenges arising from digitalization.
Research Equations Second, the research emphasizes the importance of managing and improving the quality of human resources in the maritime sector.				
Research Differences This journal is more focused on the impact of digitalization that causes technostress among seafarers, while the research being studied more broadly covers the influence of competencies (language, digital, soft skills, work ethic) on the quality of seafarers.				
5	Impact Of Emerging Technologies On Maritime Education And Training: A Phenomenological Study (Maghoromi, 2023)	1. Emerging Technologies 2. Maritime Education and Training/MET 3. Perceptions of Instructors and Trainees	Phenomenological Studies	This research aims to investigate how evolving technologies affect MET, including its programs, activities, and practices. This study highlights the importance of understanding how instructors and trainees perceive new technologies to inform MET research, policy, and practice. The results of the study show the potential of phenomenological approaches in longitudinal studies of technology adoption and adaptation trends needed to fill the knowledge gaps

				about evolving technological attitudes, experiences, and perceptions within MET.
Research Equations Both studies emphasize the importance of improving the quality of human resources in the maritime sector.				
Research Differences The journal emphasizes individual perceptions and experiences of technology, while the research being studied includes language competence, digital, soft skills, and work ethic.				
6	Physical and social environment as predictors of job satisfaction for seafarers: An empirical study of the shipping industry in Indonesia (Kundori et al., 2025)	1. Physical environment 2. Social environment 3. Job satisfaction	Quantitative Survey	This study investigates how the physical and social environment in the workplace affects the job satisfaction of seafarers in Indonesian shipping companies. The results of the study show that both the physical and social environment have a positive effect on job satisfaction. Social factors have a 42% greater influence than physical conditions. Sailors with more than five years of experience reported 28% higher satisfaction. The research challenges industry practices that emphasize physical rather than social improvement, suggesting investment in leadership training and communication systems to improve job satisfaction.
Research Equations The second study focuses on the factors that affect human resources in Indonesia's maritime industry.				
Research Differences The first journal emphasizes the physical and social environment, while the research being studied emphasizes language, digital, soft skills, and work ethic competencies.				
7	International Journal Of Multidisciplinary: Applied Business And Education Research (Framework & Cabaron, 2023)	1. Factors in Education and business 2. Quality of education 3. Innovation in education	Qualitative analysis	This journal discusses the importance of integration between education and business to improve the quality of human resources. Research shows that innovations in teaching methods and business practices can improve educational outcomes and company performance. The results of the research lead to recommendations for closer collaboration between educational institutions and the business sector.
Research Equations Both studies focus on factors that affect the improvement of the quality of human resources in their respective contexts.				
Research Differences The first journal emphasizes the integration of education and business, as well as innovation in both, while the research being studied focuses on the influence of individual competencies on the quality of seafarers.				
8	The impact of automation on maritime workforce management: A conceptual framework (Popoola et al., 2024)	1. Automation 2. Maritime Manpower Management 3. Skill Requirements 4. Employment Patterns	Literature study	This study discusses how the integration of automation technology is changing skill requirements, employment patterns, and operational dynamics in the maritime industry. Key findings highlight a significant shift toward a higher demand for technical proficiency and digital literacy among the workforce, coupled with the potential for a decline in traditional manual roles. The analysis also reveals the dual impact of automation, offering opportunities for improved operational efficiency and safety, while also posing challenges related to the relocation of the workforce and the need for extensive upskilling.
Research Equations Both studies highlight the importance of human resources in the maritime sector.				
Research Differences The first journal focuses on the impact of automation on the management of the maritime workforce at large, while the second journal is more specific on the influence of various competencies on the quality of seafarers in Indonesia.				
9	Indonesia's Maritime Governance Law, Institutions and Cooperation (Bernard, 2018)	1. Maritime Law 2. Maritime Institutions 3. Maritime Cooperation 4. Maritime Policy	Normative Juridical Analysis	This research discusses the landscape of Indonesia's maritime governance, with a focus on the laws, institutions, and cooperation that shape the country's maritime sector. It analyzes how existing laws and institutions facilitate or hinder the utilization of maritime resources and maritime security. The study also examines Indonesia's involvement in regional and international cooperation initiatives, evaluating its impact on maritime governance.
Research Equations The second research focuses on various aspects of the maritime sector in Indonesia.				
Research Differences				

The first journal emphasizes maritime law, institutions, and cooperation, while the second journal emphasizes language, digital, soft skills, and work ethic competencies.				
10	Latihan Dan Pengembangan Sdm Dalam Pt Pal Di Era Ekonomi Digital (Wahjono et al., 2024)	1. Training and development 2. Digital technology 3. Technical and non-technical skills 4. HR Competencies 5. Employee performance	Descriptive qualitative	HR training and development is essential to maintain the company's competitiveness in the digital economy era. Employee competency development is carried out to improve attitudes, knowledge, expertise, and skills.
Research Equations Both studies discuss human resource development. Research Differences This journal focuses on the training and development of human resources at PT PAL in the face of the digital era, while the research being studied focuses on the influence of various competencies on the quality of seafarers by improving the quality of maritime human resources as a mediating variable.				
12	Mapping the Competency Needs of Coastal Human Resources to Support Maritime Logistics Operations in the Digital Era (Nasihah et al., 2025)	1. The Need for Coastal Human Resources Competencies 2. Maritime Logistics Operations 3. Digital Age 4. Basic Digital Skills 5. Logistics Software Mastery 6. Data Literacy 7. Online Communication Skills	Descriptive quantitative	Digital transformation in the maritime logistics sector demands competent and adaptive coastal human resources. The most needed competencies include mastery of logistics software, data literacy, and online communication skills.
Research Equations Both studies discuss human resource development in the maritime sector and highlight the importance of digital competencies in the modern era Research Differences Research focus: Journal 1 focuses on mapping the competency needs of coastal human resources in supporting maritime logistics operations in the digital era, while the research being studied focuses on the influence of various competencies on the quality of seafarers by improving the quality of maritime human resources as a mediating variable.				
12	The Urgency of Maritime English Proficiency for Smooth Radio Communication on Ships (Haryani et al., 2022.)	1. Maritime English Urgency 2. Smooth Radio Communication 3. Seafarers' Perspectives on the Use of English in Radio Communication 4. English Language Proficiency (A language spoken on board, between ships, and from ship to shore)	Descriptive qualitative	This study identifies the urgency of the English language and seafarers' perspectives in radio communication. Understanding and awareness of the urgency of maritime English can avoid accidents and miscommunication.
Research Equations Both studies discuss the importance of language competence in the maritime sector. Research Differences The journal is more specific to maritime English and radio communication, while the research being studied is broader by including digital competencies, soft skills, and work ethic.				
13	Analysis of Seafarer Certification, Skills, and Crew Welfare as Mediating Variables on Ship Operational Performance (Seafarer et al., 2022)	1. Seafarer Certification, Crew Skills 2. Ship Operational Performance 3. Crew Well-Being	Quantitative	Seafarer certification has a positive and significant effect on the welfare of the crew. The skills of the crew have a positive and significant effect on the welfare of the crew. The welfare of the crew has a positive and significant effect on the ship's operational performance. The implementation of STCW 1978 Amendments 2010 has a positive effect on the operational performance of ships through certification, skills, and welfare of crew members.
Research Equations Both studies discuss the factors that affect the quality of human resources in the maritime sector. Research Differences This journal focuses on the certification, skills, and welfare of the crew on the ship's operational performance, while the research being researched focuses on language competence, digital competence, soft skills, and work ethic on the quality of seafarers.				

14	User Satisfaction Analysis of Industrial Practice Graduates of Indonesian State Maritime Polytechnic Students (Maritim & Indonesia, 2021)	1. User satisfaction 2. Quality of graduates 3. Relevance of the curriculum	Descriptive quantitative	The significant influence of language competence, digital competence, soft skills, and work ethic on the quality of seafarers. The role of improving the quality of Indonesian maritime human resources as a mediating variable between these competencies and the quality of seafarers. Research implications for human resource development in Indonesia's maritime sector.
Research Equations Both studies discuss the quality of human resources in the maritime sector.				
Research Differences This journal uses user satisfaction as the main variable, while the research being studied uses language competence, digital competence, soft skills, and work ethic.				
15	The Influence of Information and Communication Technology on Maritime Literacy in the Digital Era (Dewi, 2023)	1. Information and Communication Technology (ICT) 2. Maritime Literacy 3. Maritime Security	Mix Methods	ICT has a positive impact on maritime literacy by facilitating access to information and decision-making. The use of ICT is important for social, economic, cultural, and maritime security in coastal areas. ICT advances allow for increased surveillance, rapid response to threats, and increased coordination in maintaining maritime security. Challenges include the high cost of ICT and the complexity of its use. Opportunities related to the use of ICT in maritime education and training include wider training, more flexible learning, improved training quality, and reduced costs.
Research Equations Both studies discuss improving the quality of human resources in the maritime sector and highlight the importance of technology/ICT and digital competence in the digital era.				
Research Differences This journal researches ICT and maritime literacy, while the research being researched examines language competence, digital competence, soft skills, and work ethic.				
16	The Urgency of English Language Mastery in the Recruitment of Prospective Seafarers at PT. Major Marine Equinox (Salsabila et al., 2025)	1. English Language Proficiency 2. Recruitment Criteria for Prospective Seafarers 3. English Language Mastery Strategy	Descriptive qualitative	This study discusses the urgency of English language proficiency in the recruitment process of prospective seafarers at PT. Equinox Marine Main. English is a determining factor in all stages of the selection process, from interviews to online tests (Marlins and CES). Aspiring seafarers' strategies to improve English language skills include courses, reading ship safety manuals, speaking exercises, and interview simulations.
Research Equations Both studies discuss the importance of language competence in the maritime sector and highlight aspects of maritime human resources and improving their quality.				
Research Differences This journal focuses on the urgency of English language proficiency in the recruitment of prospective seafarers at PT. Equinox Bahari Utama, while the research being studied focuses on the influence of various competencies (including language) on the quality of seafarers.				
18	Socialization of Improving Seafarer Competency through the Marlins Test Program for Seafarers in the Pati Region (Purnawati, 2023)	1. Improving the Competence of Seafarers 2. Marlins Test Program 3. Maritime English Proficiency 4. Soft skills (the ability to innovate, create, and communicate in a foreign language)	Studi Literature	This activity aims to provide information and knowledge to seafarers in order to improve soft skills, especially English language skills. English language skills are essential for seafarers to communicate effectively on board.
Research Equations Both studies discuss improving the quality of human resources in the maritime sector. Both highlighted the importance of language competence, especially English, for seafarers.				
Research Differences This journal focuses on efforts to improve seafarers' competency through the socialization of the Marlins Test program, while the research being studied focuses on the influence of various competencies on the overall quality of seafarers.				
18	Building Human Resources and Information Technology as the Basis for Maritime	1. Maritime Human Resources (HR) 2. Information Technology 3. Indonesia's Maritime Glory	Literature studies, qualitative	Superior and creative human resources are important assets to advance Indonesia's maritime world. Information technology plays a role as a support for human resources in socio-cultural transformation in maritime society. Information technology can open up

	Glory in Indonesia (Kundori, 2023)			the isolation of coastal areas to maritime production technology.
Research Equations Both studies discuss improving the quality of human resources in the maritime sector and both highlight the importance of information technology and digital competence in the digital era.				
Research Differences This journal focuses on the development of human resources and information technology as the basis for Indonesia's maritime glory, while the research being studied focuses on the influence of various competencies on the quality of seafarers.				
19	Character education development: challenges of forming reliable prospective seafarers (<i>Gartinia</i> , 2019)	1. Character Education Development 2. Competencies of Reliable Seafarers 3. Work Ethic 4. Discipline of English Language Proficiency	Study literature	This article discusses the challenges in developing character education to produce competent and reliable seafarers. The quality of Indonesian seafarers' human resources is still low in terms of work ethic, discipline, and English language skills. Globalization and the era of free trade are threats if Indonesia is unable to produce competent seafarers. The competence of reliable seafarers needs to receive the main attention for companies in the transportation sector and the education sector.
Research Equations Both studies discuss improving the quality of human resources in the maritime sector and highlight the importance of language competence, soft skills, and work ethic for seafarers.				
Research Differences This journal focuses on the development of character education to form the competencies of reliable prospective seafarers, while the research being studied focuses on the influence of various competencies on the quality of seafarers.				

CONCLUSION

This bibliometric study presents a comprehensive synthesis of the key factors influencing seafarers' performance in the context of an increasingly digitized maritime industry, with a special emphasis on digital competencies and work ethic. The results of the study show that seafarers' performance is shaped by the integrated interaction between technological capabilities, work attitudes and behaviors, as well as the support of organizational systems. Digital competencies have proven to be an important prerequisite in supporting the effectiveness of task implementation, decision-making accuracy, and adaptability to modern ship systems. Meanwhile, work ethic plays a strategic role in strengthening the discipline, responsibility, motivation, and professionalism of seafarers in a high-risk maritime work environment that demands adherence to strict operational standards.

The findings of this study also show that digital competencies and work ethic do not work separately, but complement and reinforce each other in improving seafarers' performance. Bibliometric mapping indicates that digital competencies are closely related to knowledge, skills, and technology implementation, while work ethic is strongly correlated with individual work motivation, leadership, and performance. This interconnectedness emphasizes the importance of a maritime human resource development approach that focuses not only on technical aspects, but also on the formation of professional work attitudes and values.

From a theoretical perspective, the results of this study support a competency-based framework and human capital, which emphasizes that optimal performance can be achieved when individual knowledge, skills, and attitudes are aligned with operational demands. However, the study also identified research gaps, particularly in developing maritime countries such as Indonesia, where most studies still examine digital competencies and work ethic separately, without integrating them into a single comprehensive seafarer performance model.

Overall, the study confirms that improving seafarers' performance in the digital age demands a holistic approach that integrates digital competencies, work ethic, and institutional support. This approach is an important foundation in improving the safety, operational efficiency, and global competitiveness of Indonesian seafarers in the international shipping industry

REFERENCE

- Autsadee, Y., Jeevan, J., Haqimin, N., Salleh, M., & Othman, M. R. (2024). *Digital wind of changes : navigating competitiveness in the maritime sector through the transformation in human resource development*. May. <https://doi.org/10.1108/MABR-11-2023-0079>
- Barasa, L., Simanjuntak, M., & Syafitra, B. W. (2025). *The Asian Journal of Shipping and Logistics Factors affecting the safety climate of the ship ' s crew : Empirical evidence from shipping companies in Indonesia*. 41(February), 75–82.
- Bautista-bernal, I., Quintana-garcía, C., & Marchante-lara, M. (2024). Safety culture , safety performance and financial performance . A longitudinal study. *Safety Science*, 172(May 2023), 106409. <https://doi.org/10.1016/j.ssci.2023.106409>
- Bayrak, D., & Muslu, A. (2025). The impact of digitalization on the maritime sector : Analyzing technostress among officer seafarers. *Journal of International Maritime Safety, Environmental Affairs, and Shipping*, 00(00). <https://doi.org/10.1080/25725084.2025.2478751>
- Bernard, L. (2018). *Indonesia ' s Maritime Governance* (Vol. 6). <https://doi.org/10.1163/22134484-12340110>
- BPSDMP. (2023). *Transportation Human Resources Development Agency*.
- Brooker, P. (2006). *Air Traffic Management accident risk . Part 1 : The limits of realistic modelling*. 44, 419–450. <https://doi.org/10.1016/j.ssci.2005.11.004>
- Chauvin, C., Lardjane, S., Morel, G., Clostermann, J., & Langard, B. (2013). Human and organisational factors in maritime accidents : Analysis of collisions at sea using the HFACS. *Accident Analysis and Prevention*, 59, 26–37. <https://doi.org/10.1016/j.aap.2013.05.006>
- Chinniah, Y. (2015). Analysis and prevention of serious and fatal accidents related to moving parts of machinery. *Safety Science*, 75, 163–173. <https://doi.org/10.1016/j.ssci.2015.02.004>
- Dewi, I. M. (n.d.). *LITERASI MARITIM DI ERA DIGITAL*. 313–321.
- Emad, G. R., & Shahbakhsh, M. (2022). *Digitalization Transformation and its Challenges in Shipping Operation : The Case of Seafarer ' s Cognitive Human Factor*. 60, 684–690.
- Framework, D., & Cabaron, R. R. (2023). *INTERNATIONAL JOURNAL OF MULTIDISCIPLINARY : APPLIED*. 4(4), 1096–1101. <https://doi.org/10.11594/ijmaber.04.04.06>
- Gartinia. (2019). 2010.
- Haryani, H., Mujiyanto, J., Hartono, R., & Yuliasri, I. (n.d.). *Urgensi Keahlian Bahasa Inggris Maritim terhadap Kelancaran Komunikasi Radio diatas Kapal*. 454–458.
- Herrero-fernández, D., Macía-guerrero, P., Silvano-chaparro, L., Merino, L., & Jenchura, E. C. (2016). *Risky behavior in young adult pedestrians : Personality determinants , correlates with risk perception , and gender differences*. 36, 14–24. <https://doi.org/10.1016/j.trf.2015.11.007>
- IMO. (2022). *International Maritime Organization (IMO)*.
- Janssens, O., Embo, M., Valcke, M., & Haerens, L. (2023). *When theory beats practice : the implementation of competency-based education at healthcare workplaces*. 1–13.
- Kundori, K. (2023). *MEMBANGUN SUMBER DAYA MANUSIA DAN TEKNOLOGI INFORMASI*. March. <https://doi.org/10.33556/jstm.v23i2.337>
- Kundori, K., Fauziningrum, E., & Sukrisno, S. (2025). *Physical and social environment as predictors of job satisfaction for seafarers : An empirical study of the shipping industry in Indonesia*. 5(3), 95–108.
- Maghoromi, B. E. (2023). *The Maritime Commons : Digital Repository of the World Maritime Impact of emerging technologies on maritime education and training : a phenomenological study IMPACT OF EMERGING TECHNOLOGIES ON MARITIME*

EDUCATION AND TRAINING :

- Maritim, P., & Indonesia, N. (2021). *Analisis Kepuasan Pengguna Lulusan Kerja Praktek Industri Mahasiswa Politeknik Maritim Negeri Indonesia*. 7(1), 25–31.
- Nasihah, A., Pujo, E., Lazaro, C., & Hodayat, S. (2025). *Pemetaan Kebutuhan Kompetensi Sdm Pesisir Untuk Mendukung Operasi Logistik Maritim Di Era Digital*. 1, 4–9.
- Pelaut, A. S., Kapal, A., Potto, I., Sudarmo, S. T., Handayani, S., & Tatiana, Y. (2022). *Jurnal Penelitian Transportasi Laut*. 24, 33–40.
- Pengabdian, J., & Masyarakat, K. (n.d.). *Journal Of Transportation Society Empowerment*. 2.
- Popoola, O. A., Akinsanya, M. O., & Nzeako, G. (2024). *The impact of automation on maritime workforce management: A conceptual framework*. 6(5), 1467–1487. <https://doi.org/10.51594/ijmer.v6i5.1095>
- Salsabila, N. A., Kusumawati, E., Kurniawan, E., & Johanda, I. A. (2025). *Urgensi Penguasaan Bahasa Inggris dalam Perekrutan Calon Pelaut di PT . Equinox Bahari Utama*.
- Shi, K., Fan, S., Weng, J., & Yang, Z. (2024). Seafarer competency analysis : Data-driven model in restricted waters using Bayesian networks. *Ocean Engineering*, 311(P2), 119001. <https://doi.org/10.1016/j.oceaneng.2024.119001>
- Simanjuntak, M. B., Rafli, Z., & Utami, S. R. (2024). *Impact of english language proficiency on maritime safety and environmental protection*. 01002.
- Sulistiana, O., Rachman, T., Jinca, M. Y., & Ali, M. S. S. (2025). *Competency and Certification Gaps Among Traditional Shipping Seafarers in South Sulawesi , Indonesia*. 1–13.
- Theotokas, I. N., Lagoudis, I. N., & Raftopoulou, K. (2024). Challenges of maritime human resource management for the transition to shipping digitalization. *Journal of Shipping and Trade*. <https://doi.org/10.1186/s41072-024-00165-0>
- Wahjono, S. I., Surabaya, U. M., Yadi, S., Surabaya, U. M., Surabaya, U. M., Ikhsan, A. M., & Surabaya, U. M. (2024). *Makalah 1 Seminar MSDM latihan dan pengembangan sdm dalam pt pal di era ekonomi digital*. October.
- Yahya, S. (2024). Design of Digital Learning for Preventing Human Error in Ship Accidents. *International Journal of Marine Engineering Innovation and Research*, 9. <https://doi.org/10.12962/j25481479.v9i4.21873>.