Systematic Literature Review and Bibliometric Analysis Seafarer Supply and Demand

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Abstract: This study conducts a systematic assessment of the literature and does a bibliometric analysis to investigate the fluctuations in the availability and need for seafarers in the marine sector. The study examines a diverse selection of publications from several subfields within the seafarer workforce domain, analysing significant patterns, difficulties, and opportunities for enhancement. The study provides insights into the scholarly landscape of seafarer workforce research by analyzing highly cited articles, prolific authors, and influential journals. The findings highlight the significant impact of technological advancements, demographic shifts, regulatory changes, and economic factors on seafarer supply and demand dynamics. The systematic review and bibliometric analysis offer valuable information for policymakers, industry stakeholders, researchers, and academicians seeking to understand and address the complexities of the seafarer workforce. The initial review of articles obtained from the pilot search informed the formulation of research questions to understand the current state, trends, impactful studies, influential authors, and areas for future exploration within the seafarer workforce literature. Keywords related to seafarers and workforce were identified and refined through a three-step process to create an optimal set of search terms. This systematic literature review has provided valuable insights into various aspects of the seafarer workforce, including trends, challenges, and potential areas for future research. By employing a rigorous methodology and analyzing relevant literature, this study contributes to the ongoing discourse on seafarer supply and demand dynamics, offering a foundation for informed decision-making and further exploration in this field.

Keyword: Maritime, Labor, Bibliometric.

INTRODUCTION

The global maritime industry critically depends on the seafarer workforce for smooth international trade. The demand for seafarers has consistently risen in recent years, particularly in major seafaring nations such as China, India, and the Philippines (Slišković & Penezić, 2015). However, this increasing demand has led to a significant shortage of skilled

seafarers, which presents a major challenge for shipping companies worldwide. Untuk mengatasi kelangkaan ini, perlu dilaksanakan inisiatif pendidikan dan pelatihan yang kuat yang menjamin masuknya pekerja terampil maritim secara konsisten (Corovic, 2013). Analisis menyeluruh terhadap kebutuhan dan ketersediaan pelaut niaga di seluruh dunia menyoroti pentingnya memperoleh pemahaman yang lebih mendalam tentang pola jangka panjang di sektor maritim (Imai, 2006).

The seafarer workforce faces substantial challenges, including aging demographics, skill shortages, and evolving regulatory landscapes (Devereux & Wadsworth, 2021). These issues are compounded for seafarers on temporary contracts who frequently encounter problems related to work scheduling and rest periods, highlighting the precarious nature of their employment. Additionally, the geographical mobility of seafarers exposes them to various occupational health and safety hazards, further intensified by limitations in regulatory protection (Lippel & Shan, 2019).

Efforts to enhance the sustainability and efficiency of the seafarer workforce market require a multifaceted approach. Addressing the aging workforce and skill shortages involves strategic human resource policies, succession planning, and talent management strategies (Ajayi & Udeh, 2024; Caesar, 2013). Ensuring occupational health and safety requires proactive measures and adopting technological solutions, particularly in mobility (Wissemann dkk., 2022). Moreover, maritime education and training are crucial for developing a competent seafarer workforce capable of effectively managing ships and ensuring environmental and crew safety (Derevenskiy & Ananchenkova, 2023). To sustain the seafarer workforce, psychosocial stressors, work-life balance, and coping mechanisms for stressors at sea must also be considered (Mendoza dkk., 2021; Ogedengbe dkk., 2024).

Despite extensive research and data collection, several critical seafarer supply and demand aspects must be better understood. These gaps pose challenges to policymakers, industry stakeholders, and researchers. One significant area of uncertainty is the long-term impact of technological advancement on seafarer demand. Although automation and digitalization promise increased efficiency and safety in maritime operations, their effects on job availability and the required skill sets for seafarers still need to be fully understood. Questions remain regarding how quickly and extensively new technologies will be adopted across different shipping industry segments and how this will alter the demand for traditional maritime roles versus new technology-oriented positions.

Another area of limited understanding is the demographic trends that affect the seafarer workforce. Although the workforce is aging, detailed projections of retirement rates and entry of new seafarers into the industry are sparse. The need for precise demographic forecasting complicates efforts to plan future workforce requirements. Additionally, younger generations' motivations and career aspirations regarding maritime careers need to be well documented, making it challenging to develop targeted recruitment strategies.

Regional disparities in the quality and access to maritime education and training (MET) also present a knowledge gap. While it is recognized that MET standards vary globally, the specific deficiencies and strengths of different MET programs need to be comprehensively mapped. This lack of detailed comparative data makes it challenging to implement uniform improvements and to understand how regional variations impact the global supply of qualified seafarers.

Occupational health and safety (OHS) concerns, particularly seafarers' mental health, are another underresearched topic. Although the stressful nature of working at sea is recognised, there is a lack of statistics regarding the frequency of mental health problems among seafarers and the efficacy of current support systems. Further investigation is needed to explore the correlation between specific job conditions, such as the duration of contracts and the type of ship, and the impact on mental health outcomes. This research will help in

developing interventions that are specifically tailored to address these issues. Nevertheless, the impact of legislative changes on the availability and demand for seafarers remains uncertain. In order to properly comprehend the effects of rules such as the Standards of Training, Certification, and Watchkeeping (STCW) and the Maritime Labour Convention (MLC) on workforce dynamics, it is crucial to have a comprehensive understanding of their actual implications, notwithstanding their claimed purpose of standardising qualifications and enhancing working conditions. Specifically, how these regulations affect seafarer retention and recruitment in various regions and ship types requires more detailed investigation.

Economic factors that influence seafarer supply and demand include other areas in which knowledge is incomplete. The maritime industry is susceptible to global economic fluctuations, affecting shipping volumes, employment rates, and wage levels. However, predicting how economic cycles influence long-term seafarer supply and demand remains challenging. Additionally, the financial incentives necessary to attract and retain seafarers, particularly in light of increasing competition from other industries, need to be quantified.

Finally, the impact of geopolitical events and policies on the seafarer workforce must be thoroughly understood. Geopolitical tensions, trade disputes, and immigration policies can significantly influence seafarers' availability and mobility. For instance, visa restrictions or changes in international relations can affect where seafarers work and how easily they can be deployed in different regions. Understanding these geopolitical influences requires a more comprehensive and up-to-date analysis.

A systematic literature review (SLR) of seafarer supply and demand can address several critical research gaps in the current body of knowledge, encompassing technological impacts, demographic trends, regional disparities in training, mental health, regulatory influences, economic factors, and geopolitical effects. By providing a comprehensive and synthesized analysis of the impacts of technological advancements, demographic trends, regional disparities in MET, mental health issues, regulatory changes, economic factors, and geopolitical events, SLR has the potential to fill several critical research gaps. These findings can provide guidance to policymakers, industry stakeholders, and researchers in formulating effective policies to ensure a strong and enduring seafarer workforce and tackle the intricate difficulties encountered by the worldwide marine industry, as well as comprehensively overview anticipated changes in seafarer roles and skills through a review of studies on technological trends in the marine sector.

The SLR can collate and analyze data on demographic trends, retirement projections, and recruitment patterns, offering insights into workforce dynamics. An SLR can highlight best practices by examining the literature on Maritime Education and Training (MET) programs across regions and identify areas that require improvement. Additionally, an SLR can aggregate findings from seafarers' mental health and occupational health and safety (OHS) studies, pinpointing everyday stressors and successful intervention strategies. Reviewing the literature on the implementation and effects of international regulations, such as the Standards of Training, Certification, and Watchkeeping (STCW) and the Maritime Labor Convention (MLC), an SLR can assess its influence on seafarer recruitment, retention, and job satisfaction; identify regulatory gaps; and suggest areas for policy improvement. Furthermore, an SLR can analyze studies on economic factors influencing seafarer supply and demand, providing insights into how economic cycles affect the industry. By systematically reviewing the literature on geopolitical factors affecting the maritime sector, an SLR can map how these influences impact seafarer mobility and workforce planning and offer recommendations for mitigating the adverse effects of geopolitical changes.

This would help stakeholders plan for change by identifying patterns in technology adoption and predicting future workforce needs. Additionally, synthesizing studies on the attitudes and career motivations of younger seafarers can provide insights into attracting and

retaining new talent in the industry. An integrated approach can offer a comparative analysis of MET quality and accessibility and recommend harmonizing training standards. This analysis can guide the development of adequate mental health support, occupational health, and safety (OHS) policies. Although international regulations such as the Standards of Training, Certification, and Watchkeeping (STCW) and the Maritime Labor Convention (MLC) aim to standardize qualifications and improve working conditions, their impact on workforce dynamics must still be fully understood. Furthermore, it can identify effective economic incentives and strategies to stabilize the workforce, emphasizing the importance of understanding the effects of geopolitical events and policies on the seafarer workforce.

METHOD

To achieve the objectives of this study, we utilised a systematic literature review process. The selected strategy was chosen for its capacity to conduct a comprehensive, methodical, and unbiased analysis of the literature (Denyer & Tranfield, 2009). We followed the five-step systematic literature review process, as described by Denyer & Tranfield (2009). The process entails formulating research inquiries, locating pertinent articles, selecting and evaluating the articles, analysing and synthesising the data, and presenting the findings.

The systematic literature review process begins with the establishment of a research question. Research questions are essential in directing the research process. They aid in formulating the search strategy, choosing pertinent studies, and employing suitable techniques to assess and combine the selected studies (Denyer & Tranfield, 2009). We began by performing a literature search in the SCOPUS database using precise search phrases related to seafarers and the supply and demand issue. Our preliminary examination of the papers acquired from this search has given us a more profound comprehension of the literature concerning sailors and the labour force. We were able to develop the following study questions with the assistance provided. Our preliminary evaluation of the articles acquired through the pilot search has enhanced our comprehension of the current body of literature regarding the seafarer workforce. The aforementioned information prompted us to formulate the subsequent research inquiries:

1. "RQ1: What is the current state of the seafarer workforce literature? What are the publication trends, which studies have had the most impact, and who are the most influential authors?
2. RQ2: What are the most researched aspects of the seafarer workforce?
3. RQ3: Which subfields of the seafarer workforce have shown significant development and improvement?
4. RQ4: What areas of the seafarer workforce offer potential for future studies, and what topics should be explored in these studies?"

Ensuring a methodical and unbiased selection of articles within the specific subject area is a crucial need for performing a systematic literature review. The systematic article selection procedure begins by identifying appropriate keywords and search terms (Tranfield et al., 2003). We utilised a three-step process to determine the most suitable search terms for obtaining articles. Initially, we found crucial terminology associated with sailors. Subsequently, we honed the keywords that are linked to the labour force. In the end, we incorporated expressions pertaining to both mariners and the labour force to form a comprehensive compilation of search terms. These terms were subsequently employed to get articles from the SCOPUS database. Here are the search phrases that make up the final list. (seafare*OR sailor or mariner or seaman OR "crew member" OR deckhand or navigator OR "seafaring worker" OR "marine worker" OR "ship crew") AND ("supply and demand" OR market)

In August 2023, the researchers utilised SCOPUS to conduct a search for papers that fulfilled the specific requirements of this study. The search terms were pre-established and had to be present in the title, abstract, and keyword parts of the articles (Ruiz-Coupeau et al., 2020). A total of 634 documents were obtained from this search and subsequently subjected to further analysis. In order o mitigate the impact of personal prejudice, we collaboratively established the criteria for selecting and excluding papers for this study. The included publications were of peer-reviewed journals, conference proceedings, and review articles that were accessible in the English language. We also examined papers from diverse subject domains sourced from SCOPUS, including policy, law, business, management, economics, human resources, finance, engineering, energy, and social sciences, with a specific focus on those pertaining to maritime transportation.

Furthermore, our search was limited to publishers that are widely recognised for their substantial publication of journals in the domain of supply chain and operations management. The publishers mentioned are Elsevier, Springer, Wiley-Blackwell,Taylor & Francis, Sage, Emerald, John Wiley, Kluwer, Cambridge University Press, Palgrave, and IEEE (Bhattacharya et al., 2024). We used a systematic method to collect papers and excluded a total of 573 publications that were irrelevant to the research topic.

Furthermore, a total of 61 papers underwent a comprehensive evaluation process. Out of the 61 publications that were examined, 50 were eliminated due to their lack of direct relevance to the research topic. In order to accommodate the potential occurrence of additional publications during the study procedure, we performed an additional search in June 2024 using SCOPUS. One additional article was included in our database, bringing the total number of articles to 12. These papers were subsequently utilised for further study.

We employed Denyer & Tranfield's (2009) systematic methodology to present the results of our inquiry. The introduction establishes the background and outlines the research inquiries of our investigation. The methodology section provides a detailed account of the precise processes employed in the review. The bibliometric analysis and content analysis sections offer comprehensive evaluations of the reviewed papers. The seafarer supply and demand frameworks provide a comprehensive overview of the existing knowledge and identify areas that require additional investigation in relation to the research topics. Ultimately, we present a progressive research framework, acknowledge the limitations of our study, and conclude by offering a succinct overview of our review.

RESULTS AND DISCUSSION

To explore our primary research question, RQ1: What is the current state of the literature on the seafarer workforce? Which authors have exerted the most significant influence? We utilised bibliometric methods, specifically descriptive analysis and citation analysis. In order to conduct a descriptive analysis, we utilised the analysis tool pack given by SCOPUS to investigate the distribution of 12 publications based on their year, journal, and contributing authors. Furthermore, we analysed the sequential progression of the scientific discipline throughout three distinct temporal intervals. In order to do the citation analysis, we obtained the bibliographic data of the publications in ".csv" format and imported them into VOSviewer. VOSviewer is a widely used tool for bibliometric analysis in various research fields. It allows researchers to perform citation and co-citation analysis, visualize research field patterns, and identify critical publications and authors (Su & Rungruang, 2024). The VOSviewer citation analysis is presented in Fig 1.
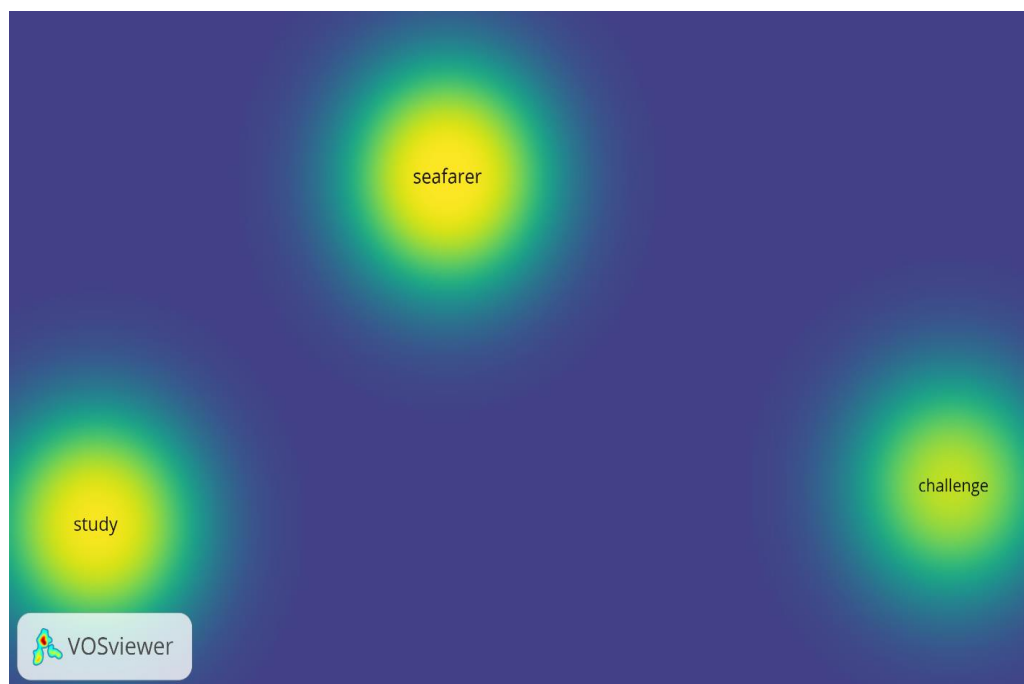
Fig.1 VOSviewer Citation Analysis

VOSviewer analysis demonstrates a close correlation between the literature concerning the seafarer workforce and studies focusing on seafarers and their challenges. This analysis prompts the question: What is the current status of the literature pertaining to the seafarer workforce? By examining the interconnectedness revealed through VOSviewer analysis, we gain insights into the prevailing themes, trends, and research focus within seafarer studies and workforce challenges. To learn from the articles, we analyzed them as shown in Table 1.

Table 1 Citation Analysis

Article	Total Citation	Journal
(B. M. Gardner dkk., 2007)	10	Marine Policy
(B. Gardner & Pettit, 1999)	14	Marine Policy
(Glen, 2008)	31	Marine Policy
(Li dkk., 2020)	4	Maritime Technology and Research
(Lobrigo & Pawlik, 2012)	6	Maritime Policy & Management
(Lobrigo & Pawlik, 2015)	13	WMU Journal of Maritime Affairs
(Lušić dkk., 2019)	11	Transactions on Maritime Science
(Park dkk., 2023)	6	The Asian Journal of Shipping and Logistics
(Tang & Bhattacharya, 2021)	8	WMU Journal of Maritime Affairs
(Tang & Zhang, 2019)	11	Industrial Relations Journal
(Wu, 2003)	4	WMU Journal of Maritime Affairs
(Wu, 2004)	30	Maritime Policy and Management

The reviewed articles were published between 1999 and 2023. The distribution of articles by publication year is as follows: one article each in 1999, 2003, 2004, 2007, 2008, 2012, 2015, 2020, 2021, and 2023, and two articles in 2019. The range of publication years from 1999 to 2023 indicates a sustained research interest in the topic, highlighting its ongoing relevance to the maritime industry.

The journals that most frequently published articles on this topic are Marine Policy and WMU Journal of Maritime Affairs, each publishing three articles. Marine Policy includes articles by B. M. Gardner et al. (2007), B. Gardner & Pettit (1999), and Glen (2008). WMU Journal of Maritime Affairs includes articles by Lobrigo & Pawlik (2015), Tang &

Bhattacharya (2021), and Wu (2003). Maritime Policy & Management published two articles by Lobrigo & Pawlik (2012) and Wu (2004). Marine Policy and WMU Journal of Maritime Affairs emerge as the leading journals publishing research on the seafarer workforce, marking them as crucial sources for stakeholders seeking information on maritime labor markets, policies, and challenges.

The most frequent authors on this topic are Wu, with two articles published in 2003 and 2004, and Lobrigo & Pawlik, with two articles published in 2012 and 2015. Notable contributors such as Wu and Lobrigo & Pawlik have published multiple articles, demonstrating their expertise and continuous interest in this field.

The articles cover a broad range of topics, including market structure, labor challenges, policy implications, and demographic studies, reflecting the multifaceted issues faced by seafarers and the maritime industry. Multiple studies concentrate on distinct geographical areas, such as Brazil, China, and Korea, emphasising the worldwide scope of the maritime sector and the diverse obstacles encountered in different regions. Highly cited articles like those by Glen (2008) and Wu (2004) indicate significant impacts on the field, serving as foundational works frequently referenced by other researchers.

Recent articles, such as Park et al. (2023), address contemporary issues like the impact of COVID-19 on the seafarer market, showing the literature's responsiveness to emerging global events. The seafarer workforce literature is well-documented and diverse, with significant contributions from key authors and prominent journals. This ongoing and region-specific research underscores the dynamic and global nature of challenges within the seafaring profession.

This analysis shows that the literature on the seafarer workforce is often published in prominent journals like Marine Policy and WMU Journal of Maritime Affairs, with active contributors such as Wu and Lobrigo & Pawlik. The range of publication years spans from 1999 to 2023, indicating ongoing development in research on the seafarer workforce and the challenges they face.

The articles provide several insights into the seafarer workforce and maritime labor market. These articles cover a range of themes, including the demand for seafaring skills in land-based jobs, the dynamics of the global seafaring labor market, regional specificities, and the impact of policies and external factors such as technological advancements and global crises.

Gardner and Pettit (1999) and Gardner et al. (2007) examine the process of seafarers transitioning to work on land in the UK. They emphasise the need for marine capabilities in different industries and consider the consequences of a decreasing number of seafarers available for land-based professions. They stress the significance of maintaining maritime capabilities in the economy and the possible repercussions of market failure. Wu's papers published in 2003 and 2004 analyse the worldwide labour market, with a specific emphasis on the principles of the SIRC Seafarers Database and the firsthand experiences of Chinese seafarers. According to Wu (2003), comprehensive databases play a crucial role in comprehending global labour patterns. According to Wu (2004), Chinese sailors face many difficulties such as unequal distribution of income and the necessity for government intervention to oversee crewing organisations. Both papers illustrate the intricate and interconnected nature of the worldwide maritime labour market.

Lobrigo and Pawlik's studies (2012, 2015) provide an in-depth look at the seafaring labor market in Brazil and other countries like the Philippines, Poland, and Germany. They discuss restrictive policies, challenges in maritime education, and the impact of national policies on the labor market, suggesting policy amendments and increased promotion of maritime careers to address the seafaring labor market's deficits. Lušić et al. (2019) discuss future challenges for the seafarer market, focusing on the shortage of skilled seafarers and the

impact of digitization and automation. They emphasize the need for updated education and training systems to meet new technological demands, highlighting the importance of continuous learning and requalification.

Tang and Zhang (2019) shed light on the issue of unfree labor relations in China, where crewing agencies control seafarers' mobility and impose harsh penalties. This article highlights seafarers' power dynamics and vulnerabilities under restrictive employment practices. Li et al. (2020) focus on the Chinese cruise seafarer market, discussing the increasing demand for seafarers due to market growth and the challenges faced, such as long working hours and language barriers. This study emphasizes the importance of practical training and language proficiency for Chinese seafarers.

Park et al. (2023) analyze the impact of COVID-19 on the Korean seafarer market, noting the challenges posed by the pandemic on seafarer supply, work conditions, and industry productivity. They discuss the aging trend among Korean seafarers and the high separation rate of qualified graduates, suggesting policy implications for developing a sustainable market structure. Tang and Bhattacharya (2021) revisit the issue of seafarer officer shortages, proposing a new approach to analyzing statistical data. Their findings suggest an oversupply of junior officers and emphasize the need for quality training programs and addressing shortages at higher officer levels.

The key insights from these articles collectively emphasize the persistent relevance of seafarer workforce issues, the importance of policy and regulatory frameworks, the impact of technological advancements, and the challenges of labor practices and external crises like COVID-19. These insights highlight the need for ongoing research and adaptive strategies to address the evolving challenges in the maritime industry.

Discussion

The most extensively studied parts of the seafarer workforce involve a variety of crucial problems. The transfer to land-based jobs is a major area of interest, as evidenced by the research conducted by Gardner and Pettit (1999) and Gardner et al. (2007). These studies investigate the need for seafaring abilities in land-based roles, the process of transitioning from a seafaring career to a land-based one, and the consequences of a decreasing supply of seafarers for land-based positions. Wu's papers (2003, 2004) delve into the concepts of the SIRC Seafarers Database, the experiences of Chinese seafarers in the worldwide market, salary inequalities, and the necessity of regulating crewing agencies. These publications shed light on the dynamics of the global labour market, which is a crucial topic of study.

Additionally, regional specificities and policies are analyzed in depth by Lobrigo and Pawlik (2012, 2015), who focus on the seafaring labor market in Brazil and other countries, discussing restrictive policies, challenges in maritime education, and the impact of national policies. Lušić et al. (2019) address future challenges and technological impacts, highlighting the effects of digitization and automation, the shortage of skilled seafarers, and the necessity for updated education and training systems. Labor relations and employment practices are critically examined by Tang and Zhang (2019), who investigate the unfree labor relations and employment practices of crewing agencies in China, revealing power dynamics and seafarer vulnerabilities.

Market demand and training are focal points in Li et al. (2020), which delve into the labor market for Chinese cruise seafarers, discussing market demand, challenges, and the importance of practical training and language proficiency. The impact of external crises, such as the COVID-19 pandemic, is explored by Park et al. (2023), who analyze the pandemic's effects on the Korean seafarer market, including changes in supply and demand, work conditions, and industry productivity. Finally, Tang and Bhattacharya (2021) revisit the issue

of seafarer officer shortages, using a novel approach to assess the supply and demand balance, particularly emphasizing the quality of training and the oversupply of junior officers.

These aspects highlight the multifaceted nature of seafarer workforce research, covering employment transitions, global market dynamics, regional policies, technological impacts, labor relations, training needs, and the effects of external crises.

Advancements in technology adoption within the maritime industry have led to significant improvements in areas such as navigation systems, communication equipment, safety protocols, and efficiency in vessel operations. This has enhanced the overall safety and productivity of seafarers while also reducing operational risks and environmental impact. There is a greater emphasis on providing comprehensive and specialized training programs that equip seafarers with the necessary skills to operate modern vessels and handle advanced technologies effectively. Continuous professional development programs have also become more prevalent, ensuring seafarers stay updated with industry standards and best practices. Notable advancements have been made in labour relations, specifically in addressing concerns related to equitable compensation, satisfactory working environments, and the well-being of employees. Efforts to enhance the welfare of crew members, provide mental health assistance, and establish a healthy work-life equilibrium have gained momentum, resulting in a more favourable and enduring work atmosphere for seafarers. Finally, there has been substantial progress in the policy frameworks that control the workforce of seafarers, especially in areas such as marine legislation, crew certification standards, environmental sustainability, and international collaboration. The implementation of treaties like as the Maritime Labour Convention (MLC) and the Standards of Training, Certification, and Watchkeeping (STCW) has improved standards in the industry and created fair competition for seafarers globally. These subfields have shown substantial progress and improvement, reflecting ongoing efforts to enhance the seafarer workforce's capabilities, well-being, and overall effectiveness within the maritime industry.

Several areas within the seafarer workforce present promising avenues for future research and exploration. One such area is the impact of emerging technologies on seafaring operations, including autonomous vessels, artificial intelligence (AI), and advanced navigation systems. Understanding how these technologies influence job roles, skills requirements, and safety protocols can provide valuable insights for enhancing training programs and optimizing vessel operations.

Additionally, mental health and well-being among seafarers are critical areas that warrant further study. Research can delve into the prevalence of mental health issues, stress factors onboard ships, and effective intervention strategies to promote better mental health outcomes for seafarers. This includes exploring the role of social support, access to mental health resources, and organizational policies prioritizing crew welfare.

The globalization of the maritime industry also raises questions about labor mobility, cross-cultural interactions, and the impact of diverse crews on operational efficiency. Future studies can investigate the dynamics of multinational crews, communication challenges, and strategies for fostering collaboration and teamwork among seafarers from different backgrounds.

Environmental sustainability is another key area for future exploration within the seafarer workforce. This includes researching adopting eco-friendly practices, compliance with environmental regulations, and developing green technologies in maritime operations. Understanding how these initiatives affect seafarers' roles, responsibilities, and job satisfaction can inform policies for promoting sustainable practices in the industry.

Lastly, digitalization and data analytics in maritime operations present opportunities for research on data-driven decision-making, cybersecurity challenges, and integrating digital tools into everyday tasks onboard ships. Exploring the potential benefits and risks of digital

transformation in the seafarer workforce can guide efforts to harness technology effectively while mitigating associated challenges.

Future studies in the seafarer workforce should focus on emerging technologies, mental health and well-being, cultural diversity and teamwork, environmental sustainability, and the impact of digitalization. By addressing these areas, researchers can contribute to enhancing the effectiveness, safety, and resilience of the seafaring profession in a rapidly evolving maritime industry landscape.

CONCLUSION

In conclusion, the systematic literature review and bibliometric analysis conducted on seafarer supply and demand have provided valuable insights into various aspects of the maritime workforce. Through the analysis of a wide range of articles spanning different subfields within the seafarer workforce, key trends, challenges, and areas of improvement have been identified. The analysis has highlighted the significant impact of technological advancements, demographic shifts, regulatory changes, and economic factors on the seafarer supply and demand dynamics.

Moreover, the bibliometric analysis has illuminated the most influential articles, authors, and journals in the field, contributing to a better understanding of the scholarly landscape related to seafarer workforce research. Identifying highly cited articles and prolific authors underscores the importance of specific topics and perspectives within seafarer supply and demand discourse.

Overall, this systematic review and bibliometric analysis serve as a comprehensive resource for policymakers, industry stakeholders, researchers, and academicians interested in the dynamics of the seafarer workforce. The findings presented here can guide future research endeavors, policy formulation, training initiatives, and strategic planning to address challenges and maximize opportunities within the maritime industry's human resource domain.

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