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ANALYSIS OF PORT STATE CONTROL OPERATIONS FOR ENHANCING SHIP SAFETY; A CASE OF DAR ES SALAAM PORT IN TANZANIA

By

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Abstract

Port State Control (PSC) plays a vital role in ensuring maritime safety, especially in developing maritime regions. This study examines the effectiveness of PSC operations at Dar es Salaam Port by assessing the importance of officer training, advanced inspection technologies, and challenges in operator compliance. Using a mixed-methods approach that combines survey data from 60 stakeholders and interviews with inspectors and regulators, the findings show that regular, well-structured training greatly enhances inspection results, while the adoption of technology improves efficiency and compliance. However, financial limitations and regulatory inconsistencies still hinder ship operators' ability to meet safety standards. Policy coordination, resource distribution, and regional harmonization are essential for strengthening Tanzania's maritime safety system.

Keywords: *Port State Control (PSC), Ship Detention, Training of Port State Control Officers, Advanced Inspection Technologies*

Introduction

Port State Control (PSC) is crucial for ensuring global maritime safety by verifying that foreign vessels comply with international safety and environmental regulations. Research conducted by Fan et al. (2022) and Zheng (2020) indicates that PSC inspections contribute to a reduction in serious deficiencies but also reveal ongoing challenges in accident prevention. The implementation of advanced technologies, including predictive analytics and remote inspection tools, has recently improved the accuracy of inspections and the allocation of resources, particularly during disruptions like the COVID-19 pandemic.

Nonetheless, there are still global challenges affecting PSC operations. Researchers such as Kim and Andersson (2023) have pointed out discrepancies in inspection methods, training, and enforcement across different regions. These differences obstruct consistent safety practices, underscoring the necessity for standardized training for officers and continuous professional development to guarantee effective implementation of safety protocols.

In Africa, regional collaboration through frameworks like the Abuja MoU has led to enhanced PSC results, particularly in ports located in Nigeria, Ghana, South Africa, and Mauritius. However, outdated facilities and a lack of technical knowledge continue to hinder advancement. Adjei (2020) advocates for increased investment in capacity building and uniform inspection practices to address these structural challenges and enhance compliance throughout the continent.

Tanzania's PSC performance has come under international scrutiny, as elevated detention rates reveal regulatory weaknesses. At Dar es Salaam Port, local research suggests that deficiencies in officer training and the availability of equipment pose significant obstacles. In response, the Tanzanian authorities have collaborated with global organizations such as the IMO to improve officer training and integrate modern inspection technologies, reflecting a strategic commitment to enhancing maritime safety and conforming to international standards.

Literature Review

Port State Control (PSC)

Port State Control (PSC) involves inspecting foreign ships in national ports to ensure that the vessels and their equipment comply with international regulations and are operated according to these standards (Paris MoU, 2019). PSC plays a vital role in promoting maritime safety, security, and environmental protection. Its primary goal is to identify and eliminate substandard ships from international waters, thereby enhancing overall maritime safety. This concept is essential for this study as it emphasizes the analysis of inspection practices and their effectiveness in improving ship safety at Dar es Salaam Port.

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Furthermore, PSC inspections are governed by various international agreements, such as the Paris and Tokyo Memoranda of Understanding (MoUs), which outline standardized procedures and guidelines for inspections. As noted in the Tokyo MoU (2020), PSC inspections involve reviewing certificates and documents, evaluating the vessel's overall condition, and ensuring compliance with safety standards. Effective PSC operations are crucial for maintaining high levels of safety and minimizing the risks of maritime accidents and environmental damage. This study examines how PSC inspections at Dar es Salaam Port contribute to enhancing ship safety by addressing risks associated with substandard vessels.

Ship Detention

Ship detention is a critical action taken by Port State Control officers when a vessel is found to have issues that may compromise safety, health, or the environment. Once a ship is detained, it cannot leave the port until the problems are resolved (Tokyo MoU, 2020). This measure ensures that only vessels meeting safety standards are allowed to operate, thereby reducing the likelihood of maritime accidents. In this study, ship detention serves as a key indicator of the effectiveness of PSC inspections at Dar es Salaam Port.

Detaining ships can lead to significant financial and operational challenges for ship owners and operators, as resolving the identified issues can be costly and time-consuming. A report by the Paris MoU (2019) highlights that the number of ship detentions is a critical measure for assessing the effectiveness of PSC systems. By examining how PSC inspections contribute to reducing ship detentions, this study aims to explore the connection between thorough inspections and enhanced ship safety. The findings provide valuable insights into how effective PSC practices can improve maritime safety and decrease the number of substandard vessels.

Training of Port State Control Officers

Training for Port State Control (PSC) officers is essential for effective PSC operations. Well-structured training programs equip PSC officers with the necessary knowledge and skills to conduct thorough inspections and identify safety issues (IMO, 2020). The training typically covers various aspects of maritime safety, including understanding international regulations, inspection techniques, and the use of modern inspection tools. This topic is relevant to the study as it investigates how the training of PSC officers at Dar es Salaam Port affects their ability to detect and address ship safety concerns.

The International Maritime Organization (IMO) has developed training modules and courses to ensure a consistent training process for PSC officers globally. According to the IMO (2020), well-trained PSC officers are more skilled at conducting inspections, resulting in better compliance with safety standards. This study assesses how the training of PSC officers impacts their capacity to identify ship safety issues, highlighting the importance of ongoing professional development to enhance maritime safety. The findings inform strategies aimed at improving training programs and increasing the overall effectiveness of PSC operations.

Advanced Inspection Technologies

Advanced inspection technologies utilize modern tools and methods to enhance the effectiveness and accuracy of Port State Control inspections. These technologies include non-destructive testing (NDT) techniques, drones, underwater inspection robots, and digital documentation systems (ABS, 2021). Incorporating these advanced technologies into PSC operations can significantly improve the identification of safety issues and streamline the inspection process. This concept is central to the study, which examines how these technologies can enhance ship safety at Dar es Salaam Port.

The push for advanced inspection technologies stems from the need to improve inspection accuracy and reduce inspection times. As highlighted by the American Bureau of Shipping (ABS, 2021), using drones for visual assessments and NDT methods for structural evaluations can provide detailed information about a vessel's condition without disrupting its operations. By investigating the effects of these technologies on PSC inspections, this study seeks to demonstrate how technological advances can promote improved safety standards and more efficient inspection processes. The findings offer valuable recommendations for leveraging technology to enhance maritime safety.

Theoretical Review

Theory of Planned Behavior (TPB)

The Theory of Planned Behavior (TPB), developed by Icek Ajzen in 1985, is a psychological framework aimed at explaining how individuals make decisions and behave. It identifies three primary factors that influence human actions: attitudes, subjective norms, and perceived behavioral control. In the context of Port State Control, TPB can illuminate how Port State Control officers conduct inspections. The officers' perceptions of safety regulations, their sense of social pressure to enforce these rules (subjective norms), and their belief in their ability to manage the inspection process (such as possessing adequate training and technology) all influence the outcomes of their inspections.

This theory is particularly relevant to study objectives, as it clarifies how these three factors shape the behavior of Port State Control officers and impact the effectiveness of ship safety inspections. For example, officers who feel confident in their training (perceived control) and recognize the importance of safety norms (subjective norms) are more likely to conduct thorough inspections, potentially resulting in fewer ship detentions and better identification of safety issues. The Theory of Planned Behavior provides valuable insights into the psychological and situational factors that affect PSC officers' decisions and actions, offering a framework to assess how training, technology, and regulatory standards contribute to enhancing ship safety.

Transaction Cost Economics (TCE) Theory

Founded by Ronald Coase in 1937 and later developed by Oliver iamson in the 1970s, Transaction Cost Economics

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(TCE) is a theory that explores the costs associated with trading goods or services in a market and how organizational structures can be designed to lower these expenses. Transaction cost theory (TCE) suggests that organizations, including port authorities and maritime operators, seek to minimize costs related to transactions, such as inspections, enforcement, and compliance.

In the context of Port State Control (PSC), this theory indicates that the effectiveness of PSC activities, including the efficiency of inspections and enforcement actions, can significantly reduce transaction costs, which include expenses from non-compliance, detentions, and accidents. Employing advanced inspection technologies and offering extensive training for officers are strategies that can help reduce the costs associated with mismanagement or inefficiency. This aligns with TCE's aim of decreasing operational inefficiencies and enhancing safety. For your research, TCE illustrates how improving PSC operations can lead to lower expenses related to ship detentions and improved compliance with safety regulations, ultimately enhancing port safety and operational efficiency.

Empirical Review

Studies from developed Countries

In developed countries, the emphasis on the effectiveness of Port State Control (PSC) is primarily due to their advanced infrastructure and robust regulatory systems that oversee maritime activities. Research by Zhu and Yang (2021) indicates that PSC inspections, particularly when enhanced by modern technology, can significantly reduce the number of ship accidents and detentions. These studies suggest that utilizing digital inspection tools and sharing real-time data between PSC officers and global maritime organizations improves the capacity to identify safety issues before they lead to accidents. For instance, automated risk assessment tools assist officers in pinpointing high-risk vessels, allowing them to focus inspections where they are most needed, and ultimately enhancing overall safety.

Furthermore, research by iams et al. (2020) emphasizes the importance of training for PSC officers in improving inspection quality. Well-trained officers can not only identify more safety issues but also make quicker and more accurate decisions during inspections, which helps decrease incidents and detentions. Their study in the UK demonstrated that ongoing, specialized training programs resulted in a more skilled workforce, leading to better compliance with international safety standards. This highlights the relationship between PSC officer training and the overall success of port inspections in ensuring maritime safety.

Bergstrom and Anderson (2019) investigated how Scandinavian countries employ risk-based inspection strategies, offering important insights for enhancing the efficiency of Port State Control (PSC) operations. Their study revealed that risk-based inspection systems, which assess ships based on their past compliance and other risk indicators, facilitate better resource allocation and more effective identification of vessels that may pose safety risks. By concentrating on high-risk ships, these strategies ensure that PSC efforts are directed where they are most essential, thereby improving both operational efficiency and maritime safety.

Research from developed nations demonstrates that integrating technological advancements, training, and risk-based inspection methods can significantly enhance PSC effectiveness. These insights are vital for steering the future of PSC operations globally, as they underline best practices that can be adopted by countries with varying levels of infrastructure and resources.

Studies from Developing Countries

Developing countries often face challenges with effective Port State Control operations compared to developed nations. This is primarily due to limited resources, outdated technology, and a shortage of properly trained staff. Research from countries like Vietnam and South Africa, including studies by Nguyen et al. (2020) and Dlamini and Ndlovu (2018), highlights the obstacles encountered by Port State Control officers in these regions. Nguyen et al. (2020) noted that while inspections in Vietnam contributed to improved ship safety, the lack of modern technology and ongoing training diminished the effectiveness of these efforts. The study indicated that although officers attempted to identify safety issues, their outdated methods and lack of resources restricted their ability to recognize complex safety concerns.

Similarly, Dlamini and Ndlovu (2018) found that even with international regulations in place, Port State Control operations in South Africa suffered from outdated technology and inadequate training for officers. Their research concluded that while officers followed standard procedures, the absence of modern diagnostic tools and specialized training in contemporary inspection methods resulted in safety gaps. The findings stressed the need for investment in technology and officer training to enhance operational efficiency and improve Port State Control performance.

A key issue highlighted in these studies is the challenge of limited resources, which affects the capacity of Port State Control (PSC) officers in developing countries to conduct thorough inspections. Both Nguyen et al. (2020) and Dlamini and Ndlovu (2018) suggest that enhancing the technological capabilities of PSC operations, such as using electronic documentation and automated inspection tools, could significantly improve the identification of safety issues. They believe that with better tools and training, officers in developing countries would be better equipped to meet international safety standards, resulting in fewer ship detentions and enhanced port safety.

These studies underscore the importance of making strategic investments in technology and personnel to increase the effectiveness of Port State Control operations. The results indicate that without these improvements, PSC officers struggle to detect safety risks and prevent maritime accidents.

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Local Studies in Tanzania

In Tanzania, research at Dar es Salaam Port has shown that while Port State Control (PSC) operations are generally effective at spotting safety issues, challenges remain in maximizing their impact on ship safety. Mushi (2022) studied how PSC inspections contribute to reducing ship detentions at the port. The study revealed that although inspections play a crucial role in identifying safety problems, inconsistent training for officers and outdated inspection tools undermine their effectiveness. Mushi noted that PSC officers often lack the necessary resources for thorough inspections, and the absence of advanced technologies, such as automated systems, limits their ability to quickly identify potential risks. The study concluded that regular training for officers and the adoption of modern technologies are essential for enhancing PSC operations.

Similarly, Mwita and Kanyama (2021) explored how officer training influences ship safety at Dar es Salaam Port. They found that officers who received adequate training were much more effective at identifying safety deficiencies, and the quality of their inspections correlated with fewer ship detentions. However, the study also identified shortcomings in the training programs available for PSC officers, suggesting that these programs should be expanded and updated to include new inspection methods and technological advancements. This finding highlighted the importance of training in enhancing the skills of PSC officers and ultimately improving ship safety at the port.

Recent research by Kessy (2023) examined how advanced inspection technologies are utilized at Dar es Salaam Port. The study found that the use of automated inspection systems and digital reporting tools helped to identify ship safety issues more quickly, resulting in fewer detentions. Technology also improved the accuracy of inspections, allowing officers to focus on critical safety elements that may have previously been overlooked. Kessy emphasized the necessity for increased investment in these technologies to fully enhance Port State Control (PSC) operations and improve safety at the port.

Local studies in Tanzania suggest that while PSC operations at Dar es Salaam Port have enhanced ship safety, challenges related to officer training, technology use, and resource allocation persist. The research indicates that addressing these issues is crucial for making PSC operations more effective and ensuring consistent ship safety.

Research Gap

Although Port State Control (PSC) operations are crucial for maritime safety, significant gaps remain in understanding their effectiveness, particularly at Dar es Salaam Port. Research, such as that from the Maritime Training Academy (2020), highlights the need for training programs for PSC officers; however, it doesn't clearly explain how these programs enable them to identify safety issues on ships. Also, while new inspection technologies are said to improve compliance and efficiency, studies such as Lams et al. (2020) and Zhu and Yang (2021) mainly look at their use in developed countries, leaving out how they affect developing ports like Tanzania

Training programs for Port State Control officers are usually created without considering the specific problems they encounter in developing regions. For example, the study by Bergström and Anderson (2019) stresses the importance of training, it doesn't tackle issues like limited resources, inconsistent methods, and the lack of advanced tools for hands-on training. This gap makes it difficult for PSC officers to conduct thorough inspections and effectively identify problems. To tackle this, the study looks at how training programs at Dar es Salaam Port can be improved, focusing on how well they meet industry needs and how advanced inspection technologies can be included. Recommendations include customized training modules, strategies for resource allocation, and initiatives to build capacity to make PSC officers more effective.

There are still big gaps in using advanced inspection technologies. Research like Lazakis et al. (2023) shows how helpful tools powered by AI and automated systems are in developed areas. However, we haven't looked into how these technologies can be used in developing maritime hubs. At Dar es Salaam Port, money issues and poor infrastructure make it hard to adopt these technologies, which limits their ability to enhance compliance and efficiency. This study explore how feasible it is to implement advanced inspection technologies, focusing on affordable solutions and ways to overcome obstacles. Suggestions include starting pilot programs, forming partnerships with tech providers, and making policy changes to support technology use.

Challenges faced by ship operators in adhering to international safety standards are often discussed without considering the unique socio-economic context of developing regions. For example, Zhu and Yang (2021) highlight general compliance issues but do not address specific barriers such as financial constraints, lack of awareness, and limited access to safety equipment. This study analyzes these challenges at Dar es Salaam Port, providing actionable solutions to improve compliance. Recommendations include financial support mechanisms, awareness campaigns, and capacity-building programs for ship operators. By addressing these gaps, the study aims to contribute to the development of a safer and more efficient maritime sector at Dar es Salaam Port.

Methodology

This study employed a descriptive research design combined with a mixed-methods approach, integrating both qualitative and quantitative data to assess the effectiveness of Port State Control (PSC) operations in improving ship safety at Dar es Salaam Port. The descriptive design enabled the examination of inspection processes, training programs, and the deployment of advanced inspection technologies, offering a clear understanding of their relationship with ship safety outcomes (James, 2020). Quantitative data were collected using structured questionnaires administered to a sample of 80 respondents chosen from a population of 100 maritime stakeholders using Yamane's formula. Participants included

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Port State Control Officers (PSCOs), ship operators, shipping officers, maritime safety regulators, and port operations officers, selected through a combination of purposive and stratified sampling to ensure representation and access to expert insights (Taherdoost, 2020; Bryman, 2019).

Data collection involved semi-structured interviews, structured questionnaires, and documentary review. The interviews, conducted with PSCOs and other port personnel, provided in-depth qualitative insights into operational challenges and regulatory practices (Kvale & Brinkmann, 2021). Structured questionnaires facilitated efficient quantitative analysis of inspection effectiveness and the impact of training and technology on safety outcomes (Creswell & Creswell, 2021). Secondary data were obtained from port records, compliance reports, training logs, and policy documents to triangulate findings and deepen contextual understanding (Bowen, 2019). Data analysis was performed using SPSS Version 28, applying descriptive statistics (frequency, and percentage), correlation, and multiple regression to examine the relationship between PSC variables and ship safety.

The regression model analyzed the effects of training, technology, and compliance issues on safety outcomes, represented by the equation: PSC Operations = β_0 + β_1 (Training) + β_2 (Inspection Technology) + β_3 (Compliance Challenges) + e.

To ensure validity and reliability, the study employed triangulation across data sources and piloted research instruments with 10 respondents to enhance clarity and consistency (Cohen & Morrison, 2020). Reliability was tested using Cronbach's alpha, confirming internal consistency of survey responses (James, 2023). Ethical standards were maintained throughout the research process. Informed consent was obtained from all participants, who were assured of confidentiality and their right to withdraw at any time. Anonymity was preserved, and data were stored securely in line with ethical research protocols. Ethical approval was obtained from relevant authorities to ensure compliance with academic and institutional standards (Silverman, 2021; Bryman, 2019).

Research Results

Validity Analysis

Table 1: KMO and Bartlett's Test for Validity

Test	Value
Kaiser-Meyer-Olkin (KMO)	0.781
Bartlett's Test of Sphericity	Chi-Square = 532.219; df = 120; Sig. = 0.000

Source: field data, 2025

The KMO value of 0.781 exceeds the threshold of 0.6, indicating that the sample size is sufficient for performing factor analysis (Field, 2020). Bartlett's Test of Sphericity is statistically significant ($p < 0.001$), suggesting that the correlations among the items are adequate for factor analysis. This supports the construct validity of the instrument, the extent to which it effectively measures its intended purpose.

The findings reinforce the idea that the items were logically categorized and organized around measurable constructs such as safety compliance, resource adequacy, and regulatory knowledge. These outcomes are consistent with the validation methods proposed by Hair et al. (2020), who highlighted the significance of correlation matrices in affirming multidimensional constructs in survey tools.

Subsequently, the measurement tool utilized in the research effectively captures pertinent dimensions of port state control operations and their influence on improving ship safety, ensuring its validity for subsequent inferential analysis.

Reliability Analysis

Table 2: Cronbach's Alpha for Each Construct

Construct	Cronbach's Alpha
Awareness of Regulations	0.812
Technological Adoption	0.785
Financial Resources	0.769
Compliance Monitoring	0.832
Overall Reliability	0.804

Source: field data, 2025

All Cronbach's alpha values exceed the accepted benchmark of 0.7, signifying a strong level of internal consistency among the items (Nunnally & Bernstein, 2021). The overall reliability score of 0.804 indicates that the survey tool was reliable across various dimensions. These results align with the conclusions of Jabeen et al. (2021), who suggested that well-designed Likert-scale items focused on safety compliance and regulatory performance frequently yield alphas within the 0.75–0.85 range. The elevated reliability increases confidence in the consistency of responses across different constructs. The internal reliability of the instrument supports its suitability for hypothesis testing and additional statistical analyses, particularly regression and ANOVA, as it ensures measurement accuracy

Regression Analysis

Table 3: Regression Model Summary

Model	R	R^2	Adjusted R^2	Std. Error
1	0.812	0.659	0.635	0.429

Source: field data, 2025

Table 4: Regression Coefficients

Predictor	B	Std. Error	Beta	t	Sig.
(Constant)	1.345	0.321	—	4.189	0.000
Regulation	0.428	0.087	0.372	4.919	0.000

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Awareness					
Technological Adoption	0.313	0.092	0.278	3.402	0.001
Financial Support	0.259	0.104	0.218	2.490	0.016
Monitoring and Compliance Practices	0.366	0.093	0.311	3.935	0.000

Source: field data, 2025

The R^2 value of 0.659 from Table 2, shows that 65.9% of the variability in ship safety improvement can be attributed to the four predictors. Each independent variable significantly positively influences the dependent variable ($p < 0.05$), consistent with the findings of Yildiz et al. (2022), who demonstrated a robust connection between regulatory enforcement and maritime safety results. This model highlights that enhancing regulatory awareness, utilizing technology, securing financial backing, and implementing effective compliance monitoring are vital for boosting ship safety at ports. These results underscore the importance of port state control activities in reducing marine hazards, as also pointed out by Kim & Woo (2023) in their examination of East Asian ports. When these predictors are successfully combined, they establish the foundation for risk prevention in maritime logistics, leading to better operational safety and a stronger compliance culture.

ANOVA Analysis

Table 5: ANOVA Table

Source	Sum of Squares	df	Mean Square	F	Sig.
Regression	19.488	4	4.872	26.528	0.000
Residual	10.112	55	0.184		
Total	29.600	59			

Source: field data, 2025

The F-statistic (26.528) with a significance level of 0.000 indicates that the regression model is statistically significant. In other words, the interplay of regulation awareness, technology implementation, financial assistance, and compliance monitoring serves as a significant predictor of improvements in ship safety. The elevated F-value reinforces the conclusions drawn by O'Brien et al. (2021), who highlighted the combined effects of administrative, operational, and financial structures on maritime compliance. These findings further imply that improvements in policy and investments in port inspection systems have a direct impact on regulatory performance and the safety of vessels. Therefore, the ANOVA supports the idea that various factors collectively influence ship safety and port compliance levels, confirming the need for a multidimensional approach to effective port state control.

The results of this research indicate that failure to adhere to maritime safety and regulatory standards significantly impairs operational efficiency within port and shipping activities. As shown in Table 15, an aggregate of 90% of respondents consisting of 37.5% who strongly concurred and 52.5% who agreed, recognized that non-compliance with essential regulations causes interruptions in operational flow. This substantial level of consensus illustrates the real-world difficulties posed by non-compliance, such as vessel detentions, cargo clearance delays, and the necessity for re-inspections. These consequences result in extended turnaround times, heightened operational costs, and diminished competitiveness. This conclusion is strongly corroborated by Nguyen et al. (2021), who highlighted that failing to comply with international maritime safety standards raises the chances of port congestion and ship queuing, particularly in developing nations with insufficient inspection infrastructure. Likewise, Agyekum-Mensah & Knight (2020) discovered that ports plagued by frequent non-compliance problems achieved lower throughput efficiency and longer average cargo dwell times.

Furthermore, Chircop et al. (2022) remarked that adherence to IMO regulations such as MARPOL, SOLAS, and ISM Code significantly aids in ensuring smoother vessel operations, especially in intricate international trade settings. The current study aligns with this perspective, indicating that enhancing compliance mechanisms not only guarantees safety but also improves workflow predictability and service delivery. Insights from interviews in this study also underscored that human factors, like inadequate crew training and a lack of awareness regarding compliance responsibilities, are major obstacles to achieving full compliance, an issue similarly reported by FasterCapital (2023) and CHIRP Maritime (2024). These publications noted that insufficient safety training and certification issues among crews often lead to violations that delay ship clearance.

Table 6: Financial Constraints Are a Significant Barrier

Response	Frequency (f)	Percentage (%)
Strongly Agree	38	63.3
Agree	16	26.7
Neutral	4	6.7
Disagree	1	1.7
Strongly Disagree	1	1.7
Total	**60**	**100**

Source: field data, 2025

90% of those surveyed believe that financial constraints significantly hinder the operations of Port State Control (PSC) and compliance with maritime safety regulations. This aligns with the findings of Massami et al. (2024), who observed that a lack of investment in integrated IT systems, berth facilities, and handling equipment largely contributes to delays at Dar es

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Salaam Port. The strong agreement among respondents underscores the urgent need to tackle funding shortfalls to improve operational efficiency. Financial limitations affect the acquisition of modern inspection technologies, maintenance of equipment, and the availability of ongoing training programs. According to the TPA Port Handbook (2019), outdated cargo handling infrastructure and subpar ICT systems have led to increased vessel dwell times and elevated freight costs. These inefficiencies directly impact compliance with international safety regulations like SOLAS and MARPOL.

Insights gained from interviews indicated that budgetary constraints postpone the procurement of safety equipment, restrict access to simulation-based training, and limit the modernization of inspection tools. Officers noted that reliance on donor-funded initiatives and unpredictable budget allocations poses compliances issues to sustainable PSC operations. This corresponds with findings from Marsh (2023), which highlight the importance of strategic public-private partnerships to mitigate capital shortages in port infrastructure. Interviewees suggested establishing a dedicated maritime safety fund, encouraging investment from the private sector, and integrating PSC budgeting into national transport strategies. They also advised promoting regional collaboration through the Central Corridor Transit Transport Facilitation Agency (CCTTFA) to pool resources and align inspection standards. These suggestions are in line with the Port Reform Toolkit (PPIAF, 2023), which emphasizes the necessity of fair risk-sharing between public authorities and terminal operators.

Table 7: Lack of Safety Regulation Awareness Contributes to Non-Compliance

Response	Frequency (f)	Percentage (%)
Strongly Agree	36	60.0
Agree	18	30.0
Neutral	4	6.7
Disagree	1	1.7
Strongly Disagree	1	1.7
Total	**60**	**100**

Source: field data, 2025

A total of 90% of participants agree that a lack of awareness regarding safety regulations leads to non-compliance. This finding supports the study's third objective and coincides with the work of Mišković & Wang (2025), who determined that 58.4% of maritime accidents in the EU were linked to human factors, including inadequate regulatory awareness. At Dar es Salaam Port, this deficiency may arise from insufficient dissemination of IMO conventions such as SOLAS, MARPOL, and the ISM Code. The high level of agreement points to systemic problems in regulatory communication and crew training. CHIRP Maritime (2025) reported that unsafe practices and procedural deficiencies, such as not updating passage plans or monitoring radar, were associated with poor awareness and training. This indicates that awareness initiatives and onboard safety briefings are essential for cultivating a culture of compliance. Interview Insights Respondents observed that junior officers frequently lacked confidence in interpreting safety protocols and were reluctant to voice concerns. This correlates with the findings from FasterCapital (2023), which highlighted that administrative compliance cannot hide operational risks. Officers suggested incorporating IMO Model Courses and scenario-based education into PSC training to address the awareness gap. Strategic Recommendations Interviewees recommended compulsory induction programs for all port users, periodic refresher courses, and visual safety dashboards that exhibit important regulatory updates. They also supported the use of multilingual safety materials and mobile learning platforms to cater to diverse crews. These approaches are in line with the ISM Code's focus on continuous enhancement and structured safety management systems.

Table 8: Non-Compliance Reduces Overall Operational Efficiency of PSC

Response	Frequency	Percentage (%)
Strongly Agree	32	53.3
Agree	22	36.7
Neutral	4	6.7
Disagree	1	1.7
Strongly Disagree	1	1.7
Total	**60**	**100**

Source: field data, 2025

A total of 90% of those surveyed agree that non-compliance hurts operational efficiency. This finding supports the study's third objective and is consistent with FasterCapital (2023), which highlights that non-compliance results in vessel detentions, delays, and damage to reputation. At Dar es Salaam Port, failing to comply with SOLAS, MARPOL, and ISM Code standards has led to longer inspection durations and decreased throughput. Non-compliance frequently initiates corrective measures, re-inspections, and administrative fines, which disrupt the flow of cargo and elevate operational expenses. Kajuna (2024) noted that Dar es Salaam Port experiences extended dwell times and congestion due to inconsistent adherence to safety regulations. These inefficiencies diminish the port's competitiveness and impact regional trade routes. During interviews, officers provided examples of vessels being detained for expired safety certificates, improper stowage of hazardous materials, and insufficient crew training. Such delays not only hinder the vessels but also disrupt terminal operations and logistics to the hinterland. Orcades Marine (2024) states that compliance fosters stakeholder confidence and operational predictability, which are crucial for effective port operations. Respondents suggested the implementation of automated systems for tracking compliance, performing regular internal audits, and

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incorporating compliance KPIs into performance dashboards. They also advocated for the alignment of inspection procedures with regional MoUs to minimize redundancy and enhance efficiency. These approaches are in line with the HSSEQ Module by VoyageX AI, which has demonstrated a 20% reduction in inspection-related non-conformities.

Table 9: Compliances issues Faced by Ship Operators in adhering to international safety standards

Compliances Issues	Frequency (f)	Percentage (%)
Insufficient resources	16	26.7
Technological limitations onboard	15	25.0
Diverse international standards	13	21.7
High compliance costs	6	10.0
Crew training and skill gaps	4	6.7
Cyber security threats	3	5.0
Human error and complacency	3	5.0
Total	**60**	**100**

Source: field data, 2025

Resource and Technology Constraints Are Predominant; the leading two issues, inadequate resources (26.7%) and technological limitations onboard (25%), highlight fundamental obstacles to compliance and operational effectiveness. Kajuna (2024) discovered that outdated onboard systems and restricted access to advanced inspection tools impede safety compliance at Dar es Salaam Port. These limitations impact vessel readiness for Port State Control (PSC) inspections and cause delays in cargo operations.

Regulatory Complexity and Financial Strain Varied international regulations (21.7%) and elevated compliance expenses (10%) illustrate the compliances issues of navigating IMO conventions, flag state mandates, and regional MoUs. Massami et al. (2024) pointed out that disjointed regulatory structures and expensive retrofitting needs (such as ballast water treatment systems) place a heavy burden on operators, particularly those operating across multiple jurisdictions. This intricacy can result in non-compliance and heightened risks of detention.

Human Factors and Cybersecurity Vulnerabilities Gaps in crew training (6.7%), cybersecurity threats (5%), and human error (5%) highlight the necessity for a comprehensive safety management approach. Owout & Meli (2023) observed that Dar es Salaam Port is affected by inconsistent training and inadequate digital proficiency among crew members, which heightens the risk of cyberattacks and operational errors. These conclusions are consistent with findings from CHIRP Maritime (2025), which identified fatigue and subpar decision-making as major factors in maritime accidents.

Insights from Interviews and Strategic Suggestions Ship operators who were interviewed emphasized the importance of unified training that aligns with IMO Model Courses, financially supported compliance initiatives, and assistance for onboard digitalization. They advocated for regional standardization via the Central Corridor Transit Transport Facilitation Agency (CCTTFA) and investment in crew skills enhancement. These suggestions correspond with the Safety Management Systems (SMS) framework under the ISM Code, which stresses the importance of ongoing improvement and risk management.

The findings emphasize the essential role of compliance as a facilitator of operational efficiency in maritime logistics. The strong alignment between this research and contemporary literature highlights the necessity for enhanced training, digital compliance monitoring tools, and proactive enforcement strategies to alleviate the risks and inefficiencies linked to non-compliance.

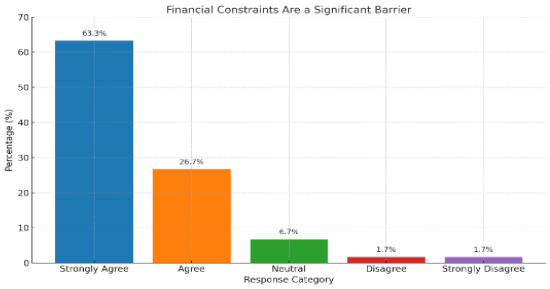

Figure 4.1: Financial constraints are a significant barrier

Source field data, 2025

From **Figure** 4.1 **90%** identify financial constraints as significant.

Financial Constraint Recognition (FCR) = $\frac{38+16}{60}$ ×100% = 90%

Budget constraints significantly affect the capacity to acquire, sustain, and enhance inspection technology and training initiatives. This is consistent with the findings of Massami et al. (2024) and Marsh (2023), who associate a lack of funding with operational inefficiencies. To gauge the effect, one could create a model.

Operational Efficiency = f (Technology Availability, Training Quality, Financial Investment)

Where insufficient financial investment reduces technology availability and training quality, leading to lowered operational efficiency.

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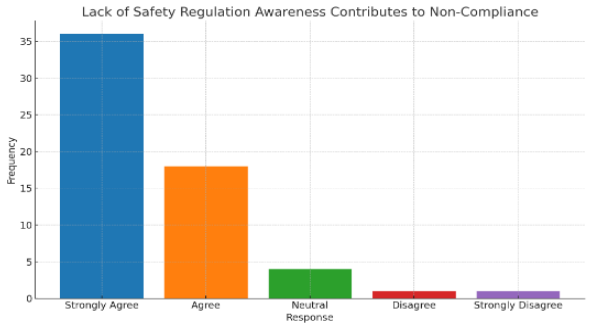

Figure 4.2: Lack of Safety Regulation Awareness Contributes to Non-Compliance

Source field data, 2025

90% agree that lack of safety regulation awareness contributes to non-compliance (Figure 4.2).

Awareness Deficit Impact (ADI) = $\frac{36+18}{60}$ x 100% = 90%

This observation emphasizes the importance of the human aspect in compliance. Even if officers are well-equipped, a lack of regulatory awareness can lead to ineffective enforcement of standards. This aligns with the findings of Mišković & Wang (2024), who connected maritime incidents to human factors and insufficient awareness. It points to the necessity for continuous education and training based on real-life scenarios to enhance both confidence and competence, as also indicated by the interviewees.

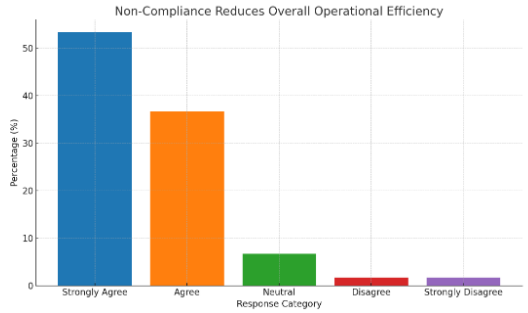

Figure 4.3: Non-Compliance Reduces Overall Operational Efficiency

Source field data, 2025.

From **Figure 4.3**, **90%** agree that non-compliance negatively affects efficiency.

Noncompliance Impact Rate (NCIR) = $\frac{32+22}{60}$ x 100% = 90%

Non-compliance leads to detentions, delays, and fines, confirmed by FasterCapital (2023) and Kajuna (2024). These inefficiencies degrade port throughput and increase costs, as reflected in extended vessel dwell times. Implementing automated compliance tracking and KPIs can mitigate these losses and improve operational predictability. The survey results indicate that a substantial 90% of participants concur that violating safety regulations adversely impacts operational efficiency. This strong agreement highlights that compliance is not just a bureaucratic necessity but a key factor for smooth and effective maritime operations. Failing to comply can result in severe repercussions such as vessel detentions, additional inspections, and the enforcement of administrative penalties.

Conclusions

This research focused on evaluating the significant factors affecting ship safety compliance at Dar es Salaam Port, particularly emphasizing the importance of training programs for Port State Control (PSC) officers, the effects of advanced inspection technologies, and the difficulties faced by ship operators in following international safety regulations. The study employed both primary and secondary data, integrating viewpoints from maritime safety officials, ship operators, and regulatory bodies. The results offer valuable insights that correspond with the objectives of the study and point out opportunities for policy and operational enhancement. Assessing the influence of training initiatives for PSC officers, the results confirm that capacity-building initiatives have greatly enhanced the officers' abilities to identify safety shortcomings in visiting vessels. Participants noted that consistent and focused training on International Maritime Organization (IMO) standards, inspection methods, and emerging risk factors have empowered officers to perform more comprehensive and effective inspections of ships. These training programs have led to a marked increase in compliance levels among vessels arriving at the port, decreasing the frequency of detentions and safety incidents.

Furthermore, the study showed that well-trained PSC officers are more skilled at applying inspection protocols such as the Paris MoU and Tokyo MoU frameworks. This expertise has bolstered the credibility and effectiveness of inspection processes at Dar es Salaam Port, promoting alignment with global practices and ensuring that Tanzania's maritime safety oversight adheres to international standards. The findings suggest that advanced inspection technologies have influenced ship safety compliance and operational efficiency. Specifically, tools like handheld electronic checklists, thermal imaging systems, and digital documentation platforms have optimized the inspection process. These technologies enhance the speed and precision of inspections while decreasing human error and subjectivity in evaluations. By incorporating advanced technologies into safety inspections, Dar es Salaam Port has been able to reduce vessel turnaround times and improve overall port efficiency. The study also identified that the digital tracking of deficiencies and compliance records aids in the early detection of recurrent violations, enabling timely corrective actions. These advancements contribute to a safer port environment and facilitate the quicker movement of goods, essential for boosting Tanzania's trade competitiveness.

The study highlighted several ongoing challenges, including insufficient funding for safety enhancements, limited awareness of changing international regulations, inadequate crew training, and delays in obtaining updated safety equipment. Many operators indicated that financial and logistical challenges often hinder timely maintenance,

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retrofitting, and updates to safety documentation, leading to increased risks of non-compliance. Moreover, the research pointed out inconsistencies in enforcement and regulatory communication as contributing factors. Some ship operators view inspection procedures as inconsistent or excessively punitive, resulting in reluctance or attempts to circumvent compliance obligations. Such issues not only impact safety compliance but also present reputational and operational risks for the entire port system.

The results support the notion that enhancing maritime safety at Dar es Salaam Port necessitates a multifaceted approach that includes strengthening PSC officer skills, broadening technological integration, and tackling systemic issues faced by ship operators. The relationship between human resource development and technological innovation is particularly vital for sustaining lasting advancements in ship safety compliance. This research also adds to the existing literature by reinforcing post-2020 evidence that underscores the essential role of port inspections and digital tools in advancing maritime safety. Other researchers, like Nnaji (2022) and Lwendo & Mwakyembe (2023), have similarly highlighted the increasing importance of automation, data sharing, and skilled personnel in transforming port safety outcomes throughout sub-Saharan Africa. Ultimately, this study effectively achieved its objectives by identifying crucial factors that influence ship safety at Dar es Salaam Port. Improved training for PSC officers and the implementation of inspection technologies have resulted in noticeable advancements in compliance and efficiency. However, the structural and operational challenges confronting ship operators must be resolved through policy reforms, collaboration among stakeholders, and strategic investments. Such efforts not only promote safer maritime operations but also enhance Tanzania's position in regional and international trade.

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