



The Strategic Role of Human Resource Management in Maritime Safety and Operational Efficiency: A Literature Review

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Abstract. This study aims to analyze the strategic role of HRM in supporting maritime safety and operational efficiency through a Systematic Literature Review (SLR) approach. The review was conducted on literature published during the 2021–2026 period, including accredited national journals and reputable international publications. The article selection process followed the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) guidelines, while data analysis was conducted using thematic analysis to identify and synthesize key findings from the analyzed literature. The study identified seven main themes: human resource competency, training and professional development, human factors, safety culture, leadership and performance management, crew welfare, and digital transformation in maritime HRM. The findings indicate that effective HRM practices contribute significantly to strengthening safety culture, reducing risks originating from human factors, enhancing workforce competency, improving operational performance, and enhancing the organization's ability to adapt to digital transformation. This study confirms that sustainable operational excellence in the shipping industry is determined not only by technological advancements but also by strategic investment in human resource development. This research provides theoretical and practical contributions to shipping companies and policymakers in formulating human resource management strategies oriented toward safety, efficiency, and organizational sustainability.

Keywords: *Human Resource Management, Maritime Safety, Operational Efficiency, Shipping Industry, Systematic Literature Review, Thematic Analysis*

1. INTRODUCTION

The shipping industry serves as the backbone of global trade, transporting approximately 80% of international merchandise trade by volume and playing a crucial role in supporting the global economy (UNCTAD, 2024). As globalization continues to advance and supply chains become increasingly interconnected, maritime transport faces increasing operational complexity driven by digital transformation, environmental sustainability requirements, stringent international regulations, and higher safety expectations (Noviyanti & Mokodompit, 2025). Despite significant technological advances in navigation systems, automation, digital communications, and vessel monitoring technology, the human factor remains a major cause of maritime

accidents and operational failures (Umasangadji, 2026). Numerous maritime accident investigations have shown that human factors, such as inadequate training, ineffective communication, fatigue, and poor decision-making, are more likely to contribute to shipping incidents than technical failures alone (ILO, 2023; Albert, 2024). Furthermore, research on maritime safety management indicates that organizational culture, leadership practices, competency development, and workforce behavior play a significant role in shaping the safety and operational performance of shipping organizations (Putra et al., 2026). These developments require shipping companies to not only invest in advanced technology and modern fleet management systems, but also strengthen the management of human resources responsible for maritime operations. Human resources are one of the most critical factors influencing operational safety, service quality, regulatory compliance, and overall organizational performance in the maritime sector. Competent, well-trained, and highly motivated seafarers and shore personnel are essential to ensure efficient ship operations, minimize human error, and maintain a strong safety culture in an industry characterized by a high-risk work environment and continuous operational demands (Putra et al., 2026). Consequently, effective Human Resource Management (HRM) has emerged as a strategic function that contributes significantly to operational excellence and sustainable competitive advantage in modern shipping organizations.

In line with the development of maritime technology, digital transformation has changed the way shipping organizations manage their operations and human resources. The implementation of smart shipping, automated navigation systems, and the use of data-driven technology require a maritime workforce with adequate technical and digital competencies. The International Maritime Organization (IMO) emphasizes that the human element is a key factor influencing safety, security, environmental protection, and operational efficiency in shipping. Furthermore, competency development, well-being, and engagement of the maritime workforce are integral to an organization's safety strategy (IMO, 2023). Therefore, shipping organizations need to develop human resource management strategies that support competency improvement, technology adaptation, and continuous learning for both crew and shore personnel (Theotokas et al., 2024).

Although various studies have addressed crew competency, safety culture, leadership, and human factors in maritime safety, most studies still focus on these aspects separately. Studies that comprehensively synthesize the strategic role of Human Resource Management in supporting maritime safety and operational efficiency through a literature review approach are still relatively limited, especially in the context of the development of the modern shipping industry characterized by digitalization, regulatory changes, and sustainability demands. Therefore, this study aims to analyze the strategic role of Human Resource Management in supporting maritime safety and operational efficiency based on a synthesis of research results published during the period 2021–2026.

2. METHODOLOGY

This study employed a Systematic Literature Review (SLR) method with a thematic analysis approach to identify, evaluate, and synthesize research findings regarding the strategic role of Human Resource Management (HRM) in supporting

maritime safety and operational efficiency. A literature search was conducted across various academic databases using keywords relevant to the research topic and limited to publications from the 2021–2026 period. The article selection process adhered to the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) guidelines (Page et al., 2021). The search yielded 24 relevant references. After a screening process based on inclusion and exclusion criteria, 20 articles and documents meeting the criteria were used as the primary data sources in the analysis. Meanwhile, four methodological references served as the basis for the SLR, thematic analysis, and PRISMA procedures. Data analysis was conducted using a thematic analysis approach (Braun & Clarke, 2006) through the stages of reading and understanding articles thoroughly, identifying key findings, grouping findings based on conceptual similarities, and compiling a thematic synthesis to explain the relationship between HRM practices, maritime safety, and operational efficiency. The analysis results identified seven main themes, namely HR competency, training and professional development, human factors, safety culture, leadership and performance management, crew welfare, and digital transformation in maritime HRM.

Table 1. Inclusion and Exclusion Criteria

Criteria	Inclusion	Exclusion
Publication Period	Articles published in 2021–2026	Articles published before 2021
Research Topics	Discussing Human Resource Management (HRM), maritime safety, human factors, safety culture, leadership, seafarer welfare, or operational efficiency in the shipping industry	Articles unrelated to the maritime sector or not addressing HRM and maritime safety aspects
Publication Type	Scientific journal articles, international organization reports, and relevant official documents	Popular articles, news, opinion pieces, blogs, or non-scientific publications
Document Access	Available in full-text	Articles that cannot be fully accessed
Publication Language	Indonesian and English	Indonesian and English
Source Quality	Accredited national journals, reputable international journals, and official documents from international organizations (IMO, ILO, UNCTAD, BIMCO-ICS)	Publications with unclear methodology or unverifiable sources
Content Relevance	Presents findings related to the role of HRM in maritime safety and/or efficiency	Operational Articles that only discuss the technical aspects of a ship without any connection to human factors or HR management

Source: Compiled based on Kitchenham & Charters (2007), Snyder (2019), and Page et al. (2021)

Article selection adapted the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) guidelines (Page et al., 2021), which include identification, screening, eligibility, and inclusion stages.

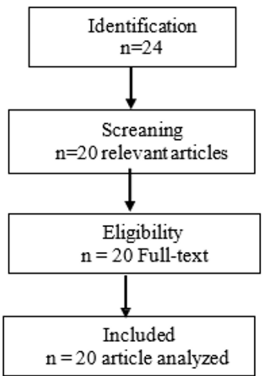


Figure 1. Flowchart of Literature Selection Based on Prism

The article identification and selection process adhered to the Preferred Reporting Items for Systematic Reviews and Meta-Analysis (PRISMA) guidelines (Page et al., 2021). The selection process included identification, screening, eligibility evaluation, and determination of articles used in the analysis.

Table 2 Characteristics of the Literature Analyzed

No	Author Name/Year	Study Focus	Contribution to Research
1	ILO (2023)	Fatigue management and seafarer welfare	Explaining the importance of fatigue management in maritime safety
2	Albert (2024)	Human factors in maritime accidents	Demonstrates the influence of human factors on ship accidents
3	BIMCO & ICS (2021)	Global seafarer workforce availability	Describing the global maritime human resource challenges
4	UNCTAD (2024)	Global maritime transportation trends	Explaining the operational challenges and changes in the shipping industry
5	Farhan et al. (2025)	Safety leadership and safety culture	Demonstrate leadership role in shaping a safety culture
6	Gulen & Arslan (2025)	Seafarers' adaptation to digital transformation	Explaining the digital competency needs of maritime HR
7	Harahap (2026)	Seafarer welfare and safety culture	Explaining the relationship between welfare and organizational safety
8	IMO (2023)	Human Element Vision and Goals	Emphasizing the importance of the human element in the shipping industry

9	Kuzu (2026)	Non-technical skills of ship crew	Demonstrates the importance of non-technical competencies in ship operations
10	Moejiono et al. (2025)	Human error, safety culture, and seafarer performance	Explaining the relationship between human factors and operational performance
11	Moreno et al. (2022)	Human factors and maritime safety	Identifying human factors that influence shipping safety
12	Noviyanti & Mokodompit (2025)	Regulation and sustainability of the maritime industry	Explaining the regulatory and governance challenges of the shipping sector
13	Putra et al. (2026)	Crew behavior and demonstrates the influence of safety culture	safety culture on operational performance
14	Raihansyah et al. (2024)	Shipping industry HR strategy	Explain HR practices in the face of industrial change
15	Setiawan & Sopiah (2026)	Organizational culture and leadership	Explaining the relationship between leadership and organizational performance
16	Theotokas et al. (2024)	HRM and shipping digitalization	Identifying HR challenges in the digital shipping era
17	Umasangadji (2026)	Fatigue, workload, and CRM	Explaining the impact of workload on maritime safety
18	Veltsin et al. (2025)	Critical success factors for maritime safety	Identifying key success factors for maritime safety
19	Ward & Roberts (2021)	Human error and maritime accident evaluation	Demonstrates the limitations of an approach that focuses solely on human error
20	Xu et al. (2023)	Maritime safety management	Presenting a synthesis of maritime transportation safety research

Source: Results of the author's analysis based on reviewed literature (2026)

Of the 20 literatures analyzed, 11 are reputable international journals, 5 are national journals, and 4 are official reports or documents from international organizations (ILO, IMO, BIMCO-ICS, and UNCTAD). The reviewed literature shows that research on maritime safety and operational efficiency is dominated by discussions related to human factors, safety culture, crew competence, leadership, seafarer welfare, and digital transformation in maritime human resource management.

Based on a selection process referring to the PRISMA guidelines, 20 articles that met the inclusion criteria were used as data sources in this study. Furthermore, the data were analyzed using a thematic analysis approach (Braun & Clarke, 2006). The analysis was carried out through several stages, namely reading and understanding the contents of the articles thoroughly, identifying key concepts and findings, grouping findings based on similar meanings into certain themes, and compiling a thematic synthesis to explain the relationship between human resource management practices, maritime safety, and operational efficiency in the shipping industry.

Table 3 Thematic Analysis Results

Themes	Reference	Findings
HR Competency	Raihansyah et al. (2024); IMO (2023); Kuzu (2026)	The technical and non-technical competencies of ship crews are fundamental factors in supporting shipping safety, compliance with international regulations, and operational efficiency.
Professional Training and Development	ILO (2023); Raihansyah et al. (2024); Veltsin et al. (2025); Kuzu (2026)	Continuous training programs improve skills, risk readiness, decision-making abilities, and adaptation to maritime technology developments.
Human Factors	Albert (2024); Ward & Roberts (2021); Moreno et al. (2022); Moejiono et al. (2025); Umasangadji (2026)	Human factors such as fatigue, workload, ineffective communication, and poor decision-making remain the main causes of maritime accidents and operational disruptions.
Safety Culture	Putra et al. (2026); Farhan et al. (2025); Moejiono et al. (2025); Harahap (2026)	A strong safety culture increase compliance with procedures, risk awareness, safe behavior, and reduces the potential for accidents in the maritime work environment.
Leadership and Performance Management	Farhan et al. (2025); Setiawan & Sopiah (2026); Veltsin et al. (2025)	Effective leadership plays a role in Building safety commitment, increasing work motivation, and optimizing individual and organizational performance.
Crew Welfare	ILO (2023); Harahap (2026); Umasangadji (2026)	The physical and psychological well-being of crew members contributes to productivity, occupational health, organizational resilience, and reduced risk of errors due to stress and fatigue.
Digital Transformation of Maritime HR	Theotokas et al. (2024); Gulen & Arslan (2025); UNCTAD (2024)	Digitalization demands increased HR competency, digital skills development, and adaptive HR strategies to support the efficiency and competitiveness of shipping companies.

Source: Results of analysis based on reviewed literature (2026)

The thematic analysis identified seven key themes that explain the strategic role of human resource management in supporting maritime safety and operational efficiency. These themes include HR competency, training and professional development, human factors, safety culture, leadership and performance management, crew welfare, and the digital transformation of maritime resource management. This analysis serves as a basis for discussing the strategic role of HRM in improving maritime safety and operational efficiency in the shipping industry (Braun & Clarke, 2006; Snyder, 2019).

3. DISCUSSION

Based on a thematic analysis of 20 literature sources that met the inclusion criteria, this study identified seven key themes that explain the strategic role of Human Resource Management (HRM) in supporting maritime safety and operational efficiency. These seven themes include HR competency, training and professional development, human factors, safety culture, leadership and performance management, crew welfare, and digital transformation in maritime HRM. These findings demonstrate that the operational success of the shipping industry is determined not only by technological and infrastructure advancements, but also by the effectiveness of human resource management as a key element in the maritime safety and operational system.

Human Resources Competence

The study results show that human resource competency is the main foundation in creating safe and efficient shipping operations. Raihansyah et al. (2024) emphasized that shipping companies face increasingly complex challenges due to technological developments, regulatory changes, and the demands of globalization, thus requiring a workforce with adequate technical and non-technical competencies. In line with this, according to the International Maritime Organization (2023) the human element as a critical factor in improving maritime safety and operational performance. The findings of Kuzu (2026) show that non-technical skills such as communication, teamwork, leadership, and decision-making have a significant contribution to the success of ship operations. This indicates that HR competency in the shipping industry is no longer limited to technical shipping capabilities, but also includes interpersonal skills and adaptation to changes in the work environment. Therefore, an HR strategy oriented towards competency development is a long-term investment that can improve operational reliability and reduce the risk of maritime accidents.

Professional Training and Development

Training and professional development are among the HR practices most associated with improving maritime safety. The ILO (2023) emphasizes the importance of training programs that increase crew awareness of the risks of fatigue and its impact on maritime safety. Furthermore, Raihansyah et al. (2024) state that continuous competency development is a fundamental need to address technological changes and international regulations.

Veltsin et al. (2025) identified training, communication, and decision-making skills as critical success factors in creating a safe work environment. These findings are supported by Kuzu (2026), who demonstrated that developing non-technical skills through training can improve crew coordination and work effectiveness. Thus, training not only serves to improve technical skills but also strengthens a safety culture and workforce readiness in facing dynamic operational situations.

Human Factors

Literature analysis shows that human factors remain a major cause of maritime accidents. Albert (2024) found that most ship accidents are related to human error, influenced by communication, decision-making, and adherence to safety procedures.

This finding aligns with Ward and Roberts (2021), who assert that maritime accidents cannot be explained solely through human error but are also influenced by organizational factors, work systems, and the operational environment.

Moreno et al. (2022) demonstrated that human factors are closely related to the safety performance of ship traffic service operators. Meanwhile, Moejiono et al. (2025) found that the human element influences seafarer performance through the mediating role of safety culture. Research by Umasangadji (2026) also showed that fatigue, workload, and poor implementation of crew resource management contribute to the increased risk of maritime accidents. These findings indicate that human factor management must be a top priority in shipping organizations' safety strategies.

Safety Culture

Safety culture emerged as the most dominant theme in the analyzed literature. Putra et al. (2026) found that crew behaviors that support safety are positively related to improved operational performance of shipping companies. Furthermore, Farhan et al. (2025) demonstrated that safety leadership plays a crucial role in shaping a safety culture through improved communication and organizational commitment. Moejiono et al.'s (2025) findings show that safety culture is a mediating factor that strengthens the influence of human factors on seafarers' performance. Conversely, Harahap (2026) emphasized that a safety culture supported by workforce well-being can enhance organizational resilience post-pandemic. Thus, safety culture can be viewed as an organizational mechanism that integrates various HR practices to reduce operational risks and improve work system reliability.

Leadership and Performance Management

Leadership is a strategic factor that determines the effectiveness of safety policy implementation and performance management in shipping organizations. Farhan et al. (2025) found that safety leadership has a significant influence on the formation of a safety culture and increased workforce commitment. This finding is supported by Setiawan and Sopiah (2026), who stated that leadership and organizational culture contribute to improving overall organizational performance.

Furthermore, Veltsin et al. (2025) identified leadership as a key success factor in maritime safety systems. Leaders who are able to provide direction, build effective communication, and encourage employee participation will be more successful in creating a safe and productive work environment. Therefore, leadership capacity development is an essential part of HR strategies in the shipping industry.

Crew Welfare

The study results show that crew well-being is closely linked to work safety and productivity. The ILO (2023) emphasized that fatigue is a major threat to maritime safety. Long working hours, operational pressures, and limited rest time can reduce crew concentration and decision-making quality.

Umasangadji (2026) found that high workloads and ineffective fatigue management increase the risk of human error during shipping operations. Meanwhile, Harahap (2026) highlighted the importance of psychological well-being and workforce resilience in supporting an organization's safety and sustainability culture. These

findings suggest that HRM practices oriented toward employee well-being not only benefit individuals but also contribute to improving the safety and operational efficiency of organizations.

Digital Transformation in Maritime Human Resource

Digital transformation has become a strategic issue increasingly discussed in maritime literature. UNCTAD (2024) notes that digitalization has transformed various aspects of shipping operations, including navigation systems, communications, and fleet management. These changes require organizations to develop higher digital competencies in their workforce. Theotokas et al. (2024) explain that digitalization creates new challenges for HRM, particularly in terms of competency development, training, and workforce adaptation to new technologies. Meanwhile, Gulen and Arslan (2025) found that low human resource preparedness for digital transformation can create new sources of operational risk. Therefore, shipping organizations need to integrate digital transformation strategies with HRM policies through digital competency enhancement, continuous learning, and the development of an organizational culture that adapts to technological change.

Overall, the study results indicate that HRM plays a strategic role in supporting maritime safety and operational efficiency through competency management, training, human factors, safety culture, leadership, crew welfare, and digital transformation. These seven aspects are interconnected and form a system that determines the success of shipping organizations in facing the challenges of the modern maritime industry. Thus, HRM is no longer viewed solely as an administrative function but has evolved into a strategic instrument that contributes to operational excellence and sustainability for shipping organizations.

4. CONCLUSION

Based on the results of a Systematic Literature Review (SLR) of national and international literature published between 2021 and 2026, it can be concluded that Human Resource Management (HRM) plays a strategic role in supporting maritime safety and operational efficiency in the shipping industry. The thematic analysis identified seven key interrelated themes: HR competency, training and professional development, human factors, safety culture, leadership and performance management, crew welfare, and the digital transformation of maritime HRM.

The study shows that HR competency, supported by an appropriate recruitment process and continuous capacity development, is the primary foundation for creating safe and reliable shipping operations. Furthermore, professional training plays a crucial role in improving the technical and non-technical skills of crew members, thereby reducing the risk of human error. The research findings also confirm that human factors remain the dominant cause of various maritime accidents, making human resource management through strengthening a safety culture, effective communication, and safety-oriented leadership a crucial need.

Furthermore, crew welfare has been shown to contribute to increased productivity, decision-making quality, and organizational resilience in the face of operational pressures. On the other hand, digital transformation presents both new opportunities

and challenges for the shipping industry, demanding the development of digital competencies and the workforce's ability to adapt to technological changes. Therefore, the success of shipping organizations in achieving maritime safety and operational efficiency depends not only on technological advances and management systems, but also on the effectiveness of human resource management as the organization's strategic asset.

Overall, the results of this study confirm that the integration of HRM practices oriented towards competency, safety, well-being, and innovation is a key factor in enhancing operational excellence and supporting the sustainability of the shipping industry in an era of global transformation. In addition to providing theoretical contributions to the development of maritime HRM studies, this research also offers practical implications for shipping companies and stakeholders in formulating more adaptive, sustainable, and safety-oriented human resource management policies.

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