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Analysis to Reduce Ship Accidents in Indonesia through the Ship Safety Management and Regulatory Compliance Approach

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Abstract: This study examines the implementation of ship safety management in Indonesia, identifies the factors contributing to ship accidents, and evaluates the effectiveness of existing maritime safety regulations. Using a qualitative approach through in-depth interviews, field observations, and document analysis, the research aims to formulate strategic recommendations to improve maritime safety in Indonesian waters. The findings indicate a gap between regulations and their implementation, inadequate training, and challenges in law enforcement. The proposed recommendations include enhancing training programs, strengthening supervision, and adopting the latest safety technologies.

Keywords: Safety Management, Maritime, IMO, Regulations

INTRODUCTION

The international maritime industry plays a key role in global sustainability by supporting world trade and facilitating the global economy (Benamara et al., 2019). According to Kurniawan et al., (2023) maritime transportation holds a vital role in daily life due to its relatively low operational costs compared to other modes of transport. The significance of maritime transport to society is inseparable from the high frequency of ship operations. However, the high intensity of maritime traffic also poses an increased risk of ship accidents. Ship accidents refer to incidents involving vessels that may endanger the safety of the ship itself or the people on board, such as ship sinking, fires, collisions between ships, or ships running aground. According to data from the National Transportation Safety Committee (KNKT, 2023), over the past two years, there have been nearly nine ship accidents in Indonesia, as shown in Table 1.

Table 1 List of Indonesian Ship Accidents 2022-2023

Vessel Names	Type of Vessel	Types of Accidents	Accident Classification
Sabuk Nusantara 96	Passenger	Collision	Less Serious Casualties
Permata Asia	General Cargo	Sinked	VSMC
Trisila Bhakti II;Gerbang Samudra 2	Ro-Ro Passenger;Ro-Ro Passenger	Collision	Less Serious Casualties
Ladang Pertiwi 02	Fishing vessel	Sinked	VSMC
Cahaya Arafah	Passenger	Sinked	VSMC
Teman Niaga	General Cargo	Sinked	VSMC
Satya Kencana III	Ro-Ro Passenger	Sinked	Serious Casualties
Young Yong	Tanker	Collision	Serious Casualties
Evelyn Calisca 01	Passenger	Sinked	VSMC

Source: Created by author based on KNKT 2024

Statistical data reveals that half of all maritime accidents are caused by human error. This includes management errors, such as improper ship operation or deliberate overloading, as well as the limited ability of crew members to perform their duties and address various issues that arise while working on board (Sánchez-Beaskoetxea et al., 2021).

Indonesia, as the largest archipelagic country in the world, relies heavily on maritime transportation for connectivity and economic growth. However, the high rate of ship accidents in Indonesian waters has become a serious concern in recent years. According to data from the National Transportation Safety Committee (KNKT), there has been an average of 15 ship accidents per year between 2019 and 2023, resulting in hundreds of casualties (KNKT, 2024).

The importance of safety management and compliance with regulations has become increasingly crucial, given the vital role of the maritime sector in the national economy. The effective implementation of the International Safety Management (ISM) Code and other national regulations is key to reducing the risk of accidents and enhancing maritime safety. Therefore, based on the issues outlined above, the author aims to conduct research on " Analysis to Reduce Ship Accidents in Indonesia through the Ship Safety Management and Regulatory Compliance Approach."

Literature review

Ship Safety Management

Ship safety management is a crucial aspect of vessel operations. The International Safety Management (ISM) Code, adopted by the International Maritime Organization (IMO), sets international standards for the safe operation of ships and the prevention of pollution (Sagala, 2021). Safety management refers to the organizational actions implemented to ensure that an acceptable level of safety is maintained throughout the entire lifecycle of an installation. In the maritime context, this pertains to the operational lifespan of a vessel. Comprehensive safety management encompasses the full spectrum of managerial processes, which consist of planning, organizing, directing, motivating, and controlling. Embedded within these processes are crucial elements such as decision-making, strategic planning, communication, and performance assessment (Amanyire, 2007).

ISM Code

According to (Saputra, 2023) The International Safety Management (ISM) Code was created to ensure the safety of ships at sea, prevent human accidents or loss of life, and avoid damage to the maritime environment and property. In this regard, companies are required to establish a safety management system with the following objectives:

a. Prepare practical and safe working procedures for ship operations and ensure a safe working environment.
b. Establish procedures to safeguard against all potential risks.
c. Continuously improve safety management capabilities for both onshore and offshore personnel, including preparedness for emergency situations related to safety and environmental protection.

According to Khomeiny et al., (2019) The International Maritime Organization (IMO) introduced the new ISM Code as a tool to standardize the "Safe Management and Operation of Ships for Pollution Prevention." It is widely recognized that the ISM Code essentially involves the written and documented implementation of all operational procedures, both onshore and onboard ships, in an integrated manner with the primary goal of ensuring safety and protecting the marine environment. The role of the ISM Code within shipping companies is to monitor various aspects related to safety and environmental protection during ship operations, thereby ensuring optimal compliance with international standards. In ship operations, the competence, expertise, and skills of crew members are also essential in dealing with any potential situations that may arise while onboard.

Ship Safety Regulations

In Indonesia, ship safety regulations are governed by Law Number 17 of 2008 on Shipping and its various derivative regulations. However, Nurwahyudy (2014) identified a gap between regulation and field implementation, which contributes to the high number of maritime accidents.

The objectives of maritime navigation can be clearly defined based on its purposes, which include providing defense and security protection for the nation and its people, as well as fostering the country's economic development. The requirements outlined in Law Number 17 of 2008 concerning Shipping can be extended to cover all operations of sea transportation, ports, and safety, as well as the protection of maritime navigation and the preservation of Indonesia's marine environment (Pramesti et al., 2021).

METHOD

This study employs a qualitative approach to gain an in-depth understanding of the implementation of ship safety management in Indonesia. This method was chosen for its ability to explore the complexities of the issues and reveal diverse perspectives from stakeholders.

Data Collection Techniques

a. In-depth Interviews: Conducted with 5 key informants, including officials from Regulators, KNKT, and maritime safety experts.
b. The FGD in this study will involve 2 respondents from four main groups: maritime regulators, KNKT (National Transportation Safety Committee), experts or academics, and representatives from the shipping industry. Respondents are selected based on a minimum of experience and strategic positions to ensure relevant insights. Maritime regulators (1 people), such as officials from the Directorate General of Sea Transportation, will provide policy perspectives, KNKT (2 people) will contribute insights related to accident investigations and incident prevention. Experts dan Industry player related to maritime safety.
c. Document Analysis: Involves reviewing safety audit reports, accident investigation reports, and related regulatory documents.

Data Analysis Techniques

In this study, the data analysis technique employs the interactive model by Miles and Huberman which consists of three main components: data reduction, data presentation, and conclusion drawing/verification. This analysis process is reinforced by using triangulation techniques to enhance the validity and reliability of the research findings (Agustini et al., 2023).

RESULTS AND DISCUSSION

Based on the data analysis conducted using the Miles and Huberman model and triangulation, this study produces comprehensive findings regarding the implementation of ship safety management in Indonesia.

Ship Accident in Indonesia

Based on the number of shipping accident cases that occurred over approximately 10 years until December 2023, around 185 cases were recorded with the following details:

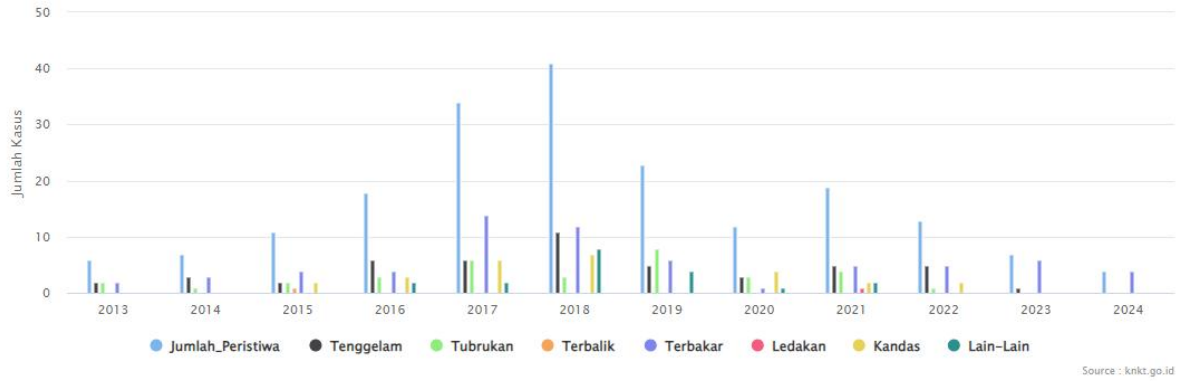

Fig. 1. Type Of Incident investigated by KNKT 2024

The data presented highlights a series of ship accidents that occurred between 2013 and 2024. These include incidents such as sunken ships, depicted in a black diagram; burning ships, shown in pink; collisions, represented in green; and ships running aground, marked in yellow. Other causes are displayed with a turquoise green diagram. The trend for burning ship accidents appears notably volatile, with a significant increase observed between 2017 and 2018. Although the other categories, such as ship sinking and the rest, also exhibit fluctuations, the spikes in these cases are less pronounced and generally consistent across categories.

Number of Maritime Accident Victims Investigated by KNKT

One of the primary concerns in shipping accidents is the loss of life. Referring to the five categories of ship accidents mentioned earlier, the following data provides information on the fatalities associated with each category:

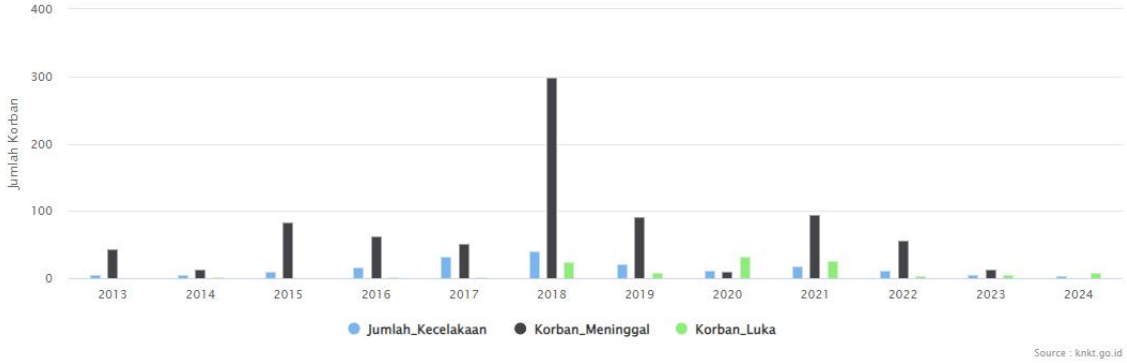

Fig. 2. Number of Maritime Accident Victims Investigated by KNKT

The data on accident victims is divided into two categories: fatalities and injuries. In 2018, ship accidents resulted in the highest number of fatalities, with 299 recorded deaths. In contrast, 2020 saw the lowest number of fatalities, with 11 deaths; However, 2020 also had the highest number of injured victims, with 33 people sustaining injuries. This indicates that while fatalities were low in 2020, it had the highest rate of injuries. Conversely, in 2013 & 2015, accidents resulting in injuries were minimal, with only two people affected. Overall, the trend shows that 2018 had the highest number of fatalities.

Recomendations by KNKT Preventive Measures for Shipping Safety

Preventive measures are implemented to ensure that risk management in shipping accidents can be effectively controlled. Key factors in risk management include the proper functioning of the supervision and control system, the utilization of facilities and infrastructure, and the enforcement of relevant regulations. According to the KNKT (2024) investigation, shipping accidents in Indonesia were attributed to four main factors: deficiencies in supervision and control, inadequate facilities and infrastructure, and violations of existing regulations. The following are the findings reported by the KNKT:

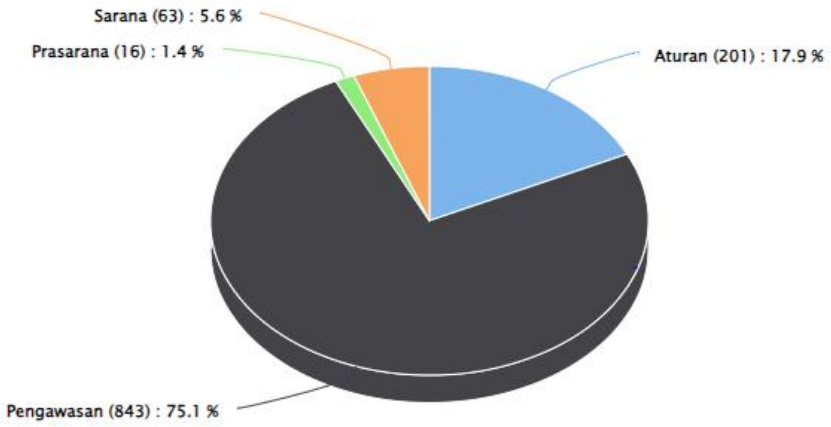

Fig. 3. Preventive Measures for Shipping Safety

In an effort to enhance maritime safety in Indonesia, the National Transportation Safety Committee (KNKT) has issued a series of recommendations that reflect a comprehensive approach to preventing ship accidents. These recommendations highlight critical aspects of the maritime industry, with a significant emphasis on the role of oversight.
Supervision stands as the primary focus of the KNKT's recommendations, accounting for 75% of the total suggestions. This indicates that the KNKT views oversight as a key factor in ensuring safety at sea. The emphasis on supervision likely includes enhancing ship safety inspections, closely monitoring operational procedures, and overseeing the qualifications and performance of the crew. The substantial percentage also suggests that human factors are considered the most crucial element in preventing ship accidents.

The next significant aspect addressed is regulations, comprising 17.9% of the total recommendations. This underscores the importance of a robust and effective regulatory framework to support maritime safety. The KNKT likely sees a need to update or strengthen existing regulations, improve the standardization of safety procedures, and enforce stricter penalties for safety violations. This notable proportion reflects the urgency to fortify the existing regulatory framework, including more effective implementation of international standards such as the ISM Code (International Safety Management Code) and various IMO (International Maritime Organization) regulations.

The KNKT’s regulatory recommendations may also relate to efforts in harmonizing national regulations with broader IMO standards. The IMO has established various

conventions and regulations covering critical aspects of maritime safety, including SOLAS (Safety of Life at Sea), MARPOL (for pollution prevention), STCW (for standards of training and certification for seafarers), and many others. The KNKT's focus on regulation may reflect the need to ensure that Indonesia's legal and regulatory framework is fully aligned with these international standards.

Although accounting for smaller percentages, the KNKT also addresses the aspects of facilities and infrastructure, at 5.6% and 1.4%, respectively. Recommendations related to facilities may involve upgrading navigation and communication technologies on ships, as well as renewing safety equipment. Meanwhile, infrastructure recommendations could include improving port facilities and developing supporting infrastructure for maritime safety.

This distribution of recommendations reflects a balanced yet focused approach by the KNKT. While supervision is the top priority, the committee also recognizes the importance of improvements across all areas to establish a comprehensive and effective maritime safety system.

Recommendations outlined by the International Safety Management (ISM) Code and the International Maritime Organization (IMO)

Equally important is the emphasis on training and competence development for all crew members and shore personnel. The ISM Code mandates that all staff understand their roles within the SMS and are capable of executing emergency procedures. Regular training sessions and simulation drills are essential to ensure that the crew is well-prepared for any potential emergencies. Research by Maritime & Coastguard Agency, (2015) indicates that continuous professional development significantly enhances crew competence, ultimately reducing the likelihood of human error—a primary factor in maritime incidents

To maintain high safety standards, companies must ensure rigorous documentation and compliance audits. This involves obtaining a Document of Compliance (DOC) for the company and a Safety Management Certificate (SMC) for each vessel. These certificates confirm that the SMS is effectively implemented. Regular audits play a crucial role in identifying compliance gaps and areas for improvement, ensuring adherence to both ISM Code and IMO regulations. As noted by (Baig et al., 2024), the continuous assessment of compliance is vital for fostering accountability and enhancing safety performance in the maritime industryk Assessment and Incident Investigation

The establishment of a robust culture of risk assessment and incident investigation is another critical strategy. Shipping companies should encourage the reporting of near misses and incidents without fear of retribution. Investigating these occurrences allows for root cause analysis, enabling organizations to implement corrective measures to prevent future incidents. The work of Hasanspahić et al., (2020) underscores the importance of learning from near-miss reports as a proactive measure in risk management .

Implementation of Ship Safety Management

The research results indicate that the implementation of the ship safety management system in Indonesia still faces various complex challenges. Some key findings include:

Gaps in Understanding and Implementation of the ISM Code

The analysis of interviews and field observations revealed a significant gap in the understanding and implementation of the International Safety Management (ISM) Code between regulators and ship operators. This finding aligns with the studies of (Istanto, 2019); (Batalden & Sydnes, (2014) and Batalden & Sydnes (2014), which identified differences in the interpretation of the ISM Code across various countries, including developing nations.

Human Resource Limitations

The issue of quality education ranks fourth among the primary goals of sustainable development worldwide (Voloshynov et al., 2022). Within the realm of seafarer competencies, there exists a skills gap in addressing the challenges of modernization (Meštrović et al., 2024).

This research finds that many shipping companies, particularly small and medium-sized enterprises, face resource limitations in comprehensively implementing safety management systems. This is consistent with the study by Bhattacharya (2012) which indicates that resource constraints often serve as a major barrier to the implementation of the ISM Code in developing countries.

In Indonesia, there remains a significant gap between the competencies possessed by seafarers and the international standards required by the modern maritime industry. This results in Indonesian seafarers often being inadequately prepared to face technological and operational challenges aboard modern vessels, which, in turn, can increase the risk of accidents (Ivan Potto, Sudjanadi Tjipto Sudarmo, Sri Handayani, Yana Tatiana, 2022).

Causes of Maritime Accidents

An analysis of accident investigation reports and interviews with experts has revealed several key factors contributing to maritime accidents in Indonesia:

Human Factors

Human error emerged as the dominant factor in 65% of the analyzed accident cases. This includes navigational errors, crew fatigue, and a lack of adequate training. These findings are consistent with a global study conducted by Allianz Global Corporate & Specialty (2022), which reported that human factors contribute to 85% of maritime accidents worldwide.

Technical Factors

Document analysis indicates that 30% of maritime accidents are caused by technical factors, particularly inadequate vessel maintenance and equipment failure. This aligns with the findings of (Pristrom et al., 2016) who identified poor maintenance as a significant risk factor in maritime safety.

Environmental Factors

Environmental factors, such as adverse weather conditions and challenging waterway conditions, contributed to 20% of the analyzed accidents. However, further analysis revealed that in many cases, the impact of environmental factors was exacerbated by crew unpreparedness or poor navigational decisions.

A study by Kurniawan et al., (2023) on the impact of climate change on maritime safety supports these findings, emphasizing the importance of improving weather prediction systems and crew training to cope with increasingly unpredictable environmental condition.

CONCLUSION

The conclusions drawn from this information indicate that the National Transportation Safety Committee (KNKT) places supervision as a primary aspect in enhancing maritime safety in Indonesia, with 75% of total recommendations related to oversight. This underscores the importance of vessel inspections, monitoring operational procedures, and assessing the qualifications and performance of crews in preventing maritime accidents.

Additionally, regulations also play a crucial role, with 17.9% of recommendations emphasizing the need to strengthen the regulatory framework and align national standards with international standards, such as the ISM Code and IMO regulations. Recommendations

concerning facilities and infrastructure, although smaller in proportion, are still regarded as vital for updating navigation technology, communication systems, safety equipment, and enhancing port infrastructure.

This distribution reflects KNKT's comprehensive approach to creating an effective maritime safety system in Indonesia.

Based on the findings of this research, it can be concluded that a holistic approach is needed to enhance maritime safety in Indonesia. This approach must involve the harmonization of regulations with international standards, increased investment in safety technology and infrastructure, as well as strengthening the oversight system and enforcement of safety standards.

Implications

The findings underscore the need for enhanced maritime safety policies through better regulatory oversight and harmonization. Training programs for seafarers should be revised to address competency gaps, particularly in human factors linked to accidents. Shipping companies may need to improve their safety management systems, while increased investment in safety technologies, such as ship design and navigation systems, is crucial. International collaboration and alignment with global standards, like the ISM Code, can further strengthen maritime safety. Future research could explore comparative studies, assess the long-term impact of safety interventions, and evaluate economic benefits by reducing accident costs and boosting the maritime industry's efficiency.

Research limitations

This study is focused on maritime safety in Indonesia, limiting its generalizability to other maritime contexts. The research primarily uses available data from the National Transportation Safety Committee (KNKT), which may omit certain incidents or unpublished reports. The dynamic nature of maritime regulations and technology also poses a temporal limitation, potentially impacting the relevance of the findings over time. Some stakeholder groups may be underrepresented, which could affect the comprehensiveness of the perspectives gathered. Additionally, while the study centers on qualitative analysis, a more extensive quantitative

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