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## Factors Affecting the Safety of Shipping of Domestic Ships: Analysis of Human Resources Quality, Infrastructure and Technology

Subehana Rachman<sup>1</sup>

<sup>1</sup>Politeknik Ilmu Pelayaran, Makassar, Indonesia, email: [subehana@pipmakassar.ac.id](mailto:subehana@pipmakassar.ac.id)

Corresponding Author: [subehana@pipmakassar.ac.id](mailto:subehana@pipmakassar.ac.id)<sup>1</sup>

**Abstract:** Article on Infrastructure, Technology, and Human Resource Quality as They Affect Domestic Ship Navigation Safety. This work aims to develop a hypothesis regarding the relationship between factors that can be applied to subsequent studies. The descriptive qualitative research methodology is applied. The descriptive qualitative approach employs data from online academic media, including digital reference books, Taylor & Francis, Scopus Emerald, Web of Science, DOAJ, EBSCO, and Sinta Journal, as well as from prior research that is pertinent to the current study. This article's conclusions are as follows: 1) Infrastructure Affects Shipping Safety; 2) Technology Affects Shipping Safety; and 3) Human Resource Quality Affects Shipping Safety.

**Keyword:** Shipping Safety, Human Resources Quality, Infrastructure, Technology

### INTRODUCTION

Given that Indonesia is an archipelagic nation with a sizable region of waterways, domestic shipping safety is an essential component of the maritime industry. Indonesia is a marine nation, hence shipping is a major means of connecting its islands and distributing goods and services across the area. Domestic ships, which include fishing, cargo, and passenger ships, are essential to the country's economy. However, shipping safety concerns remain a significant issue that continues to impair the success of Indonesia's marine economy, despite the sector having a lot of promise (Bernanda and Loisa 2021).

Both big and small ships have mishaps in Indonesian seas on a regular basis. These mishaps result in a considerable number of fatalities in addition to material losses. Data from the Ministry of Transportation and the National Search and Rescue Agency (Basarnas) indicate that marine mishaps such ship-to-ship collisions, fires, sinkings, and ships running aground are still frequently reported. Given the significance of maritime transportation for Indonesians' daily lives particularly in remote places that are inaccessible by road or air this shipping safety issue must undoubtedly be taken very seriously (Bayu satrio 2021).

The caliber of human resources (HR) used in shipping operations is one of the key elements taken into account to influence shipping safety. It is the duty of ship crews, captains,

and sailors to make sure that the voyage is safe and uneventful. But human resource competency-related concerns are frequently in the news. It was discovered that ship crews or sailors lacked the necessary certification or had not received the required safety training in a number of marine incidents. Furthermore, inadequate educational attainment and insufficient hands-on training may also compromise their capacity to manage crisis scenarios at sea (Haryadi and Kundori 2022).

The upkeep of port infrastructure and other auxiliary facilities is crucial to the safety of shipping. Port infrastructure in a number of Indonesian locations still falls well short of expectations. Certain ports lack the necessary contemporary equipment, such as emergency response facilities, radars, and navigation systems, to enable safe ship operations. Furthermore, poor infrastructure frequently results in port congestion, which raises the possibility of mishaps because of erratic ship movements as they approach and exit ports. The absence of auxiliary safety infrastructure, like fire extinguishers, rescue centers, and other emergency supplies, poses a significant threat to the safety of shipping in Indonesian waters (Susanto, Pahala, and Setyowati 2021).

Enhancing transportation safety is a major benefit of technology as well. Modern navigation systems, such the Electronic Chart Display and Information System (ECDIS), Automatic Identification System (AIS), and Global Positioning System (GPS), have been shown to increase the effectiveness and safety of ship operations in this digital age. However, there is still a very minimal amount of use of this technology on Indonesian domestic ships, particularly on tiny or traditional ships. The danger of mishaps remains high because some ships lack advanced technologies that could assist prevent collisions or accidents at sea. Maximizing the advantages of technology for shipping safety is further hampered by the crew's inadequate technological knowledge and proficiency.

The safety situation at sea is influenced not only by infrastructure, technology, and human resources, but also by legislation governing shipping safety. The International Maritime Organization (IMO) and other international organizations, as well as the central government, both have legislation in Indonesia that regulate maritime safety requirements. Nevertheless, these restrictions are frequently not adequately enforced or monitored. It is still common for many ships to be in service without having the necessary safety equipment, crew certification, or shipworthiness. Weak supervision and ambiguous penalties for shipping safety infractions are to blame for this (Hendrawan 2019).

Another external aspect affecting maritime safety is the weather. Maritime accidents are frequently caused by storms, strong winds, and other unexpected weather conditions. Although there is currently an early warning system for marine weather in Indonesia, its use is still not at its best. Since many ships lack a real-time weather information system, they are unable to take the appropriate safety measures when the weather gets worse. However, there is still a lack of awareness among ship captains and crews regarding the need of paying attention to weather information (Bayu satrio 2021).

An all-encompassing and coordinated strategy is required to raise the standard of domestic ship navigation safety. Through ongoing education and international standard-compliant certification, the caliber of human resources must be raised. Furthermore, the government must take its responsibility for building port infrastructure and providing sufficient safety facilities more seriously. It is also necessary to promote the use of cutting-edge technology, particularly for small and conventional ships, by offering financial incentives or technical support to enable their adoption. However, in order to have a deterrent impact, stricter oversight of the application of safety laws is required, as well as severe penalties for infractions. It is envisaged that by taking these elements into consideration, the safety of domestic shipping can be raised, supporting the development of a more sustainable marine sector and lowering the likelihood of accidents that cause multiple injuries (Suryani, Yudi Pratiwi, and Hendrawan Dosen Akademi Maritim Nusantara Cilacap 2018).

Based on the background of the problem above, the following problem formulations are determined: 1) Analyzing the influence of Human Resource Quality on Shipping Safety?; 2) Analyzing the influence of Infrastructure on Shipping Safety?; 3) Analyzing the influence of Technology on Shipping Safety?.

## **METHOD**

The authoring of this literature review employs the descriptive qualitative method. way to gather data by reviewing the literature or analyzing pertinent earlier studies. Data from digital reference books, Taylor & Francis, Scopus Emerald, Web of Science, DOAJ, EBSCO, and Sinta Journal are among the online academic media that are used in the descriptive qualitative approach. Other relevant prior research is also incorporated into the analysis. Additionally, e-library on prestigious schools, such as the libraries at Harvard, Cambridge, and Oxford, are a source for it. The current literature review helps researchers discover gaps in the literature, choose the best methodological strategy, and discover previous explorations of the study issue. Consequently, the research issue becomes more narrowly focused and pertinent, and further research will undoubtedly make a substantial contribution to the current field of study. The exploratory nature of this study is the primary justification for performing qualitative analysis (Ali, H., & Limakrisna 2013).

## **RESULTS AND DISCUSSION**

Based on the background of the problem and the formulation of the problem above, the results of this study are as follows:

### **Shipping Safety**

A set of procedures, policies, and guidelines known as "shipping safety" are designed to guarantee the security and safety of each and every component used in shipping operations. This covers the ships, the people on board, the crew, and any cargo or items being moved. Any activity involving the movement of people and products that takes place on the water's surface be it in rivers, lakes, or the ocean is referred to as shipping. In order to avoid maritime mishaps or occurrences that could cause fatalities, property damage, or negative environmental effects, shipping safety is crucial. Marine authorities around the world, like the International Maritime Organization (IMO), enforce international norms and standards that contribute to marine safety. One of the primary tools for guaranteeing shipping safety is the International Convention for the Safety of Life at Sea (SOLAS), which was developed by the IMO. The SOLAS regulations cover a range of technical standards pertaining to the construction, equipment, operation, and design of ships. Before being permitted to sail, every ship must comply with certain requirements. Furthermore, SOLAS mandates the use of safety gear including lifeboats, life jackets, and cutting-edge navigation systems and highlights the significance of crew training and expertise in handling emergency circumstances. Another crucial component of maritime safety is the state of the weather and the sea. Storms, huge waves, and strong winds are examples of bad weather that can cause accidents at sea. Therefore, in order to foresee such hazards during shipping, every ship needs to be outfitted with a highly advanced navigation system and weather forecast systems. In addition to having a solid understanding of weather patterns, the captain and crew must be able to make wise decisions in potentially hazardous situations. To guarantee that you have the most recent information on maritime conditions, it's also critical to maintain excellent communication with the coast station or port authorities (Soesanto et al. 2023).

Indicators or dimensions contained in the shipping safety variables include: Ship Health and Readiness: Verify that all of the ship's systems, including the engines, navigational aids, and safety gear, are in working order; 2) Safety Equipment: Fire extinguishers, life jackets, and life rafts must be included in the ship's inventory. 3) Regulation and Compliance: The ship

needs to abide by global safety requirements that are established by the International Maritime Organization (IMO).

Maritime safety has been studied by several researchers, including: (Yasin Muhammad Syibli and Nuryaman 2021), (Yasin Muhammad Syibli and Nuryaman 2021).

### **Human Resources Quality**

In the current digital age, technology literacy and digital abilities are also becoming more and more connected to the caliber of human resources. A competitive edge belongs to human resources personnel who are proficient in using technology in their day-to-day tasks. The ability of a person to interact and work well in a team is another factor that determines the quality of human resources. This is significant in the increasingly dynamic and cross-disciplinary modern workplace culture. Thus, when evaluating the caliber of human resources, soft skills like leadership, creativity, critical thinking, and communication are crucial. The degree of skill, knowledge, and ability possessed by individuals or groups within a nation or organization to accomplish specific objectives is referred to as the quality of human resources (HR). There are several aspects of quality HR, like as knowledge, technical proficiency, interpersonal skills, moral character, and work ethics. Furthermore, the quality of HR is also associated with the capacity to adjust to changes in technology and the ever-changing dynamics of the global marketplace. A person's degree of education and training has a significant impact on the formation of quality human resources (HR), as well-trained and educated personnel are better equipped to solve problems, increase productivity, and foster innovation in the workplace. The productivity and success of an organization are significantly impacted by the quality of its human resources. Organizational performance will benefit from human resources that are highly committed, results-driven, and take the initiative to keep learning and growing (Sholihah Izaatus and Firdaus Zakaria 2019).

Indicators or dimensions contained in the human resource quality variable include: 1) Education Level: Increasing one's level of education can help one become more capable and productive. The primary metrics are literacy rates, access to high-quality education, and basic to higher education; 2) Productivity and abilities: Enhancing the caliber of human resources requires a focus on developing both technical and non-technical (soft) abilities; 3) Health: Productivity and competitiveness are impacted by the health of human resources.

The quality of human resources has been studied by several researchers, including: (Sholihah Izaatus and Firdaus Zakaria 2019), (Rahardja 2022), (Caron and Markusen 2016), (Maulyan 2019).

### **Infrastructure**

An essential component of a nation's social and economic development is its infrastructure. The degree to which physical infrastructure such as roads, bridges, ports, airports, electrical networks, clean water supplies, and communication and transportation facilities is planned, constructed, and maintained to sustain both economic activity and human existence is referred to as infrastructure quality. The primary attributes of high-quality infrastructure are resilience, effectiveness, ease of use, and safety. A further crucial factor is sustainability, which requires that new infrastructure be built with an eye toward the environment and with the ability to endure over time without endangering the ecosystem (Maisharoh and Ali 2020).

Improving economic efficiency requires a strong infrastructure because it makes it easier for people, goods, and services to move around. For example, faster and more effective delivery of goods results from adequate road and transportation infrastructure, which lowers logistical costs and boosts product competitiveness in the market. Additionally, having quick and dependable internet connectivity and consistent electricity are essential for enhancing business performance, particularly in the current digital era. Good telecommunications infrastructure

makes it easier for businesses to operate, innovate, and connect with the global market (Bagaskara et al. 2023).

In addition to promoting economic expansion, well-maintained infrastructure is crucial for raising communal standards of living. For example, hospitals and health centers are examples of health infrastructure that is crucial to guaranteeing equitable access to healthcare for all societal strata. The infrastructure of education, which includes colleges and universities, also helps to raise the caliber of human resources. However, public infrastructure like parks, hygienic water systems, and effective waste management helps to make the community a comfortable and healthy place to live (Rapat Piter Sony Hutauruk 2021).

Indicators or dimensions contained in infrastructure variables include: 1) Connectivity and Transportation: The effectiveness of logistics and the movement of people and commodities are impacted by the state of roads, railroads, ports, and airports. Market and economic opportunity accessibility is increased by well-maintained infrastructure; 2) Energy Network: In order to sustain industry, technology, and everyday necessities, there must be a reliable and reasonably priced supply of electricity and energy. robust energy infrastructure promotes sustainable development and economic expansion; 3) Telecommunication Infrastructure: In the digital age, having access to dependable, quick internet and communication networks is crucial. The expansion of the technology and innovation sectors is facilitated by the availability of digital infrastructure.

Infrastructure has been studied by several researchers, including: (Sukwika 2018), (Antoni et al. 2021), (Rapat Piter Sony Hutauruk 2021).

## **Technology**

The degree of invention, efficiency, dependability, and advancement that a given technology possesses is referred to as its technological quality. High-quality technology can more effectively, efficiently, and sustainably address the needs of its users. Constant innovation, interoperability with other systems, user-friendliness, and the enhancement of human well-being, productivity, and efficiency are the hallmarks of high-quality technology. The advancement of the economy, education, health, and other areas is contingent upon the caliber of technology in the age of globalization and digitalization (N. Ashshidiqy 2019).

The capacity of high-quality technology to resolve issues more rapidly and effectively is one of its primary features. For instance, in the industrial sector, high-quality technology can boost process automation, which in turn lowers production costs and boosts output. Modern medical technology makes it possible to diagnose patients with greater accuracy and treat them with greater efficacy. High-quality digital technology in education makes it possible for students to acquire knowledge more widely through e-learning and to create more dynamic and captivating teaching strategies (Zahran and Ali 2020).

Furthermore, there is a connection between technology quality and sustainability and security issues. Good technology needs to be sufficiently secure to shield users from different risks including hacking and invasions of privacy. Another key area of emphasis is sustainability, since contemporary technology is made to have a minimally harmful influence on the environment. This could entail lower carbon emissions, more effective use of energy, and designs that encourage component recycling or reuse (Student et al. 2021).

Indicators or dimensions contained in the technology variable include: 1) Adoption of Digital Technology: A region's level of technological sophistication is demonstrated by the usage of digital technologies such as the internet, cloud computing, big data, and artificial intelligence (AI) in a variety of commercial and public sectors; 2) Information and Communication Technology Availability: Having access to digitalization-supporting hardware and software, including computers, smartphones, servers, and productivity and efficiency-boosting apps; 3. Technological Infrastructure Capacity: The ability of a nation to create and

improve infrastructure, such data centers, 5G networks, and technology innovation hubs, that facilitates the usage of cutting-edge technology.

The technology has been studied by several researchers, including: (Wahyudi and Sukmasari 2018), (Maritsa et al. 2021).

## Discussion

Based on the formulation of the problem, research results and relevant previous research, the discussion in this study includes:

### 1. Human Resources Quality Affects Shipping Safety

Shipping safety is impacted by a number of factors, including safety equipment, laws and compliance, ship health and readiness, and the quality of human resources (HR). In the shipping industry, having high-quality HR is essential to guaranteeing security and safety on the journey. Sufficient educational attainment of ship crew members is crucial for their comprehension and execution of intricate safety protocols. In addition to imparting fundamental knowledge of shipping methods, a quality education also teaches particular skills for using safety equipment and an awareness of relevant international regulations. Higher education tends to make seafarers more adept at resolving crises, which lowers the possibility of mishaps and damage to ships (Maulyan 2019).

Ensuring shipping safety is contingent upon HR productivity. Being able to work quickly and efficiently is typically linked to high production, which is crucial in emergency situations. For instance, the capacity to initiate evacuation or repair plans as soon as the ship develops technical issues may have an impact on how things turn out in the end. Crews that are productive and well-trained will be able to work faster and more accurately, which will lower possible dangers and protect shipping safety (Setiadi 2023).

Moreover, HR's non-technical and technical skills support shipping safety. To make sure the ship stays on course and can contact with the emergency coordination center if necessary, it must be able to operate current navigation equipment and communication systems. Understanding standard ship maintenance and repair processes is another aspect of this expertise that helps to prevent damage that could endanger safety. The crew's interpersonal and managerial abilities, such as their capacity for team leadership and effective communication, also have an impact on the formulation and application of safety policies.

Another important aspect that significantly impacts the ship's safety is the state of its human resources. The crew's emotional and physical well-being is crucial since it might have a negative impact on their productivity. Crew members must be in excellent physical and mental health to handle the stress and exhaustion that come with spending extended amounts of time at sea. Maintaining good health also has an impact on the crew's capacity to focus on high-stakes activities like navigation and safety equipment monitoring. A strong health program and routine medical examinations can also aid in preventing health issues that might compromise ship safety (Setiadi 2023).

The caliber of human resources is inextricably linked to the ship's health and safety apparatus. Maintenance performed by a competent and experienced crew results in a ship that is in good shape and safety equipment that is operating as intended. Thus, having top-notch human resources will guarantee that ship maintenance is done correctly and that the ship stays in the best possible shape for safe sailing. A significant component of human resources' role in shipping safety is also adherence to relevant safety rules. Strict safety laws and global norms need to be followed to guarantee that every facet of ship operations from safety gear to evacuation protocols meets the required criteria (Sucipto, Mukson, and Syaifulloh 2021)

Overall, a key factor influencing shipping safety is the caliber of human resources, which includes factors like productivity, health, education, and ability. Excellent education creates knowledgeable and competent crew members; high productivity guarantees effectiveness in

emergency scenarios; technical and non-technical skills enable efficient management of equipment and circumstances; and excellent health guarantees both physical and mental preparedness. All of these elements support keeping the ship in good condition and preparedness, controlling safety gear, and abiding by safety rules all of which eventually support overall maritime safety.

The quality of human resources affects shipping safety, this is in line with research conducted by: (Zaky 2022)

## **2. Infrastructure Affects Shipping Safety**

The improvement of maritime safety is largely dependent on infrastructure, which includes energy networks, telecommunications infrastructure, connectivity and transportation infrastructure, safety devices, and regulation and compliance (Murdiono et al. 2024). These infrastructural components are all interrelated and have a big influence on the effectiveness and safety of shipping. The cornerstones of maritime safety are transportation and connectivity. Ships are guaranteed efficient and easy port access with good connectivity. For ships to be able to perform important maintenance and repairs on time, this accessibility is crucial. Ships may find it difficult to dock or move safely if ports and navigation channels, for example, are in poor or inadequate condition. The ability of ships to communicate with emergency services and shipping authorities, which is crucial in emergency situations, is also impacted by connectivity.

Additionally, the upkeep of ship and port infrastructure activities depends on a dependable and effective energy network. All ship systems, including the navigation and communication systems, depend on a steady energy source to operate correctly. Ship equipment malfunctions can compromise safety due to disruptions in the energy supply. Rapid emergency response is made possible by well-maintained energy infrastructure, which also supports port facilities and emergency services (Leonita 2020).

Due to its ability to facilitate efficient communication between ships, ports, and shipping authorities, telecommunication infrastructure is essential to maritime safety. Ships can get critical information about weather, sea conditions, and other possible risks with the help of effective communication systems. Ships that have good communication can also report emergencies fast and get the help they need. Insufficient telecommunications infrastructure can make it harder for ships to communicate, which can exacerbate emergency circumstances and raise the possibility of mishaps (Husen and Baranyanan 2021). The proper integration of operating procedures and infrastructure is critical to the health and preparedness of ships. Sufficient infrastructure lowers the possibility of equipment failure or damage by guaranteeing that ship maintenance facilities can perform maintenance efficiently. Furthermore, effective communication systems make it easier to keep an eye on ship conditions and enable real-time health assessments. Crew and passenger safety can be enhanced by ships that have enough safety gear, such as fire extinguishers, whistles, and life jackets. To guarantee ship preparedness in an emergency, infrastructure supporting personnel certification and training is also crucial.

Life jackets, life rafts, and emergency communication devices are among the safety equipment on board that needs to be routinely inspected and maintained. Sufficient infrastructure facilitates the upkeep and substitution of this safety apparatus. For instance, port facilities with workshops and equipment warehouses may guarantee prompt delivery of replacement equipment and maintenance for ships. Safeguard equipment can be promptly distributed to ships in need thanks to effective logistics networks. Infrastructure has a significant impact on two crucial components of maritime safety: compliance and regulation. Shipping authorities may guarantee that ships adhere to set standards and provide the most recent safety requirements when there is a strong telecommunications infrastructure. Networks

for energy and connectivity are also necessary for the monitoring and auditing systems that make sure port facilities and ships adhere to safety standards.

Infrastructure that facilitates the application and supervision of safety laws, such as those established by global organizations like the International Maritime Organization (IMO), is necessary for compliance (Ariani 2023). Ultimately, increasing maritime safety depends on the effective integration of connectivity with energy, transportation, and telecommunications infrastructure. This infrastructure guarantees readiness and adherence to safety regulations in addition to supporting the regular operations of ships and ports. The danger of mishaps and incidents can be reduced, increasing overall shipping safety, by making sure that every component of the infrastructure is in good working order and supports one another.

Infrastructure affects shipping safety., this is in line with research conducted by: (Antoni et al. 2021), (Bagaskara et al. 2023), (Rapat Piter Sony Hutauruk 2021).

### **3. Technology Influences Shipping Safety**

The availability of information and communication technology, transportation and connection, and the capability of technical infrastructure are only a few of the significant ways that technology has an impact on maritime safety. Each of these technological components is essential to maintaining the integrity of safety equipment, the health and preparedness of ships, and adherence to relevant laws and regulations in the context of maritime safety (Yasin Muhammad Syibli and Nuryaman 2021).

First, communication between ships and between ships and land-based control centers has improved because to advancements in transportation and communications. Ships can operate with precise and current position data thanks to modern navigation technologies like GPS and AIS (Automatic Identification System). This lowers the chance of collisions considerably and aids in the ships' avoidance of obstructions and inclement weather. Furthermore, real-time data interchange is made possible by advanced satellite communication systems, which enable ships to obtain the most recent weather reports and safety directives from maritime authorities (Nisa, Rooswidjajani, and Fristin 2019). Connectivity technology enhances overall maritime safety by facilitating quicker response times and improved decision-making in emergency scenarios.

Additionally, having access to information and communication technology (ICT) is essential to making sure ships have effective management systems. Real-time monitoring of ship conditions, including the identification of potential damage and required maintenance, is made possible by advanced ICT technology (Ricardianto et al. 2023). By providing information on engine status, fuel levels, and ship safety systems, computer-based management systems enable sailors to take preventive action before issues worsen into emergencies. Furthermore, ICT facilitates crew training by offering instructional resources and simulations that might enhance their ability to manage emergency scenarios. The crew's preparedness and emergency response skills are enhanced by the usage of this equipment, which ultimately improves shipping safety.

The ability of the IT infrastructure to support shipping safety is also crucial. Sufficient infrastructure, including contemporary ship repair and maintenance facilities, enables ships to maintain their best possible condition. Furthermore, modern technology-equipped ports and terminals facilitate safer and more effective loading and unloading procedures. Systems for monitoring and controlling maritime traffic are made possible by technology, giving shipping authorities more control over the movement of ships. The danger of accidents can be reduced and ship and passenger safety can be better maintained with a robust infrastructure (Sawitri et al. 2019).

The newest technology also helps to raise safety standards when it comes to safety gear. Life jackets, life rafts, and emergency alert systems are examples of ship safety equipment that is updated often to guarantee maximum functionality. Automation systems that can react fast

to emergencies and more user-friendly, efficient equipment have been made possible by technological advancements. For instance, contemporary lifebuoys and life rafts come with tracking and communication equipment that makes it simpler for rescue personnel to find and help occupants in an emergency (Muttamimah and Irwansyah 2023).

Technological advancements also have a significant impact on regulation and compliance. Technology makes it easier to perform audits and inspections to make sure ships meet the safety requirements set by global regulatory organizations. Electronic reporting and documentation systems that rely on technology make it simpler to monitor adherence to safety standards and offer the proof required for audits and inspections. The possibility of infractions that could jeopardize shipping safety is decreased when safety laws are implemented more effectively and transparently thanks to integrated and modern technologies (Judijanto et al. 2024).

All things considered, the use of technology in the shipping industry has greatly improved shipping safety. Enhanced connectivity, the availability of ICT, and sufficient infrastructure capacity all help to improve safety gear, regulatory compliance, and the condition and preparedness of ships. The shipping sector may be more successful in controlling hazards and guaranteeing the safety of shipping, for both ships and their passengers, by continuing to embrace and develop the newest technologies.

Technology affects shipping safety, this is in line with research conducted by: (Anggraeni and Elan Maulani 2023), (Putri Primawanti and Ali 2022).

### Conceptual Framework

Based on the formulation of the problem, relevant previous research and the results and discussion of the research above, including:

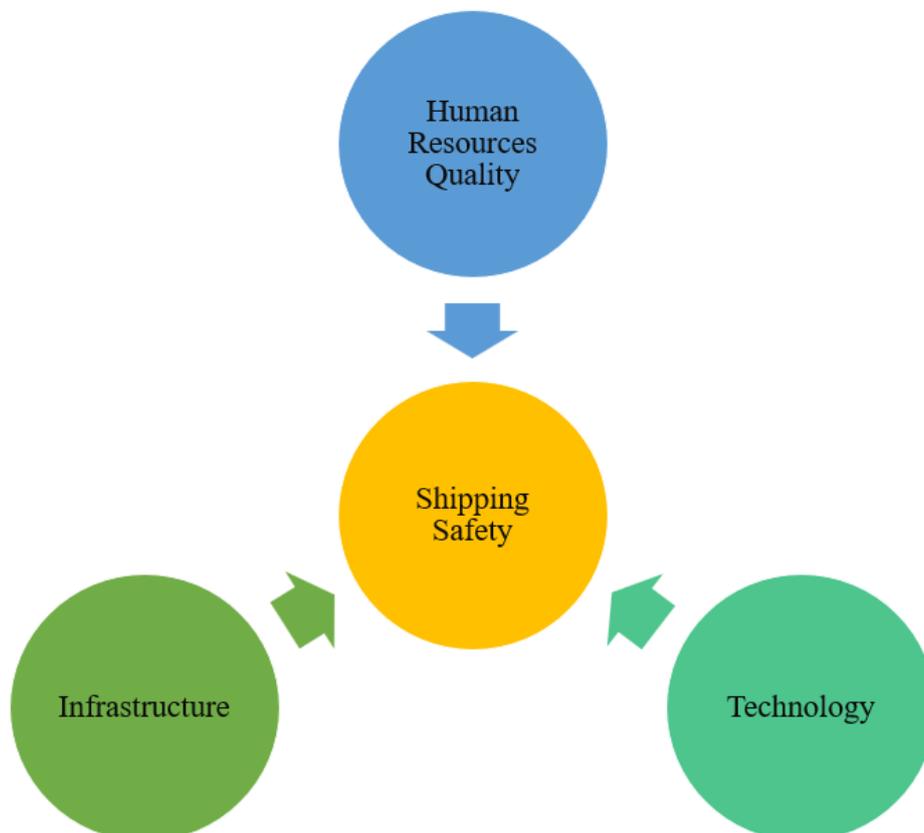


Figure 1. Conceptual Framework

Based on Figure 1 above, the quality of human resources, infrastructure and technology affect shipping safety. In addition to the independent variables above that affect the dependent variable (shipping safety), there are other variables that affect shipping safety, including:

- 1) Ship Load Capacity and Stability: (Rizky et al. 2018), (Nusantara 2023), (Sulistianingtyas, Amiruddin, and Manik 2018).
- 2) Weather and Ocean Conditions: (Minarto and Santoso 2023), (Muh. Aldy Subar., Arlizar Djamaan. 2020), (Tasya Olivia Rinekso, Supriyatno Widagdo, and Rudi Siap Bintoro 2023).
- 3) Security and Terrorism Threats: (Ali, Yudho, and Sianturi 2021), (Samy and Kusumadewi 2021), (N et al. 2024).

## CONCLUSION

Based on the problem background, problem formulation, previous research, results and discussion above, the following research conclusions are obtained:

- 1) Human Resources Quality Affects Shipping Safety
- 2) Infrastructure Affects Shipping Safety
- 3) Technology Affects Shipping Safety

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