

The Impact of Seafarers' Welfare on the Operational Efficiency of Marine Vessels in Tanzania

¹Alexander Ernest Meena; ²Juma M. Msabaha

Dar es Salaam Maritime Institute (DMI), Maritime Transport Department,
P.O Box 6727, Dar es Salaam, Tanzania

Abstract:- This study explores the critical relationship between seafarers' welfare and the operational efficiency of marine vessels in Tanzania. So the study aims to investigate the critical aspects of seafarers' welfare and their impact on the operational efficiency of marine vessels in Tanzania. The objectives are, To identify the factors that affect the living and working conditions on the operational efficiency of a marine vessels in Tanzania, To evaluate the working environment standard that influence the efficiency of a marine vessels, To examine the condition of their salary to afford the living standard.

Tanzania ratified the MLC 2006, setting minimum international standards for seafarers' working and living conditions, significantly improving their welfare. Despite ratifying international conventions, Tanzanian seafarers face challenges on their welfare that the absence of a comprehensive maritime policy exacerbates these issues. This study employs a mixed methods research design, integrating both quantitative and qualitative data collection and analysis to provide a comprehensive understanding of the impact of seafarers' welfare on the operational efficiency of marine vessels. A sample size of 80 participants from various marine vessels and ship managers were selected regression and thematic analysis was been used in data analysis and concurrent triangulation method was used in data intergration.

The findings of this study underscore the importance of prioritizing seafarers' welfare to ensure the sustainable and efficient operation of marine vessels in Tanzania. By addressing the identified welfare issues. The research recommend for policy changes and the development of a more supportive and productive maritime sector as well as establishment of welfare centers like Stella Maris and mision to seafarers, to support seafarers and fishing communities.

I. INTRODUCTION

➤ Background Information

Maritime transportation revolves around the transportation of goods (cargoes) and individuals via sea and other water ways. Over 80% of global trade relies on maritime transport to deliver goods from their manufacturing locations to their final destinations by sea.

Early Development, Tanzania's maritime history began with the union of Tanganyika and Zanzibar in 1964, forming the United Republic of Tanzania. The country's strategic location along the Indian Ocean made maritime trade and seafaring crucial for its economy.

Maritime Labour Convention (MLC) 2006. Tanzania ratified the MLC 2006, which sets minimum international standards for working and living conditions for seafarers. This was a significant step in improving seafarer welfare, ensuring better working conditions, fair treatment, and access to medical care.

Challenges and Policies. Despite the ratification of international conventions, seafarers in Tanzania have faced challenges such as inadequate employment opportunities, lack of proper training, and insufficient welfare facilities. The absence of a comprehensive maritime policy has also been a hurdle in addressing these issues effectively.

Seafarers' welfare is a subject that lacks a clear definition and understanding. The ambiguity surrounding the term "special protection" and the concept of seafarers' welfare has led to confusion in the literature. Various researchers associate seafarers' welfare with different aspects such as working conditions, abuse prevention, health improvement, and family well-being. This complexity creates a challenge in defining and addressing seafarers' welfare. However, it is agreed that welfare encompasses four dimensions: organizational, managerial, social, and physical workplace features. (Exarchopoulos et al.)

In Tanzania, despite the efforts to protect seafarers, by implementation of provided specific standards in which State is required to adhere to during implementation and enforcement of the MLC.

Support Organizations like the Mission to Seafarers and Stella Maris have been instrumental in providing welfare services to seafarers in Tanzania. These organizations offer practical, pastoral, and spiritual support, helping seafarers cope with the stresses of long voyages and isolation.

The establishment of welfare centers and the involvement of international organizations have improved the situation. For instance, Stella Maris recently launched operations in Dar es Salaam to support seafarers and fishing communities along the Tanzanian coast.

The minimum requirements for seafarer to work onboard including the minimum age, medical fitness, trainings and qualifications (Mutaki, 2015). Their welfare remains insufficiently addressed in the maritime industry. Economic problems, including trade slumps and intense competition, have led shipowners to implement cost-cutting measures that adversely affect seafarers. Unethical crewing practices, such as unfair contracts, wage delays or non-payment, denial of shore leave, lack of rest hours and freedom of exploitation, further contribute to seafarers' hardships. Numerous maritime workers characterize their occupations as a trade-off between earning money and feeling homesick, or as a form of confinement that comes with a paycheck, as they strategize the duration of their time at sea in order to alleviate their situation.

II. LITERATURE REVIEW

A. Introduction

Welfare can be defined as the overall well-being and prosperity of an individual or a collective, along with the legal processes or societal initiatives aimed at enhancing the fundamental physical and material welfare of individuals in distress. Within the maritime domain, onboard welfare pertains to fulfilling the essential requirements of seafarers to ensure their sound health and contentment. The national maritime authority and seafarer's community should establish statutory procedures to address this important theme. The needs and desires of seafarers are not different from those of other human beings and all labor forces. International Labour Organisation (ILO) Declaration MLC 2006 recognizes the need for special protection for seafarers due to the global nature of the shipping industry. (Exarchopoulos et al., 2018)

Existing literature suggests that the introduction of new technologies in the shipping industry has had a significant impact on the safety and well-being of seafarers (Bhardwaj et al., 2019). While the regulatory intention behind these technological advancements is to improve safety, the actual implementation process is often driven by economic rationality, leading to work intensification and increased surveillance in the workplace (Bhardwaj et al., 2019). Additionally, the findings indicate that the literature on the topic has primarily focused on the environmental externalities associated with ship-port interface operations, with limited attention given to the human element (Giudice et al., 2021).

The mental health of seafarers is a critical issue that has significant implications for the seafarers themselves, their families, and the shipping industry as a whole. The mental health of seafarers has been a prevalent issue, with cases of depression leading to suicide being widely reported (Galbadage, Peterson, & Gunasekera, 2020). It is evident that the poor mental health of seafarers has serious and often fatal consequences. This issue demands attention and action from all parties involved in the international maritime shipping industry.

However, despite the importance of addressing the mental health of seafarers, there are still significant gaps in research and practice in this area. The literature on the mental health of seafarers is limited, and there is a need for more comprehensive research on the factors contributing to poor mental health among seafarers and the most effective interventions to address these issues. Future research should focus on exploring the specific stressors and challenges faced by seafarers, as well as developing and evaluating targeted interventions to improve their mental well-being.

B. Theory Guiding The Study

➤ Accident Proneness Theory (Drake 1937)

Drake in his theory of accident Proneness states that where perception level is equal to or higher than the motor level, the employee is relatively a safe worker. But where perception level is lower than the motor level, the employee is accident prone and his accident Proneness becomes greater as the differences increase. He also believes that his theory is applicable to all types of accidents. However the obvious limitation of this theory is lack of consideration of individual's personality and contributing emotional factor.

➤ Job Safety Theory (Skiba 2011)

In the theory of Job safety which states that, Job safety is the interrelationships between people and work equipments, machinery and environment. Skiba also states that relationship that can cause incidents and harmful working conditions are caused by combining people and the objective working environment for production. Relationship of workers and objective environment is not compatible is one example that means that the person is either not qualified for the job or the objective part of the system is not working which could lead to unsafe conditions and accidents.

According to the International Covenant on Economic, Social, and Cultural Rights, seafarers have the right to safe working conditions, rest, equitable treatment, and fair compensation. These rights cover helping those in need, being returned home, receiving medical care, shore leave, being paid fairly, having acceptable living conditions, and being safe from harm. Additionally applicable are ethical obligations and international customs, such as offering aid in times of need or medical attention.

➤ Herzberg's Two-Factor Theory:

This theory distinguishes between hygiene factors (e.g., working conditions, salary) and motivators (e.g., recognition, job satisfaction). Improving hygiene factors can prevent dissatisfaction, while motivators can enhance job performance and satisfaction.

The Maritime Labour Convention, 2006 (MLC, 2006) is an international labor convention that was ratified by the International Labour Organization (ILO). It serves as a sort of bill of rights for seafarers, outlining the basic standards for life and employment that all seafarers on board vessels flying the flags of ratifying countries must adhere to. (Maritime Labour Convention, 2006, 2006).

C. Empirical Literature Review

Empirical studies have demonstrated the positive impact of seafarers' welfare on operational efficiency. For example, research has shown that improved living conditions and mental health support lead to higher job satisfaction, reduced turnover rates, and better crew performance. Additionally, well-maintained vessels with motivated crews are more likely to operate efficiently and adhere to schedules.

III. RESEARCH DESIGN METHODOLOGY

A. Research Design

The total population for this study includes 100 individuals, and 25 vessels, encompassing both commercial ships and domestic ferries. Through this research, the aim is to provide insights into the correlation between seafarers' welfare and the operational outcomes of marine vessels. The findings will help in formulating strategies to enhance both the welfare of seafarers and the efficiency of maritime operations in the region. This study employed a mixed methods research design, integrating both quantitative and qualitative data collection and analysis to provide a comprehensive understanding of the impact of seafarers' welfare on the operational efficiency of marine vessels in Tanzania.

For Quantitative Data Collection the structured questionnaire with closed-ended questions designed to measure various aspects of seafarers' welfare. And on data analysis, a descriptive statistics was used to summarize the data, and inferential statistics to examine the relationship between seafarers' welfare and operational efficiency metrics. And for Qualitative Data Collection, a Semi-structured interview guide with open-ended questions aimed at exploring participants' experiences and perceptions regarding the impact of welfare on operational efficiency. On data analysis, Thematic analysis was used to identify common themes and patterns in the qualitative data.

B. Data Integration

The Concurrent Triangulation method was used where by data from the surveys and interviews was analyzed separately and then integrated during the interpretation phase.

The quantitative data provided a broad understanding of the relationship between seafarers' welfare and operational efficiency, while the qualitative data will offer deeper insights into the underlying reasons and context.

IV. RESULTS DISCUSSION AND FINDINGS

On this chapter provides the results and analysis of the data. The result obtained is been presented as a series of figures, tables and charts, with the descriptive text and interpretation of results. He is the part to present the findings of the condition of the working environment onboard ship. Certainly! The working environment onboard a ship is crucial for seafarers' safety and well-being. Here are some key aspects of a safe ship working environment.

- **Ergonomics and Risk Assessment:** where by the seafarers should avoid awkward positions (e.g., working on their knees, with raised arms or bent back/neck) during tasks, also Risk assessments should evaluate equipment and technical aids used as well as the shipowners should implement Occupational Safety and Health (OSH) policies and involve the master and safety officers in planning and risk assessment.
- **General Conditions:** where the adequate lighting, proper ventilation, and clear spaces are essential, and unwanted items, rubbish, and oil spills should be removed from work areas, emergency and protective equipment must be well-maintained and stowed properly.
- **Living Conditions:** Shared cabins maximize space efficiency but limit personal space and privacy, not only that but also the crew members adapt to communal living in close quarters with colleagues.

The analysis of the condition of working environment onboardship involved 80 responses received as per sample size by (Gregoire & Affleck, 2018). The respondents a where asked a survey question justify the condition of the woking environment where by the 51% responds with very bad working environment, 39% bad working environment and 8% moderate, 2% good and 0% very good.

Table 1: Perception of Respondents in Condition of the Working Environment Onboard the Ship

Responses	Frequency	Percent's (%)
very good	0	0%
good	2	3%
Moderate	6	8%
bad	31	39%
very bad	41	51%
Total	80	100%

Source: field data (2024)

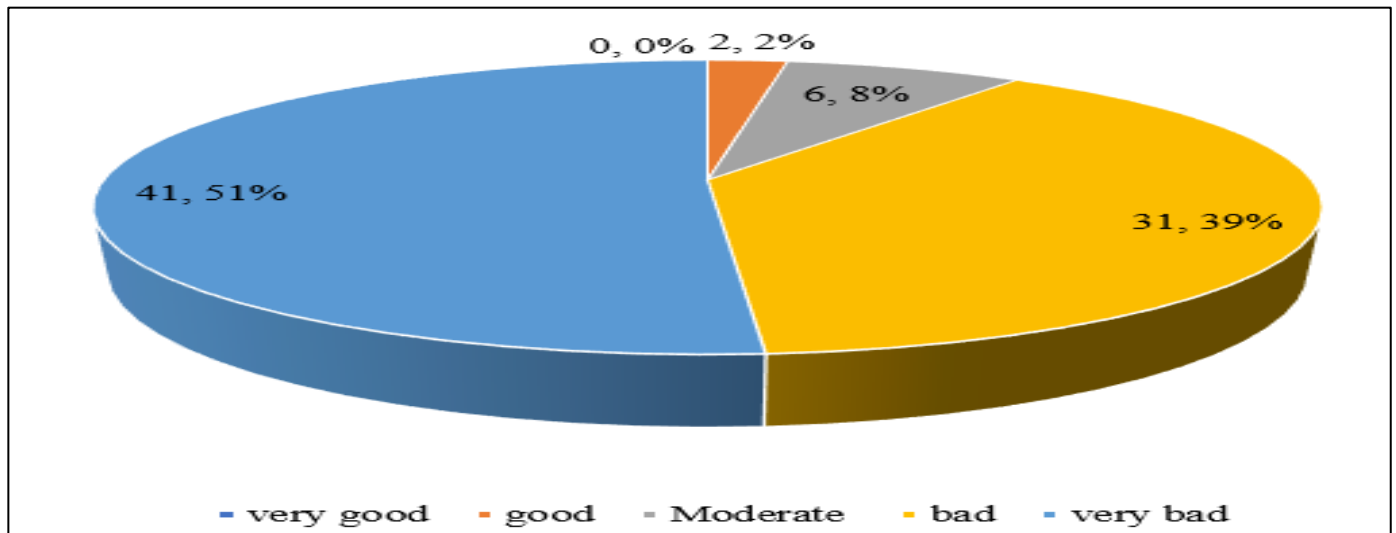


Fig 1: Perception of Respondents toward the Condition of Working Environment Onbord Ship

The survey results indicate a predominantly negative perception of the working environment among respondents, with a majority rating it as very bad or bad. This Highlights Significant Challenges in meeting the MLC standards.

➤ *Provision of Health Protection and Social Security:*

Shipowners have specific responsibilities regarding the health protection and social security of seafarers.

- **Health Protection:** The Maritime Labour Convention (MLC) sets out minimum working and living rights for seafarers. Under the MLC, shipowners must provide the decent onboard health protection facilities, including essential dental care, the right for seafarers to visit qualified medical personnel while in port, access to a qualified medical doctor on ships carrying more than 100 people on international voyages lasting more than 3 days, Work environments on ships must undergo regular risk

assessments for workplace hazards, ensuring seafarers' safety.

- **Social Security:** The MLC Regulation 4.5 aims to achieve progressively comprehensive social security protection for seafarers. This includes, Medical care, Sickness benefit, Unemployment benefit, Old-age benefit, Employment injury benefit, Family benefit, Maternity benefit, Invalidity benefit, Survivors' benefit. The respondents a where asked a survey question that, do the companies provide health protection and social security, and 41% responds with very No, 13% No I can't answer and 46% gives a Yes response.

Table 2: Perception of Respondents on, do the Companies Provide Health Protection and Social Security

Responses	Frequency	Percent's (%)
Yes	37	46%
No response	10	13%
No	33	41%
Total	80	100%

Source: Field Data (2024)

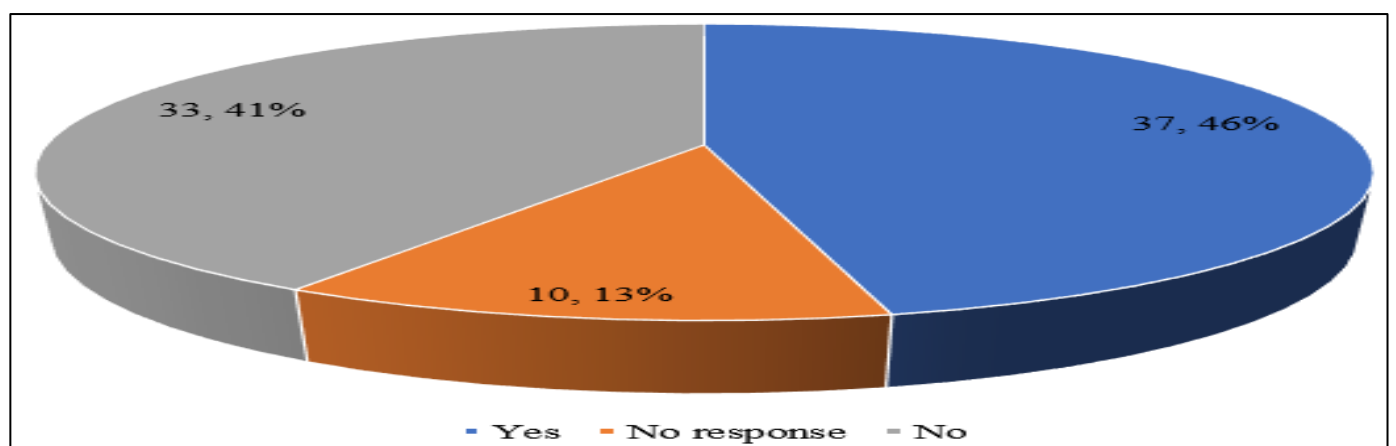


Fig 2: Perception of Respondents on, do the Companies Provide Health Protection and Social Security

The high percentage of respondents reporting “very bad” and “bad” working environments suggests that the current conditions may not be meeting the standards set by the MLC. This discrepancy could be due to several factors, including inadequate enforcement of regulations, lack of resources, or insufficient training and awareness among shipowners and operators.

➤ *Seafarers’ Employment Contracts are Governed by the Maritime Labour Convention (MLC) 2006:*

- **Working Time Regulations and Rest Hours:** Seafarers on seagoing ships are entitled to a minimum of 10 hours’

rest in any 24-hour period and 77 hours’ rest in any 7-day period. They should receive at least 4 weeks’ paid annual leave. Crew exercises (like lifeboat drills) should minimize disruption to rest periods, and any rest periods interrupted must be compensated. The respondents were asked a survey question that, does the working hours standards align with the as MLC standards. And 15% strongly disagree, 41% responds to disagree, 23% moderate response, 13% agree, and 09% strongly agree response.

Table 3: Perception of Respondents on the Working Hours Standards as per MLC Standards

Responses	Frequency	Percent's (%)
Strongly agree	7	9%
Agree	10	13%
Moderate	18	23%
Disagree	33	41%
Strongly disagree	12	15%
Total	80	100%

Source: Field Data (2024)

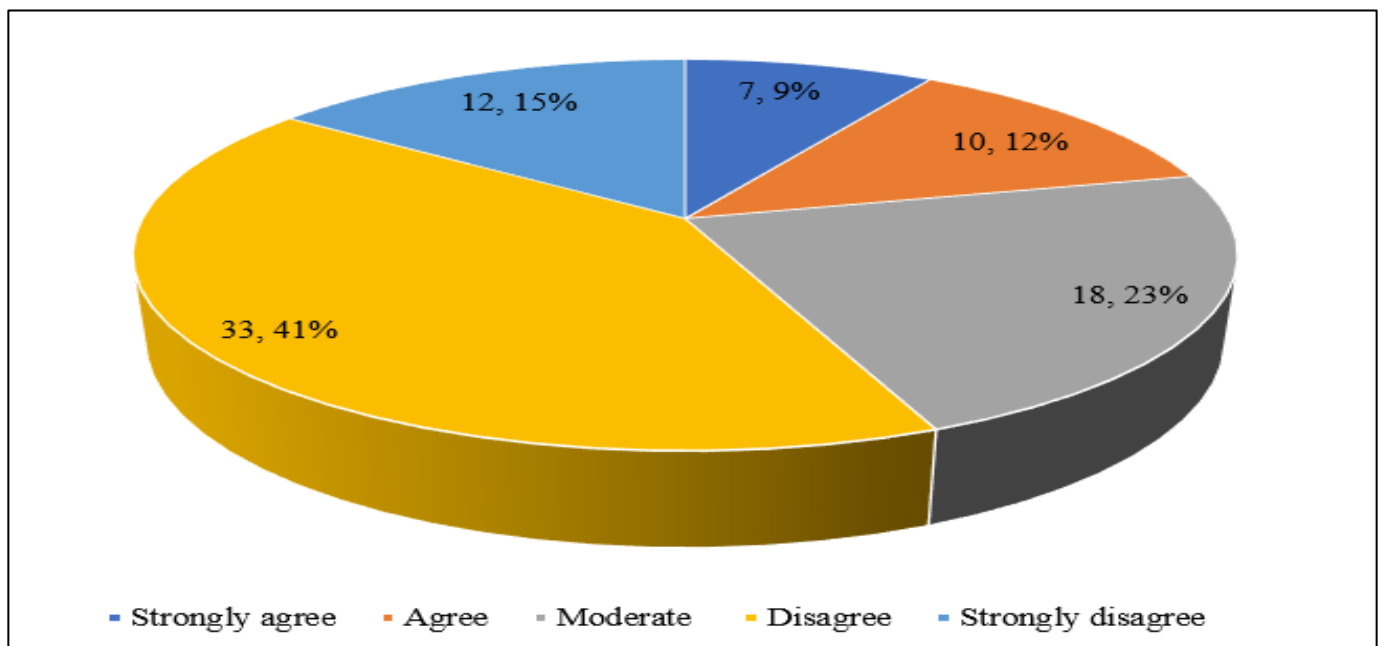


Fig 3: Perception of Respondents on the Working Hours Practiced as per MLC Standards

The survey results reveal a mixed perception among respondents regarding the alignment of working hours standards with the Maritime Labour Convention (MLC) standards. The response of the crew on working hours onboard the ship, provides the understanding that by the standards set by MLC are not being implemented effectively.

- **Employment Contracts:** Contracts between seafarers and shipowners must provide fair living and working conditions. These contracts should be in English and include details such as the shipowner’s name, the seafarer’s name, conditions for termination, health and social security benefits, and the right to repatriation. The respondents were asked a survey question that, does the company offer standard contracts that have all qualities and consider the well-being of the seafarer. And 61% responds with No answer, 13% I don’t know and 26% gives a Yes response.

Table 4: Perception of Respondents on, does the Companies Offers Contracts tha have all Qualities and Consider the Well Being of the Seafarer

Responses	Frequency	Percent's (%)
Yes	21	26%
I don't know	10	13%
No	49	61%
Total	80	100%

Source: Field Data (2024)

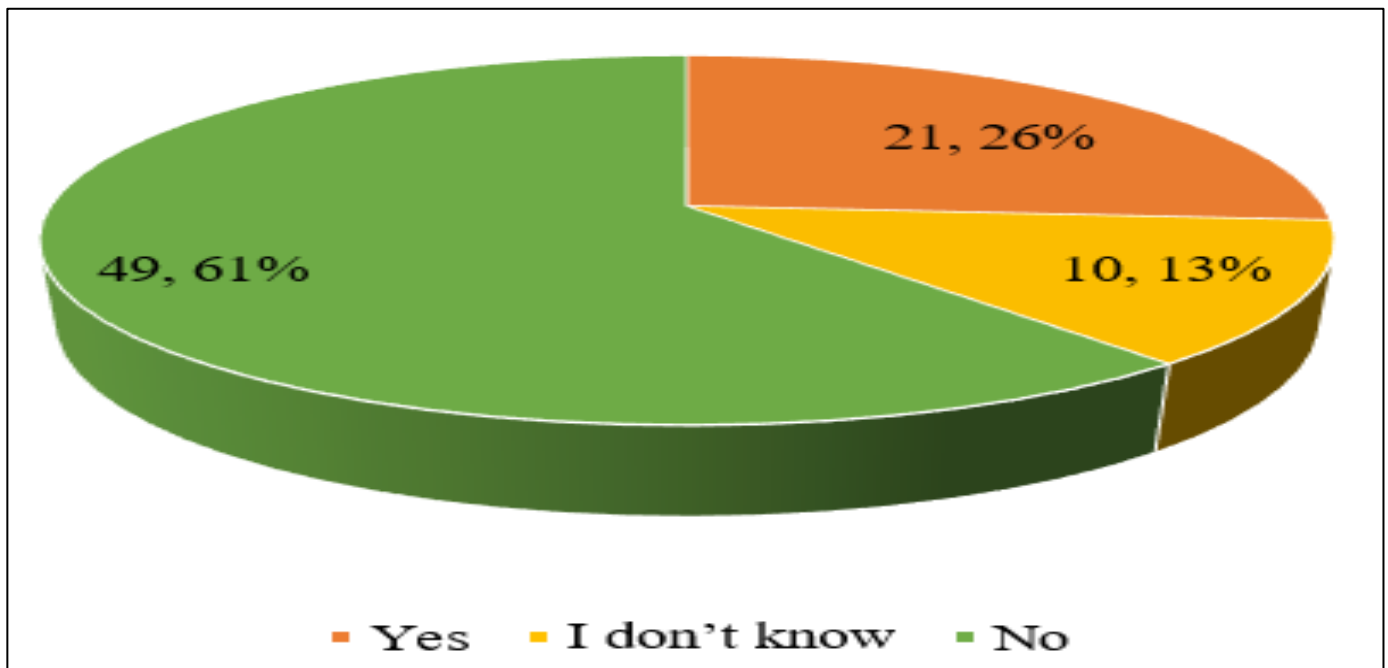


Fig 4: Perception of Respondents on, does the Companies Offers Standard Contracts that have all Qualities and Consider the well-being of the Seafarer

The survey's findings reveal differing opinions about whether standard contracts that take seafarers' welfare into account are provided by companies. Even though a sizable segment of respondents remained silent, a noteworthy proportion of them think companies are adhering to MLC standards.

conversion charges kept reasonable. The respondents a where asked a survey question that, is their wages/earn, timely, and weght proportional to the current living standards, and 41% responds to disagree, 13%, 25% moderate, 21% agree, 13% gives a strongly agree response.

- **Wages:** Seafarers' wages must be paid regularly, including monthly statements of accounts. They should be allowed to transfer part or all of their wages and currency

Table 5: Perception of Respondents on the Wages/Earn, Weght Proportional to the Current Living Standards

Responses	Frequency	Percent's (%)
Strongly agree	10	13%
Agree	17	21%
Moderate	20	25%
Disagree	33	41%
Total	80	100%

Source: Field Data (2024)

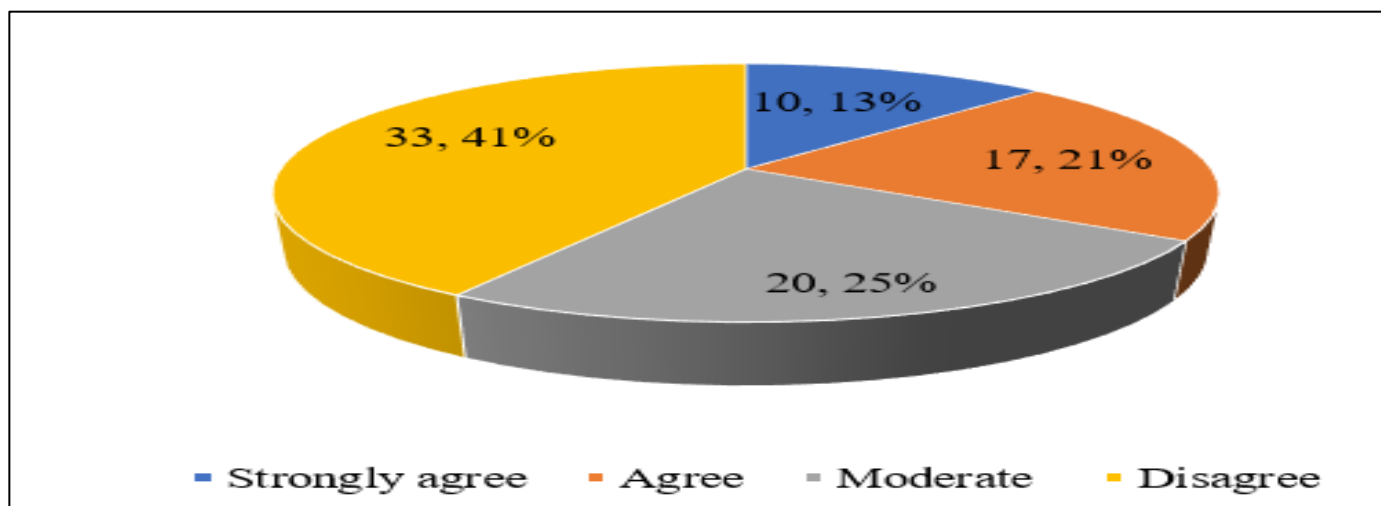


Fig 5: Perception of Respondents on the Wages/Earn, Weight Proportional to the Current Living Standards and Timely Paid

Regarding the timeliness and proportionality of wages to current living standards, the survey results show a wide range of opinions. Although a sizable fraction of respondents express dissatisfaction, a noteworthy proportion express satisfaction or strong satisfaction. This emphasizes how crucial it is to meet MLC requirements and improve the welfare of seafarers by enhancing wage policies, making sure payments are made on time, and upholding transparency.

➤ Discussion

The welfare of seafarers is a critical factor that significantly influences the operational efficiency of marine vessels. In Tanzania, where the maritime industry plays a vital role in the economy, ensuring the well-being of seafarers can lead to numerous benefits, both for the individuals and the industry as a whole.

These findings highlight a critical issue that needs to be addressed to improve the welfare and operational efficiency of seafarers. According to the Maritime Labour Convention (MLC), 2006, seafarers are entitled to decent working and living conditions, which include adequate accommodation, food, medical care, and protection of health and safety. The MLC sets out minimum standards for working conditions on ships, aiming to ensure that seafarers have a safe and secure workplace, fair terms of employment, decent living conditions, and social protection.

Providing social security and benefits, such as insurance, pensions, and family support, ensures that seafarers and their families are financially secure. This security reduces stress and allows seafarers to focus on their work without worrying about their family's well-being. A secure and content workforce is more productive and committed to their roles.

The cumulative effect of these welfare measures is a significant improvement in operational efficiency. Healthy, well-trained, and motivated seafarers are more capable of maintaining the vessel, handling cargo, and navigating safely. This leads to fewer delays, lower operational costs, and higher overall productivity. Additionally, a positive

reputation for seafarer welfare can attract skilled personnel, further enhancing the efficiency and competitiveness of Tanzania's maritime industry.

V. CONCLUSION AND RECOMMENDATION

The welfare of seafarers is undeniably linked to the operational efficiency of marine vessels in Tanzania. This research has highlighted several key areas where seafarers' well-being directly impacts their performance and, consequently, the overall efficiency of maritime operations. Ensuring the health, safety, and mental well-being of seafarers, along with providing adequate training, work-life balance, and social security, leads to a more motivated, skilled, and stable workforce.

Healthy and content seafarers are more productive, less prone to errors, and better equipped to handle the demands of their roles. This results in fewer operational disruptions, lower costs, and higher productivity. Moreover, a positive approach to seafarers' welfare can enhance the reputation of Tanzania's maritime industry, attracting skilled personnel and fostering a culture of excellence.

Investing in the welfare of seafarers is not just a moral obligation but a strategic imperative that can drive significant improvements in the operational efficiency of marine vessels. By prioritizing seafarers' well-being, Tanzania can strengthen its maritime sector and ensure sustainable growth and competitiveness in the global market.

➤ Recommendation.

Despite the challenges facing seafarers in maritime industry hence lowering their ability to work effectively, and and increasing the level of human errors for chances of accident to occur, dealing with mental health support by offering confidential counseling services to help seafarers cope with stress, isolation, and other mental health challenges, not only that but also providing opportunities for recreational activities and social interaction to promote mental well-being and reduce feelings of isolation.

- Continuous Training and Development: (Skill Enhancement Programs) Invest in continuous training and development programs to keep seafarers updated with the latest industry practices and technologies, as well as Create clear career paths and opportunities for advancement to motivate seafarers and reduce turnover rates.
- Work-Life Balance Initiatives
- Adequate Rest Periods: Ensure that seafarers have sufficient rest periods to prevent fatigue and maintain high levels of alertness and efficiency. Implement policies that allow seafarers to take regular shore leave, enabling them to spend time with their families and recharge.
- Social Security and Benefits: Provide comprehensive insurance coverage, including health, life, and accident insurance, to protect seafarers and their families. Establish pension plans to ensure financial security for seafarers after retirement. Offer support programs for seafarers' families, such as educational scholarships for children and financial assistance during emergencies.
- Improved Communication and Feedback Mechanisms: Establish open communication channels where seafarers can voice their concerns and suggestions without fear of retaliation. Conduct regular feedback sessions to understand the needs and challenges faced by seafarers and take appropriate actions to address them.
- Collaboration with Stakeholders: Work closely with shipowners, maritime unions, and government agencies to develop and implement welfare programs.
- Policy Development: Advocate for the development of national policies and regulations that prioritize seafarers' welfare.
- Monitoring and Evaluation: Establish monitoring and evaluation mechanisms to assess the effectiveness of welfare programs and make necessary adjustments. Conducting awareness campaigns to highlight the importance of seafarers' welfare and encourage industry-wide adoption of best practices.

REFERENCES

- [1]. Ang, J. H., Goh, C., Saldivar, A., & Li, Yun. (2017). Energy-efficient through-life smart design, manufacturing and operation of ships in an industry 4.0 environment. *Energies* , 10 , 610 . <http://doi.org/10.3390/EN10050610>
- [2]. Bajaj, V. (2023). Labor rights of the seafarers. *Social Science Research Network*. <https://doi.org/10.2139/ssrn.4647836>
- [3]. Exarchopoulos, G., Zhang, P., Pryce-Roberts, N., & Zhao, M. (2018). Seafarers' welfare: A critical review of the related legal issues under the Maritime Labour Convention 2006. *Marine Policy*, 93, 62–70.
- [4]. Exarchopoulos, Georgios, et al. "Seafarers' welfare: A critical review of the related legal issues under the Maritime Labour Convention 2006." *Marine Policy*, vol. 93, July 2018, pp. 62–70. <https://doi.org/10.1016/j.marpol.2018.04.005>.
- [5]. Galbadage, Thushara., Peterson, Brent M., & Gunasekera, R. S.. (2020). Does COVID-19 Spread Through Droplets Alone?. *Frontiers in Public Health* , 8 . <http://doi.org/10.3389/fpubh.2020.00163>.
- [6]. Impact of the marine environment on the health and efficiency of seafarers. (n.d.). <https://www.wseas.org/multimedia/journals/economics/2019/a565107-095.php>
- [7]. INTERNATIONAL CONVENTION FOR THE SAFETY OF LIFE AT SEA 2004. (n.d.). Retrieved May 16, 2024, from https://seafarersrights.org/wp-content/uploads/2014/11/INTERNATIONAL_TREATY-INTERNATIONAL-CONVENTION-SOLAS_1974_ENG.pdf
- [8]. Khan, M., Faruque, M., & Newaz, Alvi. (2017). Fuzzy Logic Based Energy Storage Management System for MVDC Power System of All Electric Ship. *IEEE Transactions on Energy Conversion* , 32 , 798-809 . <http://doi.org/10.1109/TEC.2017.2657327>
- [9]. Kianto, A., Shujahat, Muhammad., Hussain, S., Nawaz, F., & Ali, Murad. (2018). The impact of knowledge management on knowledge worker productivity. *Baltic Journal of Management* . <http://doi.org/10.1108/BJM-12-2017-0404>
- [10]. Kothari, C. R. (2009). *Research Methodology, Methods and Techniques*. 2nd Revised Edition. New age international publishers
- [11]. Marine Insight. (2016, July 23). Maritime Labour Convention 2006: What it is, what it does, how it works. <https://www.marineinsight.com/maritime-law/maritime-labour-convention-2006-what-it-is-what-it-does-how-it-works/>
- [12]. Maritime Labour Convention, 2006. (2006, February 7). https://www.ilo.org/global/standards/maritime-labour-convention/WCMS_087350/lang-en/index.htm
- [13]. Maritime transport is 'Backbone of global trade and the global economy', says Secretary-General in Message for International Day | Meetings coverage and press releases. (2016, September 22).
- [14]. Maslow, A. (1954). *Motivation and personality*. New York, NY: Harper. ISBN978 – 0 – 06 – 041987 - 5.
- [15]. MSEd, K. C. (2024, April 2). Maslow's Hierarchy of Needs. Verywell Mind.
- [16]. Mutaki, L. M. (2015). THE MERCHANT SHIPPING (SEAFARERS' CONDITIONS OF EMPLOYMENT), REGULATIONS, 2015. <https://imli.org/wp-content/uploads/2021/04/LETICIA-MICHAEL-MUTAKI-.pdf>
- [17]. Paradigms, theories, and how they shape a researcher's approach. (n.d.). https://saylordotorg.github.io/text_principles-of-sociological-inquiry-qualitative-and-quantitative-methods/s05-02-paradigms-theories-and-how-the.html

- [18]. Payoyo, P. B. (2019). Seafarers' human rights: compliance and enforcement. In Brill | Nijhoff eBooks (pp. 468–472). https://doi.org/10.1163/9789004380271_081
- [19]. Roosma, Femke., & Oorschot, Wim van. (2018). Public opinion on basic income: Mapping European support for a radical alternative for welfare provision. *Journal of European Social Policy* , 30 , 190 - 205 . <http://doi.org/10.1177/0958928719882827>
- [20]. safety. (2024). In Merriam-Webster Dictionary. <https://www.merriam-webster.com/dictionary/safety>
- [21]. Skjong, Espen., Johansen, T., Molinas, M., & Sørensen, A.. (2017). Approaches to Economic Energy Management in Diesel–Electric Marine Vessels. *IEEE Transactions on Transportation Electrification* , 3 , 22-35 . <http://doi.org/10.1109/TTE.2017.2648178>
- [22]. What is a Seafarer? | Seafarers Meaning | The Mission to Seafarers. (2023, June 6). The Mission to Seafarers.
- [23]. Zeng, Cheng., Wang, Jun-Bo., Ding, Changfeng., Zhang, Hua., Lin, Min., & Cheng, Julian. (2021). Joint Optimization of Trajectory and Communication Resource Allocation for Unmanned Surface Vehicle Enabled Maritime Wireless Networks. *IEEE Transactions on Communications* , 69 , 8100-8115 . <http://doi.org/10.1109/tcomm.2021.3115115>
- [24]. Zhang, Tianwen., Zhang, Xiaoling., & Ke, Xiao. (2021). Quad-FPN: A Novel Quad Feature Pyramid Network for SAR Ship Detection. *Remote. Sens.* , 13 , 2771 . <http://doi.org/10.3390/rs13142771>.
- [25]. Zhu, Yuanqing., Zhou, Weihao., Xia, Chong., & Hou, Qichen. (2022). Application and Development of Selective Catalytic Reduction Technology for Marine Low-Speed Diesel Engine: Trade-Off among High Sulfur Fuel, High Thermal Efficiency, and Low Pollution Emission. *Atmosphere* . <http://doi.org/10.3390/atmos1305073>