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The Effect of Maritime Safety Training and the Availability of Safety Equipment on Occupational Health and Safety (OHS) and the Performance of Evergreen Container Ship Crews at Tanjung Emas Port, Semarang

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Abstract

This study examines the effects of maritime safety training and the availability of safety equipment on occupational health and safety (OHS) and ship crew performance aboard Evergreen container ships at Tanjung Emas Port, Semarang. A quantitative, descriptive-associative approach was employed using multiple regression and correlation analyses to assess the relationships among the research variables. The findings indicate that maritime safety training and safety equipment availability received average ratings of 4.84 and 4.70, respectively, while OHS and ship crew performance achieved average ratings of 4.73 and 4.81. Regression analysis demonstrates that safety training and equipment availability jointly and significantly influence OHS ($F = 13.558$, $p < 0.05$) and ship crew performance ($F = 17.756$, $p < 0.05$). Both variables also have positive and significant partial effects on OHS and crew performance. The adjusted R-squared values indicate that the independent variables explain 34.8% of the variation in OHS and 41.6% of the variation in crew performance. These findings highlight the importance of integrating structured safety training with adequate, well-maintained safety equipment to strengthen crew competence, improve workplace safety, and enhance operational effectiveness. Further attention is recommended for lifeboat readiness and workload management to support safer and more reliable maritime operations.

Keywords: **Maritime Safety Training; Safety Equipment Availability; Occupational Health and Safety (OHS); Ship Crew Performance; Maritime Safety.**

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INTRODUCTION

Shipping plays a vital role in Indonesia's economy, encompassing maritime transportation, port operations, safety, security, and environmental protection, as stipulated in Law No. 17 of 2008 on Shipping. Maritime safety is influenced by human factors, vessel conditions, and port infrastructure, while weaknesses in regulations, management, and operational practices can increase accident risks and disrupt economic activities (Mursidi, 2023). International safety standards, including the International Safety Management (ISM) Code, International Regulations for Preventing Collisions at Sea (COLREGs), International Ship and Port Facility Security (ISPS) Code, and Standards of Training, Certification and Watchkeeping (STCW), provide essential guidance for improving maritime safety. Previous studies also highlight the significant contribution of human error and inadequate safety management to maritime accidents (Naily et al., 2019).

Maritime accidents remain a concern in Indonesia. According to the National Transportation Safety Committee (KNKT), 389 ship accident reports were recorded in 2023, an increase from 323 reports in 2022. These incidents resulted in 32 fatalities and 43 missing persons in 2023. Contributing factors include crew performance, weather conditions, and technical problems. At Tanjung Emas Port in Semarang, several incidents have highlighted safety deficiencies, including the collision of MV Soul of Luck with a container crane and fires involving KM Awu in 2019 and KM Kirana 1 in 2024, as well as a worker falling from a height during ship cleaning in 2024. These incidents emphasize the importance of effective safety procedures, adequate equipment, and competent personnel in preventing accidents.

Maritime safety training is an essential factor in improving crew competence and preparedness for emergencies. Regular and structured training enables crew members to identify hazards, implement preventive measures, and respond effectively to critical situations. Setyawan et al. (2020) found that regular safety training helps crews recognize risks and take preventive action, while Baliyan and Dhankher (2022) emphasized that emergency simulations improve coordination among crew members. Similarly, Dhany et al. (2024) reported that routine safety training contributes to reducing accident risks and improving emergency response. Tac and Celik (2022) further highlighted the role of emergency simulation training in strengthening safety practices, communication, teamwork, and the ability to make appropriate decisions under pressure.

The availability of adequate safety equipment is equally important in protecting crew members and supporting occupational health and safety (OHS). Equipment such as lifeboats, life jackets, fire detection systems, and emergency communication devices enables faster responses and more effective evacuation during emergencies. Rahman (2024) emphasized that vessels equipped with safety equipment meeting international

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standards are better positioned to protect crews and cargo during incidents. Burgén and Bram (2024) highlighted the importance of adequate equipment in reducing emergency response time, while Amin et al. (2018) noted that complete safety equipment can increase crew confidence in handling emergencies. Furthermore, Kuncowati (2024) stressed that regularly updated safety equipment supports more efficient emergency management, whereas inadequate equipment may delay responses and increase the likelihood of severe consequences.

The integration of maritime safety training, adequate safety equipment, and a strong OHS culture is therefore essential for improving the safety and operational performance of Evergreen container ship crews at Tanjung Emas Port. Effective safety practices can reduce fatalities, minimize vessel damage and cargo losses, and maintain operational continuity. Purnomo et al. (2021) associated a strong OHS culture with greater customer confidence in shipping companies, while Khan et al. (2019) linked investment in safety with improved operational efficiency and client satisfaction. Fan et al. (2023) also found that comprehensive and frequent emergency drills can reduce crew anxiety and strengthen their ability to respond appropriately during critical situations. Accordingly, maritime safety training and the availability of safety equipment are important factors in supporting OHS implementation, enhancing crew performance, and ensuring sustainable container shipping operations.

LITERATURE REVIEW

Maritime Transportation Management

Sea transportation plays a vital role in Indonesia's national development by connecting islands, supporting economic growth, and improving public welfare (Saputra, 2022). The International Maritime Organization (IMO), as a specialized United Nations agency, establishes international regulations to enhance maritime safety, security, and pollution prevention (Sagala, 2021; Suwito et al., 2023). Through international conventions and cooperation among member states, the IMO develops and updates maritime legislation and safety standards (Saputra, 2023; Sitorus et al., 2024). One of the key instruments is the International Convention for the Safety of Life at Sea (SOLAS), which establishes minimum requirements for ship construction, equipment, and operations to protect human life, property, and the marine environment (Erwin, 2022; Hendrawan, 2020; Nanggala et al., 2024).

Chapter IX of SOLAS 1974 introduced the International Safety Management (ISM) Code, emphasizing that advanced equipment alone cannot guarantee safety without effective operational management. The ISM Code provides international standards for safe ship operations, accident prevention, protection of human life, and prevention of marine pollution (Khomeiny et al., 2019; Lasse, 2017). Shipping companies are required

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to establish a Safety Management System (SMS) containing operational procedures, risk-control measures, emergency preparedness, and continuous improvement mechanisms. Reporting, analyzing, and learning from non-conformities, accidents, and near misses are essential components of this system (Amalina & Larasati, 2020). Compliance is demonstrated through the issuance of a Document of Compliance (DOC) to the shipping company and a Safety Management Certificate (SMC) to the vessel (Arianti et al., 2023).

The implementation of the ISM Code aims to ensure maritime safety, prevent accidents and loss of life, protect the marine environment, and improve the efficiency and reliability of ship operations (Santoso & Prebawa, 2023). The certification process involves operating the vessel under a company holding a valid DOC, submitting an application and supporting documents to the Indonesian Classification Bureau (BKI), undergoing an onboard audit, and correcting identified non-conformities before permanent certification is issued (Puspitawati, 2019). The ISM Code comprises 16 elements covering general requirements, safety and environmental policies, company and master responsibilities, personnel resources, operational planning, emergency preparedness, incident reporting, ship maintenance, documentation, audits, and certification (Saputra, 2023). Therefore, effective ISM Code implementation requires integrated planning, execution, accountability, adequate resources and personnel, and consistent procedures to maintain safe ship operations and protect the marine environment.

Concepts of Maritime Safety Training, Availability of Safety Equipment, Occupational Health and Safety (OHS), and Ship Crew Performance

Maritime safety training is a systematic learning process designed to equip ship crews with the knowledge and practical skills required to respond effectively to emergencies, including fires, collisions, grounding, and man-overboard incidents. Through regular drills and realistic simulations, crew members learn evacuation procedures, the proper use of lifesaving equipment, and their respective responsibilities in protecting themselves and passengers (Putra et al., 2024; Saifudin et al., 2024). Maritime safety also depends on seaworthiness, competent and certified personnel, well-maintained machinery, and adequate safety equipment (Maliota et al., 2020). Indonesia's Law No. 17 of 2008 on Shipping and international standards, including SOLAS, STCW, the ISM Code, and the ISPS Code, provide the regulatory foundation for safe maritime operations (Hendrawan, 2020). Effective training should include theoretical knowledge, practical simulations, performance assessment, safety culture awareness, and continuous monitoring and evaluation. Regular drills strengthen emergency preparedness, improve coordination, and increase crew confidence (IMO, 2020).

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The availability of safety equipment is essential for protecting crew members and passengers during emergencies. Such equipment includes lifebuoys, lifeboats, life jackets, fire extinguishers, emergency communication systems, evacuation signs, and first-aid kits. All equipment must comply with applicable SOLAS requirements, remain accessible, and be regularly inspected and maintained to ensure operational readiness (Rahman, 2024). Effective safety equipment management also requires sufficient quantities based on the number of people onboard, clear identification and placement, ease of use, and the crew's ability to operate the equipment correctly (Djulis et al., 2019). Furthermore, companies must provide appropriate equipment, masters must supervise compliance, and safety procedures should be displayed in hazardous work areas. Regular safety talks, safety meetings, and toolbox meetings also reinforce crew awareness and compliance with safety procedures (Nanggala et al., 2024). Administrative requirements, including the Document of Compliance (DOC), Safety Management Certificate (SMC), and relevant vessel safety certificates, support the implementation and verification of maritime safety management (Rahman, 2024).

Occupational Health and Safety (OHS) is a fundamental component of maritime operations because it protects workers, reduces accidents, and supports efficient and uninterrupted activities. Effective OHS implementation addresses human welfare, economic costs and benefits, legal accountability, and organizational reputation. Emergency preparedness is particularly important in maritime environments, where fires, collisions, capsizing, and grounding can occur unexpectedly. Preventive measures include conducting emergency drills, checking weather forecasts, obtaining sailing permits, planning safe routes using GPS and navigation charts, and ensuring that crew members understand the use of life jackets, lifeboats, and fire extinguishers. According to Mangkunegara (2020), OHS consists of two dimensions: occupational health, measured through the physical work environment, health facilities and services, recreational facilities, and occupational health regulations; and occupational safety, measured through the use of work equipment and personal protective equipment, workload, safety regulations, communication, and support.

Ship crew performance is critical to maritime safety, operational efficiency, and environmental protection. It encompasses technical skills, communication, teamwork, and compliance with safety procedures, while also being influenced by weather conditions, regulations, and organizational culture (IMO, 2020). Technical competence in operating navigation equipment, communication systems, and ship machinery requires continuous training and certification. Effective communication is equally important because communication failures can contribute to maritime accidents, particularly during emergencies. Strong teamwork improves coordination, performance, and stress management among crew members, while compliance with safety procedures helps

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reduce incidents (EMSA, 2021). In addition, a supportive safety culture strengthens both safety outcomes and operational efficiency. Therefore, integrating safety training, adequate safety equipment, effective OHS practices, and continuous crew development is essential to improving ship crew performance and ensuring safe and reliable maritime operations.

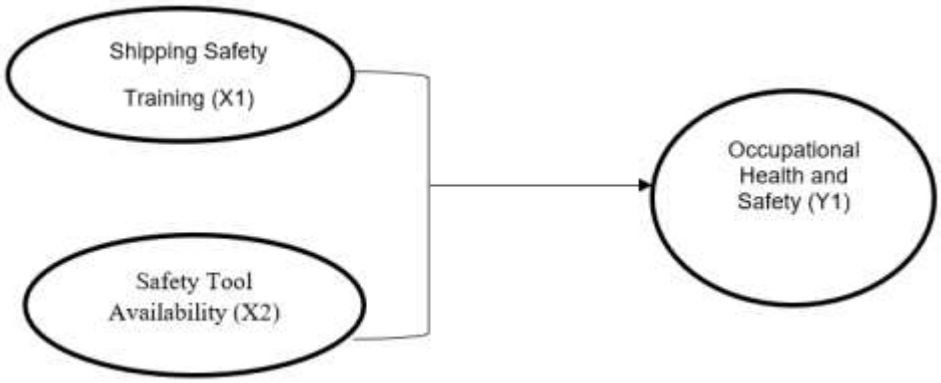
RESEARCH METHODOLOGY

This study employs a quantitative approach using multiple correlation and regression analysis to examine the relationships among variables and predict the dependent variable based on independent variables (Sugiyono, 2023). It also adopts a descriptive approach to systematically and accurately describe the research variables, consistent with the conceptual framework, and to establish factual information about existing phenomena. Furthermore, this research uses an associative research design, which aims to identify relationships and associations between two or more variables through statistical analysis (Agustin, 2023). Specifically, the study investigates the effects of maritime safety training and the availability of safety equipment on occupational health and safety (OHS), as well as their subsequent impact on the performance effectiveness of container ship crews operating at Tanjung Emas Port, Semarang.

This study employs multiple regression analysis to examine the effects of independent variables on dependent variables. The independent variables consist of maritime safety training and the availability of safety equipment, while the dependent variables are occupational health and safety (OHS) and ship crew performance. This analysis aims to determine the extent of the direct effects of the independent variables on the dependent variables. The research model is illustrated in the following figure:

Gambar 1. Model Penelitian

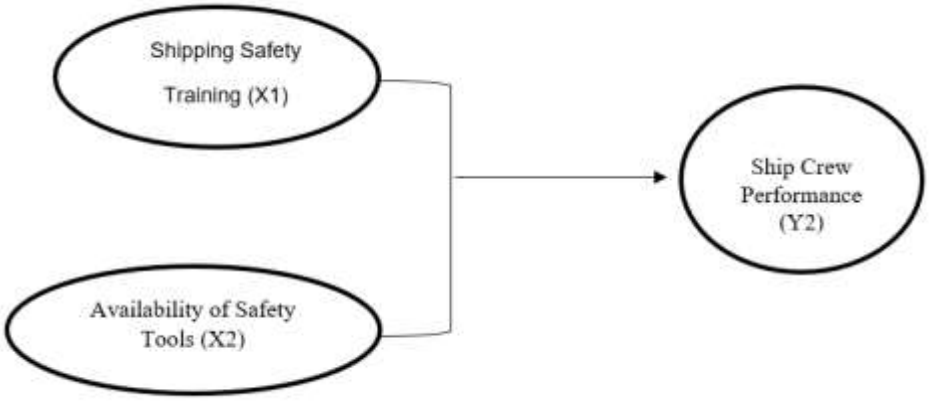
Model 1



Model 2

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Source: Processed by Researcher 2025

RESULT AND DISCUSSIONS

Overview of Shipping Safety Training

Table 1. Analysis of the Shipping Safety Training Index

Variable	Indicator	Index	Remarks
X_1	$X_{1.1}$	4.77	Excellent
	$X_{1.2}$	4.77	Excellent
	$X_{1.3}$	4.77	Excellent
	$X_{1.4}$	4.85	Excellent
	$X_{1.5}$	4.88	Excellent
	$X_{1.6}$	4.83	Excellent
	$X_{1.7}$	4.94	Excellent
	$X_{1.8}$	4.92	Excellent
Average		4.84	Excellent

Based on Tables 1., maritime safety training received a very good rating, with an overall mean index of 4.84 and individual scores ranging from 4.77 to 4.94. Emergency security procedures and accident evacuation training each scored 4.77, indicating that respondents had a good understanding of emergency responses, including risk mitigation, incident response, and emergency simulations. Training on the use of safety equipment, including life buoys, life jackets, and life rafts, scored 4.88, while increased hazard awareness and emergency response capabilities were rated 4.85 and 4.88, respectively. Safety equipment inspections scored 4.83, and functional testing achieved the highest score of 4.94, demonstrating the importance of routine inspections and

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equipment testing to ensure operational readiness. Furthermore, understanding of emergency procedures scored 4.92, reflecting improvements in evacuation skills, emergency communication, and teamwork. Overall, the high and relatively consistent ratings indicate that maritime safety training has been implemented effectively, enhancing crew members' knowledge, hazard awareness, practical skills, and preparedness to respond to emergencies and potential risks, thereby supporting a safer working environment aboard ships.

Safety Tool Availability Overview

Table 2. Safety Equipment Availability Index Analysis

Variabel	Indicator	Index	Remarks
X_2	$X_{2.1}$	4.79	Excellent
	$X_{2.2}$	4.75	Excellent
	$X_{2.3}$	4.77	Excellent
	$X_{2.4}$	4.81	Excellent
	$X_{2.5}$	4.69	Excellent
	$X_{2.6}$	4.29	Excellent
	$X_{2.7}$	4.65	Excellent
	$X_{2.8}$	4.79	Excellent
	$X_{2.9}$	4.81	Excellent
Average		4.70	Excellent

Based on Tables 2., the availability of safety equipment received a very good rating, with an overall mean index of 4.70 and individual scores ranging from 4.29 to 4.81. Essential equipment, including life buoys (4.79), life jackets (4.75), fire plans (4.77), and life rafts (4.81), was generally perceived as readily available, while supporting facilities such as fire extinguishers (4.79), lashing bars (4.81), and designated emergency assembly areas on the top deck (4.65) also received positive ratings. These findings are consistent with the Risk Control Hierarchy, maritime risk management principles, safety behavior theory, Maslow's hierarchy of needs, and Expectation-Disconfirmation Theory, which emphasize adequate safety provisions, risk reduction, crew confidence, and satisfaction when facilities meet expectations. The availability of life rafts scored 4.69, whereas lifeboats received the lowest score (4.29), indicating potential concerns regarding their quantity, condition, or adequacy. This finding highlights the need for further evaluation of lifeboat maintenance, distribution, and crew awareness of emergency procedures. In accordance with the International Safety Management (ISM)

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Code and the International Convention for the Safety of Life at Sea (SOLAS) 1974, ships must be equipped with sufficient, properly maintained, and operational safety and emergency equipment. Overall, the high ratings indicate that safety equipment provision is generally effective in supporting crew preparedness, preventing workplace accidents, securing cargo, and improving onboard safety, although the availability and readiness of lifeboats require particular attention.

Overview of Occupational Health and Safety (OHS)

Table 3 Analysis of the Occupational Health and Safety (OHS) Index

Variable	Indicator	Index	Remarks
Y_1	$Y_{1.1}$	4.65	Excellent
	$Y_{1.2}$	4.63	Excellent
	$Y_{1.3}$	4.65	Excellent
	$Y_{1.4}$	4.83	Excellent
	$Y_{1.5}$	4.90	Excellent
	$Y_{1.6}$	4.54	Excellent
	$Y_{1.7}$	4.81	Excellent
	$Y_{1.8}$	4.73	Excellent
	$Y_{1.9}$	4.85	Excellent
Average		4.73	Excellent

Based on Tables 3., occupational health and safety (OHS) on Evergreen container ships received a very good rating, with an overall mean index of 4.73 and individual scores ranging from 4.54 to 4.90. The working environment's influence on crew health and the availability of health services and supporting facilities scored 4.65, 4.63, and 4.65, respectively. Compliance with occupational health regulations scored 4.83, while the use of personal protective equipment (PPE) in accordance with standard operating procedures (SOPs) achieved 4.90, indicating strong safety compliance. Safety regulations scored 4.81, safety communication equipment 4.73, and management support for crew safety 4.85, reflecting the importance of clear rules, effective communication, and management commitment. These findings are consistent with occupational ergonomics and health theory, Behavioral Safety Theory, and safety management principles, which emphasize healthy working conditions, compliance with procedures, effective communication, and strong safety leadership in reducing workplace risks. However, workload-related safety risks received the lowest score (4.54), indicating the need for further evaluation to prevent excessive fatigue and potential accidents. Overall, the high OHS index suggests that safety practices aboard Evergreen container

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ships are generally well implemented, supported by adequate health facilities, clear safety policies, and crew compliance, thereby helping protect crew health, minimize occupational accidents, and promote safe and efficient maritime operations.

Overview of Ship Crew Performance

Table 4. Analysis of Ship Crew Performance Index

Variable	Indicator	Index	Remarks
Y_2	$Y_{2.1}$	4.67	Excellent
	$Y_{2.2}$	4.88	Excellent
	$Y_{2.3}$	4.67	Excellent
	$Y_{2.4}$	4.77	Excellent
	$Y_{2.5}$	4.85	Excellent
	$Y_{2.6}$	4.81	Excellent
	$Y_{2.7}$	4.81	Excellent
	$Y_{2.8}$	4.94	Excellent
	$Y_{2.9}$	4.88	Excellent
	$Y_{2.10}$	4.85	Excellent
Average		4.81	Excellent

Based on Tables 4., ship crew performance received a very good rating, with an overall mean index of 4.81 and individual scores ranging from 4.67 to 4.94. Crew members' knowledge of safety procedures scored 4.67, while clear work and safety policies scored 4.88, indicating good safety awareness and regulatory implementation. The accuracy of arrival and departure schedules scored 4.67, and the accuracy of safety-related navigation data scored 4.77, highlighting the importance of operational efficiency and reliable information. Compliance with international shipping standards scored 4.85, while maritime communication technologies, including GMDSS, AIS/VTS, and SRS, as well as radio equipment, computers, and databases, each scored 4.81, demonstrating effective communication and information management. Compliance with national and international maritime regulations achieved the highest score of 4.94, followed by crew professionalism at 4.88 and compliance with Tanjung Emas Port administrative regulations at 4.85. These findings align with maritime safety and operational management principles, including the International Safety Management (ISM) Code, the International Convention for the Safety of Life at Sea (SOLAS), and the roles of the International Maritime Organization (IMO), which emphasize regulatory compliance, accurate data, effective communication, competence, and discipline. Overall, the high

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and relatively consistent scores indicate that ship crews demonstrate strong competence, professionalism, and regulatory compliance, supported by effective communication technologies and operational systems, thereby contributing to safer, more efficient, and reliable maritime operations.

Analysis of the Influence of Shipping Safety Training and the Availability of Safety Equipment on Occupational Health and Safety (OHS)

A. Multiple Linear Regression Analysis

Table 5. Multiple Linear regression equations

Coefficients[a]						
Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	11.565	6.288		1.839	.072
	Training X_1	.545	.160	.414	3.412	.001
	Tool Availability X_2	.232	.078	.363	2.996	.004
a. Dependent Variable: k3Y1						

Source processed in 2025

The regression equation is $\boldsymbol{Y_1 = 11.565 + 0.545X_1 + 0.232X_2}$, where Y_1 represents occupational health and safety (OHS), X_1 represents maritime safety training, and X_2 represents the availability of safety equipment. The constant of 11.565 indicates the predicted OHS score when both independent variables are zero. The positive coefficient of 0.545 for safety training indicates that a one-unit increase in training is associated with a 0.545-point increase in OHS, assuming the other variable remains constant. Similarly, the positive coefficient of 0.232 for safety equipment availability indicates that a one-unit increase in availability is associated with a 0.232-point increase in OHS, holding the other variable constant. These results suggest that both maritime safety training and the availability of safety equipment have positive relationships with OHS, with safety training showing the larger regression coefficient.

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B. Correlation Analysis

Table 6. Analysis of the Correlation of Shipping Safety Training and Equipment Availability to Occupational Health and Safety

Model Summary				
Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.613[a]	.376	.348	1.745
a. Predictors: (Constant), Ready tools X2, Training X1				

Data sources to be processed in 2025

The research results show a correlation coefficient (R) of 0.613, indicating a strong relationship between maritime safety training, the availability of safety equipment, and occupational health and safety (OHS).

C. Model Fit Analysis

Table 7. Model Suitability of the Effect of Shipping Safety Training and the Availability of Safety Equipment on Occupational Safety and Health (OSH)

Independent Variable	Dependent Variable	t	(Sig)	F (Sig)	Adjusted R Square
Cruise Safety Training	Occupational Safety and Health	3.412	0.001	0.001	0.348
Availability of Safety Tools		2.996	0.004		

Data sources to be processed in 2025

The research findings indicate that the Adjusted R-squared value is 0.348, meaning that 34.8% of the variation in the dependent variable can be explained by the independent variables, while the remaining 65.2% is attributable to other factors not examined in this study. The significance value of the F-test is 0.001, indicating that the independent variables jointly have a statistically significant effect on the dependent variable. Furthermore, the t-test results indicate that maritime safety training and the availability of safety equipment each have a positive effect on occupational health and safety (OHS).

D. Hypothesis Test

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The simultaneous test shows an F-value of 13.558 with a significance value of 0.000 ($p < 0.05$), indicating that maritime safety training (X_1) and the availability of safety equipment (X2) jointly have a statistically significant effect on occupational health and safety (OHS) (Y_1). This finding confirms that both independent variables collectively contribute to OHS outcomes among ship crews.

The partial tests demonstrate that each independent variable has a positive and statistically significant effect on OHS. Maritime safety training (X_1) has a regression coefficient of 0.545, a t-value of 3.412, and a significance value of 0.001, while safety equipment availability (X_2) has a regression coefficient of 0.232, a t-value of 2.996, and a significance value of 0.004. Since both significance values are below 0.05, the results indicate that maritime safety training and the availability of safety equipment each significantly contribute to improving occupational health and safety among ship crews.

Analysis of the Influence of Shipping Safety Training and Safety Equipment Availability on Ship Crew Performance

A. Multiple Linear Regression Analysis

Table 8. Multiple Linear Regression Analysis

Coefficients[a]						
Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	21.448	5.193		4.130	.000
	Training X_1	.383	.132	.333	2.900	.006
	Tool Availability X_2	.279	.064	.500	4.354	.000
a. Dependent Variable: Performance Y_2						

Source processed in 2025

The regression equation is $\boldsymbol{Y_2 = 21.448 + 0.383X_1 + 0.279X_2}$, where Y_2 represents ship crew performance, X_1 represents maritime safety training, and X_2 represents the availability of safety equipment. The positive constant of 21.448 indicates the predicted crew performance score when both independent variables are zero. The coefficient of 0.383 for maritime safety training indicates that a one-unit increase in training is associated with a 0.383-point increase in crew performance, assuming safety equipment availability remains constant. Similarly, the coefficient of 0.279 for safety equipment availability indicates that a one-unit increase in availability is associated with a 0.279-point increase in crew performance, holding training constant. These results suggest that

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both maritime safety training and the availability of safety equipment have positive relationships with ship crew performance.

B. Correlational Analysis

Table 9. Analysis of the Correlation of Shipping Safety Training and Tool Availability to Ship Crew Performance

Model Summary				
Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.664[a]	.441	.416	1.441
a. Predictors: (Constant), Ready Tools X_2, Training X_1				

Data sources to be processed in 2025

The research findings indicate that the correlation coefficient (R) is 0.664, demonstrating a strong relationship between maritime safety training, the availability of safety equipment, and ship crew performance.

C. Model Fit Analysis

Table 10. Model Suitability of the Effect of Shipping Safety Training and Safety Equipment Availability on Ship Crew Performance

Independent variable	Dependent variable	t	sig	F sig	Adjusted R Square
Sailing south training	Crew performance	2.900	0.006	0.001	0.416
Availability of safety tools		4.354	0.001		

Data sources to be processed in 2025

The research findings indicate that the Adjusted R-squared value is 0.416, meaning that 41.6% of the variation in ship crew performance can be explained by the independent variables, while the remaining 58.4% is attributable to other factors not examined in this study. The F-test significance value of 0.001 indicates that the independent variables jointly have a statistically significant effect on the dependent variable. Furthermore, the t-test results demonstrate that maritime safety training and the availability of safety equipment have positive effects on ship crew performance.

D. *Hypothesis Test*

The simultaneous hypothesis test results ishow an F-value of 17.756 with a significance value of 0.000 ($p < 0.05$), indicating that maritime safety training (X_1) and the

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availability of safety equipment (X_2) jointly have a statistically significant effect on ship crew performance (Y_2). These findings demonstrate that both variables collectively contribute to crew performance in maritime operations.

The partial hypothesis test results indicate that both independent variables have positive and statistically significant effects on ship crew performance. Maritime safety training (X_1) has a regression coefficient of 0.383, a t-value of 2.900, and a significance value of 0.006, while the availability of safety equipment (X_2) has a regression coefficient of 0.279, a t-value of 4.354, and a significance value of 0.000. Since both significance values are below 0.05, the results confirm that maritime safety training and the availability of safety equipment each contribute significantly to improving ship crew performance.

Multivariate Test of the Effect of Shipping Safety Training (X_1) and Safety Equipment Availability (X_2) on Occupational Safety and Health (Y_1) and Ship Crew Performance (Y_2).

1. *Homogenites*

Tabel 11. homogenitas

Box's Test of Equality of Covariance Matrices[a]

Box's M	12.733
F	1.429
df1	6
df2	295.234
Sig.	.203

The table shows a significance value of 0.203, which is greater than 0.05, indicating that there is no significant difference in covariance between the groups and that the sample data are homogeneous.

2. *Multivariat Test*

Tabel 12. Multivariate Test

Independent variable	Dependent variable	Wilks' Lambda	Beetwen Subject Effect
Sailing south training and	Occupational safety and health	0.042	0.032

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Availability of safety tools	Crew performance		0.040

The table shows a Wilks' Lambda significance value of 0.042, indicating that maritime safety training (X_1) and the availability of safety equipment (X_2) have a significant effect on occupational health and safety (Y_1) and ship crew performance (Y_2) jointly. The between-subjects effects test shows a significance value of 0.032 for the relationship between maritime safety training and the availability of safety equipment and occupational health and safety (OHS), indicating a significant effect. Meanwhile, the between-subjects effects test for ship crew performance shows a significance value of 0.040, indicating a significant effect of maritime safety training and the availability of safety equipment on ship crew performance.

There is a Simultaneous Effect of Shipping Safety Training and the Availability of Safety Equipment on Occupational Safety Health

The simultaneous test results indicate that maritime safety training and the availability of safety equipment jointly have a significant effect on occupational health and safety (OHS) among ship crews. This finding emphasizes that safe and healthy working conditions require an integrated safety management system rather than reliance on a single factor. Safety training improves crew members' knowledge, preparedness, and compliance with safety procedures, while adequate safety equipment provides practical protection against workplace accidents and occupational health risks. Conceptually, OHS in maritime operations depends on the synergy between competent, well-prepared personnel and adequate safety facilities. When both factors are implemented simultaneously, crew members can better identify and prevent hazards and apply safety procedures effectively, thereby creating a safer, more controlled working environment and reducing the risks of occupational accidents and work-related illnesses.

There is a Simultaneous Influence of Shipping Safety Training and the Availability of Safety Equipment on Ship Crew Performance

The simultaneous test results indicate that maritime safety training and the availability of safety equipment jointly have a significant effect on ship crew performance. This finding suggests that crew performance depends on an integrated occupational safety system rather than a single factor. Enhancing human resource competence through safety training and providing adequate safety equipment create a safer, more structured, and well-controlled working environment. In maritime operations, effective crew performance relies on the alignment of individual competencies and the readiness

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of supporting safety facilities. Safety training without adequate equipment may limit the effective implementation of safety procedures, and vice versa. Therefore, improving ship crew performance requires the simultaneous implementation of maritime safety training and adequate safety equipment as an integrated occupational safety management system.

There is an Effect of Shipping Safety Training on Occupational Health and Safety

The t-test results indicate that maritime safety training has a partial effect on occupational health and safety (OHS) among ship crews, confirming its essential role in maritime safety management. Such training equips crew members with the knowledge and skills to identify, assess, and control workplace hazards, understand safety procedures, and use personal protective equipment (PPE) appropriately. Regular and structured training also improves emergency preparedness, including evacuation, firefighting, and first aid, while fostering a safety culture and shared responsibility among crew members. These findings are consistent with Sumantri and Susilawati (2023), who highlighted the role of OHS training in enhancing workers' safety awareness and competence, Hendrawan (2022), who found that training, safety education, and health examinations can reduce shipboard accidents, Syifarani and Susilawati (2023), who reported that OHS programs incorporating safety training significantly reduce onboard accidents, and Rahman (2024), who demonstrated that effective safety training improves accident prevention through greater compliance with safety regulations.

There is an Effect of the Availability of Safety Equipment on Occupational Health and Safety

The t-test results indicate that the availability of safety equipment has a partial effect on occupational health and safety (OHS) among ship crews. Adequate safety equipment is essential for preventing workplace accidents and occupational illnesses through the identification, assessment, and control of potential hazards. Personal protective equipment (PPE), such as helmets, gloves, and safety shoes, provides direct protection against physical, chemical, and biological hazards, reducing the risk of injuries and harmful exposure while promoting safety awareness and a healthier workplace culture. These findings are consistent with Widiana et al. (2023), who found that the implementation of OHS influences the productivity and comfort of construction workers. Therefore, the availability of adequate safety equipment, together with maritime safety training, plays an important role in supporting occupational health and safety among ship crews.

There is an Influence of Shipping Safety Training on Ship Crew Performance

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The t-test results indicate that maritime safety training has a partial effect on ship crew performance by improving technical skills in handling safety equipment and emergency procedures, strengthening safety awareness and compliance with protocols, and enhancing coordination and communication among crew members, thereby supporting safer and more efficient ship operations (Maulidia et al., 2024). These findings are consistent with Gemirico (2023), who found that safety training significantly influences ship crew performance, and Hadiwinoto (2023), who demonstrated that education, work experience, and safety leadership training influence ship officers' performance.

There is an Influence of the Availability of Safety Equipment on the Performance of the Ship Crew

The t-test results indicate that the availability of safety equipment has a partial effect on ship crew performance. Adequate safety equipment is essential for ensuring crew safety and operational efficiency, as maritime ergonomics theory suggests that a safe working environment and sufficient safety equipment reduce injury risks and increase crew confidence (Bridger, 2018). Similarly, the International Safety Management (ISM) Code emphasizes that safety equipment helps create a controlled, lower-risk working environment that supports productivity. Equipment such as life jackets, lifeboats, fire extinguishers, and emergency communication systems can reduce crew anxiety, improve concentration, and encourage discipline, emergency preparedness, and compliance with standard operating procedures; conversely, inadequate or malfunctioning equipment may cause stress, impair performance, and increase accident risks. These findings are consistent with Bustamin et al. (2023), who examined the influence of occupational health and safety implementation on construction workers' performance, and Hartono et al. (2016), who found that the use of occupational health and safety equipment affects worker performance.

CONCLUSION

The conclusions of this study indicate that maritime safety training and the availability of safety equipment have significant simultaneous effects on occupational health and safety (OHS) and ship crew performance. Furthermore, maritime safety training has a significant partial effect on OHS, while the availability of safety equipment also has a significant partial effect on OHS. Similarly, maritime safety training and the availability of safety equipment each have significant partial effects on ship crew performance. These findings confirm that both effective safety training and adequate safety equipment play important roles in improving occupational health and safety and enhancing ship crew performance.

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RECOMMENDATIONS

It is recommended that Evergreen container ships conduct more frequent inspections and maintenance of safety equipment on a weekly basis and before entering port. Since lifeboats received the lowest satisfaction score among the safety equipment assessed, particular attention should be given to their condition, maintenance, and operational readiness. These measures are essential to ensuring effective emergency evacuation, protecting all crew members, and complying with applicable maritime safety standards. In addition, Evergreen container ships should evaluate crew work schedules and workload distribution to reduce fatigue-related safety risks. Adjusting working hours, implementing balanced task rotations, and providing adequate rest periods can help maintain crew performance, improve operational efficiency, and enhance maritime safety.

Furthermore, Evergreen container ships should improve onboard health services by ensuring an adequate supply of medicines and strengthening emergency medical response procedures. These improvements are important to ensure that crew members receive prompt and appropriate medical care when needed, thereby supporting their safety and well-being throughout the voyage.

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