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Research Paper

Analysis of the Effect of Equipment Readiness on the Tank Cleaning Process (Case Study of MT. Akra 102)

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Abstract

Tank cleaning is defined as the activity of cleaning tanks from residues of previous cargo, including cleaning and checking pumping equipment, heater equipment, filling pipes, ventilation pipes and auxiliary engines. During the tank cleaning process there were many obstacles such as the tool not working normally, the crew's lack of knowledge, and the tank not being clean and dry which resulted in an attack on the loading process. This study set out to ascertain how equipment preparedness affected tank cleaning. This study employed a descriptive method with a quantitative approach as its research methodology. The IBM SPSS 26 program is used to process some sample data. Respondents are given questionnaires as part of data gathering processes.The results showed that equipment readiness had a significant effect on the tank cleaning process.

Keywords *Equipment Readiness, Tank Cleaning*

INTRODUCTION

Indonesia's ability to enter the category of the world's maritime axis, Indonesia has this great potential due to the vast area of Indonesian waters. Demand for chemicals can be met in various fields, including health, agriculture, industry, biology, archeology, and other fields. Due to the variety of chemicals in Indonesia, not all ships can carry dangerous cargo in the form of corrosive chemical liquids.

Chemical tanker is a type of ship specifically designed to carry dangerous cargo in tanks in the form of chemical liquids as written in Chapter 17 of the IBC Code. This type of vessel has tanks with special coatings including: stainless steel, epoxy resin and zinc silicate.

Tank cleaning is defined as the activity of cleaning tanks from residues of previous cargo, including cleaning and checking pumping equipment, heater equipment, filling pipes, ventilation pipes and auxiliary engines. The tank cleaning process is carried out to obtain a dry certificate.My experience as a writer when carrying out the sea project on the MT ship. AKRA 102, experienced a refusal to load caustic soda cargo at PT. Asahimas in Cilegon on April 4 2022. The reason for the ban on cargo loading was because the tank was not in a clean and dry condition.

Regarding the events described, the thesis title taken is "Analysis of the Influence of Equipment Readiness on the Tank Cleaning Process (Case Study of MT. AKRA 102)". Based on the background above, the problem can be formulated as follows: Is it found the effect of equipment readiness on tank cleaning?

LITERATURE REVIEW

Theory Description

a. Tool Readiness

Equipment readiness refers to the readiness of the equipment so that it can carry out operations with maximum equipment conditions (in this case minimal damage). According to PT. Pelindo (2000:35), the availability of equipment is a measure of how long a user can use the

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equipment and is usually expressed as a percentage (%).

In carrying out tank cleaning activities, supporting equipment is needed, namely polar jet machines, polar jet hoses, fresh water hoses, cleaning cloth or rags, portable blower fans, equipment for checking gas levels, stripping pumps, and general service pumps.

b. SPOB (Self Propelled Oil Barge)

According to Samuel Pardomuan Sitorus (2020) Self Propelled Oil Barge (SPOB) is a type of ship with a flat hull (barge) and has a tank and engine so it doesn't need to be towed by a tug

c. Tank cleaning

Tank cleaning is an attempt to remove gaseous hydrocarbons, compounds or deposits. Operation is designed so that the tank can be accessed. As explained in ISGOTT Chapter: 11.3 Tank Cleaning. According to Istopo (2009), cleaning tank shared become two that is cleaning where is the tank next cargo the same as the previous cargo, and the cargo is different from the previous cargo.

Research Framework

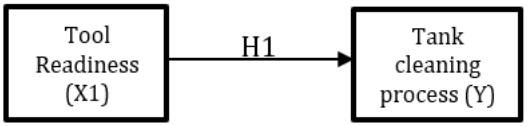

Figure 1. Research Framework

Hypothesis

H1: There is an influence from the readiness of the equipment on the tank cleaning process.

RESEARCH METHOD

According to Sugiyono (2018: 2), the research method is a scientific way to obtain information for particular purposes and goals. In this thesis, a quantitative technique is applied. According to Sugiyono (2018: 14), this research technique is built based on the positivist ideology that examines particular populations or samples; the majority of the sampling is done at random, and objective research is employed to gather data.

Respondents in this study are ship crews who work on tankers or SPOBs who also run a tank washing system on ships with the following table list:

Table 1. List of Ship Names and Total Population of Each Ship

Ship name	Amount	Total
AKRA 10	10	
AKRA 20	10	
AKRA 30	10	
AKRA 60	10	100
AKRA 70	10	
AKRA 80	10	
AKRA 90	10	

AKRA 100	10
AKRA 101	10
AKRA 102	10

Sample

Based on the calculation of the slovin formula, a total sample of 80 respondents was obtained.

Table 2. List of ship names and the number of samples for each ship

Ship name	Amount	Total
AKRA 10	8	80
AKRA 20	8	
AKRA 30	8	
AKRA 60	8	
AKRA 70	8	
AKRA 80	8	
AKRA 90	8	
AKRA 100	8	
AKRA 101	8	
AKRA 102	8	

Research Instruments

Researchers utilize instruments to measure the value of variables in order to gather information. In this study, questionnaires and instrument trials served as the research tools.

Data Processing Techniques

In the context of data collection, a questionnaire refers to a series of written questions or comments given or submitted by respondents. Testing the validity and reliability of the questionnaire instrument is very important to ensure accurate data collection

Data Analysis Techniques

In analyzing the data in this study, the writer uses Software Statistical Package for the Social Sciences (SPSS) version 26. Then, next, the writer wants to present the data. So that from these data is the elaboration of the data obtained from the results of previous studies.

FINDINGS AND DISCUSSION

Description of Research Results

a. Variable results of research

1. Tool readiness variable

Table 3. Descriptive Statistics Tool Readiness

Descriptive Statistics					
	N	Min	Max	Means	std. Deviation
X1.1	80	1	5	4.44	.653
X1.2	80	2	5	4.49	.636
X1.3	80	2	5	4.41	.650
X1.4	80	2	5	4.51	.636
X1.5	80	1	5	4.40	.789
X1.6	80	2	5	4.51	.636
X1.7	80	1	5	4.37	.682
X1.8	80	1	5	4.31	.866
TOTAL_X	80	4	5	4.56	.499
Valid N (listwise)	80				

Based on the table above, the tool readiness variable has an impact on the tank washing process is valid.

2. Tank cleaning process variable

Table 4. The process of tank cleaning descriptive statistics

Descriptive Statistics					
	N	Minimum	Maximum	Means	std. Deviation
Y. 1	80	1	5	4.34	.856
Y.2	80	1	5	4.33	.689
Y.3	80	1	5	4.51	.636
Y.4	80	1	5	4.36	.698
Y.5	80	1	5	4.50	.656
Y.6	80	1	5	4.11	.914
Valid N (listwise)					

Based on the table above, the tank cleaning process variable is valid.

b. Test research instrument
1. Validity test

Table 5. Test results for the validity of the tool readiness variable (X1)

Correlations		
X1.1	Pearson Correlation	.796**
	Sig. (2-tailed)	.000
	N	80

X1.2	Pearson Correlation	.842**
	Sig. (2-tailed)	.000
	N	80
X1.3	Pearson Correlation	.603**
	Sig. (2-tailed)	.000
	N	80
X1.4	Pearson Correlation	.861**
	Sig. (2-tailed)	.000
	N	80
X1.5	Pearson Correlation	.618**
	Sig. (2-tailed)	.000
	N	80
X1.6	Pearson Correlation	.861**
	Sig. (2-tailed)	.000
	N	80
X1.7	Pearson Correlation	.777**
	Sig. (2-tailed)	.000
	N	80
X1.8	Pearson Correlation	.704**
	Sig. (2-tailed)	.000
	N	80
Tool Readiness	Pearson Correlation	1
	Sig. (2-tailed)	
	N	80

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

Table 6. The results of the validity test of the tank cleaning process variable (Y)

correlations		
Y1	Pearson Correlation	.852**
	Sig. (2-tailed)	.000
	N	80
Y.2	Pearson Correlation	.778**
	Sig. (2-tailed)	.000
	N	80
Y.3	Pearson Correlation	.775**
	Sig. (2-tailed)	.000
	N	80
Y.4	Pearson Correlation	.801**
	Sig. (2-tailed)	.000
	N	80
Y.5	Pearson Correlation	.769**
	Sig. (2-tailed)	.000
	N	80
Y.6	Pearson Correlation	.840**
	Sig. (2-tailed)	.000
	N	80
Tank cleaning process	Pearson Correlation	1
	Sig. (2-tailed)	
	N	80

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

2. Reliability test

The indicators utilized are reliable with variable instruments, as evidenced by the results on the reliability test table.

Table 7. Reliability test results

Variables	Cronbach Alpha	Reliability Standards	Information
Tool Readiness	0.781	0.60	Reliable
Tank Cleaning Process	0.799	0.60	Reliable

c. Normality test

Table 8. Normality test results

One-Sample Kolmogorov-Smirnov Test		
		Unstandardized Residuals
N		44
Normal Parameters, b	Means	.0000000
	std. Deviation	1.64459507
Most Extreme Differences	absolute	0.80
	Positive	0.80
	Negative	-0.46
Test Statistics		0.80
asymp. Sig. (2-tailed)		.200c,d

a. Test distribution is Normal.

b. Calculated from data.

c. Lilliefors Significance Correction.

d. this is a lower bound of the true significance

According to the table above, the Kolmogorov-Smirnov test value is a significant value of 0.200. Therefore, it can be said that the residual values have a regularly distributed distribution. The significant result of 0.200 > 0.05 makes it clear.

d. Heteroscedasticity test

The scatterplot test is used to test for heteroscedasticity. According to Umar (2011: 177), the scatterplot test examines the graph plot between the variable's anticipated value, ZPRED, and the residual SRESID. The presence or absence of heteroscedasticity can be determined using the scatterplot graph between ZPRED and SRESID, where the Y axis represents the predicted value and the X axis represents the studentized residual.

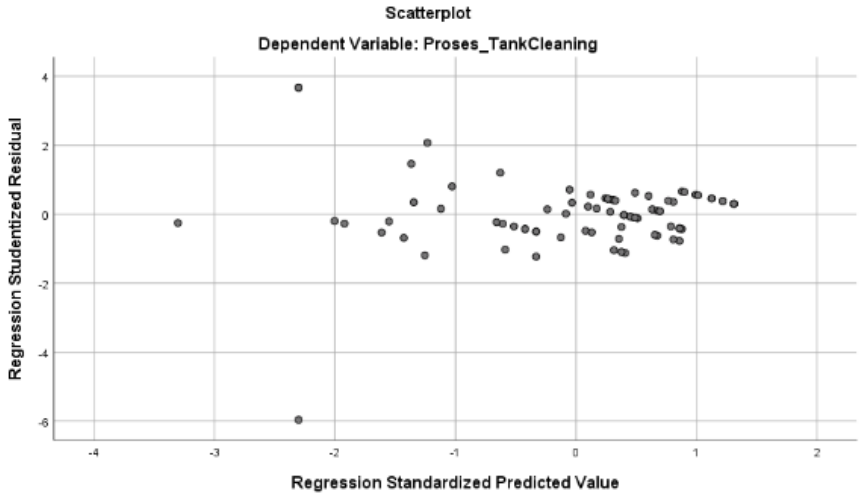

Figure 2. Heteroscedasticity test results (Scatterplot)

e. Multicollinearity test

Table 9. Multicollinearity test results

Coefficients[a]								
Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.	Collinearity Statistics	
		B	std. Error	Betas			tolerance	VIF
1	(Constant)	7,615	1873		4,066	.000		
	Readiness_Tools	10.265	2,774		3,700	.000	.930	1075

a. Dependent Variable: Process_TankCleaning

According to the results of the table above, the VIF value is less than 10.00 (1.075 10.00), and the tolerance value is more than 0.10 (0.93> 0.10). The independent variables' relationships are not mutually exclusive; therefore, further testing can be done.

3. Hypothesis testing results
   a. Test the coefficient of determination (R^2)

Table 10. The coefficient of determination

Summary model[b]				
Model	R	R Square	Adjusted R Square	std. Error of the Estimate
1	.642[a]	.412	.397	2,789

a. Predictors: (Constant), X2, X1

b. Dependent Variable: Y

From the table above, an R of 0.642 has been obtained, which explains that equipment readiness (X1) has a very strong correlation, and there is a positive relationship to changes in the tank cleaning process variable (Y) according to the results obtained, namely R of 0.642.

R square value (R^2) = 0.412. This value indicates that the equipment readiness variable (X1) contributes to the tank cleaning process variable (Y) of 41.2%, and the remaining 58.8% is influenced by other factors outside the researcher's discussion.

b. Test of effective contribution (SE)

Based on the table below, it can be seen that the amount of Effective Contribution (SE) on variable equipment readiness (X1) is 9.56, and the magnitude of SE on crew skills (X2) is 31.65. The donation size shows that variable the readiness of the crew's tools and skills to contribute with varying values and if the sum is 41.2, which is the same as R^2.

Table 11. Correlation coefficient test results

Variable	Effective Contribution (SE)
Tool Readiness (X1)	9,6
R Square	41,2

c. Relative contribution test (SR)

Table 12. Relative contribution test results (SR)

SR	MARK
X1	23,2

The table above shows that the relative contribution (SR) of the tool readiness variable (X1) is 23.2.

d. F statistic test

Table 13. F statistical test results

ANOVA$_a$

Model		Sum of Squares	df	MeanSquare	F	Sig.
1	Regression	419,401	2	209,701	26,966	.000$_b$
	residual	598,799	77	7,777		
	Total	1018,200	79			

a. Dependent Variable: Y

b. Predictors: (Constant), X2, X1

Based on calculations for multiple linear regression analysis done using the SPSS program, Fcount is more than Ftable, and the probability is significantly lower than 0.05. Fcount is 26.966 with a probability level of 0.000 (significant), while Ftable is 3.12. This shows that the equipment's readiness and the crew's skills simultaneously

affect the process of cleaning the tank.

e. Partial test (t-test)

Based on the t-test calculation table below, it can be concluded that: variable tool readiness (X1) shows a t-count value greater than t-table, equal to (2.724> 1.99125) or sig (0.008 <0.05), variable tool readiness (X1) affects the tank cleaning process (Y).

Table 14. Partial test results (t-test)

Coefficients[a]

Model	Unstandardized Coefficients		Standardized Coefficients	t	Sig.
	B	std. Error	Betas		
Constant)	10.265	2,774		3,700	.000
1	.213	.078	.247	2,724	008

a. Dependent Variable: Y

Discussion of Research Result

Effect of tool readiness (X1) on the tank cleaning process

The results showed that the equipment readiness and crew skills were significant in the tank cleaning process. This is based on the results of calculating t-count > t-table, which equals 2.724> 1.99125 with a significant value of 0.000 <0.05. The results of this study were tested so that the hypothesis was accepted.

From the statement above, the 0.000 to 0.05 significance value results are less than the probability, and the 2.724 to 1.99125 t-count value is higher than the t-table value. According to the findings, the process of cleaning the tank is impacted by readiness.

CONCLUSIONS

Conclusions

The results of the research and discussion that have been carried out related to the effect of equipment readiness and crew skills on the tank cleaning process, the following conclusions can be drawn.

Equipment preparedness significantly affects how well a tank is cleaned. Based on the study's findings, this is said. The findings indicate that the significant value of t-count > t-table is 0.008 0.05, and the value is 2.724 > 1.99125. Because the significance value is less than 0.05, it is considered significant.

Suggestion

The following suggestions are shared by the authors in this study: The equipment's readiness demonstrates that tank cleaning is impacted. Based on the study's findings, it can be concluded that t-count > t-table has a value of 2.724 > 1.99125 and a significant value of 0.008 0.05. The deck officers are advised to coordinate closely with the crew to set up timetables for the tank cleaning equipment's upkeep. They also have to ensure that spare parts are available on board, this can ensure that the tank cleaning process goes well.

REFERENCES

Abdullah, M. (2015). *Quantitative Research Methods*. Yogyakarta: Aswaja.

Adham, G. & Rukminingsih, M. L. (2020). *Educational Research Methods*. Yogyakarta: Main Erhaka.

Ghozali, I. (2013). *Multivariate Analysis Application With SPSS Program*. Semarang: Diponegoro University.

Husein, U. (2011). *Research Methods for Thesis and Business Thesis 11th Edition*. Jakarta: PT Raja Grafindo Persada.

Istopo. (2009). *Ship and cargo*. Jakarta: Nautech.

Lesmana, H. (2021). The Effect of Accounting Information Systems and Internal Control on the Quality of Financial Reports in Pasarbatang Village. *Journal of Accounting Information Systems (JASIKA), 32.*

Margono, D. S. (2004). *Educational Research Methodology*. Jakarta: Rineka Cipta.

Marton, G. (1992). *Tanker Operations Third Edition*. England.

Organization, I. M. (2004). Report of The Marine Environment Protection Committee On Its Fifty-Second Session. *Marine Environment Protection, 77.*

Purnomo, R. (2016). Effect of Ship Operation, Readiness of Loading and Unloading Equipment and Training on Loading and Unloading Productivity at PT. Jakarta International Container Terminal. *Journal of Management and Business, 6*.

Rifa'ie, I. M., Hernovianty, F. R., & Pratiwi, N. N. (2018). Analysis of Economic Factors on MSME Income Growth in Pasiran Village, West Singkawang District, Singkawang City. 3.

Sanaky, M. M., Saleh, L. M., & Titaley, H. D. (2021). Analysis of the Factors Causing Delays in the Construction Project for the Man 1 Tulehu Dormitory Building, Central Maluku. *Symmetric Journal*, *11*(1), 433.

Santosa, D. (2004). *Principles of Shipping Law*. Yogyakarta: UII Press.

Sugiyono. (2017). *Quantitative Research Methods, Qualitative, and R&D.* Bandung: Alphabet.

Sugiyono. (2018). *Quantitative Research Methods*. Bandung: Alphabet.

Supratno, J. (2010). *Statistics*. Jakarta: Erlangga.

Verwey, DA (1998). *Tank Cleaning Guide. Rotterdam: Chemical Laboratories & Superintendence Company.*

Witherby&Co. Ltd. (1996). *International Safety Guide for Oil Tankers & Terminals*. England: Witherby&Co. Ltd.