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The Effect of Ship Maintenance Management, Crew Competence and Supervision On The Smooth Distribution of Oil and Gas Mediated by Ship Reliability

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Abstract: *This study aims to analyze the influence of ship maintenance management, crew competence, and supervision on the smooth distribution of oil and gas mediated by ship reliability at the Special Terminal of PT Pertamina Energy Terminal Tanjung Uban. The study integrates variables that were previously often examined separately in the context of maritime transport, particularly in the distribution of fuel and oil. The survey was conducted using a questionnaire distributed to 120 respondents consisting of ship crew members and operational staff at the terminal. The results indicate that ship maintenance management, crew competence, and supervision have a direct, positive, and significant influence on ship reliability, which subsequently significantly impacts the smooth distribution of oil and gas. Furthermore, it was found that ship reliability mediates the relationship between the independent variables (ship maintenance management, crew competence, and supervision) and the smooth distribution of oil and gas. The findings of this study imply that PT Pertamina Energy Terminal Tanjung Uban should strengthen policies related to ship maintenance, crew training, and operational supervision to enhance ship reliability and distribution efficiency. By adopting modern technologies such as predictive maintenance, continuous training for the crew, and digital-based supervision, the company can ensure the sustainability of oil and gas distribution optimally.*

Keywords: *ship maintenance management, crew competence, supervision, smooth distribution of oil and gas, ship reliability*

INTRODUCTION

Companies engaged in the field of transportation services, especially those that provide transportation services to users/consumers, have the primary responsibility to ensure the safety of ships and crews in carrying out transportation, especially via sea routes. It is no secret that each person who sends cargo or simply ensures that the goods sent are truly safe from the point of departure to the final destination. In order to ensure that transportation is carried out safely and orderly, of course the ship used for transportation must be guaranteed or "seaworthy" (seaworthiness) (Ricardianto, et al., 2021). According to Law No. 17 of 2008, a seaworthy ship

is a ship that is equipped with a ship safety certificate, pollution, load line, gross deed, safety management, manned by a crew that meets the qualification and competency requirements, has a cooperation agreement between the crew and the owner or operator of the ship, and based on a certain type or size must be classified by a classification body.

The oil and gas industry is among the sectors with the highest risks related to health, safety, security and environment (HSE). The HSE management system is designed to integrate a company's day-to-day operations with efforts to manage and mitigate these risks, ensuring high standards of health, safety, security and environment in every aspect of its operations.

PT Pertamina Energy Terminal Tanjung Uban is located on an area of 247 hectares, with a storage tank capacity of 401,000 Kilo Liters (KL) of oil and 93,500 Metric Tons (MT) equipped with blending facilities. PT Pertamina Energy Terminal Tanjung Uban also contributes to the distribution of oil and gas to nearby terminals and local gas stations. In addition, PT Pertamina Energy Terminal Tanjung Uban also distributes oil and gas to the northern part of Sumatra, southern part of Sumatra and West Kalimantan. PT Pertamina Energy Terminal Tanjung Uban has a Daily of Throughput (DOT) of 8,715 KL/Day of oil and 2,693 MT/Day of gas transported by ship with an average number of transport ships of 224 ships per month.(Pertamina Tanjung Uban Terminal Annual Performance Report, 2023).

Based on data the highest number of ship berths occurred in March 2023. As previously stated, PT Pertamina Energy Terminal Tanjung Uban serves oil and gas distribution to several areas in Sumatra and parts of Kalimantan. The demand for oil and gas distribution increased in March 2023 in accordance with the government's assignment to Pertamina to ensure the resilience of oil and gas stocks in the community entering the homecoming and return flow of Eid al-Fitr in 2023. With a total number of ships berthed / undocked at PT Pertamina Energy Terminal Tanjung Uban, 1,608 activities or 59.84% of them were small ships berths with a size of no more than 6,500 DWT. These ships play a vital role for the community because they are used as oil and gas distribution ships to ensure oil and gas resilience in areas that can only be accessed by rivers such as Pekanbaru and Jambi as well as small islands in parts of Sumatra and parts of Kalimantan.

Based on data the unpreparedness of the port facility ship is generally caused by the long duration of the docking repair. With the long duration of the docking repair, PT. Pertamina Trans Kontinental Port Tanjung Uban must find a solution so that the ship's docking process can still be carried out so that the smooth distribution of oil and gas can be carried out without complaints from the public. In addition, the cause of the unpreparedness of the port facility ship is the problem / damage to the ship's engine.

The unpreparedness of the port facility ship can cause significant losses to PT. Pertamina Energi Terminal Tanjung Uban. When the port facility ship cannot carry out its duties in assisting the mooring-unmooring activities of tankers, the condition of oil and gas stocks in the community will be disrupted so that it will give rise to more complicated problems external to PT. Pertamina Energy Terminal Tanjung Uban. PT. Pertamina Energy Terminal Tanjung Uban will be in the spotlight of the media, the community and even competing companies which will reduce the level of public trust so that it will affect the business of PT. Pertamina Energy Terminal Tanjung Uban. To avoid these losses, PT. Pertamina Energy Terminal Tanjung Uban is required to be able to find a solution when the unpreparedness of the port facility ship occurs. PT. Pertamina Energy Terminal Tanjung Uban must be able to find a replacement ship even though the rental fee is relatively higher due to the urgency of Pertamina's operational needs.

In relation to this, it shows that the smooth distribution of oil and gas is influenced by many factors, in this study it is limited toship maintenance management, crew competence and supervision and ship reliability as mediating variables.

Ship maintenance management is a crucial component in maintaining the operational reliability of ships, especially in logistics distribution such as oil and gas. Planned and

scheduled maintenance not only ensures that the ship functions optimally but also prevents operational disruptions that can impact the smooth distribution. According to the study(Sesay, 1998)And(Nguyen, 2017), the use of modern methods such as Reliability-Centered Maintenance and maintenance optimization algorithms can overcome resource limitations and improve efficiency. However, the direct relationship between ship maintenance management and oil and gas distribution in maritime terms has not been widely studied, thus becoming an opportunity to explore its strategic role further.

A comprehensive understanding of the influence of ship maintenance management, crew competence, and supervision on ship reliability is essential in optimizing the smooth distribution of oil and gas. The findings in this study aim to identify these variables and how they can be managed to improve the operational efficiency of the ship, with a particular focus on the operational aspects of the PT Pertamina Energy Terminal Tanjung Uban Special Terminal. Seeing the conditions above, the researcher is interested in conducting a study and compiling a thesis entitled "The Influence of Ship Maintenance Management, Crew Competence and Supervision on the Smooth Distribution of Oil and Gas Mediated by Ship Reliability".

METHOD

In the process of identifying the problem, the researcher conducted initial data collection through interviews and literature review methodology. This interview was intended to identify issues within the company, especially regarding the efficiency of oil and gas distribution. Simultaneously, a literature review was conducted through examination of magazines, conferences, or textbooks that intersect with current issues or discourses. This stage resulted in research questions that have been discussed in this study.

This study uses SEM analysis through the PLS approach using the SmartPLS program, and the findings are analyzed using the SEM PLS equation. Then, SEM PLS can evaluate complex studies and several factors simultaneously. SEM PLS can perform analysis with one estimate, while others require several regression equations. SEM PLS uses a very limited sample size and serves the purpose of exploratory or theoretical expansion, finding the main determinant variables or estimating certain constructs.

The population in this study was ship crew and land personnel located at the special terminal of PT Pertamina Energy Terminal Tanjung Uban in 2024.

The population in this study was all crew members of port facilities, port management, and employees of PT Pertamina Energy Terminal Tanjung Uban in 2024, totaling 120 people.

The population consists of 120 crew members of port facilities, port management, and employees of PT Pertamina Energy Terminal Tanjung Uban, the use of saturated sampling is very appropriate. The reasons are: The population is relatively small, allowing researchers to take the entire population as a sample without burdening research resources too much. By taking the entire population, the research results will be more accurate and representative, especially since no part of the population is missed. This method also reduces bias that may arise from selecting samples that do not represent the entire population, considering that this study covers five different terminals that may have diverse working conditions and environments.

Quantitative data management requires data analysis and mathematical techniques. In quantitative research, sample characteristics are described in proportions, percentages, or means and standard deviations. Quantitative researchers make estimates of how strong the relationship is between variables and test hypotheses statistically. In quantitative research, data analysis uses statistics.(Sugiyono, 2019).

Statistical analysis in this study utilizes both descriptive and inferential statistics. Descriptive statistics are used to summarize and present data without generalizing beyond the sample, providing insights like frequency distributions and average values. Inferential

statistics, on the other hand, allow for broader conclusions to be drawn from sample data, applying results to the larger population. This study employs Structural Equation Modeling (SEM) with SmartPLS 4.0 software for data analysis, which includes assessing model measurement (Outer Model), model structure (Inner Model), and hypothesis testing. The Outer Model is evaluated through convergent and discriminant validity tests, ensuring the reliability of constructs. The Inner Model assesses relationships between variables, using metrics like R-squared, effect size (f^2), and predictive relevance (Q^2). Hypothesis testing is performed using bootstrapping with a 5% significance level, determining the strength and significance of the paths between constructs. Based on the theory and framework above, the research hypothesis can be articulated as follows:

H1 Ship maintenance management directly affects ship reliability.
H2 The competence of the ship's crew directly affects the reliability of the ship.
H3 Supervision directly affects the reliability of the ship.
H4 Ship maintenance management directly affects the smooth distribution of oil and gas.
H5 The competence of the ship's crew directly affects the smooth distribution of oil and gas.
H6 Direct and positive supervision influences the smooth distribution of oil and gas.
H7 Ship reliability has a direct impact on the smooth distribution of oil and gas.
H8 Ship maintenance management has an indirect effect on the smooth distribution of oil and gas through ship reliability as a mediating variable.
H9 The competence of the ship's crew has an indirect effect on the smooth distribution of oil and gas through ship reliability as a mediating variable.
H10 Supervision has an indirect effect on the smooth distribution of oil and gas through ship reliability as a mediating variable.

RESULTS AND DISCUSSION

Respondent Description

Statistical analysis in this study utilizes both descriptive and inferential statistics. Descriptive statistics are used to summarize and present data without generalizing beyond the sample, providing insights like frequency distributions and average values. Inferential statistics, on the other hand, allow for broader conclusions to be drawn from sample data, applying results to the larger population. This study employs Structural Equation Modeling (SEM) with SmartPLS 4.0 software for data analysis, which includes assessing model measurement (Outer Model), model structure (Inner Model), and hypothesis testing. The Outer Model is evaluated through convergent and discriminant validity tests, ensuring the reliability of constructs. The Inner Model assesses relationships between variables, using metrics like R-squared, effect size (f^2), and predictive relevance (Q^2). Hypothesis testing is performed using bootstrapping with a 5% significance level, determining the strength and significance of the paths between constructs.

Measurement Model (Outer Model)

Validity Test (Convergent Validity)

Table 1. Validity Testing

Variables	Indicator	Loading Factor	Information
Ship Maintenance Management (X1)	X11	0.812	Valid
	X110	0.856	Valid
	X111	0.819	Valid
	X12	0.830	Valid
	X13	0.772	Valid
	X14	0.811	Valid
	X15	0.847	Valid
	X16	0.753	Valid

Variables	Indicator	Loading Factor	Information
	X17	0.796	Valid
	X18	0.764	Valid
	X19	0.821	Valid
Crew Competence (X2)	X21	0.817	Valid
	X210	0.825	Valid
	X211	0.834	Valid
	X22	0.799	Valid
	X23	0.852	Valid
	X24	0.747	Valid
	X25	0.879	Valid
	X26	0.834	Valid
	X27	0.774	Valid
	X28	0.862	Valid
	X29	0.899	Valid
Supervision (X3)	X31	0.870	Valid
	X310	0.843	Valid
	X311	0.709	Valid
	X32	0.890	Valid
	X33	0.879	Valid
	X34	0.822	Valid
	X35	0.890	Valid
	X36	0.869	Valid
	X37	0.791	Valid
	X38	0.846	Valid
	X39	0.851	Valid
Ship Reliability (Z)	Y1	0.727	Valid
	Y10	0.748	Valid
	Y11	0.767	Valid
	Y2	0.745	Valid
	Y3	0.844	Valid
	Y4	0.850	Valid
	Y5	0.867	Valid
	Y6	0.823	Valid
	Y7	0.911	Valid
	Y8	0.824	Valid
	Y9	0.839	Valid
Smooth distribution of oil and gas (Y)	Z1	0.811	Valid
	Z10	0.849	Valid
	Z11	0.783	Valid
	Z2	0.749	Valid
	Z3	0.824	Valid
	Z4	0.787	Valid
	Z5	0.816	Valid
	Z6	0.742	Valid
	Z7	0.848	Valid
	Z8	0.731	Valid
	Z9	0.884	Valid

The results of the SmartPLS analysis are presented in the Table above. The outer model value or correlation between constructs and variables shows that the total loading factor exceeds 0.6-0.7, thus validating the construct for all variables in the model. The next result is related to the outer model structural model.

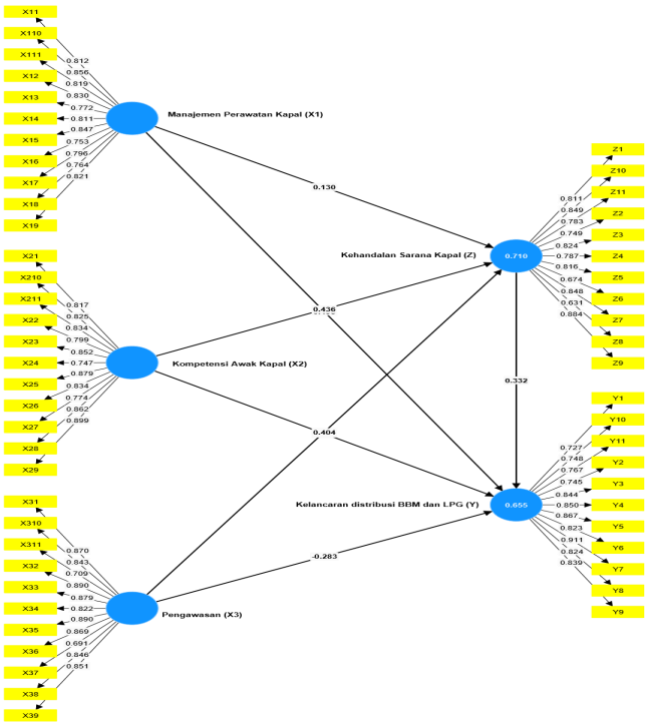

Figure 1. Outer Model Structural Model
Source: SEMPLS Processing (2024)

Discriminant Validity Test

Table 2. Discriminant Validity Testing

	Average Variance Extracted (AVE)
Ship Maintenance Management (X1)	0.653
Crew Competence (X2)	0.689
Supervision (X3)	0.698
Ship Reliability (Z)	0.625
Smooth distribution of oil and gas (Y)	0.664

This test is carried out to assess the magnitude of the gap between variables. The value observed in this test is the overall average variance extracted (AVE), with all variables showing an AVE greater than 0.5, thus confirming its validity. The findings of the Fornell-Larcker Criterion and cross-loading measurements are shown in the following Table.

Table 3. Fornell-Larcker Criterion between Variables

	Reliability Means Ship (Z)	**Smoothness distribution BBM and LPG (Y)**	**Competence Crew Ship (X2)**	**Management Maintenance Ship (X1)**	**Supervision (X3)**
Reliability Ship (Z)	0.790				
Smooth distribution Oil and gas (Y)	0.608	0.815			
Crew Competence Ship (X2)	0.803	0.584	0.830		
Maintenance Management Ship (X1)	0.311	0.651	0.245	0.808	
Supervision (X3)	0.790	0.428	0.829	0.185	0.835

The results of the Fornell-Larcker criteria presented in the Table above make it clear that the value of an indicator exceeds the value of a variable derived from another construct.

The results of the study show that each indicator has strong discriminant validity for the formation of its related variables.

Reliability Test

Table 4.Reliability Testing

Variables	Cronbach's Alpha	Composite Reliability	Rule of Thumb	Results
Ship Maintenance Management (X1)	0.939	0.943	>0.70	Reliable
Crew Competence (X2)	0.949	0.951		Reliable
Supervision (X3)	0.955	0.957		Reliable
Ship Reliability (Z)	0.947	0.948		Reliable
Smooth distribution of oil and gas (Y)	0.956	0.960		Reliable

Table above shows that the construct of all variables meets the reliability criteria. This is evidenced by the cronbach's alpha value and the composite reliability value obtained from the SmartPLS estimation findings. The resulting value exceeds 0.70, relevant to the specified requirements.

Structural Model (Inner Model)

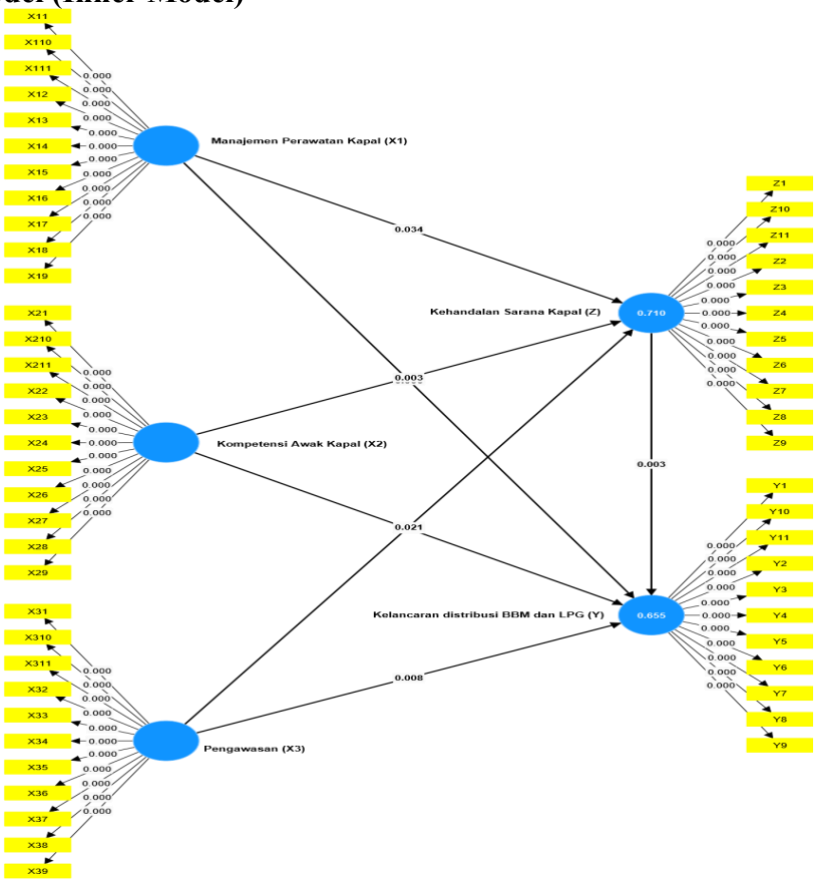

Figure 2. Inner Model (Bootstrapping)

R-Square(Coefficient of Determination)

Table 5. R-Square Test Results (R2)

	R Square	R Square Adjusted
Ship Reliability (Z)	0.710	0.703
Smooth distribution of oil and gas (Y)	0.655	0.643

In the Table above, it can be seen that the Ship Reliability variable has an R^2 value of

0.710 with an Adjusted R^2 value of 0.703, which shows that the contribution of the tested variables, such as ship maintenance management, crew competence, and supervision, to ship reliability is 71.0%. While the rest, 29.0%, is the influence of other variables not used in this study.

The Smoothness of Oil and Gas Distribution variable has an R^2 value of 0.655 with an Adjusted R^2 value of 0.643, which shows that the contribution of ship maintenance management variables, crew competence, supervision, and ship reliability to the smoothness of oil and gas distribution is 65.5%. While the rest, 34.5%, is the influence of other variables not used in this study.

Q-Square

Table 6. Q-Squared Value

	Q Square	Results
Ship Reliability (Z)	0.432	Medium Predictive Relevance
Smooth distribution of oil and gas (Y)	0.423	Medium Predictive Relevance

The Table above shows the values of Q-Square. The Q-Square values forShip Reliabilityof 0.432, the variable is classified as medium predictive relevance. While the Q-Square value forSmooth distribution of oil and gasof 0.423, the variable is classified as medium predictive relevance.

Research Hypothesis

Table 7. Analysis of Direct and Indirect Influence

Hypothesis	Influence	Original Sample (O)	T Statistics (|O/STDEV|)	P Values	Information
H1	Ship Maintenance Management (X1) -> Ship Reliability (Z)	0.130	1,823	0.034	Significant
H2	Crew Competence (X2) -> Ship Reliability (Z)	0.436	2,741	0.003	Significant
H3	Supervision (X3) -> Ship Reliability (Z)	0.404	2,047	0.021	Significant
H4	Ship Maintenance Management (X1) -> Smooth distribution of oil and gas (Y)	0.495	6,502	0.000	Significant
H5	Crew Competence (X2) -> Smooth distribution of oil and gas (Y)	0.432	4.203	0.000	Significant
H6	Supervision (X3) -> Smooth distribution of oil and gas (Y)	0.283	2.409	0.008	Significant
H7	Ship Reliability (Z) -> Smooth distribution of oil and gas (Y)	0.332	2,728	0.003	Significant
H8	Ship Maintenance Management (X1) -> Ship Reliability (Z) -> Smooth distribution of Oil and Gas (Y)	0.043	1,698	0.050	Significant
H9	Crew Competence (X2) -> Ship Reliability (Z) -> Smooth distribution of oil and gas (Y)	0.145	1,768	0.039	Significant
H10	Supervision (X3) -> Ship Reliability (Z) -> Smooth distribution of oil and gas (Y)	0.134	2,093	0.018	Significant

Hypothesis 1: Direct influence of Ship Maintenance Management on Ship Reliability

The findings of this study clarify that ship maintenance management has a significant positive effect on ship reliability. With a parameter coefficient of 0.130, a one-unit increase in ship maintenance management can increase ship reliability by 0.130. This is supported by the T-Statistics value of 1.823, above the critical limit of 1.64, and P-values of 0.034, below the

significance level of 0.05. These findings emphasize the importance of implementing planned and measured maintenance practices in maintaining ship operational reliability.

In transportation management theory, ship maintenance is considered an essential part to ensure smooth operation and safety of maritime transportation. In addition, from the perspective of Resource-Based View (RBV), ship maintenance management is one of the unique capabilities that provide competitive advantages for companies. By maintaining ships routinely and professionally, companies can reduce the risk of operational damage, increase efficiency, and create added value to maritime logistics services.

The relationship between ship maintenance management and ship reliability also shows that efforts made in maintenance not only extend the life of the ship, but also minimize operational downtime. Planned maintenance, such as routine technical inspections and replacement of critical components, ensures that the ship is ready to use at any time without significant obstacles, thus supporting the smooth distribution and transportation of the sea.

These results are supported by previous studies, such as Simanjuntak (2024), which emphasizes the importance of technology integration in ship maintenance to improve efficiency. Yuen et al.'s (2020) research also supports these findings by showing that predictive maintenance strategies significantly improve ship reliability. In addition, Muslim et al. (2022) and Mudasiru (2022) stated that routine maintenance and effective maintenance management are key to supporting reliable ship operations.

Hypothesis 2: Direct influence of crew competence on ship reliability

This study found that crew competence has a positive and significant effect on ship reliability. With a parameter coefficient of 0.436, every one unit increase in crew competence can increase ship reliability by 0.436. The T-Statistics value of 2.741, which is greater than 1.64, and the P-values of 0.003, which are smaller than 0.05, strengthen the conclusion that this relationship is significant. This shows that crew competence plays an important role in maintaining ship reliability.

In human resource management and transportation theory, crew competence is considered as an important element that supports operational efficiency. The Resource-Based View (RBV) perspective emphasizes that crew competence is an intangible asset that can provide competitive advantage. This competence enables the crew to perform their duties well, including detecting and handling potential technical problems before they impact operational reliability.

The relationship between crew competence and ship reliability shows that a well-trained crew can ensure that the ship is in the best condition. The ability to understand technology, implement safety procedures, and perform necessary maintenance are important aspects that support this positive relationship. With adequate competence, the crew can minimize human errors that have the potential to harm operations.

Previous studies support these results, such as Achdian (2024), who found that crew competence significantly affects ship performance. Research by Xu (2023) and Anggoro & Supriyadi (2022) also shows that crew competence is a key factor in improving operational efficiency and safety. Research by Muslim et al. (2022) further highlights crew readiness as a supporting element in ship operational reliability.

Hypothesis 3: Direct Effect of Supervision on Ship Reliability

The results of this study indicate that supervision has a positive and significant effect on ship reliability. With a parameter coefficient of 0.404, a one-unit increase in supervision will increase ship reliability by 0.404. The T-Statistics value of 2.047, which is greater than the critical limit of 1.64, and the P-values of 0.050, which are at a significance level of 0.05, confirm that this effect is significant. These findings indicate that good supervision is an important element in ensuring ship reliability.

The theory of control management in transportation emphasizes that supervision is an integral part of the management process to keep operations running according to standards. In terms of the Resource-Based View (RBV), effective supervision creates organizational capabilities that ensure operational continuity. In marine transportation, consistent supervision helps detect potential problems early and ensures that ship maintenance is carried out according to procedures.

The relationship between supervision and ship reliability shows that tight control in ship operations and maintenance contributes significantly to ship reliability. A supervision process that includes regular evaluation and performance assessment can minimize the risk of operational failure and increase confidence in the ship's capabilities.

Support for these results can be found in Sears' (2021) research, which highlights the importance of effective supervision in the maintenance process. Layuk et al. (2022) also found that good supervision supports the operational reliability of ships. Research by Yuen et al. (2020) and Simanjuntak (2024) further confirms that supervision integrated with technology improves efficiency and reliability.

Hypothesis 4: Direct influence of Ship Maintenance Management on the Smoothness of Oil and Gas Distribution

The results of the study indicate that ship maintenance management has a positive and significant effect on the smooth distribution of oil and gas. The parameter coefficient of 0.495 indicates that a one-unit increase in ship maintenance management can increase the smooth distribution by 0.495. With a T-Statistics value of 6.502 (greater than 1.64) and P-values of 0.000 (smaller than 0.05), these findings clearly support this hypothesis. This confirms the importance of ship maintenance in maintaining the smooth operation of oil and gas distribution logistics.

In transportation management theory, ship maintenance is an essential part to ensure the efficiency of logistics distribution. The Resource-Based View (RBV) perspective also supports that ship maintenance is a strategic resource that provides competitive advantage in oil and gas logistics. Well-maintained ships can support smooth distribution, thus helping companies achieve operational targets and maintain customer satisfaction.

The relationship between ship maintenance management and smooth oil and gas distribution shows that good maintenance plays a role in maintaining ship performance during operation. Routine technical inspections, appropriate component replacements, and the application of advanced technology ensure that ships can be used without significant operational constraints, so that distribution runs smoothly.

Support for these results can be found in the research of Yuen et al. (2020), which shows that predictive maintenance can support smooth logistics distribution. Research by Layuk et al. (2022) and Muslim et al. (2022) also noted that planned maintenance helps improve operational efficiency and logistics distribution.

Hypothesis 5: Direct influence of crew competence on smooth distribution of oil and gas

The results of the study indicate that crew competence has a positive and significant influence on the smooth distribution of oil and gas. The parameter coefficient of 0.432 indicates that every one unit increase in crew competence will increase the smooth distribution by 0.432. The T-Statistics value of 4.203 (greater than 1.64) and P-values of 0.000 (smaller than 0.05) strengthen this conclusion, indicating that crew competence plays an important role in logistics distribution.

Human resource management theory emphasizes that crew competence is one of the main elements in supporting smooth operations. In the RBV perspective, crew competence is a unique resource that provides competitive advantage, especially in oil and gas distribution

operations. Competent crew members are able to carry out operational tasks efficiently, reduce the risk of errors, and maintain smooth distribution.

The relationship between crew competence and smooth distribution shows that crews with adequate technical knowledge, experience, and training can ensure that the ship operates well during the distribution process. This competence also helps in making quick decisions that are needed during transportation operations.

Previous studies, such as Achdian (2024), support this finding by showing the importance of crew competence in operational performance. Xu's (2023) and Anggoro & Supriyadi's (2022) studies also concluded that crew competence significantly affects logistics distribution efficiency.

Hypothesis 6: Direct Effect of Supervision on Smooth Distribution of Oil and Gas

This study shows that supervision has a positive and significant effect on the smooth distribution of oil and gas. The parameter coefficient of 0.283 indicates that every one unit increase in supervision can increase the smooth distribution by 0.283. With T-Statistics of 2.409 (greater than 1.64) and P-values of 0.008 (smaller than 0.05), these results support the hypothesis that effective supervision is very important in ensuring smooth logistics distribution.

The theory of control management states that supervision is a key element in the management process, especially in the maritime transportation sector. The RBV perspective also emphasizes that good supervision is a strategic capability that can improve operational reliability and efficiency. In the case of oil and gas distribution, effective supervision helps reduce the potential for operational disruptions.

The relationship between monitoring and smooth oil and gas distribution shows that regular inspections and close monitoring can help identify potential problems before they occur. This ensures that distribution operations run according to plan without major disruptions.

This research is supported by the findings of Sears (2021), which states that good supervision improves logistics efficiency. Simanjuntak (2024) also notes the importance of supervision in integrating technology to improve operational smoothness.

Hypothesis 7: Direct influence of ship reliability on smooth distribution of oil and gas

The results of the study indicate that ship reliability has a positive and significant effect on the smooth distribution of oil and gas. With a parameter coefficient of 0.332, a one-unit increase in ship reliability can increase the smooth distribution by 0.332. The T-Statistics value of 2.728 and P-values of 0.003 indicate that this relationship is significant.

Theories in transportation management emphasize that transportation reliability is a key factor in ensuring smooth logistics distribution. The RBV perspective states that ship reliability is a core capability that not only improves operational efficiency but also provides competitive value in oil and gas distribution.

The relationship between ship reliability and smooth distribution shows that reliable ships are able to carry out distribution tasks without technical or operational disruptions. This provides direct benefits to customer satisfaction and operational cost efficiency.

Muslim et al.'s (2022) research supports this finding by showing that ship reliability is an important element in logistics distribution. Yuen et al.'s (2020) and Layuk et al.'s (2022) research also found that transportation reliability plays an important role in smooth logistics distribution.

Hypothesis 8: Indirect Effect of Ship Maintenance Management on Smooth Oil and Gas Distribution through Ship Reliability

The results of the study indicate that ship maintenance management has a positive and significant indirect effect on the smooth distribution of oil and gas through ship reliability. With a parameter coefficient of 0.043, a one-unit increase in ship maintenance management can increase the smooth distribution of oil and gas through ship reliability by 0.043. The T-Statistics value of 1.698 and P-values of 0.050 support the significance of this relationship. This confirms that the mediating role of ship reliability strengthens the relationship between maintenance management and smooth distribution.

In transportation management theory, ship maintenance is a core element to create operational efficiency. The Resource-Based View (RBV) perspective states that good maintenance is a strategic capability that supports broader operational achievements, including smooth distribution. In this case, ship reliability acts as a critical link that allows the impact of ship maintenance to be seen on smooth distribution.

The relationship between ship maintenance management, ship reliability, and smooth distribution shows that consistent and quality maintenance improves ship reliability, which ultimately supports smoother distribution. Without ship reliability, the benefits of ship maintenance will not be fully felt in the distribution process.

Previous studies support these results, such as Layuk et al. (2022), who stated that ship reliability plays an important mediating role in the transportation system. Research by Muslim et al. (2022) and Yuen et al. (2020) also found that ship maintenance improves reliability, which ultimately supports efficient logistics distribution.

Hypothesis 9: Indirect Effect of Crew Competence on Smooth Oil and Gas Distribution through Ship Reliability

This study found that crew competence has a positive and significant indirect effect on the smooth distribution of oil and gas through ship reliability. The parameter coefficient of 0.145 indicates that a one-unit increase in crew competence can increase the smooth distribution by 0.145 through ship reliability. With a T-Statistics value of 1.768 and P-values of 0.039, this relationship is declared significant. This finding indicates that ship reliability functions as a mediator that strengthens the influence of crew competence on distribution.

Human resource management theory places competency as the foundation in supporting operational efficiency. The RBV perspective states that crew competency is a strategic asset that helps maintain operational reliability, which ultimately contributes to smooth distribution. In this case, ship reliability is a critical link between crew competency and successful logistics distribution.

This relationship illustrates that a competent crew is able to maintain the reliability of the ship through proper operational implementation. With good reliability, smooth distribution can be achieved more consistently. A competent crew not only supports technical operations, but also improves the quality of decisions in critical situations.

This result is supported by Achdian's (2024) research, which shows that crew competence increases operational efficiency. Xu's (2023) and Muslim et al.'s (2022) research also highlights the importance of ship reliability in supporting logistics distribution, where crew competence plays a major role in creating this reliability.

Hypothesis 10: Indirect Effect of Supervision on Smooth Oil and Gas Distribution through Ship Reliability

The results of the study indicate that supervision has a positive and significant indirect effect on the smooth distribution of oil and gas through ship reliability. With a parameter coefficient of 0.134, a one-unit increase in supervision can increase the smooth distribution by 0.134 through ship reliability. The T-Statistics value of 2.093 and P-values of 0.018 support

the significance of this relationship. This shows that the role of ship reliability as a mediator is very important in connecting supervision and distribution.

In the theory of control management, supervision is the main mechanism that ensures all operational processes run according to standards. The Resource-Based View (RBV) perspective places supervision as an organizational capability that improves operational efficiency by strengthening ship reliability. In terms of oil and gas distribution, good supervision supports the creation of ship reliability, which then strengthens the smoothness of distribution.

This relationship shows that through effective supervision, ship reliability can be significantly improved. Routine inspections, procedure evaluations, and quality control ensure that potential operational disruptions are minimized, ultimately supporting smooth distribution. Support for these findings is found in Sears (2021) research, which shows that effective supervision improves operational reliability. Simanjuntak (2024) and Yuen et al. (2020) research also note that supervision plays a critical role in maintaining efficiency and reliability in logistics distribution operations.

CONCLUSION

1. Directly, Ship Maintenance Management has a significant positive impact on Ship Reliability.This means that the implementation of good ship maintenance management, such as routine inspections, scheduled repairs, and periodic maintenance, significantly increases the reliability of ships at the Special Terminal of PT Pertamina Energi Terminal Tanjung Uban. This reliability is an important basis for supporting oil and gas distribution operations.
2. There is a direct positive and significant influence of Crew Competence on Ship Reliability.This conclusion shows that crew competence, which includes technical skills, work experience, and adequate training, directly supports ship reliability. In this Special Terminal, competent crew ensures that the ship can operate optimally without technical disruptions.
3. There is a direct positive and significant influence of Supervision on Ship Reliability.This means that effective and consistent supervision, such as operational inspections, procedure evaluations, and periodic monitoring, directly contribute to increasing ship reliability. At Tanjung Uban Terminal, structured supervision is able to prevent potential ship damage that could disrupt distribution.
4. There is a direct positive and significant influence of Ship Maintenance Management on the Smoothness of Oil and Gas Distribution.Effective ship maintenance management not only improves reliability but also ensures smooth distribution of oil and gas. At PT Pertamina's Special Terminal, timely maintenance helps reduce operational downtime and supports efficient distribution.
5. There is a direct positive and significant influence of Crew Competence on the Smoothness of Oil and Gas Distribution.High crew competence enables smooth distribution operations. At Tanjung Uban Terminal, skilled crews are able to handle operational tasks with precision, so that oil and gas distribution runs smoothly.
6. There is a direct positive and significant influence of Supervision on the Smooth Distribution of Oil and Gas.This conclusion shows that good supervision supports smooth distribution by ensuring that every operational step is carried out according to procedure. In this Special Terminal, consistent supervision helps reduce operational risks that can hinder distribution.
7. There is a direct positive and significant influence of Ship Reliability on the Smoothness of Oil and Gas Distribution.Ship reliability is a key factor in ensuring smooth distribution. Reliable ships at Tanjung Uban Terminal are able to support oil and gas distribution without technical disruptions, so that operational targets can be achieved.

8. There is a positive and significant indirect effect of Ship Maintenance Management on the Smoothness of Oil and Gas Distribution through Ship Reliability. Good ship maintenance management not only has a direct impact but also indirectly supports smooth distribution through ship reliability. At Tanjung Uban Terminal, quality maintenance ensures that ships remain reliable, which then supports efficient distribution.
9. There is a positive and significant indirect effect of Crew Competence on the Smoothness of Oil and Gas Distribution through Ship Reliability. Crew competence indirectly affects the smoothness of distribution through ship reliability. Competent crews at the Tanjung Uban Terminal are able to maintain ship reliability well, which ultimately supports smooth oil and gas distribution.
10. There is a positive and significant indirect influence of Supervision on the Smoothness of Oil and Gas Distribution through Ship Reliability.Effective supervision not only has a direct impact but also indirectly supports smooth distribution through increased ship reliability. At PT Pertamina's Special Terminal, structured supervision ensures that ships are in optimal condition for uninterrupted oil and gas distribution.

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