

The Relationship between the Implementation of Standard Operating Procedures (SOP) and the Risk of Accidents in Anchor Handling Work on the Anchor Handling, Tug, Supply (AHTS) Vessel Owned by PT. Logindo Samudramakmur TBK.

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Abstract;

This study examines the relationship between the implementation of Standard Operating Procedures (SOPs) and the risk of accidents in anchor handling work on Anchor Handling, Tug, and Supply (AHTS) vessels owned by PT. Logindo Samudramakmur Tbk. The objectives of the study were to determine the level of accident risk and analyze the effect of SOP compliance on the risk. The research method used was quantitative with a survey design, complemented by descriptive analysis and simple linear regression. The population consisted of all deck crews involved in anchor handling work on three AHTS vessels (Logindo Enterprise, Logindo Energy, Logindo Stamina), with a total sample of 27 respondents through census techniques. Primary data were collected using a closed questionnaire that was tested for validity and reliability, then analyzed using SPSS version 26. The results showed that the risk of accidents was quite high (average 45.52 out of 50), while the implementation of SOPs was considered good (average 43.81). Pearson correlation yielded a very strong and significant negative relationship ($r = 0.946$, $p < 0.05$), with 89.4% of the risk variation explained by the regression model $\hat{Y} = 11.824 + 0.769X$. The study concluded that consistent SOP compliance significantly reduces the risk of accidents and strengthening SOPs as a safety culture is crucial for AHTS operational safety.

Keywords: Accident Risk, Anchor Handling, Anchor Handling Tug And Supply, Offshore Safety and Standard Operating Procedure.

I. INTRODUCTION

The maritime sector plays a crucial role in driving global economic activity, particularly through offshore natural resource extraction. In this context, support vessels with specialized technical specifications, particularly Anchor Handling Tugs and Supply (AHTS), serve as the backbone of exploration operations and support for platforms, barges, and submarine pipeline and cable installations (Afdhani, 2024; Nurmala et al., 2025). Globally, the increasing trend in offshore oil and gas exploration activities from 2021–2024 has driven an increase in the number and intensity of AHTS operations, which in turn confirms the importance of occupational safety aspects on these vessels as part of the maritime energy supply chain (IMCA, 2024; Kim et al., 2021). This phenomenon demonstrates that the relationship between offshore operation productivity and the level of crew safety risk on AHTS vessels is a scientifically and practically relevant study for both the maritime industry and international regulatory developers.

In Indonesia, the offshore maritime sector has also experienced significant growth, with increased utilization of AHTS vessels to support exploration and platform unit services in strategic waters, including the operational areas of national companies such as PT. Logindo Samudramakmur Tbk (Nurmala et al., 2025; Djajasasana et al., 2023). Recent studies on local AHTS vessels indicate that anchor handling activities often take place in uncertain sea conditions, high time pressure, and dynamic crew mobility, thus increasing the potential for work accidents (Afriandi, 2025; Egbert Edward Djajasasana, 2023). Empirical data from safety reports and research on AHTS vessels show that work incidents such as line of fire, falls from height, and accidents due to cable or anchor snapback remain the main causes of accidents on board ships, especially during anchor handling and mooring operations (IMCA, 2024; Nurmala et al., 2025). This phenomenon emphasizes the need to strengthen systematic studies on how operational and management factors, especially the implementation of Standard Operating Procedures (SOPs), influence the level of accident risk in anchor handling work.

In general, previous research on safety on AHTS vessels has shown that the human factor is the dominant cause of many accidents, both globally and nationally (Afriandi, 2025; Kim et al., 2021). Other studies also confirm that although OHS training programs and SOPs have been implemented, their implementation in the field is often inconsistent, so that SOPs are often seen as administrative formalities rather than a living safety culture (Afriandi, 2025; Djajasasana et al., 2023). Furthermore, qualitative research and hazard and operability analysis (HAZOP) found that the risk of accidents in AHTS operations can be categorized as medium to high, with factors such as extreme weather, equipment conditions, and coordination between crews and operating units being the main triggers (Nurmala et al., 2025; Safety Risk Analysis in AHTS Ship Operations Using the HAZOP Method, 2026). On the other hand, recent psychometric research on safety on offshore vessels shows that a strong safety culture, including SOP compliance, continuous training, and an incident reporting system, is positively correlated with a reduction in work incident rates (Ship Crew Behavior, Maritime Safety Culture, and Operational Safety, 2024; High Reliability Teams at Sea, 2025).

However, previous research has shown some inconsistencies and limitations that are worth highlighting. Several qualitative studies describe SOP implementation on AHTS vessels as frequently violated or selectively implemented, but do not always statistically measure the extent to which SOP violations contribute to increased accident risk (Analysis of Watchkeeping Implementation During Cargo Lifting on AHTS Logindo Stamina, 2026; The Effect of K3 Understanding and SOP Compliance on Occupational Accident Rates, 2023). On the other hand, quantitative research linking SOP compliance with incident rates is more often conducted in the aviation sector or terrestrial industries, while the offshore maritime context, particularly anchor handling work on AHTS vessels, is still very limited (IMCA Safety Statistics Report, 2024; The Effect of K3 Understanding and SOP Compliance, 2023). In addition, many risk analyses on AHTS vessels still focus on technical aspects (equipment, maintenance, and weather conditions) and have only just begun to integrate human and organizational variables, but rarely make SOPs the main variable that is measured quantitatively to explain variations in accident risk levels (Safety Risk Analysis in AHTS Ship Operations Using the HAZOP Method, 2026; Kim et al., 2021).

This situation opens an explicit research gap: there is a strong need for quantitative research that systematically measures the relationship between SOP implementation and the level of accident risk in anchor handling work on AHTS vessels, particularly in the context of Indonesian operations. Although several studies have shown that vessels with high SOP compliance tend to have lower work incidents (IMCA, 2024; The Effect of K3 Understanding and SOP Compliance, 2023), this causal and correlational relationship has not been explained in detail in the specific context of AHTS and anchor handling activities. Therefore, this study is formulated with two main questions: What is the level of accident risk that can occur in anchor handling work on AHTS vessels? and What is the relationship between Standard Operating Procedure (SOP) implementation and accident risk in anchor handling work on AHTS vessels? This question is then operationalized into a problem statement: there is no strong and measurable empirical evidence regarding the extent to which compliance with SOPs can reduce the risk of accidents in anchor handling work on AHTS vessels, particularly in the operational environment of PT. Logindo Samudramakmur Tbk.

This study aims to measure the level of accident risk that can occur in anchor handling work on several AHTS vessels owned by PT. Logindo Samudramakmur Tbk—namely AHTS Logindo Enterprise, AHTS Logindo Energy, and AHTS Logindo Stamina—and analyze the relationship between the implementation of SOPs and the level of risk. The urgency of this research is very high considering the increasing frequency of offshore operations in Indonesia and the need for stronger operational guidelines to reduce potentially fatal work incidents. The novelty of this research lies in the combination of a quantitative approach with the specific context of AHTS vessels and anchor handling work, which has previously been studied more descriptively qualitatively or generally in maritime vessel risk analysis. Theoretically, this research will enrich the literature on safety management on AHTS vessels, especially the relationship between SOPs, safety culture, and the risk of work accidents. Practically, the results of the study are expected to be a basis for the management of PT. Logindo Samudramakmur Tbk, ship officers, and all deck crew to strengthen the implementation of SOPs as an integral part of safety culture, so that the risk of

accidents in anchor handling work can be minimized and the productivity of offshore operations remains safe.

II. METHOD

This study uses a quantitative approach with a survey design that aims to examine the relationship between the implementation of Standard Operating Procedures (SOPs) and the risk of accidents in anchor handling work on Anchor Handling, Tug, and Supply (AHTS) vessels. This research design is categorized as causal-associative research because it focuses on measuring the causal relationship between independent and dependent variables through statistical analysis (Sugiyono, 2020; Pasaribu et al., 2022). The quantitative methodology was chosen because it allows researchers to measure variables objectively through a numerical scale, as well as test hypotheses with simple linear regression analysis as the main technique (Pasaribu et al., 2022; Mutmainah, 2024). This approach is in line with the trend in maritime occupational safety research that integrates questionnaires and inferential statistics to link SOP compliance with work incident rates (IMCA, 2024; Ship Crew Behavior, Maritime Safety Culture, and Operational Safety, 2024).

The study population consisted of all deck crew members involved in anchor handling work on three AHTS vessels owned by PT. Logindo Samudramakmur Tbk., namely AHTS Logindo Enterprise, AHTS Logindo Energy, and AHTS Logindo Stamina. The sampling technique used was census or total sampling, where all deck crew members who met the inclusion criteria (having carried out anchor handling work directly and being in the author's sea practice period on August 1, 2024–August 5, 2025) were included as respondents without stochastic sampling (Sugiyono, 2020; Andari et al., 2024). This approach was chosen to maximize data coverage on each vessel, minimize selection bias, and ensure that operational characteristics between vessels could be represented proportionally. The number of samples collected was explicitly recorded so that it could be replicated by other researchers in a similar context.

The main research instrument used was a closed-ended questionnaire developed based on the conceptual framework of SOPs and occupational accident risks. The questionnaire consisted of two parts: (1) SOP implementation indicators, measuring aspects of compliance with procedures, communication, and the use of safety equipment, and (2) accident risk indicators, which describe the frequency and severity of potential incidents in anchor handling work (Soesana et al., 2023; Analysis of Watchkeeping Implementation During Cargo Lifting on AHTS Logindo Stamina, 2026). Prior to use, the instrument was qualitatively reviewed by experts in the field of ship safety and reviewed based on the latest literature to ensure conceptual clarity and relevance to the AHTS context (Ahadi et al., 2023; Farida et al., 2022). Validity testing was carried out using item-total correlation testing and reliability testing using Cronbach's alpha coefficient to ensure that each questionnaire item was able to consistently measure the intended construct (Soesana et al., 2023; Pasaribu et al., 2022).

The research procedure was carried out in stages, starting from the preparation stage, implementation, and data analysis. During the preparation stage, the researcher applied for research permits from the company and relevant authorities, developed a questionnaire, and conducted a pilot test of the instrument on a small number of crew members to revise ambiguous items. During the sea practice period (August 1, 2024–August 5, 2025), the researcher collected primary data by distributing questionnaires directly to the deck crew on each ship, assisted by a brief explanation of the research objectives and the importance of honesty in completing the questionnaires (Nurmala et al., 2025; Egbert Edward Djajasasana et al., 2023). The data were then processed in digital format to facilitate statistical processing, ensuring the confidentiality of respondents' identities and the protection of personal data in accordance with ethical protocols and company policies. All these procedures were designed to be replicable in similar studies on other AHTS vessels without changing the essence of the measurement concept.

The data analysis technique combines descriptive analysis and simple linear regression analysis. Descriptive analysis is used to describe the distribution and characteristics of the respondents, as well as to calculate the accident risk level using the $Tingkat\ Risiko = \frac{Skor\ aktual}{Skor\ maksimum} \times 100\%$, thereby providing an empirical picture of the risk level in anchor handling work (Pasaribu et al., 2022; The Influence of OSH

Understanding and SOP Compliance on Workplace Accident Rates, 2023). Next, simple linear regression analysis was used to test the relationship between SOP implementation (independent variable, X) and accident risk (dependent variable, Y) using the model $Y = a + bX$, which was tested via the t-test and the coefficient of determination R^2 to assess the significance and magnitude of SOP's contribution to the variance in accident risk (Pasaribu et al., 2022; Mutmainah, 2024). Prior to the analysis, classical assumption tests were conducted, including tests for normality, linearity, and heteroscedasticity, to ensure the suitability of using a parametric regression model (Farida et al., 2022; IMCA Safety Statistics Report, 2024). Statistical analysis was performed using SPSS software, with each stage of the process detailed to allow for replication by other researchers.

The data analysis technique combines descriptive analysis and simple linear regression analysis. Descriptive analysis is used to describe the distribution and characteristics of respondents, and to calculate the accident risk level through an equation to obtain an empirical picture of the risk level in anchor handling work (Pasaribu et al., 2022; The Effect of K3 Understanding and SOP Compliance on Occupational Accident Rates, 2023). Next, simple linear regression analysis is used to examine the relationship between SOP implementation (independent variable, X) and accident risk (dependent variable, Y) with the model, which is tested through a t-test and coefficient of determination to assess the significance and magnitude of the SOP's contribution to accident risk variance (Pasaribu et al., 2022; Mutmainah, 2024). Prior to the analysis, classical assumption tests including normality tests, linearity tests, and heteroscedasticity tests are conducted to ensure the feasibility of using the parametric regression model (Farida et al., 2022; IMCA Safety Statistics Report, 2024). Statistical analysis was performed using SPSS software, detailing each stage of the process so that it can be replicated by other researchers.

$$\text{Tingkat Risiko} = \frac{\text{Skor aktual}}{\text{Skor maksimum}} \times 100\% \quad Y = a + bXR^2$$

All research implementations adhered to ethical research aspects, including obtaining written informed consent from all respondents, who expressed their willingness to participate without coercion and with the right to withdraw at any time. Respondent identities and personal data were kept confidential, so that research results are presented only in aggregate form and cannot be linked individually (Andari et al., 2024; Ship Crew Behavior, Maritime Safety Culture, and Operational Safety, 2024). Furthermore, the researcher secured official permission from PT. Logindo Samudramakmur Tbk. and the authors' educational institutions before commencing data collection, and complied with applicable Occupational Safety and Health (K3) regulations on board the ship during the survey. This ethical approach not only meets international journal standards but also strengthens respondents' trust and compliance with the research, thereby enhancing the credibility and validity of the data obtained.

III. RESULTS AND DISCUSSION

Respondent Characteristics

Table 1. Respondent Characteristics Based on Age

		Usia			
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	30 - 35 tahun	4	14.3	14.8	14.8
	36 - 40 tahun	5	17.9	18.5	33.3

Source: Processed Primary Data, 2026

Based on the data, the majority of respondents were in the age group above 45 years old at 40.7%, followed by the 41–45 age group at 25.9%, 36–40 years old at 18.5%, and 30–35 years old as the smallest group at 14.8%. This distribution indicates the dominance of mature age respondents who tend to have a high level of job satisfaction in anchor handling activities at AHTS.

Table 2. Respondent Characteristics Based on Position on Ship

		Jabatan			
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Master	3	10.7	11.1	11.1
	Chief Officer	4	14.3	14.8	25.9
	2nd Officer	4	14.3	14.8	40.7
	3rd Officer	1	3.6	3.7	44.4
	Bosun	4	14.3	14.8	59.3
	AB	11	39.3	40.7	100.0
	Total	27	96.4	100.0	
Missing	System	1	3.6		
Total		28	100.0		

Source: Processed Primary Data, 2026

Based on the table above, it is known that respondents with the position of Able Seaman (AB) are the largest number, namely 11 people or 40.7% of the total respondents. Furthermore, respondents with the positions of Chief Officer, 2nd Officer, and Bosun each numbered 4 people or 14.8%. Respondents with the position of Master numbered 3 people or 11.1%, while the position of 3rd Officer was the smallest number, namely 1 person or 3.7%. Based on this distribution, the majority of respondents were deck crew directly involved in anchor handling activities on AHTS vessels.

IV. Description of Research Variables

A general overview of the conditions of each research variable in the application of Standard Operating Procedures (SOPs) and Accident Risk in anchor handling work on the AHTS vessel of PT. Logindo Samudramakmur Tbk is presented using descriptive analysis. The following table displays the findings of the descriptive analysis.

Table 3. Descriptive Statistics

Descriptive Statistics					
	N	Minimum	Maximum	Mean	Std. Deviation
Penerapan SOP	27	38.00	50.00	43.8148	3.77275
Risiko Kecelakaan	27	40.00	50.00	45.5185	3.06808
Valid N (listwise)	27				

Source: Processed Data, 2026

A. Standard Operating Procedure Implementation Variable (X)

Based on the results of descriptive statistical analysis, the Implementation variable *Standard Operating Procedure* (SOP) has a total of 27 respondents (N). The minimum score obtained is 38, while the maximum score is 50. The mean score for this variable is 43.81 with a standard deviation of 3.77. This mean score indicates that the level of SOP implementation in anchor handling work on AHTS vessels is generally good. The relatively low standard deviation indicates that respondents' responses regarding SOP implementation are generally consistent or do not fluctuate much.

B. Accident Risk Variable (Y)

There were 27 respondents (N) for the Accident Risk variable. Respondents received a minimum score of 40 and a maximum score of 50. This variable had a mean score of 45.52 and a standard deviation of 3.07. Based on these findings, there is a relatively high risk of accidents when handling anchors. The relatively low standard deviation indicates that respondents' opinions about the likelihood of accidents are generally uniform or do not differ substantially from one another.

Thus it can be concluded that the work *anchor handling* has a high potential risk of accidents, so the implementation of Standard Operating Procedures (SOP) is very important in minimizing the occurrence of work accidents on board ships.

Research Instrument Testing

Instrument testing is a series of testing procedures carried out on research measuring instruments, including validity and reliability tests, to ensure that the instruments used are able to measure what should be measured accurately, consistently, and can be scientifically accounted for. The level of validity of each statement item is ensured through item validity analysis, which ensures that each item accurately reflects the variables being studied. IBM SPSS Statistics version 26 for Windows software was used for all data processing and testing in this study.

A. Item Validity Analysis

The validity level of each statement in the research questionnaire was assessed using an item validity test. Twenty statements, divided into two variables, formed the research instrument: Implementation of Standard Operating Procedures (SOP) (X) and Accident Risk (Y) in anchor handling work on AHTS vessels.

Item validity is assessed through the Corrected Item-Total Correlation value in the SPSS output. An item is declared valid if the calculated r value exceeds the r table at a significance level of 5%, according to the testing criteria. The r table value for 27 respondents is 0.381. Consequently, each statement item is considered valid if the Corrected Item-Total Correlation value is positive and greater than 0.381.

All statement items in the research instrument had a Corrected Item-Total Correlation value greater than r table and was not negative, according to the results of the item validity analysis. Consequently, all 20 statement questions in the questionnaire were considered valid and suitable for use as a tool in this study.

B. Validity Test

Implementation of Standard Operating Procedures (X) and Accident Risk (Y) in anchor handling activities on AHTS vessels are two research variables whose validity was tested in this study. The Corrected Item-Total Correlation approach, which examines the relationship between the score of each statement item and the overall score of the variable, was used to conduct the validity test.

A 5% significance level ($\alpha = 0.05$) was used to assess validity. The r -table value with 27 respondents was 0.381. If the r -count value is higher than the r -table ($r\text{-count} > r\text{-table}$) and the significance value is less than 0.05, the item or variable is considered acceptable.

Table 4. Instrument Validity Test

Variabel	Butir	R _{hitung}	R _{tabel}	Status
Penerapan <i>Standard Operating Procedure</i> (X)	1	0,948	0,381	Valid
	2	0,681	0,381	Valid
	3	0,841	0,381	Valid
	4	0,806	0,381	Valid
	5	0,788	0,381	Valid
	6	0,926	0,381	Valid
	7	0,815	0,381	Valid
	8	0,796	0,381	Valid
	9	0,753	0,381	Valid
	10	0,883	0,381	Valid
Risiko Kecelakaan (Y)	11	0,963	0,381	Valid
	12	0,622	0,381	Valid
	13	0,963	0,381	Valid
	14	0,837	0,381	Valid
	15	0,936	0,381	Valid
	16	0,749	0,381	Valid
	17	0,936	0,381	Valid
	18	0,963	0,381	Valid
	19	0,963	0,381	Valid
	20	0,797	0,381	Valid

Source: Processed Primary Data, 2026

Each statement item in the Standard Operating Procedure (SOP) Implementation variable (X) and the Accident Risk variable (Y) has a calculated r value that is greater than r table (0.381), according to the

validity test results in Table 3. Therefore, all statement questions in the research questionnaire are considered valid and suitable for use as a research tool.

C. Reliability Test

Reliability testing is an evaluation method designed to assess the extent to which a research instrument can produce uniform and reliable measurements when applied repeatedly to identical research samples in similar situations. The main purpose of reliability testing is to verify that the applied research instrument has a sufficient level of trustworthiness and stability, so that the data output can be considered accurate and can be used as a foundation for producing scientifically valid inferences. In this study, the Cronbach's Alpha method was used with the help of IBM SPSS Statistics version 26. The research instrument is said to be reliable if the Cronbach's Alpha value exceeds 0.60.

Table 5. Instrument Reliability Test

Variabel	Cronbach's Alpha	Status
Penerapan <i>Standard Operating Procedure</i> (X)	0,960	Reliabel
Risiko Kecelakaan (Y)	0,974	Reliabel

Source: Processed Primary Data, 2026

Based on the reliability test results presented in Table 4, the Cronbach's Alpha coefficient values for the SOP Implementation construct (variable X) and Accident Risk (variable Y) showed figures exceeding the threshold of 0.60. This finding indicates that each item in the questionnaire has a substantial level of intercorrelation, confirming strong internal consistency. Therefore, this research instrument can be considered valid and has sufficient reliability for use in subsequent data analysis stages.

Classical Assumption Test

A. Normality Test

The normality test serves to identify the appropriate statistical analysis method for data processing. If the data is normally distributed, parametric statistical methods will be applied. Conversely, if the data is not normally distributed, nonparametric statistical methods will be used. Given the sample size of less than 50 respondents, the Shapiro-Wilk test will be applied.

Based on the normality test criteria, data is declared normally distributed if the significance value (Sig.) is greater than 0.05. Conversely, if the significance value is less than 0.05, the data does not meet the normality assumption.

Table 6. Results of the Shapiro-Wilk Normality Test

Tests of Normality						
	Kolmogorov-Smirnov ^a			Shapiro-Wilk		
	Statistic	df	Sig.	Statistic	df	Sig.
Risiko Kecelakaan	.171	27	.041	.930	27	.070
a. Lilliefors Significance Correction						

Source: Processed Primary Data, 2026

A significance value of 0.070 was determined using the normality test findings in Table 6. Since this value is higher than 0.05 ($0.070 > 0.05$), it can be said that the research data is regularly distributed. Therefore, one of the traditional assumptions of linear regression analysis has been met by the research data.

B. Linearity Test

Linearity testing was performed to ensure that the data obtained meets the assumptions of normal distribution so that the results of the statistical analysis used can be scientifically accounted for and produce valid conclusions.. The relationship is declared linear if the Sig value. Deviation from Linearity > 0.05 , and

not linear if the value is < 0.05 .

Table 7. Linearity Test Results

ANOVA Table			Sum of Squares	df	Mean Square	F	Sig.
Risiko Kecelakaan * Penerapan SOP	Between Groups	(Combined)	227.717	11	20.702	18.241	.000
		Linearity	218.856	1	218.856	192.838	.000
		Deviation from Linearity	8.861	10	.886	.781	.647
	Within Groups		17.024	15	1.135		
Total			244.741	26			

Source: Processed Primary Data, 2026

The Sig. Deviation Value from Linearity is 0.647, which is greater than 0.05 ($0.647 > 0.05$), according to the findings of the linearity test in Table 4.6. Based on the findings of the linearity test results, it can be stated that the relationship pattern between the Standard Operating Procedure (SOP) implementation variable and the work accident risk variable forms a linear relationship, so that a simple linear regression analysis is feasible to use.

C. Heteroscedasticity Test

The purpose of the heteroscedasticity test is to detect the presence of unequal residual variances in a regression model. This is essential to ensure that the applied regression model meets the homoscedasticity assumption, which in turn will produce efficient and unbiased estimates. A scatterplot approach was used in this study to perform this test.

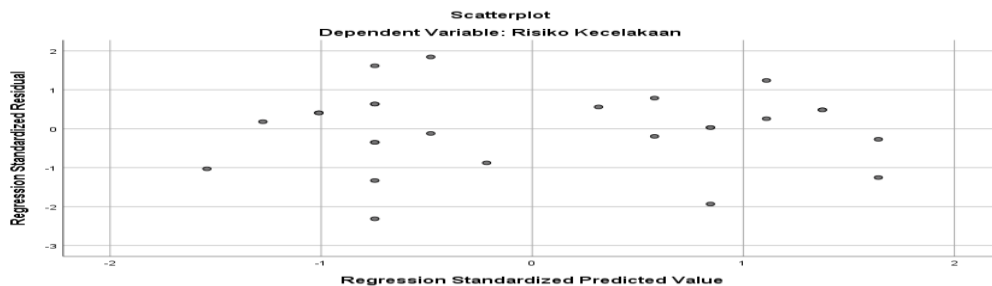


Fig.1. Heteroscedasticity Test Based on Scatterplot

Visual analysis using scatterplots confirmed the absence of a systematic pattern, either showing a curved trend, convergence, or divergence, as well as the distribution of data points that were randomly scattered around the horizontal reference line on the Y-axis. This observation indicated that the phenomenon of heteroscedasticity was not observed in the constructed regression model.

Consequently, it can be concluded that the regression model used in this study complies with the homoscedasticity assumption, making it valid and suitable for further inferential analysis.

Correlation Test

To determine the magnitude of the relationship between the implementation of Standard Operating Procedures (X) and the risk of work accidents (Y), statistical analysis was conducted using the Pearson Product Moment correlation method. This method is a common parametric correlation technique used in quantitative research.

In correlation testing, a significant relationship between variables is indicated when the significance value is less than 0.05, while it is considered insignificant if the value exceeds 0.05.

Table 8. Pearson Correlation Test Results

Correlations			
		Penerapan SOP	Risiko Kecelakaan
Penerapan SOP	Pearson Correlation	1	.946**
	Sig. (2-tailed)		.000
	N	27	27
Risiko Kecelakaan	Pearson Correlation	.946**	1
	Sig. (2-tailed)	.000	
	N	27	27

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

Source: Processed Primary Data, 2026

The correlation coefficient (r) value is determined based on the results of the correlation test in Table 8, which shows a relationship between the variables of SOP Implementation and Accident Risk. SOP implementation and accident risk in anchor handling activities on AHTS vessels are significantly correlated, as indicated by a significance value of less than 0.05.

Simple Linear Regression Test

The direction of the relationship and the relationship model between the Standard Operating Procedure (SOP) Implementation variable and the Accident Risk variable in anchor handling work on the AHTS vessel of PT. Logindo Samudramakmur Tbk. have been determined in this study using simple linear regression analysis. In addition, regression analysis is also used to determine the extent of the contribution of the SOP implementation variable to the accident risk.

Table 9. Correlation Coefficient

Interval Koefisien	Tingkat Hubungan
0,00 – 0,199	Sangat rendah
0,20 – 0,399	Rendah
0,40 – 0,599	Kuat
0,60 – 1,000	Sangat kuat

Source: Sugiyono (2019)

Table 10. Model Summary

Model Summary ^b				
Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.946 ^a	.894	.890	1.01754
a. Predictors: (Constant), Penerapan SOP				
b. Dependent Variable: Risiko Kecelakaan				

Source: Processed Primary Data, 2026

Based on the simple linear regression analysis presented in the Model Summary Table, an R value of 0.946 was identified. This figure indicates a very strong correlation between the variables of Standard Operating Procedure (SOP) Implementation and Accident Risk. The coefficient of determination (R squared) of 0.894 indicates that 89.4% of the variability in accident risk can be attributed to SOP implementation. The remaining 10.6% of the variability is influenced by other variables not included in the scope of this study.

The Adjusted R Square value of 0.890 shows that after adjustments were made to the number of samples and research variables, the contribution of the SOP Implementation variable to Accident Risk still shows a large influence.

Table 11. Simple Linear Regression Equation

Coefficients ^a						
Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	11.824	2.326		5.084	.000
	Penerapan SOP	.769	.053	.946	14.539	.000
a. Dependent Variable: Risiko Kecelakaan						

Source: Processed Primary Data, 2026

The following regression equation is obtained from the findings of the simple linear regression analysis in Table 11:

$$\hat{Y} = 11,824 + 0,769X$$

The regression equation can be seen to have a constant value of 11.824, which means that the Accident Risk value is equal to 11.824 if the SOP Implementation variable is zero. The Accident Risk variable will

vary by 0.769 units for every one-unit increase in the SOP Implementation variable, in accordance with the regression coefficient value of 0.769.

Furthermore, the Coefficient table produces a significance value of 0.000 and a t-value of 14.539. The implementation of Standard Operating Procedures (SOP) and the risk of accidents in anchor handling work on the AHTS vessel of PT. Logindo Samudramakmur Tbk are significantly correlated, as indicated by a significance value of less than 0.05 ($0.000 < 0.05$).

Thus, the implementation of SOPs has a very strong relationship with the level of accident risk in anchor handling operational activities on AHTS vessels.

V. DISCUSSION

Accident Risk Level in Anchor Handling Work

Based on the descriptive analysis of accident risk variables, the accident risk level in anchor handling jobs is relatively high. This is reflected in the average score of respondents, which indicates that the majority of respondents considered the job to have significant potential hazards during the operational process.

Anchor handling is a ship operational activity with a high risk of accidents. This is because the work involves the use of various heavy equipment such as anchor chains, wire ropes, and towing winches, and the work is carried out on the ship's deck, which has limited space. Furthermore, this work requires good coordination among the ship's crew to ensure each stage of the work is carried out safely and according to procedures.

Pekerjaan anchor handling memiliki potensi bahaya yang tinggi

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Setuju	14	50.0	51.9	51.9
	Sangat Setuju	13	46.4	48.1	100.0
	Total	27	96.4	100.0	
Missing	System	1	3.6		
Total		28	100.0		

Pergerakan wire rope saat operasi dapat menimbulkan risiko kecelakaan

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Setuju	21	75.0	77.8	77.8
	Sangat Setuju	6	21.4	22.2	100.0
	Total	27	96.4	100.0	
Missing	System	1	3.6		
Total		28	100.0		

Fig.2. Respondents' Answers

The results of the study showed that the majority of respondents agreed to strongly agree with the statement regarding the potential dangers in anchor handling work, which indicates a high awareness of the risk of accidents in this work.

Most respondents also stated that anchor handling is potentially hazardous, and that the movement of wire rope during operations can pose a risk of accidents if not handled carefully. The movement of wire rope under tension can pose hazards such as snapback, potentially causing serious injury to crew members on the ship's deck.

Kondisi cuaca buruk dapat meningkatkan risiko kecelakaan saat anchor handling

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Setuju	13	46.4	48.1	48.1
	Sangat Setuju	14	50.0	51.9	100.0
	Total	27	96.4	100.0	
Missing	System	1	3.6		
Total		28	100.0		

Fig. 3. Respondents' Answers

In addition to equipment, environmental factors also influence the risk of accidents. Respondents stated that adverse weather conditions can increase the risk of accidents during anchor handling activities. Unstable weather, high sea waves, and unstable ship movements can affect the crew's balance while working on deck.

The risk of accidents in anchor handling is caused by several factors, such as errors in work procedures, lack of vigilance when operating equipment, and suboptimal implementation of safety standards. If work procedures are not properly implemented, the potential for accidents on the ship's deck can increase.

Thus, research data indicates that anchor handling carries a high potential risk of accidents. Therefore, proper work procedures, increased vigilance, and increased safety awareness are essential for all ship crew members to minimize the risk of accidents during anchor handling operations.

The Relationship between SOP Implementation and Accident Risk in Anchor Handling Work

Based on the findings of the correlation analysis, a correlation coefficient of 0.946 was found with a significance value of 0.000. This figure indicates that the probability of accidents in anchor handling operations is strongly and significantly correlated with the implementation of Standard Operating Procedures (SOPs). This high correlation indicates that the implementation of SOPs is very important in reducing the probability of work accidents in the ship's operational environment. The probability of accidents during the implementation of anchor handling tasks decreases as the crew's compliance with the SOPs.

Furthermore, the results of the simple linear regression analysis showed a coefficient of determination (R Square) of 0.894, which indicates that the SOP implementation variable can explain 89.4% of the relationship with accident risk, with the remaining 10.6% influenced by variables not included in this study, such as weather, crew work experience, equipment conditions, and work environment factors.

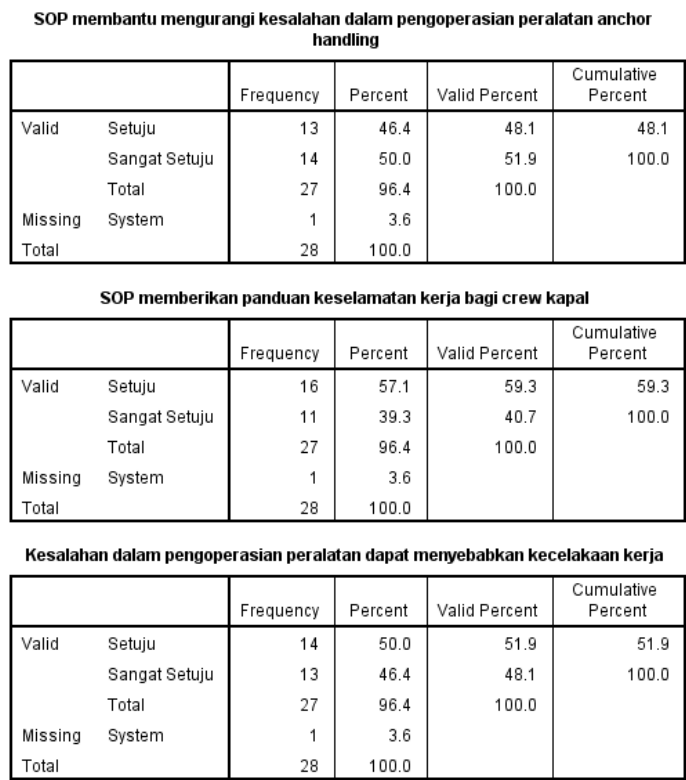


Fig. 4. Respondents' Answers

The results show that the majority of respondents agree on the importance of implementing SOPs in carrying out work. Respondents stated that SOPs help reduce errors in the operation of anchor handling equipment and provide safety guidance for ship crews during operational processes. Furthermore, respondents also recognized that errors in equipment operation can lead to workplace accidents, making implementing SOPs crucial in minimizing these risks.

Based on this, implementing proper SOPs is crucial for maintaining occupational safety in anchor handling activities. SOPs serve as work guidelines that regulate operational steps to ensure work is carried

out safely, systematically, and in accordance with established safety standards.

With proper implementation of SOPs, ship crews can understand proper work procedures, identify potential hazards, and take preventative measures to prevent workplace accidents. Therefore, consistent and disciplined implementation of SOPs is a key factor in improving occupational safety on board ships.

Thus, the findings of this study indicate a very strong relationship between the implementation of SOPs and the level of accident risk in anchor handling work on the AHTS vessel of PT. Logindo Samudramakmur Tbk.

V. CONCLUSION

This study found that the implementation of Standard Operating Procedures (SOPs) in anchor handling work on the AHTS vessel of PT. Logindo Samudramakmur Tbk. has a very strong and significant relationship with the level of accident risk. Correlation analysis and simple linear regression showed a correlation coefficient of 0.946 and a determination coefficient of 0.894, which means that 89.4% of the variability in accident risk can be explained by the SOP implementation variable, while the rest is influenced by other factors such as weather conditions, crew skills, and equipment conditions. This finding confirms that consistent and disciplined SOP implementation plays a crucial role in reducing the potential for accidents, so that SOPs should no longer be viewed as an administrative formality, but rather as the axis of safety culture on AHTS vessels. On the other hand, this study is still limited to three AHTS vessels and a relatively small sample size, and only observes the SOP and accident risk variables without including intermediary variables such as safety culture, competence, and organizational factors in more depth.

These limitations open up opportunities for broader follow-up research, both in terms of the vessels and the variables studied, and the use of a combination of quantitative and qualitative methods to understand the context of safety behavior and culture at the crew level. Future researchers can develop a model that integrates SOPs, training, safety leadership officers, and incident reporting systems to examine their combined effects on accident risk. Practically, the results of this study provide a strong foundation for the management of PT. Logindo Samudramakmur Tbk. to optimize SOP implementation through regular supervision, evaluation, and training, as well as strengthening the monitoring and auditing system for SOP compliance on board. Broader implications, this study supports efforts to build a sustainable safety culture in the offshore maritime industry, where SOP compliance is a crucial indicator in maintaining crew safety and the continuity of productive operations.

REFERENCE

- [1]. Afriandi, S. (2025). Standar kesehatan dan keselamatan kerja yang tinggi dalam dunia pelayaran pendukung pengeboran minyak dan gas bumi (tipe kapal AHTS). *Jurnal Kesehatan & Multi Disiplin*, 3(1), 48–61.
- [2]. Ahadi, G. D., Nur, N., & Ersela, L. (2023). The simulation study of normality test using Kolmogorov-Smirnov. *Journal of Statistics and Data Science*, 6(1).
- [3]. Al Afdhani, A. A. (2024). Analisis pelaksanaan kerja dalam pelayanan anchor handling di deck AHTS Etzomer 505 (Doctoral dissertation, Politeknik Ilmu Pelayaran Makassar).
- [4]. Alam, M. F. (2023). *Upaya pencegahan kecelakaan kerja di deck pada saat kegiatan anchor handling di AHT S1 Flicker (Doctoral dissertation, Politeknik Ilmu Pelayaran Makassar)*.
- [5]. Amalia, R., Herwanto, D., & Zahra, W. R. (2023). Analisis potensi bahaya dan risiko kecelakaan kerja dengan menggunakan metode hazard identification risk assessment and risk control (HIRARC) pada pemotongan kayu. *Jurnal Teknik Industri*, 13–19.
- [6]. Andari, T., Widyastuti, R., Mukhlis, I. R., Tondong, H. I., Kusumastuti, S. Y., Kurniawan, S., Judijanto, L., Pratama, A., Boari, Y., & Purnamasari, N. (2024). Metodologi penelitian. Penerbit Akademia.
- [7]. Auliya, N. H., Andriani, H., Fardani, R. A., Ustiawaty, J., Utami, E. F., Sukmana, D. J., & Istiqomah, R. R. (2020). Metode penelitian: Kualitatif dan kuantitatif. CV Pustaka Ilmu Group.
- [8]. Bambang, B., Fauzi, N., Priatna, T., Ilham, A., Syah, F., Ramadhan, F. C., & Mubarak, M. H. (2026). Kajian teori sebagai fondasi perumusan hipotesis penelitian. *Journal of Philosophy*, 2(1), 14–20.
- [9]. Bueger, C., & Liebetau, T. (2023). Critical maritime infrastructure protection: What's the trouble? *Marine Policy*, 155, 105772. <https://doi.org/10.1016/j.marpol.2023.105772>

- [10]. Cruz, G. S. Dela, & Ocampo, A. P. (2025). Applied ISO 31000 risk management in practice: Adoption challenges and benefits in Qatar's leading construction firm. *International Journal of Multidisciplinary Applied Business and Education Research*, 6(8), 4190–4208. <https://doi.org/10.11594/ijmaber.06.08.33>
- [11]. Djajasasana, E. E., Indarti, W., & Purnomo, J. (2023). Meningkatkan efektivitas penerapan langkah keselamatan sebagai tindakan preventif di kapal AHTS Peteka 5402. *Ocean Engineering: Jurnal Ilmu Teknik dan Teknologi Maritim*, 2(4), 164–173. <https://doi.org/10.58192/ocean.v2i4.1615>
- [12]. Farida, D., Pratama, G., & Susanto, B. (2022). Pengaruh corporate social responsibility dan likuiditas terhadap kinerja keuangan perusahaan yang memperoleh sustainability reporting award. *Jurnal Analisis Bisnis Ekonomi*, 885–905.
- [13]. Ghufron, I., & Andayani, S. A. (2022). Standar operasional prosedur (SOP). CV Mitra Cendekia.
- [14]. IMCA. (2024). Annual safety statistics report. International Marine Contractors Association. <https://www.imca-int.com/resources/safety/>
- [15]. IMO. (2020). International convention for the safety of life at sea (SOLAS). International Maritime Organization.
- [16]. Indartini, M., & Mutmainah. (2024). Analisis data kuantitatif: Uji instrumen, uji asumsi klasik, uji korelasi dan regresi linier berganda. Deepublish.
- [17]. Ismoko, I., Asmoro, E. I., & Hidayat, Z. I. (2023). Pengaruh pemahaman K3 dan ketaatan SOP terhadap tingkat kecelakaan kerja. *Marine Science and Technology Journal*, 4(1), 36–42.
- [18]. Mylonopoulos, F., Polinder, H., & Member, S. (2023). A comprehensive review of modeling and optimization methods for ship energy systems. *IEEE Access*, 32697–32707.
- [19]. Nurfaui, B. B., Raihan, M., Damar, P., Wahyuni, S., Halim, H. A., Priatna, T., & Sunan, U. I. N. (2026). Perencanaan penelitian pendidikan yang sistematis. *Jurnal Pendidikan Agama Islam*, 3(1), 12–30.
- [20]. Nurmala, E., Baihaqi, B., Hartati, D. V., Darmayanti, N. L., & Saputra, I. (2025). Loading and unloading planning to prevent work accidents on the AHTS Amber. *ALTAIR: Jurnal Transportasi dan Bahari*, 2(1), 19–26. <https://doi.org/10.62554/t92e3069>
- [21]. OLF/NSA. (2020). *Safe anchor handling and towing*. Norwegian Shipowners' Association.
- [22]. Pasaribu, B. S., Herawati, A., Utomo, K. W., & Aji, R. H. S. (2022). *Metodologi penelitian untuk ekonomi dan bisnis*. Media Edu Pustaka.
- [23]. Rahmawati, F., & Suryana, N. N. (2024). Pentingnya standar operasional prosedur (SOP) dalam meningkatkan efisiensi dan konsistensi operasional pada perusahaan manufaktur. *Jurnal Manajemen Bisnis Digital Terkini*, 1(3), 2–15.
- [24]. Saputra, A., Hariyanto, S., Alwi, M. R., & Rivai, H. (2023). Identifikasi risiko bahaya keselamatan dan kesehatan kerja area sistem docking di galangan kapal dengan metode JSA melalui pendekatan HIRADC. *Jurnal Penelitian Enjiniring*, 27(2), 76–86. <https://doi.org/10.25042/jpe.112023.02>
- [25]. Sarjana, S., Nardo, R., & Hartono, R. (2022). *Manajemen risiko*. Penerbit Widina.
- [26]. Soesana, S., et al. (2023). *Metodologi penelitian kuantitatif*. CV Literasi Nusantara.
- [27]. Subandi, S., Rahmawati, E., & Hasanah, I. (2024). Pemahaman konseptual tentang standard operating procedure (SOP): Dasar, tujuan, manfaat, dan implementasi. *Jurnal Media Akademik*, 2(6).
- [28]. Sugiyono. (2019). *Metode penelitian kuantitatif, kualitatif, dan R&D* (2nd ed.). Alfabeta.
- [29]. Syarifudin, M. D., Rushanti, S., & Tripariyanto, A. Y. (2025). Analisis risiko keselamatan kesehatan kerja (K3) karyawan dengan pendekatan manajemen risiko. *Venus: Jurnal Publikasi Rumpun Ilmu Teknik*, 3.