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Management of Fishing Safety for Small Fisheries: An Empirical Analysis

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Abstract

This research highlights the significance of fishing vessel safety in the coastal fishing port in Morodemak, Demak, aiming to identify factors influencing safety and vulnerabilities that may compromise it. Employing a mix of quantitative and qualitative methods, the study collects data through surveys, interviews, observations, and historical incident records. The results reveal critical factors impacting fishing vessel safety, including environmental conditions, vessel maintenance, crew experience and training, safety equipment availability, regulatory compliance, and port infrastructure. Understanding these factors enables the formulation of effective safety enhancement strategies and the promotion of safer fishing practices. The research provides valuable insights for policymakers, port authorities, and fishing communities, contributing to the knowledge on fishing vessel safety. The study's recommendations include reduce accidents, safeguard fishermen's well-being, and foster sustainable fishing practices in the Morodemak Port.

Keywords:

Safety Equipment, Vessel Crew, Vessel Seaworthiness, Navigational Aids

1. Introduction

Indonesia, as the world's largest archipelagic nation, boasts over 1,751 thousand islands and encompasses vast marine waters estimated at 5.8 million km2, with a coastline stretching approximately 81,000 km. This geographical advantage offers tremendous potential in the field of fisheries, with an estimated fishing capacity of 6.10 million tons per year (Cribb & Ford, 2009).

The fishing sector holds a strategic role in the national economy as a subsector of development. The number of crew members on fishing vessels, including traditional fishermen in Indonesia, is estimated at approximately 2.78 million individuals, operating over 555,940 fishing vessels. This constitutes around 10% of the global fishing population (Sodik, 2009). However, the fishing sector is also confronted with high risks related to accidents and safety. Data from the Subdirectorate of Fishing Vessel Manning records around 607 fishing vessel accidents from 2001 to 2008. The causes of these accidents include adverse weather conditions, crew negligence, conflicts among fishermen, unseaworthy vessels, lack of weather information, and other contributing factors. The total casualties resulting from these accidents reached 405 individuals (Mujahid et al., 2022).

The Maritime Advocacy Society for Shipping, Ports, and the Environment (MAPPEL) reported nine fishing vessel accidents involving fire, sinking, and piracy from 2003 to 2005, resulting in a total of 24 fatalities (Samekto, 2019). Additionally, the National Transportation Safety Committee (KNKT) reported 204 vessel accidents from 2007 to 2008, with a total of 306 fatalities, including 14 cases of fishing vessel accidents. The Coalition of People for Fisheries Justice (KIARA) asserts that despite the increasing number of fishing vessels operating at sea, the economic and welfare conditions of coastal communities remain unsatisfactory without adequate facilities, safety equipment, and sufficient fishing resources. Data from 2013 indicated that 255 fishermen experienced accidents, disappearances, or fatalities at sea without life protection (Supriono et al., 2021).

During the period from 2008 to 2013, the rate of fishing vessel accidents in the Java Sea area exhibited alarming escalation. The government needs to foster collaboration to reduce accident rates and dispel the notion that fishing work is hazardous. Fishing activities at sea constitute an ancestral profession primarily observed in the Central Java Province among coastal communities. Based on data from the Governor of Central Java in January 2015, fish catch production in the region reached 60.396.1 tons, with 120.966 crew members (79.52%) operating 23,692 units of mostly traditional fishing vessels. This production contributed to 27.26% of the total capture fishery production in 2014.

The significance of the fisheries sector in the regional economy has led the government to promote the legal fishing program, aimed at safe and secure fishing practices at sea. However, several challenges persist, including the abundance of fishing fleets in Central Java, the lack of fishing crew skills and expertise, and the high rate of fishing vessel accidents in the Java Sea waters. This research was conducted at the Morodemak Coastal Fishing Port in Demak, the berthing and anchoring site for fishing vessels. Data from the number of fishermen and vessels operating at Morodemak port was utilized in this study. The research aims to analyze the factors influencing the safety of fishing vessel navigation in the Morodemak Port, Demak, Indonesia.

2. Literature Review

2.1. Management of Fishing Vessels

Davis (2012) categorizes work on fishing vessels as falling into the "3d" classification, denoting dangerous, dirty, and difficult attributes. The profession of seafarers on these vessels exhibits these characteristics due to the elevated risks, demanding and unsanitary conditions, especially when dealing with small-sized vessels navigating through turbulent waters and unpredictable weather. The safety of fishing vessels is influenced by an intricate interplay of factors encompassing human elements (shipmasters and crew members), mechanical components (vessels and safety equipment), and environmental factors (weather and fisheries resource management).

Talley et al. (2005) identified five factors contributing to accidents among fishing vessel crew members. Firstly, many accidents occur due to the crew's limited awareness of safety protocols during sailing and fishing activities. Secondly, accidents are linked to crew members lacking sufficient mastery of sailing and fishing safety competencies. Thirdly, inadequate safety equipment on vessels, despite regulations, plays a role in accidents. Fourthly, adverse weather conditions, such as high waves and severe illnesses during voyages, pose additional risks. Finally, safety equipment and the seaworthiness of vessels emerge as crucial concerns for both fishing crew and government stakeholders, particularly fisheries supervisors. Addressing these factors can help mitigate accidents and enhance safety measures within the fishing industry.

2.2. Safety Equipment on Vessels

Safety equipment on vessels is used to protect and ensure the safety, security, and comfort of fishing crew members. Operational safety factors on fishing vessels at sea are crucial to prioritize. Occupational safety and health aim to prevent or reduce accidents and their consequences, as well as to safeguard vessels, work equipment, and the resulting products (Jin et al., 2001).

As per Minister of Transportation Decree No. KM 46 of 1996, fishing vessels are required to have specific safety equipment based on their size. For vessels below GT 150 or (< 425 m3), the mandated safety equipment includes various auxiliary floating devices in orange color, such as life rafts, life jackets, floating devices with lights and smoke signals, and those equipped with lights and ropes. Communication radio equipment, like telephones and VHF radio devices, are necessary for maintaining contact. Distress signaling equipment, comprising signaling whistles and other sound-producing devices, is also essential. Additionally, navigation equipment, including a steering guide and nautical charts, aids in safe voyages. Proper medical supplies like bandages, external medicine for minor wounds and burns, eye drops, and cough medicine are also a requirement.

For vessels with a size of GT 150 - GT 304 or 425-850 m3, the mandated safety equipment includes life-saving equipment such as inflatable life rafts and working lifebuoys with oars. Navigation equipment such as a compass, bearing devices, nautical guidebooks, Indonesian Lighthouse List (DSI), catalogs, and nautical charts are vital for navigation. Communication equipment, including telephones and VHF radio communication devices, is necessary for communication purposes. Distress signaling equipment, such as parachute distress signals, red flares, and floating smoke signals, enhances the vessel's ability to call for help during emergencies. Finally, medical supplies like bandages, external medicine for minor wounds and burns, eye drops, and cough medicine are also required to address health issues that may arise during voyages. The regulation also states that each vessel must have a qualified telecommunication radio station with a minimum range of 100 miles for vessels sized from 100 m3 to 850 m3. All safety equipment must meet the standards and requirements set to ensure safety and security during fishing vessel voyages.

2.3. Resource of Fishing Vessel Crew

The crew members on a fishing vessel are individuals who work or are employed onboard by the owner or operator of the vessel to perform duties as stated in the crew's certificate. According to Article 341 of the Indonesian Trade Code, crew members are those whose names are listed in the Crew Certificate. Based on the Government Regulation of the Republic of Indonesia No. 7 of 2000 concerning Seafaring for the Crew of Fishing Vessels, a fishing vessel must be manned by a Master (Nakhoda) and several ship officers who possess certificates of competence for fishing vessel seafarers and basic seafarer skills corresponding to the navigation area, vessel size, and propulsion power. The requirements for crewing fishing vessels vary based on vessel size and operating area.

The Minister of Transportation Regulation KM 9 of 2005 concerning Education, Training, Examinations, and Certification of Fisheries Seafarers establishes the types and levels of Fishing Vessel Seafarer Certificates (COC), such as ANKAPIN-I, ANKAPIN-II, ANKAPIN-III, ATKAPIN-I, ATKAPIN-II, ATKAPIN-III, and Fishing Vessel Rating Certificates. Additionally, there are Fishing Vessel Seafarer Skill Certificates (COP) that crew members must hold, such as the Basic Safety Fishing Vessel (BST-F) Certificate. Small vessel Masters must possess adequate competence in operating the vessel safely and securely, managing the vessel continuously, and mastering various aspects, including machinery operation and maintenance, handling emergencies, navigation, weather conditions, vessel stability, and accident prevention. To achieve this competence, a small vessel Master must have at least a secondary education in fisheries, such as a fisheries business school or a senior high school, in addition to seafarer training covering navigation, vessel operation, safety, and fishing.

2.4. Vessel Seaworthiness

Under the Law No. 21 of 1992, which was revised by Law No. 17 of 2008 concerning Shipping, vessel seaworthiness is defined as the condition of a vessel that meets the requirements of vessel safety, prevention of water pollution from vessels, crew manning, loading, crew health and welfare, and the legal status of the vessel to sail in certain waters. Seaworthiness is executed by issuing a seaworthiness certificate and crewing the fishing vessel by the General Port Master under the Ministry of Transportation.

The seaworthiness requirements for fishing vessels encompass several aspects. These include obtaining a Nationality Certificate, consisting of the Ship's Certificate, Annual Pass, and Small Pass, issued based on the vessel's size. For vessels below GT 150 or (< 425 m3), the seaworthiness demands various navigation equipment and lights. On the other hand, vessels with a gross tonnage (GT) between 150 and 304 or 425 and 850 m3 must meet requirements for navigation, life-saving, distress signaling, and communication equipment. Additionally, crew manning for fishing vessels must adhere to the Government Regulation of the Republic of Indonesia No. 7 of 2000 concerning Seafaring and the Minister of Transportation Regulation KM 9 of 2005, which addresses the education, training, examinations, and certification of fisheries seafarers. Compliance with these regulations ensures that fishing vessels are adequately equipped and staffed for safe operations at sea..

The Port Master is responsible for certifying the seaworthiness of fishing vessels (Aguw, 2013). This certification process must be conducted every three months. After obtaining the seaworthiness certificate, the vessel can apply for and obtain a Port Clearance issued by the Port Master or General Port Master in the fishing port. The importance of policies regarding fishing vessel seaworthiness is to provide safety and security for fishermen at sea and prevent damage to the marine ecosystem resulting from shipping activities. Seaworthiness certification and Port Clearance are mandatory documents that must be held by every vessel intending to sail to ensure the vessel is ready for voyages and meets safety requirements. These regulations mandate the government to protect and preserve maritime waters as public spaces for the common interest.

2.4. Role of Navigational Aids in Shipping (SBNP)

Navigational Aids in Shipping (SBNP) are external aids that assist navigators in determining a ship's position and/or heading, as well as indicating hazards and/or navigation obstacles for safe navigation. SBNP play a crucial role in both international and domestic shipping, connecting island regions, and assisting vessel navigation in water areas (Wahyuni, 2019, October).

SBNP (Short-Range Aids to Navigation) serves crucial functions in marine navigation, as highlighted by Muhammad (2021). Firstly, it plays a vital role in determining a ship's position and heading, providing essential information to captains and navigators for safe and accurate passage. Secondly, SBNP serves as a warning system, alerting vessels about navigation hazards and obstacles, such as buildings, reefs, and shipwrecks, enabling them to avoid potential dangers. Thirdly, it marks safe navigation lanes and separation lines for vessel traffic, ensuring orderly and efficient movement through busy waterways. Moreover, SBNP designates special zones and activities in the waters, such as areas undergoing dredging or salvage operations, further enhancing navigational safety. Lastly, SBNP aids in indicating the territorial waters of a country, serving as a boundary marker and reinforcing jurisdictional boundaries. SBNP encompasses several types of aids that collectively enhance navigation safety. Visual Navigational Aids, including lighthouses, beacon buoys, floating buoys, and daymarks, are easily recognizable by their distinct colors and shapes during both daytime and nighttime, providing visual guidance to mariners. Electronic Navigational Aids employ advanced technologies like GPS (Global Positioning System), DGPS (Differential Global Positioning System), and radar, offering precise and real-time ship position information, particularly useful in modern navigation. Additionally, Audible Navigational Aids come into play, using sounds like whistles, gongs, bells, and sirens, especially in foggy or low-visibility areas, where audial cues are critical for safe maneuvering. The combination of these SBNP types ensures a comprehensive and reliable aid system that enhances maritime safety and helps ships navigate through various challenges and conditions.

The system of floating aids is divided into "A" and "B" regions, each using lateral marks with red and green colors to indicate ship direction and position. There are also isolated danger marks and special marks to identify specific zones on charts. Navigational districts are responsible for conducting navigation activities in Indonesian waters and overseeing navigation activities by entities. This administration is essential to support safety and security in shipping across Indonesian waters.

2.5. Safety in Fishing Vessel Navigation

Safety and security in shipping refer to a state where safety and security requirements are met during voyages in waters, ports, and the maritime environment. The international organization responsible for matters related to maritime safety and security is the International Maritime Organization (IMO), under the United Nations (UN). The skills and competence of the individuals involved in vessel operations are vital in achieving safety and security in shipping. Accidents at sea are largely caused by human errors (Loughran et al., 2002).

Threats to the safety and security of vessels can come from various sources, such as natural hazards (tsunamis, storms, earthquakes), human-caused hazards (piracy, terror, sabotage), and hazards related to specific cargoes requiring special handling. To address these threats, increased awareness and security measures are necessary on vessels and port facilities (Atzampos et al., 2018). The International Ship and Port Facilities Security (ISPS) Code on security in vessels and port facilities has been in effect since June 1, 2004. The Indonesian government collaborates with business and users to enhance safety and security on vessels and ports to achieve higher standards.

2.6. Hypotheses

The hypothesis proposed in this context suggests that there is a positive correlation between the quality of safety equipment on fishing vessels and the level of safety in navigation. It posits that vessels equipped with better safety gear are expected to experience higher levels of safety during their operations. Additionally, the hypothesis suggests that the safety level of fishing vessel navigation is influenced by the quality of the crew resources on board. Vessels with a more skilled and well-trained crew are expected to demonstrate higher safety levels. Furthermore, the hypothesis implies that the seaworthiness of fishing vessels is linked to the safety level during shipping. Vessels that meet better standards of seaworthiness are expected to exhibit higher safety levels. Lastly, the hypothesis proposes that the presence of effective Navigational Assistance Facilities (SBNP) contributes to the safety level of fishing boat shipping. Vessels operating with well-established SBNP are expected to achieve higher safety levels due to improved navigational aids and support. Thus, the following hypotheses were proposed:

H1 *The better the safety equipment on the vessel, the higher the level of safety in fishing vessel navigation.*
H2 *The better the quality of the fishing vessel crew resources, the higher the level of safety*
H3 *The better fulfilled the ship's seaworthiness, the higher the safety level of fishing boat shipping.*
H4 *The better the role of the existing Navigational Navigation Assistance Facilities (SBNP), the higher the safety level of fishing boat shipping.*

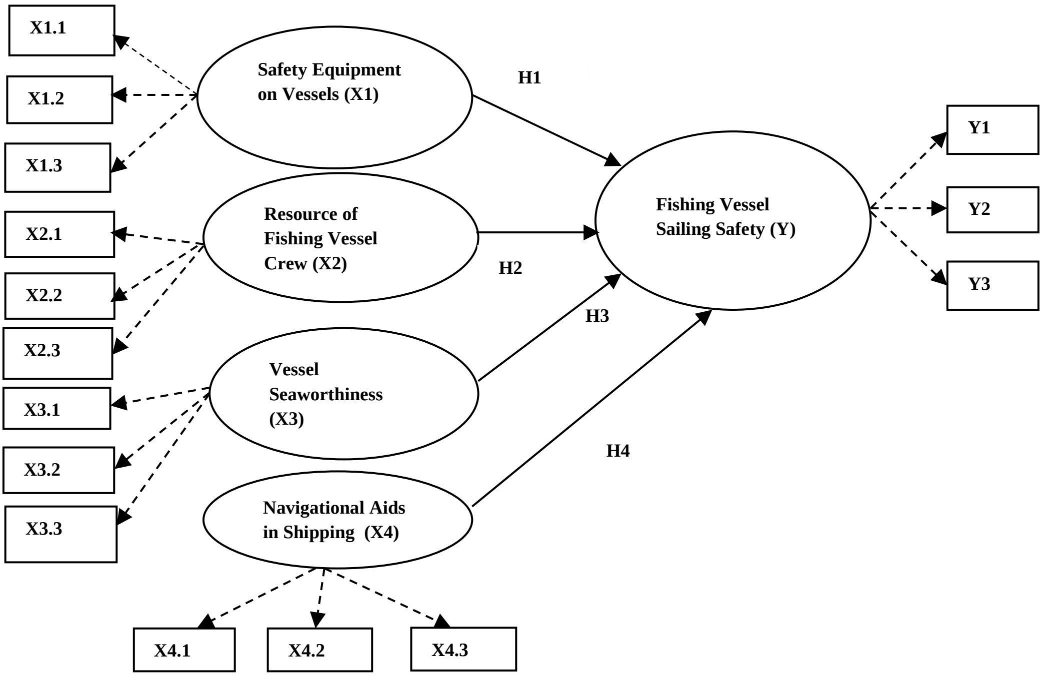

Figure 1. Theoretical Thinking Framework

3. Methods

This study focuses on the conversion of qualitative data into quantitative data to facilitate data analysis. Qualitative data were gathered for the research, and to achieve a more comprehensive analysis, a Likert scale was employed to convert the qualitative data into quantifiable values. The Likert scale is a widely used method for measuring respondents' opinions and attitudes, enabling the transformation of qualitative responses into numerical data. This process allows researchers to apply statistical analysis methods and draw more accurate conclusions from the collected data. The utilization of Likert scale aids in enhancing the reliability and validity of the research outcomes.

Multiple linear regression analysis is used to measure the strength of the relationship between two or more variables and also indicates the direction of the relationship between the independent variables (ship safety equipment, fishing vessel crew resources, ship seaworthiness, SBNP role) individually affecting the dependent variable (safety of fishing vessel navigation) (Ghozali, 2011). The results obtained from the calculation using the statistical program SPSS (Statistic Package for Social Science) Version 22

4. Results

Table 1 shows the results of an analysis involving the model's unstandardized coefficients, standardized coefficients, t-values, and significance levels (Sig.) for each predictor variable. The model aims to understand the relationship between different factors and their impact on the dependent variable, likely related to the safety level of fishing vessel navigation. (Table 1).

Table 1. Direct Effects

Model	Unstansdardized Coefficients		Standardized coefficient	t.	Sig.
	B	Std Error	Beta		
(constant)	0.364	1,679		0.217	0.829
Vessel safety equipment	0.306	0.112	0.336	2.726	0.008
Resource of Fishing Vessel Crew	0.243	0.114	0.264	2.138	0.036
Vessel Seaworthiness	0.230	0.080	0.260	2,863	0.006
The role of the SBNP	0.227	0.090	0.214	2,531	0.014

Based on Table 1 it can be explained, the multiple linear regression equation in this study is as follows:

$$Y = 0.364 + 0.306\ X_1 + 0.243\ X_2 + 0.230\ X_3 + 0.227\ X_4 + \mu$$

Notes :

Y = Fishing Vessel Sailing Safety
a = Constant
X1 = Ship Safety Equipment
X2 = Fish Vessel Crew Resources
X3 = Ship Seaworthiness
X4 = Role of Navigation Assistance.
b1 = Regression coefficient of the Ship Safety Equipment variable
b2 = Regression coefficient of Fish Crew Resources variable
b3 = Regression coefficient of Ship seaworthiness variable
b4 = Regression coefficient of the SBNP
μ = Other factors outside the regression/unexpected variable.

In the given regression analysis, the constant value of 0.364 signifies the intercept of the regression equation. It indicates that when all independent variables (Ship Safety Equipment, Fishing Vessel Crew Resources, Ship Seaworthiness, and SBNP Role) have no influence (i.e., their values are zero), the Safety of Fishing Vessel Navigation (Y) has a fixed value of 0.364. Moreover, the regression coefficients represent the change in the dependent variable (Safety of Fishing Vessel Navigation, Y) associated with a one-unit increase in each independent variable while keeping other variables constant. The coefficient for Ship Safety Equipment (X1) is 0.306, which suggests that if Ship Safety Equipment increases by 1 unit while other variables remain constant, the Safety of Fishing Vessel Navigation (Y) will increase by 0.306 units. Ship Safety Equipment refers to the safety equipment on the vessel, meeting national standards, regularly checked by port manager, and appropriate for the crew's capacity.

Similarly, the coefficient for Fishing Vessel Crew Resources (X2) is 0.243, implying that a one-unit increase in Fishing Vessel Crew Resources while holding other variables constant leads to a 0.243 unit increase in the Safety of Fishing Vessel Navigation (Y). Fishing Vessel Crew Resources encompass qualified crew members, trained and certified in fishing vessel skills, and certified by port manager. In addition, the coefficient for Ship Seaworthiness (X3) is 0.230. This indicates that a one-unit increase in Ship Seaworthiness while other variables are constant results in a 0.230 unit increase in the Safety of Fishing Vessel Navigation (Y). Ship Seaworthiness encompasses meeting safety requirements, proper staffing, and obtaining seaworthiness certification and Port Clearance.

Furthermore, the coefficient for SBNP Role (X4) is 0.227, indicating that a one-unit increase in SBNP Role while other variables are constant leads to a 0.227 unit increase in the Safety of Fishing Vessel Navigation (Y). SBNP Role includes providing information on navigation hazards, indicating safe navigation boundaries, and acting as indicators for specific areas or activities in the waters.

Lastly, the variable μ represents the influence of other variables not included in the study. The Adjusted coefficient of determination (R2) is 53.9%, signifying the proportion of the dependent variable (Safety of Fishing Vessel Navigation, Y) variation explained by the independent variables. The remaining variability (46.1%) is attributed to other factors not considered in this analysis. The regression analysis provides insights into the relationship between the independent variables and the Safety of Fishing Vessel Navigation. Each independent variable shows a positive association with the dependent variable, and together, they account for 53.9% of the variation in the Safety of Fishing Vessel Navigation, leaving the rest attributed to other variables not studied. Based on this analysis, it can be explained that there is an influence or close relationship between the independent variables (ship safety equipment, fishing vessel crew resources, ship seaworthiness, SBNP role) on the dependent variable of safety in fishing vessel navigation.

Next analysis is the t test which is used to show whether an independent variable individually affects the dependent variable (Ghozali, 2011). The hypothesis used in the study is a standard set of hypotheses to determine the effect of independent variables on a dependent variable. The null hypothesis (Ho) states that the coefficient of the independent variable (bi) is equal to zero, implying that the independent variable has no effect on the dependent variable. On the other hand, the alternative hypothesis (Ha) posits that the coefficient (bi) is greater than zero, suggesting a positive effect of the independent variable on the dependent variable.

The significance level (α) for the hypothesis test is set at 0.05, which means that the researcher is willing to accept a 5% chance of making a Type I error (rejecting a true null hypothesis). To test the hypotheses, the researcher uses a t-test. If the calculated t-statistic (t stat) is greater than the critical t-value (t table), the null hypothesis (Ho) is rejected, and the alternative hypothesis (Ha) is accepted, indicating a statistically significant effect of the independent variable on the dependent variable. Conversely, if the t stat is less than the critical t-value (t table), the null hypothesis is accepted, indicating that there is no statistically significant effect of the independent variable on the dependent variable.

Table 2. T-test

Model	**Unstandardized Coefficients**		**Standardized coefficient**	**t.**	**Sig.**
	B	Std Error	Beta		
(constant)	0.364	1,679		0.217	0.829
Vessel safety equipment	0.306	0.112	0.336	2.726	0.008
Resource of Fishing Vessel Crew	0.243	0.114	0.264	2.138	0.036
Vessel Seaworthiness	0.230	0.080	0.260	2,863	0.006
The role of the SBNP	0.227	0.090	0.214	2,531	0.014

To find the critical t-value (t table), Prawitno (2011) looks it up using the given information: a sample size of 68 respondents (n), four independent variables (k), and a significance level (α) of 0.05. The degrees of freedom (df) are calculated as n - k, resulting in 64 degrees of freedom. After consulting the t-table, the critical t-value is found to be 1.99773. In summary, the hypothesis testing is based on the comparison of the calculated t-statistic with the critical t-value to determine whether there is a statistically significant effect of the independent variables on the dependent variable in the study conducted by Prawitno (2011).

With reference to the calculated t_{value} and its significance value. The partial test results obtained in this study are in Table 3.

Table 3. Results Comparison t-test

Variabel	t_{stat}	>/<	t_{Table}	Sig. (pvalue)	Decision	Information
Vessel safety equipment (X_1)	2.726	>	1.99773	0.008<0.05	accepted	Significant
Resource of Fishing Vessel Crew (X_2)	2.138	>	1.99773	0.036<0.05	accepted	Significant
Vessel Seaworthiness (X_3)	2.863	>	1.99773	0.006<0.05	accepted	Significant
The role of the SBNP (X_4)	2.531	>	1.99773	0.014<0.05	accepted	Significant

From Table 3, it can be concluded that the influence of ship safety equipment on the safety of fishing vessel navigation is obtained t_{stat} = 2.726 with sig. 0.008, because the sig. obtained is less than the sign level. α = 0.05 and $t_{stat} > t_{Table}$, then Ho was rejected and Ha accepted. Therefore the hypothesis stating that the better the ship safety equipment, the higher the safety level of fishing boat voyages at Morodemak port is accepted.

In addition, the influence of fishing boat crew resources on the safety of fishing boat voyages was obtained t_{stat} = 2.138 with sig. 0.036, because the sig. obtained is less than the sign level. α = 0.05 and $t_{stat} > t_{Table}$, then the hypothesis was accepted. Therefore the hypothesis stating that the better the quality of fishing vessel crew resources, the higher the safety level of fishing vessel navigation at Morodemak port is accepted. Furthermore, the effect of ship seaworthiness on the safety of fishing vessel voyages is obtained t_{stat} = 2.863 with sig. 0.006, because the sig. obtained is less than the sign level. α = 0.05 and $t_{stat} > t_{Table}$, then Ho was rejected and Ha accepted. Therefore the hypothesis stating that the more the ship's seaworthiness is fulfilled, the higher the safety level of fishing boat voyages at Morodemak port is accepted.

The effect of the role of SBNP (Sailing Navigation Auxiliary Facilities) on the safety of fishing boat voyages is obtained t_{stat} = 2.531 with sig. 0.014, because the sig. obtained is smaller than the sign level. α = 0.05 and $t_{coun} > t_{Table}$, then Ho was rejected and Ha accepted. Therefore the hypothesis "the better the role of the Navigation Assistance Facility (SBNP), the higher the safety level of fishing vessel navigation at Morodemak port is accepted.

The next is to examine Model Feasibility Test. This test was conducted to see whether the model being analyzed has a high level of model feasibility, that is, the variables used by the model are able to explain the phenomena being analyzed (Ferdinand, 2011). To see the distribution of variance caused by regression and the variance caused by residuals. This can be analyzed through the F anova test which compares the mean square of the regression and the mean square of the residuals in the SPSS output. F calculated is then compared with F Table for df of regression and df of residuals, the result is the value of F Table. F Table is smaller than F_{stat}, so this model has a good level of goodness of fit. If the results of the SPSS application program have a significance level of <0.05, then the model with independent variables is worthy of being accepted (Ferdinand, 2011).

Table 4. F Test Results/Model Test

ANOVA[a]						
Model		*Sum of Squares*	*df*	*Mean Square*	*F*	*Sig.*
1	Regression	57.616	4	14.404	20.554	.000[b]
	Residual	44.149	63	.701		
	Total	101.765	67			
a. Dependent Variable: keselamatan pelayaran kapal ikan						
b. Predictors: (Constant), peran SBNP, Vessel safety equipment, Vessel Seaworthiness, Resource of Fishing Vessel Crew						

Based on testing with SPSS, it was found that F_{stat} (20.554) compared to F Table for regression 4 and df residual 67, the result of F Table is 2.51. $F_{stat} > F_{Table}$, namely 20.554 > 2.51, the model has a good level of goodness of fit or is accepted at the sig 0.000 level on the results of SPSS Ver.22. It can be explained that significance is <0.05, which means the model is quite good. Lastly, to examine Coefficient of Determination (R Square)is used to measure how far the model's ability to explain the variation of the dependent variable. The value of the coefficient of determination is between zero and one (Ghozali, 2011). The coefficient of determination can be used to determine the percentage of Y values that can be explained by the regression line or how much the percentage of shipping safety of fishing vessels can be affected by ship safety equipment, crew resources of fishing vessels, ship seaworthiness, and the role of SBNP (Saara Navigation Aid Facility).

Table 5. Coefficient of Determination (R^2)

Model Summary[b]					
Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Durbin-Watson
1	.752[a]	.566	.539	.837	1.795
a. Predictors: (Constant), the role of SBNP, ship safety equipment, ship seaworthiness, fishing vessel crew resources					
b. Dependent Variable: fishing vessel safety					

The calculation results obtained a coefficient of determination value (Adjusted R Square = 0.539), which means 53.9%. This indicates that the coefficients of the variables such as ship safety equipment, fishing vessel crew resources, ship seaworthiness, and the role of Navigational Aids (SBNP) significantly affect the safety of fishing vessel navigation. The value of 53.9% represents the portion of the variability explained by these variables, while the remaining 46.1% (100% - 53.9%) is influenced by other variables outside the scope of the research or beyond the regression equation model.

5. Conclusion

The findings indicate that each independent variable has implications for the assessment of the research object, which is the safety of fishing vessel navigation. Ship safety equipment has the highest value in multiple linear regression results, making it the most important factor in improving the safety of fishing vessel navigation. Ship owners need to enhance the quality of ship safety equipment and ensure that all vessels have safety equipment that complies with ship seaworthiness requirements.

Fishing vessel crew resources have the second-highest value after ship safety equipment, making it a crucial factor in improving the safety of fishing vessel navigation. Each crew member must have the required certifications and skills as per regulations, and authorities need to take strict action against crew members who do not meet these requirements. Ship seaworthiness has the third-highest value in multiple linear regression results. Ship owners and crew members must pay attention to ship seaworthiness, as this factor also affects the safety of fishing vessel navigation. Research findings provide input on the importance of meeting ship seaworthiness requirements. The role of Navigational Aids (SBNP) has the lowest value after ship seaworthiness, but still influences the safety of fishing vessel navigation. Crew members must understand the functions and roles of SBNP, but many are still unaware of it. The manager at Morodemak Port as a regulator should conduct training and education regarding SBNP to enhance the crew's understanding of this facility.

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