Applied Quantitative Analysis, Vol. 6 No. 2 (2026) https://doi.org/10.31098/quant.4565

Research Paper

Fire Drill Implementation Intensity on the Preparedness of the KM.DLN MANDALIKA Crew

Adreta Wiarso Helga[1*], Dian Kurnianing Sari[2], Hartoyo[3]
Politeknik Ilmu Pelayaran Semarang, Indonesia

Received : June 21, 2026	Revised : August 14, 2026	Accepted : August 18, 2026	Online : August 31 , 2026

Abstract

Fires on ships are one of the main causes of maritime accidents, demonstrating the urgency of attention to this problem. This can occur due to low awareness and lack of crew preparedness in facing emergencies on board ships. Data from the Directorate General of Sea Transportation, Ministry of Transportation, recorded 128 ship accidents throughout 2024, an increase of 37.6% from the previous year. This study aimed to determine the effect of the intensity of fire drill implementation on crew preparedness and to determine how much the intensity of fire drill implementation affects the preparedness of the KM.DLN Mandalika crew. This study used an associative quantitative approach to determine the effect of fire drill implementation intensity on crew preparedness. Data analysis was performed using simple linear regression with the help of SPSS version 31.0. The validity and reliability of the research instrument were tested on 30 sister ship respondents, the questionnaire that has been declared valid and reliable was distributed to 32 main respondents, namely the crew of KM.DLN Mandalika. The results of the study showed that the intensity of the implementation of fire drills had a positive and significant effect on crew preparedness, with a correlation value of 0.877, a regression equation of Y = 12.498 + 0.897X, a calculated t value of 10.017 greater than the t table of 2.042, and a coefficient of determination of 0.770. This shows that 77.0% of crew preparedness is influenced by the intensity of fire drill implementation, whereas 23.0% is influenced by other factors outside the study. Based on the results of the discussion, the researcher suggests that shipping companies maintain and improve the intensity of the implementation of fire drills, which can be developed through interactive discussions and case studies so that they are easily understood by the ship's crew, for the ship's crew to be more active in participating in each fire drill implementation so that crew preparedness continues to increase.

Keywords: *Fire Drill, Crew Preparedness, Ship Crew*

INTRODUCTION

Sea transportation plays an important role in the distribution of goods, especially for areas that can only be accessed by water routes (Demena & Nalurita, 2025). In addition, the sea is also related to ports, which are facilities located on the coast or seaside, which are used as a place for ships to moor or anchor, as well as an entry and exit point for goods and passengers. Ro-ro ships Passenger is a type of ship designed to transport vehicles. This ship is equipped with a ramp. Door (Rampa Door), which functions as a connecting facility between cars ship decks and docks, facilitates the transfer of vehicles from ship to land by loading them roll-on or up and roll-off or down via the ramp door without the assistance of a special crane or other supporting equipment (Novian et.al., 2021).

The KM.DLN Mandalika ship is a Roro passenger ship owned by PT. Damai Lautan Nusantara, which serves the Surabaya–Balikpapan route with a sailing time of 40 hours, carries passengers, private vehicles and company profits, heavy trucks, trucks, and heavy equipment. This ship has 3 vehicle decks: the lower deck with a capacity of 15 vehicles, the main deck with a capacity of 55

Corresponding author's email: adretaw @gmail.com

vehicles, the upper deck with a capacity of 15 vehicles, and the deck with a capacity of 42 vehicles. In addition to the vehicle deck, there is a passenger deck with a capacity of 79 passengers. With this capacity, there are factors that influence the ship's smooth operation, namely, safety.

Maritime safety and security is a condition where safety and security requirements concerning transportation in waters, ports, and the maritime environment are met (Lioso, 2025). Sea safety plays a vital role in ensuring the smooth and sustainable operation of ships. Many challenges at sea pose risks that cannot be ignored, especially those related to emergencies that can occur at any time. Emergencies in the marine environment rank highest among all hazards in terms of lost ships, cargo damage, injuries, and deaths (Tac et al., 2020). Emergency preparedness is a crucial factor in various industries given the potential for crises in various sectors. Fires on ships are one of the main causes of maritime accidents, which shows the urgency of attention to this issue (Listiyawari et al., 2025). A necessary prevention strategy is needed to reduce the risk of fire, namely a fire drill.

Recent studies published in Applied Quantitative Analysis show that quantitative approaches are increasingly being used to evaluate operational performance and decision-making in maritime transportation. The application of statistical analysis allows researchers to identify operational factors that influence maritime safety and provide empirical evidence for improving organizational performance. Consequently, quantitative methods have become an essential foundation for evaluating ship safety systems and emergency preparedness (Sianipar, 2021).

Ship crew capability is a set of competencies that include maritime knowledge, operational technical skills, cognitive and decision-making abilities, and interpersonal and communication skills, which are needed to carry out tasks effectively and safely in various situations on board the ship (Shi et al., 2024). The purpose of fire drills is to train ship crews to perform fire emergency procedures quickly, accurately, and efficiently. This includes training on how to operate fire extinguishers and deal with fire emergencies. This training is expected to improve the preparedness of the ship crew in dealing with stressful emergencies. Furthermore, fire drills are an important part of safety. Management system (SMS) is carried out on each ship, which functions as a prevention strategy to minimize the occurrence of other emergencies.

Judging from the ground facts, fire drills cannot be conducted every month. Several factors influence the intensity of fire drills. One of them is the density of the shipping route of the ship, which results in limited fire drill time. The crew's resources are limited and hampered by loading and unloading activities, resulting in less than optimal fire drill implementation. The physical and mental condition of the ship's crew also plays a significant role in the fire drill quality. Conditions such as fatigue and stress tend to make it difficult to participate optimally in the training, resulting in a lack of preparedness in dealing with emergencies, especially fires on board. Crew preparedness is assessed using various factors. Some aspects considered include their understanding of fire safety procedures, their ability to operate fire extinguishers, and their composure in dealing with emergencies when a fire occurs. In addition to the crew's ability, poor and inadequate maintenance of fire extinguishers hampers fire drills.

According to Lloyd's Register (2009) Chapter 3 reg 19, every ship's crew is required to participate in abandon ship drills and fire drills every month, and it is recommended that they attend these drills. These drills must be conducted periodically so that the ship's crew can practice their actions and reactions in emergencies such as fire, collision, and capsizing (Hermansson & Papamatthaiou, 2021). On passenger ships, fire drills are conducted once a week and when there is a crew change of at least 1/3 of the ship's crew. On the KM.DLN Mandalika ship, fire drills are carried out every month, but there are time constraints due to loading and unloading, so the implementation of the fire drill is less than optimal, causing crew preparedness to be considered lacking. This is due to the ship's busy route schedule and minimal rest time, so that the ship's crew is in a state of fatigue and stress during the fire drill. The scope of quality of implementation, namely, the extent to which the drill is conducted seriously, structured, and in accordance with applicable procedures. Crew involvement, as seen from the level of active participation of all ship crews in each fire drill. Variations in exercise scenarios are also considered to measure crew readiness in dealing with various possible emergency conditions. Adequate facilities and infrastructure, such as fire extinguishers and other safety equipment, are indicators of training intensity to ensure realistic training runs.

Based on these problems, this study aims to analyze the effect of the intensity of fire drill implementation on the preparedness of the KM. DLN Mandalika crew and to determine the extent of the contribution of fire drill implementation in improving crew readiness to face fire emergency conditions on board the ship.

LITERATURE REVIEW

Drill is an exercise to train the crew in dealing with emergency situations, including collisions, grounding, fire, abandoning a ship, man overboard, and hijacking. It can also be explained that a drill is an effort to improve human resource skills with the focus on repeated and continuous training to gain certain abilities. Training is a systematic process to change work behavior and competency levels (knowledge, abilities, and skills) including crew motivation, which helps reduce the gap between subjective qualifications (the ability to act and use competencies to achieve organizational goals) and objective qualifications (the highest level of education completed and the requirements imposed on the crew) and increase work productivity. Organizations can use training activities in the workplace or in other environments (Urbancov et al., 2021).

Fire drills on ships are fire emergency drills that are carried out in a planned and periodic manner on ships to train the ship's crew in detecting, responding to, and extinguishing fires, evacuating victims, and carrying out safety procedures according to shipping safety standards (Mahendra et al. al., 2024). Conducting drills on board a ship has many benefits. These include minimizing the response time in the event of a real emergency, improving decision-making under pressure, and familiarizing the crew with the ship's emergency equipment and procedures. The goal of emergency preparedness is to prepare for an appropriate and rapid response when a threat occurs to minimize the impact and, if necessary, move personnel from high-risk locations to safer areas (Tac et al., 2020).

Influence is a condition where In it, there is a reciprocal relationship or a causal relationship between what influences and what is influenced (Syarifuddin, 2021). Influence is defined as the power or force that comes from something, be it an individual, group, object, or even a particular event, which has the ability to shape, change, or modify a person's character, beliefs, and actions. This definition shows that influence is not a passive force but rather an active and dynamic force. Influence can work through various mechanisms, such as learning, observation, experience, or social interaction, all of which play a role in shaping an individual's way of thinking, behavior, and attitudes (Badan Pengembangan dan Pembinaan Bahasa, 2026).

Intensity is the level of implementation of an activity that can be measured absolutely or relatively, with reference to the percentage of an individual's maximum capacity and is classified into very low, low, medium, high, and very high (Bishop et al., 2025). The intensity of implementation is the level of how long, often, and in-depth training is conducted to achieve a specific goal. This includes frequency, duration, quality, and involvement in activities. Sufficient duration gives the crew the opportunity to carry out fire drills. They not only know what to do but are also ready to do it in real conditions. A quality fire drill is not only based on basic fire theory but also provides in-depth practical experience. High involvement in fire drills or conducting evacuation procedures ensures that participants understand the theory and master the skills to act quickly and appropriately in an emergency.

According to Saputra et al. (2024), implementing monthly fire drills on commercial vessels is crucial because it maintains crew preparedness and reduces fire risk. Therefore, the intensity of fire drill implementation is assessed not only by the frequency of the training, but also by its regularity and continuity.

Readiness is the ability of a ship's crew to plan, anticipate, and respond to emergencies with robust team training and coordination to minimize the risk of accidents and ensure the safety of the ship's crew. Emergency preparedness is a critical component of maritime safety, ensuring that crew members can effectively respond to fires, collisions, groundings, and flooding (Dhany et Al., 2024).

Crew readiness is determined not only by technical competence but also by individual behavior, communication, organizational commitment, and collaborative performance within the ship's environment. Human behavioral factors play a critical role in determining how crew members respond to emergency situations, particularly under high-pressure operational conditions. Therefore, enhancing emergency preparedness requires continuous competency development and organizational support that encourages safe behavior and effective teamwork.

Improved skills, mental readiness, and compliance with safety regulations are supported by training that equips ship crews with the tools and knowledge necessary to safely and efficiently perform their duties. The preparedness of ship crews can be improved through continuous training, regular drills, and simulations, enabling them to respond effectively to emergencies and supporting safer ship operations. Companies can reduce the risk of accidents, minimize operational losses, and improve operational efficiency by improving the skills and readiness of ship crews (Veltsin, 2024).

Crew preparedness in the face of fire is the ability of a ship's crew to respond to a fire emergency quickly, precisely, in a coordinated manner, and in accordance with safety procedures, which includes knowledge of fire hazards, skills in using fire extinguishers, mental readiness, division of tasks, and the ability to work together in the extinguishing and evacuation process. (Saputra et al., 2024). emphasized that ship crew alertness can be maintained through routine fire drill implementation because irregular training can reduce crew response when a fire occurs.

Quantitative assessment has become an effective approach for evaluating the operational effectiveness of maritime transportation. Previous studies published in Applied Quantitative Analysis show that statistical analysis can support the objective evaluation of safety-related operational performance, thereby assisting decision-makers in improving emergency preparedness and transportation safety (Anzani et al., 2026).

Drill intensity and crew preparedness are widely recognized due to continuous competency development. Fire drills provide crews with the opportunity to translate theoretical knowledge into practical operational experience. Increasing the intensity of fire drills is expected to enhance preparedness by improving technical competency, communication, coordination, leadership, and emergency decision-making capabilities.

The relationship between these variables can also be explained through experiential learning principles. Individuals acquire stronger competencies when they repeatedly perform specific tasks under realistic conditions. Fire drills provide a structured opportunity for experiential learning, allowing crew members to identify weaknesses, receive feedback, and continuously improve emergency performance. Therefore, repeated emergency training contributes to the long-term retention of safety procedures and operational confidence.

Furthermore, regular fire drills strengthen teamwork. Emergencies on board a ship require coordinated action involving multiple departments and non-isolated individual actions. Through ongoing emergency drills, the ship's crew becomes familiar with the command structure, communication channels, and role assignments. Better coordination minimizes operational delays and increases the effectiveness of emergency responses.

Another mechanism linking fire drills to preparedness is safety culture. Frequent emergency drills strengthen an organization's safety commitment by fostering discipline, responsibility, accountability, and continuous learning. When emergency drills become part of routine ship operations, safety awareness gradually develops into an organizational habit, rather than simply complying with regulatory requirements.

Therefore, the implementation of intensive fire drills is expected to result in measurable improvements in ship crew readiness. Increased participation in structured emergency drills improves technical competence, confidence, communication, teamwork, and readiness to effectively respond to fire emergencies on board ships.

In this study, there is one independent variable (X), namely fire drill, and one dependent variable (Y), namely crew preparedness in facing emergencies. The intensity level of fire drill implementation on crew preparedness in facing emergencies is shown by the scale score obtained for each variable.

Fire drills enable crews to effectively handle fire incidents under various maritime operational conditions. Fire simulation exercises remain a crucial component in maintaining ship crew safety while performing their duties. Regular fire drills improve crew preparedness and positively impact their mental readiness in emergencies. Fire drills are crucial because they improve the aerobic capacity of the crew, which can enhance their ability to respond quickly to emergencies on board (Ramohale, 2025). Fire drills are one of the most critical safety exercises because they can have catastrophic consequences for the ship, its crew, and its cargo (Wanga, 2024).

The preparedness of a ship's crew is about how united and ready the team is to face critical situations at sea. This is not just about reacting quickly when disaster strikes, but rather the result of thorough, long-term preparation. Through regularly scheduled training, each crew member is equipped with technical skills to avoid panic when an emergency occurs. Furthermore, the existence of standard operating procedures (SOPs) serves as the basis for them to make the right decisions, whether despite fire or other emergencies. Therefore, successful crisis management on board a ship heavily depends on the cohesiveness of the crew. Fluent communication and strong coordination are key to dealing with emergencies.

This study contributes to the literature on maritime safety in three ways. First, it provides empirical evidence on the relationship between fire drill intensity and crew preparedness. Second, it expands the application of quantitative analysis to maritime safety management. Third, the findings offer practical recommendations for improving emergency preparedness programs in commercial Indonesian shipping companies.

This conceptual framework serves as a roadmap for understanding the research structure, with each argument addressing the problem statement in stages. The theoretical description is translated into a flowchart, accompanied by a brief interpretation of each section. In this context, the diagram illustrates how the routine implementation of fire drills directly contributes to shaping the mental and technical capabilities of ship crews, ensuring maximum preparedness in emergencies.

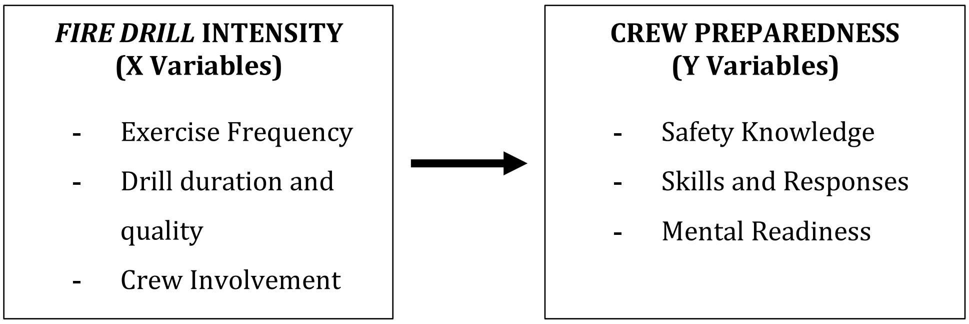

Figure 1. Framework of Thinking

A hypothesis is a testable, tentative, and reasonable (but unproven) explanation for a problem or observed phenomenon based on partial evidence (Ghasemi et al., 2025). This study was conducted to determine the effect of fire drill intensity on crew preparedness when dealing with emergencies.

The following is the formulation of the hypothesis based on the research:

H0 = There is no significant influence between the intensity of fire drill implementation and the preparedness of the KM.DLN Mandalika crew.

H1 = A significant influence exists between the intensity of fire drill implementation and the preparedness of the KM.DLN Mandalika crew.

RESEARCH METHOD

A research method is a scientific approach used to collect data for specific purposes and benefits. The scientific method refers to research principles based on scientific principles, namely, rational, empirical, and systematic. Rational means that the research process is conducted using a logical and rationally understandable approach and is based on human reasoning. The empirical results indicate that the method used can be observed through the five principles. Senses, so that the results can be measured or understood in real terms based on direct experience (Sugiyono, 2022).

Similarly, sound research methodology can generate new paradigms in the development of science. The ideas emerging from these paradigms tend not to be final and are always open to further change. In other words, the results of paradigm shifts will always be relative, depending on the data and facts obtained from reality, which are then analyzed according to applicable scientific principles (Risnita et al., 2024)

In the study entitled The Influence of Fire Drill Implementation Intensity on the Preparedness of the KM.DLN Mandalika Crew, the researcher used a quantitative method. Quantitative research is a scientific approach that is conducted in a structured manner to study a phenomenon with the aim of producing an objective and measurable understanding. This approach focuses on collecting numerical data, which is then analyzed using statistical, mathematical, or computational methods to interpret the research results in a measurable manner and test for accuracy.

Quantitative methods can be understood as a research approach based on the philosophy of positivism, which is used to study a specific population or sample. Data collection is conducted using research instruments, and data analysis is conducted quantitatively or using statistics, with the aim of describing and testing predetermined hypotheses (Sugiyono, 2022).

Population and Sample

Population

Population refers to all objects or subjects that are the focus of a study and have specific characteristics that are relevant to the study's objectives. Population is not limited to humans alone; it can also include animals, plants, phenomena, symptoms, or other events that meet certain criteria and requirements related to the research problem and can be used as a basis for sampling (Suriani et al., 2023).

The study population consisted of 32 active crew members of the KM.DLN Mandalika during the research period. This overall population selection was based on the crew's capacity to possess empirical experience and a deep understanding of the onboard operational dynamics. The crew's direct involvement in the work environment makes them a relevant primary data source for addressing the research challenges and supporting the comprehensive achievement of the study's objectives.

Although previous studies have examined emergency drills on board ships, most have focused primarily on regulatory compliance, safety procedures, or technical emergency response. Empirical evidence on how the intensity of fire drills affects crew readiness on board Indonesian commercial passenger vessels is limited. Furthermore, few quantitative studies have specifically examined this relationship using statistical modeling within the context of a Safety Management System (SMS). Therefore, this study aims to address this gap by providing empirical evidence on the effect of fire drill intensity on crew readiness on board the KM.DLN Mandalika.

This study's uniqueness lies in its empirical examination of fire drill intensity as a measurable organizational factor influencing crew readiness in Indonesian commercial passenger shipping operations. Unlike previous studies, which largely address emergency drills from a regulatory or procedural perspective, this study uses simple linear regression analysis to quantitatively evaluate the contribution of drill intensity to operational readiness.

Sample

A sample is a partial representation of a population that serves as the primary data source in a study. As a miniature representation of the population, a sample must be able to reflect the characteristics of a larger group so that the resulting generalizations have high validity. Referring to Nawawi's thinking, the application of sampling techniques is based on practical and methodological considerations, such as cost efficiency, time constraints, and population scale. Furthermore, sampling is often conducted to maintain data accuracy, accommodate destructive testing, and ensure the sustainability of the research from an economic perspective (Amin et al., 2023).

In this study, the researcher employed a saturated sampling technique, which involves the entire population as respondents. This can also be interpreted as a maximum sample size, as any increase in the number will not affect the representativeness of the population. The saturated sampling technique was used because the population size was relatively small, under 100, and all members of the population were accessible to the researcher. Therefore, 32 crew members of the KM.DLN Mandalika were selected as respondents (Sugiyono, 2022).

Data analysis was performed using SPSS version 31.0. Data testing included validity testing, reliability testing, simple linear regression analysis, t-test to determine the partial effect of independent variables on the dependent variable, and coefficient of determination (R^2) testing to determine the magnitude of the contribution of fire drill implementation intensity to preparedness of the KM.DLN Mandalika crew.

The simple linear regression model used in this study is as follows:

$$\mathbf{Y = a + bX}$$

Where:
Y = Crew readiness
a = constant
b = Regression coefficient
X = Intensity of the fire drill implementation

Primary data were collected using a structured questionnaire developed from the operational indicators of the two research variables. Each questionnaire item was rated using a five-point Likert scale ranging from strongly disagree (1) to strongly agree (5). Before distributing the questionnaire to the research respondents, the instrument was pretested on 30 respondents from similar vessels to evaluate validity and reliability. This pretesting ensured that all questionnaire items accurately measured the intended constructs and consistently represented the research variables.

Table 1. Likert Scale

Score	Assessment Categories (Statement Positive)	Assessment Categories (Negative statement)
5	Very Agree	Very No Agree
4	Agree	No Agree
3	Undecided/ Neutral	Undecided/ Neutral
2	No Agree	Agree
1	Very No Agree	Very Agree

Requirements Analysis Test

Research instrument testing

Instrument testing was conducted to ensure that the questionnaire was suitable as a research data collection tool. This testing involved two stages: validity testing and reliability testing, each of which played a distinct but complementary role in assessing each statement item's quality.

Validity Test

Validity testing was conducted to assess each statement item's ability to represent the measured variable. An item is declared valid if the calculated value is greater than the table value (0.361).

Table 2. Results of the X-Validity Test

	Correlations			
		X TOTAL	**TABLE R**	**INFORMATION**
X1	Pearson Correlation	.570 ***	0.361	VALID
	Sig . (2-tailed)	0.001		VALID

	N	32		VALID
X2	Pearson Correlation	.563 ***	0.361	VALID
	Sig . (2-tailed)	0.001		VALID
	N	32		VALID
X3	Pearson Correlation	.765 ***	0.361	VALID
	Sig . (2-tailed)	0,000		VALID
	N	32		VALID
X4	Pearson Correlation	.848 ***	0.361	VALID
	Sig . (2-tailed)	0,000		VALID
	N	32		VALID
X5	Pearson Correlation	.863 ***	0.361	VALID
	Sig . (2-tailed)	0,000		VALID
	N	32		VALID
X6	Pearson Correlation	.800 ***	0.361	VALID
	Sig . (2-tailed)	0,000		VALID
	N	32		VALID
X7	Pearson Correlation	.773 ***	0.361	VALID
	Sig . (2-tailed)	0,000		VALID
	N	32		VALID
X8	Pearson Correlation	.822 ***	0.361	VALID
	Sig . (2-tailed)	0,000		VALID
	N	32		VALID
X9	Pearson Correlation	.833 ***	0.361	VALID
	Sig . (2-tailed)	0,000		VALID
	N	32		VALID
X10	Pearson Correlation	.697 ***	0.361	VALID
	Sig . (2-tailed)	0,000		VALID
	N	32		VALID
X11	Pearson Correlation	.789 ***	0.361	VALID
	Sig . (2-tailed)	0,000		VALID
	N	32		VALID
X12	Pearson Correlation	.792 ***	0.361	VALID
	Sig . (2-tailed)	0,000		VALID
	N	32		VALID
X13	Pearson Correlation	.747 ***	0.361	VALID
	Sig . (2-tailed)	0,000		VALID
	N	32		VALID
X14	Pearson Correlation	.848 ***	0.361	VALID
	Sig . (2-tailed)	0,000		VALID
	N	32		VALID
X TOTAL	Pearson Correlation	1		
	Sig . (2-tailed)			
	N	32		

***. Correlation at 0.001 (2-tailed)
*. Correlation is significant at the 0.05 level (2-tailed).
**. Correlation is significant at the 0.01 level (2-tailed).

Table 3. Results of the Y-Validity Test

Correlations				
		Y TOTAL	**TABLE R**	**INFORMATION**
Y1	Pearson Correlation	.615 ***	0.361	VALID
	Sig . (2-tailed)	0,000		VALID
	N	32		VALID
Y2	Pearson Correlation	.744 ***	0.361	VALID
	Sig . (2-tailed)	0,000		VALID
	N	32		VALID
Y3	Pearson Correlation	.884 ***	0.361	VALID
	Sig . (2-tailed)	0,000		VALID
	N	32		VALID
Y4	Pearson Correlation	.764 ***	0.361	VALID
	Sig . (2-tailed)	0,000		VALID
	N	32		VALID
Y5	Pearson Correlation	.944 ***	0.361	VALID
	Sig . (2-tailed)	0,000		VALID
	N	32		VALID
Y6	Pearson Correlation	.831 ***	0.361	VALID
	Sig . (2-tailed)	0,000		VALID
	N	32		VALID
Y7	Pearson Correlation	.730 ***	0.361	VALID
	Sig . (2-tailed)	0,000		VALID
	N	32		VALID
Y8	Pearson Correlation	.886 ***	0.361	VALID
	Sig . (2-tailed)	0,000		VALID
	N	32		VALID
Y9	Pearson Correlation	.921 ***	0.361	VALID
	Sig . (2-tailed)	0,000		VALID
	N	32		VALID
Y10	Pearson Correlation	.923 ***	0.361	VALID
	Sig . (2-tailed)	0,000		VALID
	N	32		VALID

Y11	Pearson Correlation	.786 ***	0.361	VALID
	Sig . (2-tailed)	0,000		VALID
	N	32		VALID
Y12	Pearson Correlation	.835 ***	0.361	VALID
	Sig . (2-tailed)	0,000		VALID
	N	32		VALID
Y13	Pearson Correlation	.894 ***		VALID
	Sig . (2-tailed)	0,000		VALID
	N	32		VALID
Y14	Pearson Correlation	.883 ***	0.361	VALID
	Sig . (2-tailed)	0,000		VALID
	N	32		VALID
Y15	Pearson Correlation	.944 ***	0.361	
	Sig . (2-tailed)	0,000		
	N	32		
Y TOTAL	Pearson Correlation	1		
	Sig . (2-tailed)			
	N	32		
***. Correlation at 0.001 (2-tailed)				
*. Correlation is significant at the 0.05 level (2-tailed)				
**. Correlation is significant at the 0.01 level (2-tailed)				

Reliability Test

Reliability testing is conducted to assess the instrument's consistency using Cronbach's Alpha. An instrument is considered reliable if its value is above 0.70. The following are the results of the reliability test conducted on 30 respondents. Reliability testing is conducted to assess the instrument's consistency using Cronbach's Alpha. An instrument is considered reliable if its value is above 0.70. The following are the results of the reliability test conducted on 30 respondents.

Table 4. Reliability Test Results of Variable X

Reliability Statistics	
Cronbach's Alpha	N of Items
.941	14

Table 5. Results of the reliability test of variable Y

Reliability Statistics	
Cronbach's Alpha	N of Items
.967	15

FINDINGS AND DISCUSSION

This study describes the results of data analysis sourced from 32 crew members of KM.DLN Mandalika. Respondents have diverse characteristics, including age, length of service on board, position, and last level of education. These diverse backgrounds are significant to study, considering their potential influence on the level of understanding, accumulation of work experience, operational responsibility burden, and individual responses to the implementation of safety procedures in the work environment on board. This study presents descriptive statistical data for each variable studied in addition to presenting data on respondent characteristics. In this section, the minimum, maximum, and average (mean) values of respondents' responses to each statement indicator are displayed, so that the tendency of fire drill implementation intensity toward the level of crew preparedness can be identified before further analysis is carried out. Data are presented in the form of descriptive statistics arranged in a table to facilitate understanding, improve the structure of information, and provide a comprehensive picture of the characteristics of respondents and research variables. This study aims to evaluate the relationship between the intensity of fire drill implementation and the preparedness of the KM.DLN Mandalika crew in daily operational activities on board.

1. **Background Based on Age**

Respondents' ages were recorded to reflect the age group of the ship's crew members who were the study subjects. This data presentation profiles the participants who participated in the fire drill and gained knowledge about fires on ships. Age information serves as an indicator of the general characteristics of the participants, providing a comprehensive overview of their profiles. The following table presents the age distribution of respondents.

Table 6. Age

		Frequency	Percentage	Valid percentage	Cumulative percentage
Valid	< 30 Years	15	46.9	46.9	46.9
	30 - 45 Years	17	53.1	53.1	100.0
	Total	32	100.0	100.0	

Based on the results of data processing, the respondents in this study were dominated by ship crews aged 30-45 years, amounting to 17 people (53.1%), and 15 people (46.9%) were aged 30 years. The majority of fire drill participants and fire training recipients are in the age range of 30-45 years, which is the productive working age and is at an optimal stage in terms of physical aspects, knowledge, and work responsibilities.

2. **Background Based on Work Length on a Ship**

Length of service on board a ship reflects the crew's level of experience in implementing operational procedures and their understanding of repeated safety measures, particularly fire drills. Differences in the length of service allow for variations in the intensity of implementation and depth of understanding of the fire drill procedures. The following table shows the distribution of the length of service of the respondents on board ships.

Table 7. Length of Ship Service

LENGTH OF WORKING ON THE SHIP					
		Frequency	Percentage	Valid percentage	Cumulative percentage
Valid	< 1 Year (New)	7	21.9	21.9	21.9
	> 5 years (very experienced)	17	53.1	53.1	75.0
	1 - 3 years (intermediate)	4	12.5	12.5	87.5
	3 - 5 Years (Experienced)	4	12.5	12.5	100.0
	Total	32	100.0	100.0	

Based on the table above, respondents with more than 5 years of work experience are the largest group, with 17 respondents (53.1%), followed by those who have just worked on ships with 7 respondents (21.9%), the experienced group with 3-5 years of work experience, and the middle group with 1-3 years of work experience with 4 respondents (12.5%). This shows that most ship crews have sufficient experience and involvement in implementing ship safety procedures.

3. **Background Based on Position**
   Job titles reflect each respondent's position and responsibilities within the work structure of the ship. This study covers various levels of positions on board the ship to assess how these structural roles influence the intensity of fire drills and crew preparedness. Table 8 shows the respondents' job titles.

Table 8. Length of service on board the ship

POSITIONS ON THE SHIP BOARD					
		Frequency	Percentage	Valid percentage	Cumulative percentage
Valid	BOSUN	1	3.1	3.1	3.1
	CADET	7	21.9	21.9	25.0
	HELMSMAN	4	12.5	12.5	37.5
	SAILOR	3	9.4	9.4	46.9
	Minimum competency (KKM)	1	3.1	3.1	50.0
	CHEF	2	6.3	6.3	56.3
	ENGINEER 1	1	3.1	3.1	59.4
	ENGINEER 2	1	3.1	3.1	62.5
	ENGINEER 3	1	3.1	3.1	65.6
	ENGINEER 4	1	3.1	3.1	68.8
	ENGINEER 4 JR	1	3.1	3.1	71.9
	1st Marine	1	3.1	3.1	75.0

MUALIM 2	1	3.1	3.1	78.1
MUALIM 3	1	3.1	3.1	81.3
4th Marine	1	3.1	3.1	84.4
SCAFFOLD	1	3.1	3.1	87.5
OILER	4	12.5	12.5	100.0
Total	32	100.0	100.0	

Respondents in this study consisted of officers and cadets. The position that most frequently filled out this questionnaire was cadet with 7 people (21.9%), followed by Helmsman and Oiler with 4 people each (12.5%), Seaman with 3 people (9.4%), and Cook with 2 people (6.3%), as well as several positions ranging from Master, Chief Officer, Chief Engineers and others with smaller percentages. This shows that the research data represent various ship operation structural levels.

Based on age, most respondents were in the 30–45 years age range, amounting to 17 people (53.1%), while 15 people (46.9%) were under 30 years old. This condition shows that most respondents are of productive age with physical abilities, experience, and work responsibilities that support the implementation of safety procedures on ships.

Respondents with more than 5 years of experience constituted the largest group in terms of length of service, at 17 (53.1%). This indicates that most crew members have sufficient operational experience to understand safety procedures and conduct emergency drills. Work experience is one factor that can support the decision-making abilities of crew members when facing critical situations on board.

Respondents consisted of various levels of ship work structure, ranging from officers, ratings, to cadets. This composition shows that the study has involved various positions that have different responsibilities in the implementation of fire drills. Meanwhile, based on education level, the majority of respondents had D3/D4/S1 education (n = 16; 50%), followed by high school/vocational school graduates (n = 12; 37.5%). The variation in these characteristics illustrates that respondents have diverse backgrounds in accepting and implementing ship safety procedures.

Description of the Research Variables

The fire drill intensity variable is used to measure the level of emergency drill implementation conducted by ship crews. This variable measures crew participation, drill quality, fire extinguisher use, involvement in emergency procedures, and technical and mental preparedness for fires.

The results of the descriptive analysis show that the average value of each indicator of the fire drill intensity variable ranges from 4.50 to 4.68, with a maximum value of 5.00. These results indicate that respondents have a positive perception of the effect of fire drills on KM. DLN Mandalika. The high average value indicates that the training activities improved the understanding of safety procedures, the ability to use fire extinguishers, coordination between crews, and the speed of emergency response.

This finding strengthens the research of Saputra et al. (2024), who stated that the routine implementation of fire drills on commercial vessels plays an important role in maintaining crew preparedness and reducing the risk of fire by increasing competence and practical experience.

The crew preparedness variable is used to determine the crew's ability to deal with fire emergencies, which includes understanding safety procedures, compliance with regulations, skills in using fire extinguishers, mental readiness, and the ability to work together in emergency situations.

The results of the descriptive analysis show that the average value of the crew preparedness indicator ranges from 4.46 to 4.81. This value indicates the level of preparedness of the KM.DLN Mandalika crew is in the high category. However, there are still aspects that need attention, especially discipline in following all procedures during the fire drill. This indicates that consistent training is still needed so that all crew members can provide an optimal response when facing real conditions.

Research Instrument Testing

The fire drill intensity and crew preparedness variables had correlation values greater than the r value of 0.361. Thus, all instruments were declared valid and suitable for use in this study.

Next, the reliability testing uses Cronbach's value. The alpha indicates that the fire drill intensity and crew preparedness variables have values greater than 0.70. This indicates that the instrument has a good consistency and is suitable for data collection.

Model and Hypothesis Testing

Table 9. Normality Test Results

Tests of Normality						
	Kolmogorov-Smirnov [a]			Shapiro-Wilk		
	Statistics	df	Sig.	Statistics	df	Sig .
Drill Implementation	.129	32	.192	.962	32	.312
Crew readiness	.077	32	.200	.963	32	.323

* This is the lower bound of the true significance.

a. Lilliefors Significance Correction

Before hypothesis testing, a classical assumption test was conducted to ensure the feasibility of the regression model. The results of the normality test using the Shapiro-Wilk method showed a significance value of 0.312 and 0.323 for the fire drill intensity variable and 0.323 for crew preparedness (>0.05), indicating that the research data were normally distributed.

Table 10. Results of Heteroscedasticity Test

Coefficients [a]						
Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig .
		B	Std . Error	Beta		
1	(constant)	2,254	2,287		.985	.332
	FIRE DRILL IMPLEMENTATION INTENSITY	-.016	.035	-.084	-.460	.649

a. Dependent variable: ABS_RES

The heteroscedasticity test using the Glejser method showed a significance value of 0.649 (>0.05), indicating that the regression model did not have heteroscedasticity problems. Furthermore, the results of the linearity test showed a significance value of <0.001 and a deviation of <0.001. from linearity of 0.729 (>0.05), so the relationship between the intensity of fire drill implementation and crew preparedness is linear.

Influence of Fire Drill Implementation Intensity on Crew Preparedness

Table 11. Correlation Test Results

Correlations			
		FIRE DRILL IMPLEMENTATION INTENSITY	CREW PREPAREDNESS
FIRE DRILL IMPLEMENTATION INTENSITY	Pearson Correlation	1	.877 ***
	Sig . (2-tailed)		<.001
	N	32	32
CREW PREPAREDNESS	Pearson Correlation	.877 ***	1
	Sig . (2-tailed)	<.001	
	N	32	32

***. Correlation at 0.001 (2-tailed)

The results of the Pearson correlation analysis show that the intensity of fire drill implementation has a strong relationship with crew preparedness, with a correlation coefficient of 0.877 and a significance value of <0.001. This value indicates that an increase in the quality and intensity of fire drill implementation will be followed by an increase in crew preparedness in emergencies.

Table 12. Simple Linear Regression Test Results

Coefficients [a]						
Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(constant)	12,498	5,794		2,157	.039
	FIRE DRILL IMPLEMENTATION INTENSITY	.897	.090	.877	10,017	<.001

a. Dependent variable: CREW READINESS

The results of the simple linear regression analysis produce the following equation:

$$Y = 12.498 + 0.897X$$

The equation shows that every one-unit increase in fire drill implementation intensity will increase crew preparedness by 0.897 units. A positive regression coefficient indicates a unidirectional relationship between the two variables, i.e., the better the fire drill implementation, the higher the level of crew preparedness.

The current findings also support a previous quantitative maritime study published in Applied Quantitative Analysis, which shows that empirical statistical analysis provides valuable evidence for evaluating operational safety performance and emergency management practices on board commercial vessels. Quantitative evaluation enables shipping companies to identify operational weaknesses and continuously improve ship safety management systems (Anzani et al., 2026; Sianipar, 2021).

Table 13. t-Test Results

Coefficients [a]						
Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig .
		B	Std . Error	Beta		
1	(constant)	12,498	5,794		2,157	.039
	FIRE DRILL IMPLEMENTATION INTENSITY	.897	.090	.877	10,017	<.001

a. Dependent variable: CREW READINESS

The t-test showed a calculated t-value of 10.017 > t-table 2.042 with a significance value of <0.001. These results prove that the intensity of fire drill implementation has a significant influence on the preparedness of the KM. DLN Mandalika crew. Thus, the alternative hypothesis (H1) is accepted, and the null hypothesis (H0) is rejected.

Table 14. Results of the Determination Coefficient Test

Model Summary				
Model	R	R Square	Adjusted R-square	Std . Error in the Estimate
1	.877 [a]	.770	.762	3,595

a. Predictors : (constant), FIRE DRILL IMPLEMENTATION INTENSITY

The fire drill implementation intensity variable to crew preparedness is shown through the coefficient of determination (R^2) value of 0.770. This means that 77.0% of the variation in crew preparedness can be explained by the intensity of fire drill implementation, while the other 23.0% is influenced by other factors such as work experience, crew physical and mental conditions, safety equipment quality, leadership during emergencies, and company safety culture.

The results of this study indicate that fire drills are not only a procedural requirement under maritime safety standards but also play a role in developing emergency response habits among ship crews. Regular drills enable crews to understand the division of tasks, improve their ability to use firefighting equipment, strengthen team coordination, and build mental preparedness for fire situations.

This finding is in line with Saputra et al., (2024), who stated that crew preparedness can be maintained through regular fire drills, as inconsistent training can reduce response capabilities in the event of a fire. Therefore, improving the quality and intensity of fire drills is an important strategy for strengthening a ship's operational safety system.

Theoretical Implications

The findings of this study provide several important theoretical contributions to maritime safety management, particularly regarding emergency preparedness and human resource competency development on commercial vessels. The study demonstrates that the intensity of fire drills is a significant organizational factor influencing crew preparedness in responding to fire emergencies onboard vessels. These findings extend previous discussions that primarily emphasize emergency drills as regulatory compliance by highlighting their strategic role in strengthening operational readiness through continuous competency development.

From an organizational learning theory perspective, the findings suggest that emergency preparedness is not a static competency acquired solely through formal maritime education but rather a dynamic capability developed through repeated practical experience. Continuous participation in fire drills allows crew members to convert theoretical knowledge into procedural memory, enhance technical competency, strengthen communication patterns, and improve coordination during emergencies. This study supports the argument that experiential learning plays a fundamental role in maintaining operational safety in maritime organizations.

The results of this study also contribute to the theoretical understanding of Safety Management Systems (SMS) Although SMS is traditionally viewed as a framework for ensuring compliance with international maritime regulations, this study demonstrates that the effectiveness of such systems is highly dependent on the quality and intensity of onboard emergency training activities. Therefore, fire drills serve not only as mandatory operational exercises but also as organizational learning mechanisms that continuously strengthen safety awareness, improve teamwork, and reduce the likelihood of human error during emergencies.

Another important theoretical implication is related to the multidimensional nature of ship-crew readiness. The findings indicate that readiness encompasses technical competence, procedural knowledge, emergency communication, teamwork, discipline, decision-making skills, and psychological readiness. These dimensions develop simultaneously and not independently through ongoing emergency drills. Therefore, this study strengthens the conceptual understanding that ship crew readiness should be viewed as an integrated organizational competency, not just individual technical skills.

Furthermore, the coefficient of determination (R^2 = 0.770) indicates that fire drill intensity explains most of the variance in ship crew readiness. However, 23% of readiness is still influenced by other organizational and individual factors. In line with this, Ozili (2023) stated that a low R^2 value in social research is still tolerable because many factors that cannot all be studied in a single research model influence human behavior. These findings suggest that future theoretical models of maritime emergency preparedness should integrate additional constructs such as safety leadership, organizational safety culture, safety climate, fatigue management, work experience, psychological resilience, and organizational commitment. Such integration would contribute to a more comprehensive theoretical framework explaining emergency preparedness in commercial shipping operations.

Overall, this study enriches the literature on maritime safety by positioning the intensity of fire drill implementation as an important organizational capability that bridges ship crews' safety management policies and actual emergency response performance.

In addition to strengthening maritime safety management theory, this study also contributes to the literature on organizational behavior by demonstrating that ongoing emergency drills can enhance individual competence, collaborative performance, and organizational preparedness. Consequently, emergency preparedness should be understood because of the interaction between technical training, organizational support, and behavioral adaptations, rather than simply a procedural requirement.

Practical Implications

This study's practical implications are relevant to shipping companies, ship management, maritime educational institutions, and maritime regulatory authorities responsible for improving operational safety.

These findings suggest that conducting fire drills should be considered a strategic investment in operational safety, rather than simply fulfilling mandatory international regulations, for shipping companies. Management should ensure that emergency drills are regularly conducted using realistic scenarios that reflect the actual operational risks encountered during shipping. Furthermore, systematic evaluations after each drill should be incorporated into the company's continuous improvement process to identify weaknesses, improve emergency procedures, and strengthen organizational learning.

These findings emphasize the importance of effective leadership in conducting emergency drills for ship captains and department heads. Leadership commitment influences crew participation, discipline, communication, and coordination during emergency drills. Captains are encouraged to promote an organizational culture in which every crew member, regardless of rank or department, actively participates in emergency preparedness. Constructive post-drill discussions should also become a routine practice to foster continuous learning and improve emergency response effectiveness.

This study has implications for maritime education and training institutions. Emergency preparedness cannot be adequately developed through classroom instruction alone. Maritime academies should strengthen competency-based education by increasing the proportion of practical emergency simulations, scenario-based exercises, bridge resource management, and integrated ship safety training. Such an educational approach is expected to prepare future seafarers for the operational conditions encountered on commercial vessels.

The current findings suggest that technical emergency training alone is insufficient without ongoing behavioral reinforcement. Implementation of effective fire drills not only strengthens technical competency but also communication patterns, teamwork, and safety-oriented behaviors among crew members. This observation supports the broader organizational behavior perspective, which emphasizes that the ongoing interaction between organizational systems, leadership, and behavioral development shapes individual performance.

From the perspective of maritime regulators, emergency preparedness evaluations should go beyond administrative compliance with SOLAS requirements (Lloyd's Register, 2009). Regulatory inspections could include assessments of drill quality, crew participation, the realistic nature of emergency scenarios, the effectiveness of communications, and corrective actions implemented following drills. Such evaluations would encourage shipping companies to prioritize competency development over simply meeting documentation requirements.

Shipping companies are encouraged to complement technical fire drill programs with behavioral safety initiatives, such as leadership involvement, effective safety communication, regular briefing sessions, and ongoing feedback mechanisms. This integrated approach can strengthen a safety culture while increasing crew motivation to actively participate in group with EPP.

CONCLUSIONS

This study shows that the intensity of fire drill implementation has a positive and significant influence on the preparedness of the KM. DLN Mandalika crew in facing fire emergencies on board.

The analysis results show a correlation value of 0.877 with a significance level of <0.001, which indicates that increasing the quality and intensity of fire drill implementation is strongly related to crew preparedness. This finding confirms that fire drills function not only to fulfill shipping safety procedures but also as an instrument for developing technical competence, team coordination, and crew mental readiness in responding to emergencies.

Fire drill implementation to crew preparedness is shown through the coefficient of determination value of 0.770, which means that the intensity of fire drill implementation can explain 77.0% of the variation in crew preparedness. The regression model produces the equation **Y = 12.498 + 0.897X**, which shows that each increase in the intensity of fire drill implementation will increase crew preparedness by 0.897 units. Meanwhile, 23.0% of the variation in preparedness is influenced by other factors outside the research model, such as work experience, physical and mental conditions of the crew, quality of safety equipment, ship safety culture, and management support.

The results of this study contribute to the development of maritime safety studies by strengthening empirical evidence that human resource factors, particularly through structured and ongoing emergency drills, are critical in improving ship safety systems' effectiveness. Therefore, improving the quality of fire drill implementation through consistent, risk-scenario-based training and involving the entire crew should be a priority strategy in strengthening ship operational safety management.

LIMITATION & FURTHER RESEARCH

This study has several limitations that need to be considered when interpreting the results. First, the scope of respondents in this study was limited because data collection was conducted on only one vessel. Therefore, the results cannot be generalized to all crews within the same company or to other types of vessels with different operational characteristics. Future research is recommended to expand the scope of the research object by involving several vessels or shipping companies to obtain a more comprehensive picture of crew preparedness.

Drill intensity as an independent variable of ship crew preparedness. This study did not examine other factors that could influence preparedness, such as work experience, safety knowledge, quality of safety training, safety leadership, safety culture, and the availability of safety facilities. Therefore, further research can develop the research model by incorporating these other variables to gain a deeper understanding of the factors that shape ship crew preparedness.

Third, the data collection method in this study still uses a questionnaire as the primary data source; thus, the interpretation of the research results is highly dependent on the respondents' perceptions and honesty in providing answers. This approach can introduce subjective bias. Future research can combine quantitative methods with other approaches, such as direct observation of fire drill implementation, in-depth interviews, or performance-based evaluations, to provide a more objective and comprehensive picture of crew preparedness.

Suggestion

The research recommendations are derived from the data analysis, research conclusions, and identified limitations. These recommendations are structured based on the aspects that need to be maintained or improved. The recommendations of the researchers are as follows.

1. **For Ship Companies/Management**

Develop a monthly fire drill schedule that adjusts to the sailing and loading and unloading schedules, creates a variety of fire scenarios, ensures that all fire extinguishers are ready for use, and conducts a written evaluation after the drill is carried out. Involve passengers in the implementation of the fire drill both at the beginning before sailing and in the middle of the voyage.

Inform passengers at the beginning of the voyage regarding the fire drill steps so that when a fire occurs, passengers also understand the steps to be taken.

2. For the ship crew

Increasing active crew participation in fire drills, understanding each person's duties in the master list , getting used to using fire extinguishers and safety equipment, and providing feedback after the training.

Further Research

Other variables, such as work experience, education level, leadership, work negligence, safety culture, and safety equipment conditions, were added to make the research model more comprehensive.

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