

Research Article

# Determination of Maritime Safety in Indonesia: Analysis of Maritime Competence, Maritime Safety Management and Maritime Regulation

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**Abstract:** This study aims to analyze the influence of maritime competence, maritime safety management, and maritime regulations on maritime safety in Indonesia. The approach used in this literature review is descriptive qualitative. Data collection techniques include literature studies or reviews of relevant previous articles published between 2021 and 2026. The technique used in this literature review is Comparative Analysis. The data used in this descriptive qualitative approach comes from previous research relevant to this study and is sourced from academic online media such as Thomson Reuters Journal, Springer, Taylor & Francis, Scopus Q2-Q4 Emerald, Elsevier, Sage, Web of Science, Sinta Journal 2-5, DOAJ, EBSCO, Google Scholar, Copernicus, and digital reference books. The results of the study indicate that: 1) Maritime competence influences maritime safety in Indonesia; 2) Maritime safety management influences maritime safety in Indonesia; and 3) Maritime regulations influence maritime safety in Indonesia. The study concludes that a combined approach to enhancing maritime competence, management practices, and regulatory frameworks is critical in improving maritime safety in the region.

**Keywords:** DOAJ; Maritime Competence; Maritime Regulations; Maritime Safety; Maritime Safety Management.

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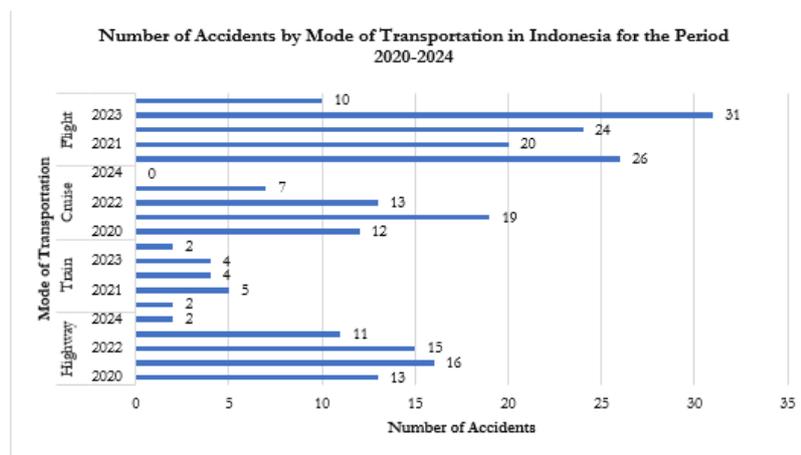
## 1. Introduction

Maritime transportation plays a strategic role in supporting global trade and inter-regional connectivity, considering that more than 80 percent of world trade volume still depends on this mode of transportation, both for the distribution of goods, energy, and human mobility (Mokodompit, 2025).

At the global level, the shipping sector continues to face pressure to improve safety standards in line with increasing maritime traffic intensity, developments in ship technology, and demands for environmental sustainability (Sarjito, 2024).

In Indonesia, an archipelagic nation with vast territorial waters and a high dependence on maritime transportation, shipping safety challenges are becoming increasingly crucial. Geographical characteristics, extreme weather variability, and the dominance of short-haul domestic shipping increase the risk of accidents if not balanced by adequate human resource competency, effective safety management, and consistently implemented shipping regulations (Baihaki et al., 2023).

Despite the implementation of various international and national safety regulations and standards, the maritime accident rate in developing countries remains relatively high. This can be seen in Table 1 below:



**Figure 1.** Number of Accidents by Mode of Transportation in Indonesia for the Period 2020-2024.

Source: (Javier, 2024)

Figure 1 shows the number of accidents by mode of transportation in Indonesia for the period 2020–2024. Accidents continue to occur across all modes of transportation—land, sea, air, and rail—with varying levels and trends. In general, land transportation continues to dominate the number of accidents due to the high volume of traffic and direct interaction with road users. However, the data in the figure also indicates that the shipping sector is one of the modes experiencing relatively high safety issues, although the frequency of traffic is not as high as land transportation (Riyadi, 2025).

The high number of accidents in the shipping sector in Indonesia reflects the complexity of maritime transport operational risks, which are influenced by extreme weather, the geographical conditions of vast waters, and the diverse characteristics of ships and cargo. Furthermore, shipping accidents generally have a greater impact than other modes of transportation, both in terms of loss of life, economic losses, and marine environmental pollution, making shipping safety a crucial issue, even though the number of incidents is not always the highest in absolute terms (Heryanto et al., 2025).

Figure 1 also indicates that maritime safety issues are structural and recurrent year after year, suggesting weaknesses in human resource competency, the implementation of maritime safety management, and the effectiveness of regulations and oversight. Therefore, the findings in this figure reinforce the argument that maritime safety in Indonesia cannot be addressed in isolation but requires a comprehensive approach that integrates increased maritime competency, strengthened safety management systems, and consistent implementation of maritime regulations to sustainably reduce accident rates.

Based on the background of the problem above, the research questions are formulated as follows: 1) Does maritime competency affect maritime safety?; 2) Does maritime safety management affect maritime safety?; and 3) Do maritime regulations affect maritime safety?.

## 2. Preliminaries or Related Work or Literature Review

Based on the background of the problem and problem formulation above, the literature review in this research is as follows:

### Maritime Safety

Maritime safety is the condition where all safety requirements are met in the implementation of maritime transportation activities to prevent maritime accidents and minimize risks to people, ships, cargo, and the marine environment. Maritime safety encompasses all stages of maritime operations, from voyage planning and departure, through seafaring, to berthing and loading and unloading at ports (Sohrabi & Lord, 2022).

Indicators contained in Maritime Safety include: 1) Shipworthiness: Describes the technical condition of the ship that meets safety standards, including the ship's structure, engine, and safety equipment that are functioning properly; 2) Crew and Passenger Safety: Shows the level of protection for the crew and passengers through safety procedures, the use of protective equipment, and preparedness for emergencies; 3) Prevention of Maritime Accidents: Relates to systematic efforts to minimize the risk of accidents through voyage

planning, operational monitoring, and the implementation of safety standards; 4) Protection of the Marine Environment: Describes the ability of the shipping system to prevent marine pollution due to oil spills, ship waste, or maritime accidents (Paulauskas et al., 2023).

The Shipping Safety Variable is relevant to previous research conducted by: (Nosov et al., 2021), (Hsu et al., 2022), (Gritsuk et al., 2023).

### **Marine Competence**

Maritime competence is the comprehensive capability possessed by a ship's crew, encompassing knowledge, skills, attitudes, and professional responsibilities in carrying out seagoing duties in accordance with safety and operational standards. This competence is acquired through formal education, technical training, work experience at sea, and certification recognized by shipping authorities. Maritime competence relates not only to technical skills such as navigation, engine operation, and cargo handling, but also includes non-technical skills such as decision-making, communication, leadership, and teamwork on board (Kilpi et al., 2021).

The indicators contained in the Maritime Competence include: 1) Technical Knowledge of Sailing: Includes the crew's understanding of navigation, machinery, meteorology, and shipping regulations; 2) Operational Skills: Demonstrates the crew's ability to operate the ship, handle cargo, and carry out safety procedures appropriately; 3) Attitude and Professionalism: Relates to the crew's discipline, responsibility, and compliance with safety standards and work ethics; 4) Certification and Work Experience: Describes the level of formal and practical competence as evidenced by certificates of expertise and sailing experience (Yuen et al., 2022).

The Marine Competence variable is relevant to previous research conducted by: (Sharma, 2023), (Belabyad et al., 2026), (Simanjuntak, 2023).

### **Maritime Safety Management**

Maritime safety management is a planned, structured, and documented management system implemented by shipping companies to ensure the safety of ship operations and the protection of the marine environment. This system includes safety policies, division of responsibilities, standard operating procedures, and risk control and evaluation mechanisms in all shipping activities. Maritime safety management aims to identify potential hazards, assess the level of risk, and establish preventative measures to minimize accidents (Xu et al., 2023).

Indicators contained in Maritime Safety Management include: 1) Safety Policy: Demonstrates the shipping company's commitment to establishing a clear vision, objectives, and safety rules; 2) Standard Operating Procedures (SOP): Relates to the availability and implementation of safe work procedures in every shipping activity; 3) Risk Identification and Control: Describes management's ability to recognize potential hazards and establish accident prevention measures; 4) Continuous Evaluation and Improvement: Demonstrates the existence of safety audits, incident reporting, and corrective actions to improve safety performance (Junaidi et al., 2024).

The Maritime Safety Management variable is relevant to previous research conducted by: (Haugen & Kristiansen, 2022), (Zhang & Wang, 2022), (Melynk et al., 2022).

### **Shipping Regulations**

Shipping regulations are a set of rules, policies, and legal provisions established by the government and maritime authorities to regulate the safe, orderly, and responsible operation of shipping activities. Shipping regulations serve as a legal basis that binds all business actors and users of shipping services to comply with established safety standards (Watson-Parris et al., 2022).

Indicators contained in the Shipping Regulations include: 1) Shipping Safety Standards: Includes rules regarding ship seaworthiness, safety equipment, and ship operating procedures; 2) Certification and Licensing: Describes the provisions related to ship permits and crew competency certificates that must be met; 3) Supervision and Law Enforcement: Relates to the role of authorities in conducting inspections, supervision, and imposing sanctions for violations; 4) Compliance with International Regulations: Shows the level of harmonization of national regulations with international shipping safety standards and conventions (Tadros et al., 2023).

Shipping Regulation Variables are relevant to previous research conducted by: (Solakivi et al., 2021), (Diamond, 2023), (Poulsen et al., 2021).

## Previous Research

**Table 1.** Previous Research

No	Author (year)	Research Results	Similarities with this article	Differences with this article
1	(Hardani et al., 2025)	Maritime Competence and Compensation Level Variables Influence Shipping Safety at PT Cipta Samudera Shipping Line	The similarity with this research is that the independent variable is Maritime Competence, the dependent variable is Shipping Safety.	The difference with this research is in the research object, namely PT Cipta Samudera Shipping Line.
2	(Rumambi et al., 2025)	The variables of Shipping Safety Management and Crew Skills and Communication Ability have an influence on Shipping Safety on the Persada Utama 9 Ship	The similarity with this research is that the independent variable is Maritime Safety Management, the dependent variable is Maritime Safety.	The difference with this research is in the independent variables of Crew Skills and Communication Skills.
3	(Adilang & Palapa, 2024)	Regulatory Variables and Navigation Tools Influence Shipping Safety	The similarity with this research is that the independent variable is Shipping Regulation, the dependent variable is Shipping Safety.	The difference with this research is in the Independent variable Navigation Tool

## 3. Materials and Method

This study employs a descriptive qualitative approach operationalized through a literature review to explore the determinants of shipping safety in Indonesia. The primary focus of the study is a systematic review of relevant previous scientific articles to provide an in-depth overview of the influence of maritime competence, shipping safety management, and shipping regulations. The analytical technique used in this study is comparative analysis, where findings from various literature sources are compared and synthesized to produce robust conclusions regarding the variables studied (Boulton, M. J., & Houghton, 2021).

The data in this study are secondary data collected through literature studies from various scientific publications published between 2021 and 2026. The data search and collection process was conducted through academic online media with a range of international and nationally reputable databases, including Thomson Reuters Journal, Springer, Taylor & Francis, Scopus (Q2-Q4), Emerald, Elsevier, Sage, Web of Science, and Sinta 2-5 accredited journals. In addition to scientific journals, this study also utilized references from digital books and global indexing providers such as DOAJ, EBSCO, Google Scholar, and Copernicus to ensure comprehensive literature coverage (Zulfikar et al., 2024).

Data analysis was conducted by linking previous research findings to test the established conceptual framework, where Maritime Competence, Shipping Safety Management, and Shipping Regulations are positioned as the main determinants of Shipping Safety in Indonesia. In addition to these main variables, the comparative analysis process in this study also considers the existence of other external factors that appear in the literature, such as safety culture, shipping operational management, and the quality of navigation facilities, in order to enrich the discussion regarding factors that influence safety in the maritime transportation sector (Hennink, M. M., Hutter, I., & Bailey, 2020).

## 4. Results and Discussion

Based on the problem formulation, literature review and relevant previous research above, the results and discussion of this research are as follows:

### **The Influence of Maritime Competence on Shipping Safety in Indonesia**

Based on a literature review and several relevant previous studies, it can be concluded that Maritime Competence influences Shipping Safety in Indonesia.

To achieve and improve Shipping Safety in Indonesia, leaders, stakeholders, and management of shipping companies can implement or prioritize Maritime Competence, which includes: 1) Technical knowledge of shipping: Management must facilitate a thorough understanding of maritime law (P2TL/COLREGs), electronic navigation (Radar, ECDIS, AIS), and ship stability; 2) Operational skills: Companies need to implement a rigorous On-the-Job Training (OJT) system and ensure that each crew member is proficient in the use of safety equipment and fire extinguishers, both mechanically and manually, not just theoretically; 3) Attitude and professionalism: Management must build a safety culture. This involves discipline in adhering to STCW-standard rest hours to prevent fatigue, integrity in maintaining ship logbooks, and an awareness of moral responsibility for human life on board.

If the leaders, stakeholders or management of the shipping companies concerned can implement the four aspects of Maritime Competence, it will have an impact on Shipping Safety in Indonesia which includes: 1) Shipworthiness: Where the ship will be maintained in good condition not only because of the service schedule, but because the competent crew is able to carry out preventive maintenance. They can detect symptoms of minor damage to the engine or hull structure before it becomes fatal damage; 2) Safety of crew and passengers: With high operational skills, evacuation procedures and the use of life-saving appliances will run effectively in the event of an emergency; 3) Prevention of shipping accidents: The majority of maritime accidents in Indonesia are caused by human error. Strong technical knowledge and high professionalism will reduce the risk of collision, stranding, or sinking due to navigational errors; 4) Protection of the marine environment: Competent crews understand MARPOL procedures in depth. They will be disciplined in operating Oily Water Separator (OWS) and will not discharge illegal waste into the sea.

The results of this study are in line with previous research conducted by (Hardani et al., 2025), which states that there is an influence between Maritime Competence and Shipping Safety in Indonesia.

#### **The Influence of Maritime Safety Management on Maritime Safety in Indonesia**

Based on a literature review and several relevant previous studies, it can be concluded that Maritime Safety Management influences Maritime Safety in Indonesia.

To achieve and improve Maritime Safety in Indonesia, leaders, stakeholders, and management of shipping companies can implement or adhere to Maritime Safety Management, which includes: 1) Safety policy: Top management must establish a written policy that prioritizes safety over commercial profit; 2) Standard operating procedures: Management must develop specific technical guidelines for each risky activity, such as bunkering procedures, enclosed space entry, and ship maneuvering in port; 3) Risk identification and control: Companies are required to conduct a risk assessment before beginning any hazardous work. This includes analyzing potential hazards (such as bad weather or equipment failure) and establishing preventative measures (such as the use of personal protective equipment or canceling voyages if conditions warrant); 4) Continuous evaluation and improvement: Management must analyze every minor incident to identify the root cause and implement system improvements to prevent similar incidents from recurring in the future.

If the leaders, stakeholders, or management of shipping companies can implement the four aspects of Maritime Safety Management, it will have an impact on Maritime Safety in Indonesia, including: 1) Shipworthiness: Good safety management will ensure timely docking schedules and the availability of genuine spare parts, so that the ship's structure and engine remain reliable according to the seaworthiness standards set by the government; 2) Crew and passenger safety: With scheduled emergency drills according to SOPs, the crew becomes highly skilled in handling crisis situations, which directly increases the chances of safety for all passengers in the event of an emergency; 3) Prevention of maritime accidents: Most accidents such as collisions or groundings can be prevented when management implements strict navigation procedures and ensures that crews do not work under fatigue conditions (fatigue management), which is part of the company's safety policy; 4) Protection of the marine environment: With good risk control during the loading and unloading of hazardous materials, the risk of oil spills that can damage Indonesia's marine ecosystem can be significantly minimized.

The results of this study are in line with previous research conducted by (Rumambi et al., 2025), which states that there is an influence between Maritime Safety Management and Maritime Safety in Indonesia.

**The Impact of Shipping Regulations on Shipping Safety in Indonesia**

Based on a literature review and several relevant previous studies, it can be concluded that Shipping Regulations influence Shipping Safety in Indonesia.

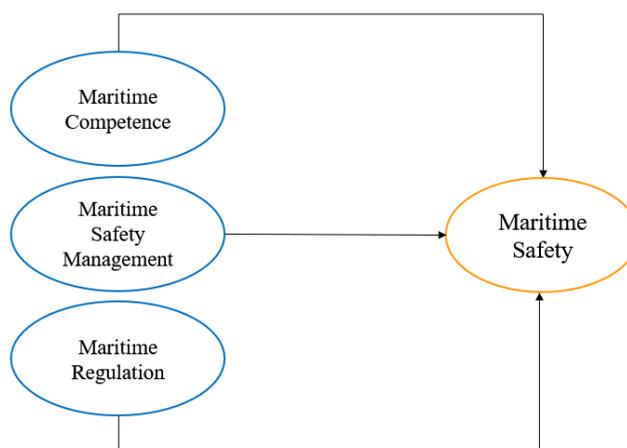
To achieve and improve Shipping Safety in Indonesia, leaders, stakeholders, and management of shipping companies can implement or adhere to Shipping Regulations, which include: 1) Shipping safety standards: Management is required to implement technical standards set by the government (such as the NCVS - Non-Convention Vessel Standard for domestic vessels); 2) Certification and licensing: Management must have an alert database system to renew certificates before they expire to avoid ship detention; 3) Supervision and legal enforcement: Companies must cooperate with inspections by harbor masters and Port State Control (PSC); 4) Compliance with international regulations: Management must adapt to the latest amendments to international regulations to prevent Indonesian vessels from being blacklisted by global maritime authorities.

If the leaders, stakeholders or management of the shipping companies concerned can implement the four points of the Shipping Regulation, it will have an impact on Shipping Safety in Indonesia which includes: 1) Shipworthiness: The regulation forces ship owners to carry out scheduled maintenance and repairs according to standards, so that the hull structure and machinery of the ship remain strong against the risk of bad weather in Indonesian waters; 2) Safety of crew and passengers: By complying with this regulation, the risk of overloading which is often the cause of accidents in Indonesia can be eliminated, and ensures that all lives on board have access to adequate safety equipment; 3) Prevention of shipping accidents: Navigation regulations ensure that every ship moves on the correct "rail" and communicates using the correct frequency, so that the potential for human error in navigation can be minimized; 4) Protection of the marine environment: By complying with the rules for waste disposal and handling of hazardous cargo, companies contribute to preserving the sustainability of Indonesia's seas from oil spills and plastic waste.

The results of this study are in line with previous research conducted by (Adilang & Palapa, 2024), which states that there is an influence between Shipping Regulations and Shipping Safety in Indonesia.

**Conceptual Framework**

Based on the formulation of the problem, relevant previous research, results and discussion of the research above, the following conceptual framework is determined:



**Figure 2.** Kerangka Konseptual.

Based on Figure 2 above, Maritime Competence, Maritime Safety Management, and Maritime Regulations influence Maritime Safety in Indonesia. In addition to the independent variables above, which influence the dependent variable (Maritime Safety), there are other variables that influence Maritime Safety, including:

- 1) Safety Culture: (Mudiyanto et al., 2023), (Albaar, 2025), (Suprapti et al., 2025).

- 2) Shipping Operations Management: (Suprpti et al., 2025), (Hati, 2025), (Zaqymullah, 2025).
- 3) Navigation Facilities Quality: (Suhendra, 2026), (Untailawal et al., 2024), (Makmur et al., 2023).

## 5. Conclusion

Based on the problem formulation, results and discussion above, the conclusion of the research with the subject of Shipping in Indonesia is: (a) Maritime Competence influences Shipping Safety in Indonesia. The higher the level of crew competency, the greater the shipping system's ability to maintain ship seaworthiness, crew and passenger safety, and protect the marine environment. (b) Shipping Safety Management influences Shipping Safety in Indonesia. Effective safety management enables proactive accident prevention and ensures crew preparedness in the event of an emergency. (c) Shipping Regulation influences Shipping Safety in Indonesia. Effective enforcement of regulations encourages proper ship maintenance, compliance with load limits, and safe and environmentally friendly operational practices.

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