DINASTI REVIEW
JEMSI: Jurnal Ekonomi Manajemen Sistem Informasi
E-ISSN: 2686-5238
P-ISSN: 2686-4916
https://dinastirev.org/JEMSI dinasti.info@gmail.com +62 811 7404 455
DOI: https://doi.org/10.38035/jemsi.v6i2

The Effect of Safety Training and Technology on Ship Officers Performance and Its Implications on Human Resource Competency on Dynamic Positioning 2 Ship at PT Wintermar Offshore Marine Indonesia

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Abstract: This research aims to analyze the influence of training and safety technology on the performance of ship officers and its implications for human resource (HR) competence on the Dynamic Positioning 2 (DP2) vessel at PT Wintermar Offshore Marine Indonesia. The issues raised include significant investments in training, the use of outdated DP2 technology, and challenges in implementing training and compliance with safety procedures. The population of the study consists of ship crew members on board in 2024, with a sample of 80 Dynamic Positioning Officers (DPOs). The research method employs a quantitative approach, using questionnaires for data collection, and analysis is conducted using SMART PLS. The results indicate that training and safety technology significantly influence the performance of ship officers, positively impacting HR competence. The dimension that best reflects training is the relevance of the material, while for safety technology, the IoT system has a dominant influence. Based on the findings, it is recommended that the company adopt innovative approaches to problem-solving and update the satellite communications system to support field operations.

Keywords: Training, Safety Technology, The Performance of Ship Officers, Human Resource Competence

INTRODUCTION

Indonesia, as the largest archipelagic country in the world, has long utilized the sea as a major asset in economic development and driving the maritime sector. The oceans surrounding the Indonesian archipelago have great potential in the exploitation of natural resources, international trade, and various other maritime activities. Indonesian sailors play an important role in maintaining the security, performance, and progress of the maritime sector. To remain globally competitive and support the development of the sector, the development of human resources for sailors is very important (Setiawan & Sari, 2020; Zhang et al., 2021).

The increase in offshore drilling activities also raises concerns regarding environmental and safety issues. This industry has the potential to have negative impacts on marine ecosystems and the surrounding environment if not managed properly. Therefore, the development of sustainable practices in this industry is essential to reduce environmental impacts and maintain the sustainability of marine resources. In addition, safety is a top priority in offshore drilling operations, given the technical complexity and risks inherent in such operations. Crew training and certification are essential to maintain safe and efficient operations on Dynamic Positioning 2 technology vessels (Soesilo & Widjaya, 2018; Tran et al., 2020)

PT Wintermar Offshore Marine Indonesia is an Indonesian company engaged in marine services, especially in the provision of vessels supporting offshore activities. Founded in 1970, the company initially focused on domestic shipping services before expanding its operations to the energy sector. Along with the development of the oil and gas industry and the need for more complex marine services, WINS directed its efforts to provide high-tech vessels, such as the Dynamic Positioning 2 (DP2) vessel, which supports deep-sea drilling activities. The company has been listed on the Indonesia Stock Exchange since 2010.

PT Wintermar Offshore Marine Indonesia is optimistic about the prospects of the offshore support vessel (OSV) business in the remainder of 2024, along with the recovery of global investment in the oil and gas sector. This recovery is driven by increasing demand and priority on energy security, especially in the offshore deepwater segment which increases the need for high-value OSV vessels, such as the Dynamic Positioning 2 (DP2) vessel. The strengthening trend of the US dollar has also had a positive impact on WINS, with most of its revenue in USD, thus strengthening the company's profits. In the second half of 2024, WINS plans to acquire another OSV vessel, with a capital expenditure allocation of US$ 35 million, of which US$ 13.9 million has been used until June 2024. The increase in charter rates in the high tier segment also drove an increase in margin to 27.1% in the first quarter of 2024 from 20.7% in 2023, along with extraordinary activity in the oil and gas sector, especially in Southeast Asia.

it needs an anchor, which is very important in operations on the high seas.

Ship safety technology, especially related to Dynamic Positioning 2 (DP2) technology, faces various operational constraints. First, there are various types of DP2, such as Kongsberg, Converteam, and MT, which have significant differences in their operation. This requires the crew to have extensive knowledge and skills for each type of DP2 system used. Second, some ships in operation still use the old type of DP2 system, so it is necessary to upgrade it to suit current operational conditions and needs. Third, the limited knowledge and skills of seafarers in repairing DP2 ship equipment are a challenge in themselves, especially if damage occurs that requires immediate handling. These problems highlight the importance of upgrading and maintaining ship safety technology to ensure safe and efficient operations.

In addition, based on a preliminary survey regarding safety technology with 30 respondents, it showed:

Tabel 1. Preliminary Survey on Safety Technology

Core Problems	No	Statement	No (Score)	Yes (Score)	Amount	Percentage Decrease
Technology Updates	1	The safety technology used on DP2 vessels is the latest	17	13	30	56.7%
Ease of Use	2	Safety technology is easy for the crew to use	20	10	30	66.7%
Availability of Technology	3	Safety technology is always available and functioning well on DP2 vessels	16	14	30	53.3%
Impact on Efficiency	4	Safety technology improves work efficiency on ships	19	11	30	63.3%
Technology Support	5	Safety technology is supported by clear and adequate procedures.	18	12	30	60%
Average Decline in Safety Technology						**60%**

From Tabel 1.5, safety technology on DP2 ships plays an important role in maintaining safety and supporting crew performance. However, from the survey, it was found that 60% of respondents felt that the available safety technology was not adequate or effective in improving their work efficiency. Many crews felt that the safety technology used was not always the latest or easy to use, and this hindered them from adapting and working efficiently. The availability of technology that functioned well was also a problem, where 53.3% of respondents reported limitations in the use of safety technology. This problem indicates that companies need to re-evaluate the technology used on DP2 ships and ensure its availability and ease of use to support operational safety and efficiency. The safety technology used on DP2 ships is not optimal, resulting in less than maximum work efficiency and safety. Updating technology and increasing its availability are important steps to improve crew performance.

PT Wintermar Offshore Marine integrates modern safety technology in the WINS Integrated Safety System to enhance operational safety and protect all personnel. This technology includes advanced monitoring such as the Safety Pyramid used to measure and analyze safety activities on board. Also, there are Life-Saving Rules that set safety standards, and the use of learning aids such as Learning Engagement Tools (LET) to ensure crew understand and comply with safety procedures effectively.

Ricardianto et al. (2021) showed the effect of occupational safety and health on crew performance with work motivation as a mediating variable, but did not include safety technology in the analysis. Ricardianto et al. (2021) also provided a transportation management system policy, but did not consider safety training and technology in the analysis of human resource competency and performance. Sabrina et al. (2021) showed the impact of occupational safety and health and the work environment on worker performance, without linking safety training and technology to human resource competency and performance. Finally, Yuen et al. (2018) found a relationship between job satisfaction and seafarers' work performance, but did not include safety training and technology and their impact on human resource competency and ship officer performance.

Overall, the existing research gap shows that although many studies have explored the training and safety aspects, there has been no research that integrates training and safety technology simultaneously to evaluate their impact on human resource competency and officer performance. New research can fill this gap by examining both aspects in a more holistic manner.

Based on the explanation of the research background above, the researcher is interested in conducting research and compiling a thesis entitled "The Influence of Safety Training and Technology on the Performance of Ship Officers and Its Implications for

Human Resource Competence on the Dynamic Positioning 2 Ship at PT Wintermar Offshore Marine Indonesia"

Based on the problem limitations above, the author can formulate the problem as follows:

1. Is there any influence of training on the performance of ship officers on the Dynamic Positioning 2 ship at PT. Wintermar Offshore Marine Indonesia?
2. Is there any influence of safety technology on the performance of ship officers on the Dynamic Positioning 2 ship at PT. Wintermar Offshore Marine Indonesia?
3. Is there any influence of training on human resource competency on the Dynamic Positioning 2 vessel at PT. Wintermar Offshore Marine Indonesia?
4. Is there any influence of safety technology on human resource competency on the Dynamic Positioning 2 vessel at PT. Wintermar Offshore Marine Indonesia?
5. Is there any influence of ship officer performance on human resource competency on Dynamic Positioning 2 ship at PT. Wintermar Offshore Marine Indonesia?
6. Is there any influence of training on human resource competency through the performance of ship officers on the Dynamic Positioning 2 ship at PT. Wintermar Offshore Marine Indonesia?
7. Is there any influence of safety technology on human resource competency through the performance of ship officers on the Dynamic Positioning 2 ship at PT. Wintermar Offshore Marine Indonesia?

METHOD

Population can be divided into two types, namely sampling population or research population and target population or target population, where the target population has a larger size than the size of the sampling population. The sampling population is a unit of analysis that provides information or data needed by a study or research. While the target population is all units of analysis in the research area. The general population in this study is the entire crew of the Dynamic Positioning 2 ship at PT. Wintermar Offshore Marine Indonesia, while the target population in the study of the crew on board in 2024 with the position of Dynamic Positioning Officer, namely

1. WM Pacific: 8 people
2. Natuna Water Resources: 8 people
3. SMS Serenity: 8 people
4. Winposh Resolve: 8 people
5. WM Sea Vega: 8 people
6. Sea Bass: 8 people
7. Winposh Regent: 8 people,
8. Evimaria: 8 people
9. WM Makassar: 8 people
10. WM Sea Vega : 8 people

Total number of samples: 80 Dynamic Positioning Officers.

The use of this method is based on the relatively small and easily accessible population. By involving all members of the population, researchers can obtain more comprehensive data on crew performance. The process of data collection and analysis becomes more efficient, without the need for more complex random sampling or stratification. By implementing saturated sampling, all perspectives and relevant data from the crew can be covered, ensuring that the research results are representative of the conditions in the field. In conclusion, the use of saturated sampling in this study serves to produce accurate data and represent the entire crew population at PT. Wintermar Offshore Marine Indonesia, so that it can provide in-depth insights into their performance and experiences in the context of ship safety and operations.

The collected data was then analyzed using SmartPLS 4. This software is designed to simplify data processing, thereby increasing the speed and accuracy of output. The editing and coding process takes place. Editing is the initial stage of data processing carried out by researchers in the field: they check for any deficiencies and uncertainties in the answers given by respondents. Coding refers to the process of assigning certain symbols or codes to different responses from the same category or classification, to facilitate tabulation for researchers..

The data obtained in this study are presented in a Tabel format to facilitate analysis and understanding, thus increasing the systematic nature of the data presented. Location for tabulation. Tabulation of Tabels is the process of calculating the data collected in each category and arranging it into a Tabel that can be understood..

After processing and sorting are complete, the data obtained will be used for statistical analysis in accordance with the research objectives. The data analysis method used is path analysis and hypothesis testing..

To analyze the research findings, the author uses paired data derived from the data obtained. Due to the large number of independent variables, namely two independent variables and one mediating variable, the analysis approach used in this thesis is as follows:

1. **Statistics Description**

   Descriptive statistics are statistics used to analyze data by describing or depicting the collected data as it is without making conclusions that apply to the public or generalizations. In this analysis, measuring the strength of the relationship between two variables consists of:

   a. The maximum value is the highest value for each variable tested.
   b. The minimum value is the lowest value for each variable tested.
   c. The mean is a technique used to measure the average and is the most common way to measure the central value of a sample data distribution.
   d. Standard Deviation (variance) is used to assess the average or sample. Once the average is known, it is necessary to determine the distribution of the data.

2. **Outer Model Test**

   The outer model test is carried out to describe the relationship between latent variables, namely with indicators from the variables.(Widarjono, 2015). So that in this test aims to get a picture of the relationship between safety training (X1), Planned maintenance system (X2), Safety technology (X3), Work competence (Z), and ship officer performance (Z) with its variable indicators.

   In relation to the outer model test, this study uses four tests, namely indicator reliability, discriminant validity, convergent validity and internal consistency.

   a. Indicator Reliability Test

   This testing stage is a test of the validity of an indicator. Indicator reliability is based on the outer loading of an indicator which is declared valid if it has a factor loading above 0.6 against the intended construct.(Widarjono, 2015). In this study there are 52 indicators for six latent variables, namely safety training (X1) with ten indicators, Planned maintenance system (X2) with four indicators, Safety technology (X3) with twelve indicators, Work competence (Z) with ten indicators and Ship officer performance (Z) with sixteen indicators.

   ***b.* Discriminant Validity Test**

   The discriminant validity test aims to test whether the indicators of a construct are not highly correlated with indicators from other constructs. The measurement of discriminant validity for the reflective model is carried out with two indicators, namely cross-loading and Fornell Larcker. In the cross-loading test, the cross loading value of the indicator variable against its latent variable must be greater than the cross loading value of the indicator variable against other latent variables.

The next discriminant validity test uses the Fornell Larcker measure, namely the comparison value between the AVE value and the quadrant of the correlation value between constructs, or comparing the root of the AVE with the quadrant of the correlation value between constructs as shown in the Fornell-Larcker Tabel. Each latent variable must be greater than the correlation between latent variables.

c. Convergent Validity Test

Convergent validity test to measure the level of accuracy of the indicators used in measuring constructs or dimensions by measuring the magnitude of the correlation between the construct and the latent variable. In measuring convergent validity according toKurniawan, Heri & Yamin (2011)and alsoThe Greatest Showman (2015)recommends the use of Average Variance Extracted (AVE) as the testing criteria. This test is to determine the feasibility of the six latent variables (Safety technology, Work competence, Planned maintenance system, Integration process, Safety training, Ship officer performance) in measuring the level of indicator accuracy with the criteria of having an AVE value greater than 0.5 to meet one of the convergent validity requirements.

d. Internal Consistency Test

Internal consistency test using composite reliability indicators and Cronbach's alpha AccepTabel limit values for the composite reliability level (pc), which for exploratory research is ≥ 0.5. Composite reliability does not assume the same boot of each indicator, while Cronbach's alpha assumes such similarity. If the six latent variables in this study have values above 0.5, it supports the internal consistency requirement.

Reliability indicates the reliability of the questionnaire as an indicator of a construct. Reliability testing aims to assess the accuracy of the research instrument. A questionnaire is considered reliable if it provides consistent results over time. In other words, even if measurements are taken by different people or at different times, the results remain consistent.(Murniati et. al, 2013). The provisions in testing the reliability of this data are as follows:

1) If the Cronbach Alpha (α) value is greater than 0.9, it can be said that the questionnaire has perfect reliability.
2) If the Cronbach Alpha (α) value is 0.7 to 0.9, it can be said that the questionnaire has high reliability.
3) If the Cronbach Alpha (α) value is 0.5 to 0.7, it can be said that the questionnaire has moderate reliability.
4) If the Cronbach Alpha (α) value is < 0.5, it can be said that the questionnaire has low reliability.

3. Inner Model Test

The inner model test (structural model analysis) is to ensure that the structural model built is robust and accurate. The evaluation of the inner model can be seen from several indicators, which in this study used multicollinearity tests, determination coefficients (R2), and Predictive Relevance (Q2), path coefficients, and F Square or Effect Size.

a. Coefficient of Determination

The coefficient of determination (R2 or R Square) is a way to assess how much the endogenous construct can be explained by the exogenous construct. The value of the coefficient of determination (R Square) is expected to be between 0 (zero) and 1 (one). An R Square value of 0.75 indicates that the model is strong. An R Square value of 0.50 indicates that the model is moderate. An R Square value of 0.25 indicates that the model is weak (Sarastedt et al., 2017). Meanwhile, Chin(Ghozali & Latan, 2015)provides different criteria, namely R2 with a value of 0.67 indicates that the model is strong; R2 with a value of 0.33 indicates that the model is moderate; and R2 with a value of 0.19 indicates that the model is weak. The Adjusted R Square is the R Square value that has been corrected based on the standard error value. The Adjusted R Square value provides a stronger picture than R Square in assessing the ability of an exogenous construct to explain an endogenous construct.

The purpose of this test is to show the coefficient of determination (R-Square) on the influence of the four independent variables (Safety technology, Work competence, Planned maintenance system, and safety training) on the dependent variable of ship officer performance.

b. Path Coefficient

Influence of latent variablesSafety training (X1), safety technology (X2), and ship officer performance (Z) towards human resource competency (Y) are partially shown by the results of the path coefficient test. The path coefficient value ranges from -1 to +1. If the path coefficient value is closer to +1, the relationship between the two constructs is stronger. A relationship that is closer to -1 indicates that the relationship is negative (Hair, 2017).

c. *F Square*or Effect Size

If the influence or path coefficient looks at whether or not there is a significant relationship between variables, then F Square or Effect Size assesses the magnitude of the influence between variables (Wong, 2013). According toHair (2017)F Square value that is smaller than 0.02 or < 0.02 then the effect is ignored or considered to have no effect; then the F Square value with a range between 0.02 to 0.15 is referred to as a small effect between variables; F-Square value with a range between 0.15 to 0.35 is referred to as a moderate effect between variables; and F-Square value > 0.35 is referred to as a large effect between variables.

Next, Godness of fit in PLS is Q-Square predictive relevance. The interpretation of Q2 is the same as the total determination coefficient in path analysis, or identical to R2 in regression. Q2 measures how good the observation values produced by the model and also its parameter estimates. A Q-square value greater than 0 (zero) indicates that the model has predictive relevance, while if the Q-square value is less than 0 (zero) indicates that the model does not have predictive relevance.(Hair, 2017)(Hair, 2017).

This criterion is basically identical to the total coefficient of determination, with the formula:

$$Q^2 = 1 - (1 - R_1^2)(1 - R_2^2) \ldots (1 - R_p^2) \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots (1.1.)$$

Where R12, R22 Rp2 is the R square of the endogenous variables in the model. Based on the R2 value, Q2 predictive relevance can be calculated Q square predictive relevance related to latent variables (training, safety technology, ship officer performance) in its predictive power on human resource competence as a dependent variable.

d. Hypothesis Testing

The testing of the research hypothesis for the analysis of the influence between independent variables (exogenous) on dependent variables (endogenous) can be seen in the path coefficient (Mean, STDEV and T-Value).

For R2 (R squares) and R2 is used to see the influence between several or a combination of independent variables and dependent variables.

Related to the t-test and probability value test (p-value). Testing the calculated t value (T statistic) is by comparing the calculated t (T statistics) with the critical t (1.96).The meaning of significance (t-test and probability value) is to test whether the relationship observed in the sample can be applied to the population as a whole. If the relationship is significant, the conclusions drawn from the sample can be applied to the population, indicating that the relationship is also significant in the population. Based on these provisions, the decision of the t-test results is as follows:
Ho: t count < 1.96, meaning there is no significant relationship between the independent variable and the dependent variable.
Ho: t count > 1.96, meaning there is a significant relationship between the independent variable and the dependent variable.
Meanwhile, the significance value of the probability value (p-value) must be less than 5% or 0.05 with the following provisions:
Ho: Accepted if the significance value (p-value) > 0.05 (5%)
Ha: Rejected if the significance value (p-value) < 0.05 (5%)

e. Simultaneous Hypothesis Testing
The F-test statistic is also known as for goodness of fit. That is, it shows how well the survey sample data aligns with the proposed regression model in the survey. To test the authenticity of Hypotheses 3 and 7, the F-test is used. The test statistic used in the simultaneous test is the F-test using the following equation:

$$F = \frac{R^2/k}{1 - R^2/(n-k-1)} \quad \text{....................(1.2.)}$$

Where:
R2 = Coefficient of Determination
k = Number of independent variables
n = sample size
To determine the critical value (FTTabel) of degrees of freedom (df), determine the numerator (df1) k and the denominator (df2) nk at the significance level (α= 5%). Where k is the number of independent variables, n is the number of samples, and the calculation results are:
1. Ho : rejected If Fcount< FTabel
2. Ho: accepted If Fcount> FTabel
If Ho is rejected and Ha is accepted, it is assumed that the influence of the independent variable can be interpreted simultaneously on the dependent variable.
If Ho is accepted and Ha is rejected, it means that the independent variable does not affect the dependent variable simultaneously.

Based on the statistical formula, the following statistical hypothesis is described:
1. The direct positive influence of training (X1) on the performance of ship officers on the Dynamic Positioning 2(Z) ship.
Determining H10 and H1a:
H0:Σ=Σ(θ) There is no direct significant influence of training on the performance of ship officers on ships.*Dynamic Positioning 2*.
Ha:Σ≠Σ(θ) There is a direct significant influence of training on the performance of ship officers on ships.*Dynamic Positioning 2*.

2. The direct positive influence of safety technology (X2) on the performance of ship officers on the Dynamic Positioning 2(Z) ship.
   Determining H20 and H2a:
   H0:Σ=Σ(θ) There is no direct significant influence of safety technology on the performance of ship officers on ships.*Dynamic Positioning 2*
   Ha:Σ≠Σ(θ) There is a direct and significant influence of safety technology on the performance of ship officers on ships.*Dynamic Positioning 2*.
3. The simultaneous positive influence of training (X1) and safety technology (X2) on the performance of ship officers on the Dynamic Positioning 2(Z) ship.
   Determining H30 and H3a:
   H0:Σ=Σ(θ) Simultaneously, there is no significant influence of training and safety technology on the performance of ship officers on ships.*Dynamic Positioning 2*.
   Ha:Σ≠Σ(θ) Simultaneously, there is a significant influence of training and safety technology on the performance of ship officers on ships.*Dynamic Positioning 2*.
4. The direct positive influence of training (X1) on human resource competency on the Dynamic Positioning 2 ship (Y).
   Determining H40 and H4a:
   H0:Σ=Σ(θ) There is no direct significant influence of training on the competence of human resources on ships.*Dynamic Positioning 2*.
   Ha:Σ≠Σ(θ) There is a direct significant influence of training on the competence of human resources on ships.*Dynamic Positioning 2*.
5. The direct positive influence of safety technology (X2) on human resource competence on the Dynamic Positioning 2 (Y) ship.
   Determining H50 and H5a:
   H0:Σ=Σ(θ) There is no direct significant influence of safety technology on the competence of human resources on ships.*Dynamic Positioning 2*.
   Ha:Σ≠Σ(θ) There is a direct and significant influence of safety technology on the competence of human resources on ships.*Dynamic Positioning 2*.
6. Direct positive influence of ship officer performance (Z) on human resource competency on Dynamic Positioning 2 ship (Y).
   Determining H60 and H6a:
   H0:Σ=Σ(θ) There is no direct significant influence of the performance of ship officers on the competence of human resources on the ship.*Dynamic Positioning 2*.
   Ha:Σ≠Σ(θ) There is a direct, significant influence of the performance of ship officers on the competence of human resources on the ship.*Dynamic Positioning 2*.
7. The simultaneous positive influence of training (X1), safety technology (X2) and ship officer performance (Y) on human resource competence on the Dynamic Positioning 2(Z) ship.
   Determining H70 and H7a:
   H0:Σ=Σ(θ) Simultaneously, there is no significant influence of training, safety technology and ship officer performance on the competence of human resources on ships.*Dynamic Positioning 2*.
   Ha:Σ≠Σ(θ) Simultaneously, there is a significant influence of training, safety technology and the performance of ship officers on the competence of human resources on ships.*Dynamic Positioning 2*.

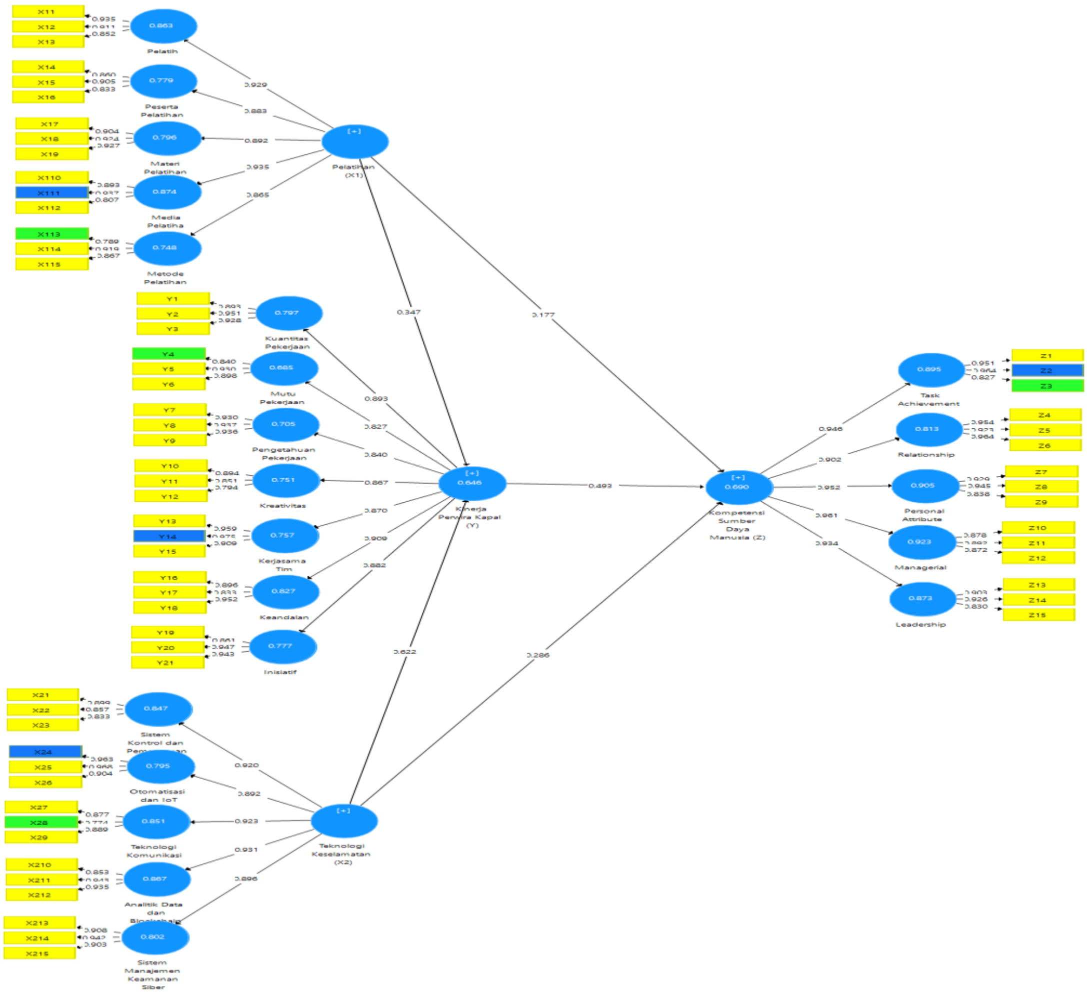
   Of all existing hypotheses using the following criteria:

a. H0 is rejected or Ha is accepted if the significance < 0.05.
b. H0 is accepted or Ha is rejected if the significance ≥ 0.05.

RESULTS AND DISCUSSION

1. Outer Model

In data analysis with PLS-SEM, the first stage is the evaluation of the outer model which is also called the measurement model. This analysis stage is to test and evaluate the relationship of reflective indicators used to measure the latent variables (constructs). The analysis of this measurement model consists of 2 types, namely reliability testing and validity testing. To obtain the outer model in this study, SmartPLS4 software was used by running the calculate menu, namely the PLS Algorithm. The outer model reflective model test of this study is arranged in 4 parts, namely sequentially 1) indicator reliability (outer loading), 2) construct reliability (Cronbach's alpha and composite reliability), 3) construct validity (average variance extracted or AVE), and 4) discriminant validity (heterotrait-monotrait ratio). The results of data processing with the PLS Algorithm get an outer model image as below.



Source: SEMPLS Processing (2024)

Figure 1. Structural Model Outer Model

Reliability Indicator

The first stage in the outer loading analysis is to assess the reliability indicator. From the results of data processing with PLS-SEM, the outer loading value is obtained which shows the relationship between the indicator and its construct. There is a required value as the limit for each indicator to be said to be reliable to measure its construct. In PLS-SEM, an indicator can be said to be reliable if it has an outer loading value of more than 0.70. (Hair et al., 2019; Hair et al., 2020). Based on the test results that can be seen in the Tabel below, there are 4 indicators from the variables in the research model that do not have an outer loading value above 0.7 as the required limit, so the model is reduced again.

Tabel 2. Outer Loading Values

Variables	Dimensions	*Loading factor*Dimensions	Indicator	Loading Factor Indicator	Caption
Training (X1)	Coach	0.929	X11	0.935	Valid
			X12	0.011	Valid
			X13	0.852	Valid
	Training Participants	0.883	X14	0.860	Valid
			X15	0.905	Valid
			X16	0.833	Valid
	Training Materials	0.935	X17	0.904	Valid
			X18	0.924	Valid
			X19	0.927	Valid
	Training Media	0.892	X110	0.893	Valid
			X111	0.807	Valid
			X112	0.807	Valid
	Training Methods	0.865	X113	0.789	Valid
			X114	0.867	Valid
			X115	0.789	Valid
Safety Technology (X2)	Control and Monitoring System	0.920	X21	0.890	Valid
			X22	0.857	Valid
			X23	0.833	Valid
	Automation and IoT	0.892	X24	0.963	Valid
			X25	0.968	Valid
			X26	0.904	Valid
	Communication Technology	0.923	X27	0.877	Valid
			X28	0.777	Valid
			X29	0.889	Valid
	Data Analytics and Blockchain	0.896	X210	0.853	Valid
			X211	0.935	Valid
			X212	0.903	Valid
	Cyber Security Management System	0.931	X213	0.908	Valid
			X214	0.909	Valid
			X215	0.903	Valid
Ship Officer Performance (Y)	Quantity of Work	0.893	Y1	0.893	Valid
			Y2	0.951	Valid
			Y3	0.928	Valid
	Quality of Work	0.893	Y4	0.840	Valid
			Y5	0.930	Valid
			Y6	0.898	Valid
	Job Knowledge	0.840	Y7	0.930	Valid
			Y8	0.937	Valid
			Y9	0.936	Valid
	Creativity	0.867	Y10	0.894	Valid
			Y11	0.851	Valid
			Y12	0.794	Valid
	Teamwork	0.909	Y13	0.959	Valid
			Y14	0.975	Valid
			Y15	0.909	Valid
	Reliability	0.882	Y16	0.896	Valid
			Y17	0.883	Valid
			Y18	0.952	Valid
	Initiative	0.890	Y19	0.861	Valid
			Y20	0.947	Valid

Variables	Dimensions	*Loading factor*Dimensions	Indicator	Loading Factor Indicator	Caption
			Y21	0.943	Valid
Human Resources Competence (Z)	Task Achievement	0.946	Z1	0.951	Valid
			Z2	0.964	Valid
			Z3	0.827	Valid
	Relationship	0.902	Z4	0.954	Valid
			Z5	0.923	Valid
			Z6	0.964	Valid
	Personal Attributes	0.952	Z7	0.920	Valid
			Z8	0.945	Valid
			Z9	0.838	Valid
	Managerial	0.961	Z10	0.878	Valid
			Z11	0.872	Valid
			Z12	0.872	Valid
	Leadership	0.934	Z13	0.926	Valid
			Z14	0.830	Valid
			Z15	0.928	Valid

Source: Results of PLS-SEM research data processing (2024)

Based on the outer loading model data from the Tabel, it can be concluded that all indicators in this research model are reliable for measuring their respective constructs.

For the Training variable (X1), the dimension with the highest loading factor is Training Material with a value of 0.935, while the dimension with the lowest loading factor is Training Method with a value of 0.865. In the indicator, the highest loading factor is in X17 (Training Material) with a value of 0.904, while the lowest loading factor is in X114 (Training Method) with a value of 0.789. This shows that Training Material provides the strongest contribution, while Training Method is slightly lower in influencing Training.

For the Safety Technology variable (X2), the highest dimension is Cybersecurity Management System with a value of 0.931, while the lowest dimension is Automation and IoT with a value of 0.892. In the indicator, the highest loading factor is in X25 (Automation and IoT) with a value of 0.968, and the lowest is in X29 (Communication Technology) with a value of 0.777. This shows that the Cybersecurity Management System as a whole is more influential, but some indicators such as X25 (Automation and IoT) still have a strong influence.

For the Ship Officer Performance variable (Y), the highest dimension is Teamwork with a value of 0.909, while the lowest is Initiative with a value of 0.890. The highest indicator is in Y14 (Teamwork) with a value of 0.975, while the lowest is in Y12 (Creativity) with a value of 0.794. This shows that Teamwork is the most dominant in Ship Officer Performance, while Initiative has a relatively smaller influence.

For the HR Competency variable (Z), the dimension with the highest loading factor is Managerial with a value of 0.961, while the lowest dimension is Personal Attribute with a value of 0.952. In its indicators, the highest loading factor is in Z2 (Task Achievement) with a value of 0.964, while the lowest is in Z9 (Personal Attribute) with a value of 0.838. This shows that Managerial plays an important role in influencing HR Competency, with Personal Attribute also making a large contribution even though there is a slight decrease in certain indicators.

Reliability Testing

Reliability testing is carried out to determine whether the variables used in this study are reliable or not. Reliability testing uses values*Cronbach's Alpha*and composite reliability. The following are the results of reliability testing.

Tabel 3. Reliability Testing

Variables	Cronbach's Alpha	Composite Reliability	Rule Of Thumb	Results
Training (X1)	0.959	0.963	>0.70	Reliable
Safety Technology (X2)	0.964	0.968		Reliable
Ship Officer Performance (Y)	0.970	0.972		Reliable
Human Resources Competence (Z)	0.973	0.975		Reliable

Source: SEMPLS Processing (2024)

Based on the Tabel above, it can be concluded that the constructs for all variables meet the reliable criteria. This is indicated by the Cronbach's Alpha and composite reliability values obtained from the SmartPLS estimation results. The resulting value is > 0.70 as recommended criteria.

Inner Model Results (Structural Model)

In the structural model (Inner Model) is a model that can prove an interaction on causality that refers to latent variables. In this study, structural examples can be assessed using the determination coefficient test (R2) and multicollinearity test. The following is a display of the path diagram (path example) using the PLS Bootstrapping calculation.

Based on Ghozali and Latan (2015), the inner model is a structural model that describes the causal influence between variables based on existing theories. The inner model will conduct an analysis where the causal influence between variables will be studied. In this section, several things that will be tested are:

R-Square (Coefficient of Determination)

MeAccording to Hair et al. (2019) the R2 or R-Square test is a way to find out how much percentage of endogenous constructs can be explained by their exogenous constructs. The coefficient of determination (R2) value is expected to be between 0 and 1. R2 values of 0.75, 0.50, and 0.25 indicate that the model is strong, moderate, and weak.

Tabel 4. R-Square (R2) Test Results

	R Square	R Square Adjusted
Ship Officer Performance (Y)	0.646	0.637
Human Resources Competence (Z)	0.690	0.678

Ssource: SEMPLS processed data (2024)

DadFrom the Tabel above, it can be seen that the ship's officer performance variable has a large R2 value, the R2 value is 0.646 with an Adjusted R2 value of 0.637, indicating that the contribution of the training and Safety Technology variables to the performance of ship's officers is 64.6%, while the remaining 35.4% is the influence of other variables not used in this study.

YesreliableHuman Resources Competencehas a large R2 value, the R2 value is 0.690 with an Adjusted R2 value of 0.678, indicating that the training, Safety Technology and ship officer performance variables have an effect onHuman Resources Competencesolarge 69.0% while the remaining 31.0% is the influence of other variables not used in this study.

Q-Square

In the analysis of model quality in PLS-SEM, the next stage is through the Q-squared test. This test aims to determine the predictive relevance of a latent variable in the research model (Hair & Sarstedt, 2021). The Q2 value is in the range of 0 to 1 (Hair et al., 2019). If a Q-squared value of more than 0 is found, it is said to have relevance, if the value is up to

0.25, it is said that the predictive relevance is small (small predictive relevance), if the Q-squared value is between 0.25 and 0.5, it is said that the predictive ability of the model is medium (medium predictive relevance), if the Q-squared value is more than 0.5, it is said to have a large predictive relevance. The greater the Q-squared value found or the closer it is to 1, the more precise the predictive ability of a research model is to predict relatively the same research output if there is a change in the data parameters. This is done in PLS-SEM with an out-of-sample approach or simulated changes in data compared to the original estimated data (Hair et al., 2019; Hair & Sarstedt, 2021). Therefore, it can be said that this value can indicate the quality of the proposed model for empirical testing, considering that this model will be tested on different data in the future.

The Q2 value of this study was obtained from the calculation results using a formula as shown in the Tabel below.

Tabel 5. Q-Squared Value

	Q Square	Results
Ship Officer Performance (Y)	0.354	Medium Predictive Relevance
Human Resources Competence (Z)	0.310	Medium Predictive Relevance

Source: SEMPLS Processing (2024)

The Tabel above presents the Q-Square values. The Q-Square value for the performance of ship officers is 0.354. While the Q-Square value forhuman resource competencyof 0.310 and both variables are classified as medium predictive relevance.

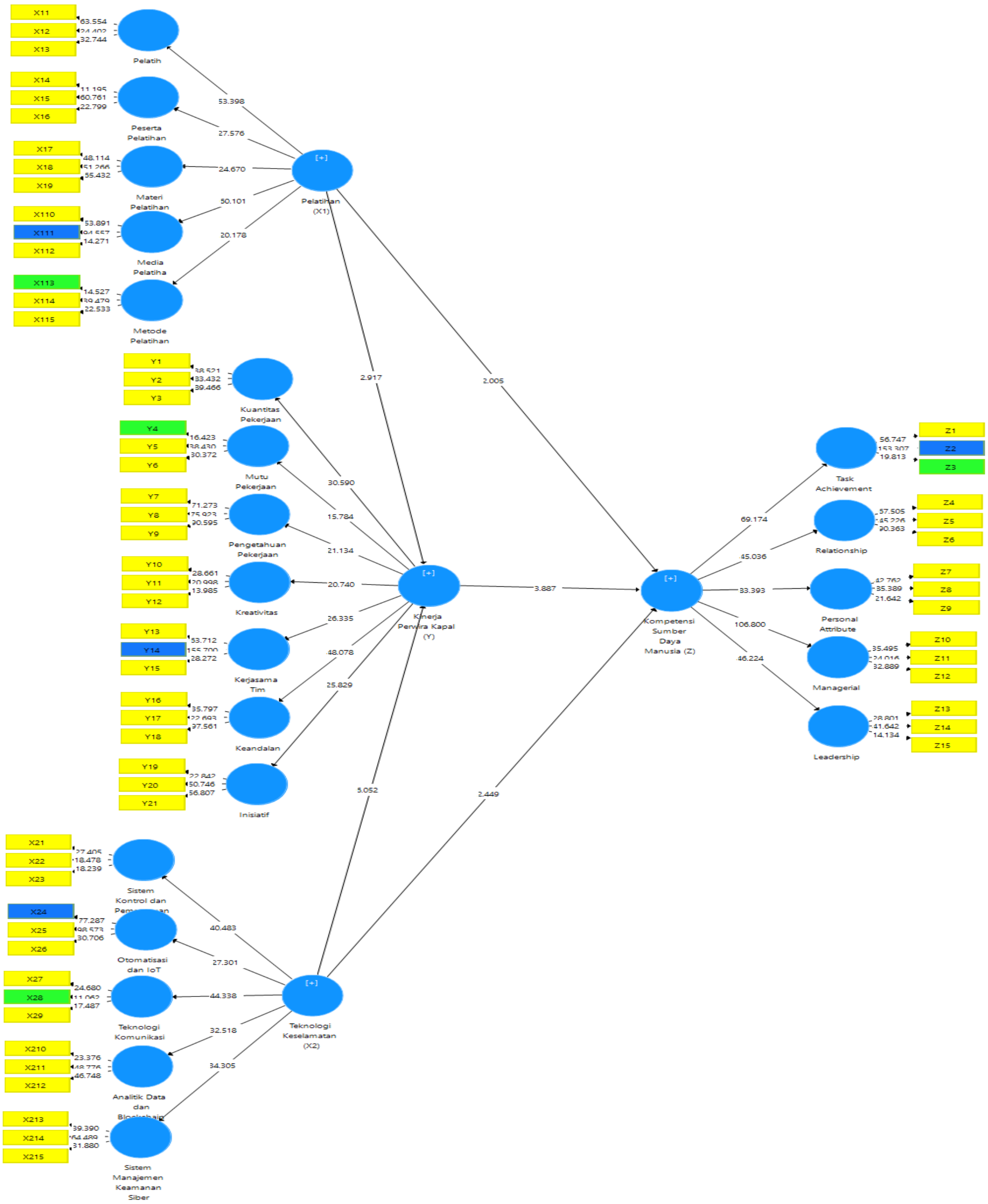
Research Hypothesis

The significance of the estimated parameters provides very useful information about the relationship between the research variables. The basis used in testing the hypothesis is the value contained in the output path coefficient.

Tabel 6. Direct and Indirect Influence Analysis

Hypothesis	Influence	Original Sample (O)	T Statistics (|O/STDEV|)	P Values	Information
H1	Training (X1) -> Ship Officer Performance (Y)	0.347	2,917	0.004	Significant
H2	Safety Technology (X2) -> Ship Officer Performance (Y)	0.622	6,052	0.000	Significant
H3	Training (X1) -> Human Resources Competence (Z)	0.177	2.005	0.045	Significant
H4	Safety Technology (X2) -> Human Resources Competence (Z)	0.286	2,449	0.015	Significant
H5	Ship Officer Performance (Y) -> Human Resources Competency (Z)	0.493	3,887	0.000	Significant
H6	Training (X1) -> Ship Officer Performance (Y) -> Human Resources Competence (Z)	0.171	2,042	0.042	Significant
H7	Safety Technology (X2) -> Ship Officer Performance (Y) -> Human Resources Competence (Z)	0.306	3.624	0.000	Significant

Source: SEMPLS Processing (2024)



Source: SEMPLS Processing (2024)
Figure 2 Inner Model Structural Model

1. Hypothesis Testing 1: Direct Effect of Training on Ship Officer Performance.

Based on Tabel 4.14 above, it shows that the influence of Training on Ship Officer Performance with a parameter coefficient of 0.347 which indicates that the direction of influence between Training on Ship Officer Performance is positive at 0.347. This means that if there is an increase in Training by 1 unit, Ship Officer Performance increases by 0.347. Furthermore, based on the T-Statistics H1 of 2.917 which is greater than its level or 2.917> 1.96, and the P-values H1 of 0.004 which is smaller than the real level or 0.004 <0.05, this shows that the direct influence of Training on Ship Officer Performance is significant. Therefore, it means that H1 is accepted, so there is a positive and significant direct influence of Training on Ship Officer Performance.

2. Hypothesis Testing 2: Direct Effect of Safety Technology on Ship Officer Performance.

Based on Tabel 4.14 above, it shows that the influence of Safety Technology on Ship Officer Performance with a parameter coefficient of 0.622 which indicates that the direction of influence between Safety Technology on Ship Officer Performance is positive at 0.622. This means that if there is an increase in Safety Technology by 1 unit, Ship Officer Performance increases by 0.622. Furthermore, based on the T-Statistics H2 of 6.052 which is greater than its level or 6.052> 1.96, and the P-values H2 of 0.000 which is smaller than the real level or 0.000 <0.05, this shows that the direct influence of Safety Technology on Ship Officer Performance is significant. Therefore, it means that H2 is accepted, so there is a direct positive and significant influence of Safety Technology on Ship Officer Performance.

3. Hypothesis Testing 3: Direct Effect of Training on Human Resource Competence.

Based on Tabel 4.14 above, it shows that the influence of Training on Human Resource Competence with a parameter coefficient of 0.177 which indicates that the direction of influence between Training on Human Resource Competence is positive at 0.177. This means that if there is an increase in Training by 1 unit, Human Resource Competence increases by 0.177. Furthermore, based on the T-Statistics H3 of 2.005 which is greater than its level or 2.005> 1.96, and the P-values H3 of 0.045 which is smaller than the real level or 0.045 <0.05, this shows that the direct influence of Training on Human Resource Competence is significant. Therefore, it means that H3 is accepted, then there is a positive and significant direct influence of Training on Human Resource Competence.

4. Hypothesis Testing 4: Direct influence of Safety Technology on Human Resource Competence.

Based on Tabel 4.14 above, it shows that the influence of Safety Technology on Human Resource Competence with a parameter coefficient of 0.286 which indicates that the direction of influence between Safety Technology on Human Resource Competence is positive at 0.286. This means that if there is an increase in Safety Technology by 1 unit, Human Resource Competence increases by 0.286. Furthermore, based on the T-Statistics H4 of 2.449 which is greater than its level or 2.449> 1.96, and the P-values H4 of 0.015 which is smaller than the real level or 0.015 <0.05, this shows that the direct influence of Safety Technology on Human Resource Competence is significant. Therefore, it means that H4 is accepted, so there is a direct positive and significant influence of Safety Technology on Human Resource Competence.

5. Hypothesis Testing 5: Direct influence of Ship Officer Performance on Human Resource Competence.

Based on Tabel 4.14 above, it shows that the influence of Ship Officer Performance on Human Resource Competence with a parameter coefficient of 0.493 which indicates that the direction of influence between Ship Officer Performance on Human Resource Competence is positive at 0.493. This means that if there is an increase in Ship Officer Performance by 1 unit, Human Resource Competence increases by 0.493. Furthermore, based on the T-Statistics H5 of 3.887 which is greater than its level or 3.887> 1.96, and the P-values H5 of 0.000 which is smaller than the real level or 0.000 <0.05, this shows that the direct influence of Ship Officer Performance on Human Resource Competence is significant. Therefore, it means that H5 is accepted, so there is a positive and significant direct influence of Ship Officer Performance on Human Resource Competence.

6. Hypothesis Testing 6: Indirect EffectTrainingtoHuman Resources CompetencethroughShip Officer Performance.

Based on Tabel 4.14 above, it shows that the indirect effect of Training on Human Resource Competence through Ship Officer Performance is positive with a parameter coefficient of 0.171 which indicates that the direction of influence between Training on Human Resource Competence through Ship Officer Performance is positive at 0.171. This means that if there is an increase in Training through Ship Officer Performance by 1 unit, Human Resource Competence increases by 0.171. Furthermore, based on the T-Statistics H6 of 2.042 which is greater than its level or 2.042> 1.96, and the P-values H6 of 0.042 which is smaller than the real level or 0.042 <0.05, this shows that the indirect effect of Training on Human Resource Competence through Ship Officer Performance is significant. Therefore, it means that H6 is accepted, so there is a positive and significant indirect effect of Training on Human Resource Competence through Ship Officer Performance.

7. Hypothesis Testing 7: Indirect EffectSafety TechnologytoHuman Resources CompetencethroughShip Officer Performance.

Based on Tabel 4.14 above, it shows that the indirect effect of Safety Technology on Human Resource Competence through Ship Officer Performance is positive with a parameter coefficient of 0.306 which indicates that the direction of influence between Safety Technology on Human Resource Competence through Ship Officer Performance is positive at 0.306. This means that if there is an increase in Safety Technology through Ship Officer Performance by 1 unit, Human Resource Competence increases by 0.306. Furthermore, based on the T-Statistics H7 of 3.624 which is greater than its level or 3.624> 1.96, and the P-values H7 of 0.000 which is smaller than the real level or 0.000 <0.05, this shows that the indirect effect of Safety Technology on Human Resource Competence through Ship Officer Performance is significant. Therefore, it means that H7 is accepted, so there is a positive and significant indirect effect of Safety Technology on Human Resource Competence through Ship Officer Performance.

CONCLUSION

Training has been proven to have a positive and significant influence on the performance of ship officers on the Dynamic Positioning 2 ship at PT. Wintermar Offshore Marine Indonesia. This can be seen from the parameter coefficient of 0.347, with a t-statistic of 2.917, greater than the t-Tabel of 1.64, and a p-value of 0.004 which is smaller than 0.05. The dimension that best reflects the training variable is the relevance of the material with a loading factor of 0.904, and the most dominant indicator is X7 (The training material provided is very relevant to the work on the DP2 ship) with a loading factor of 0.904.

Safety technology has a positive and significant effect on the performance of ship officers with a parameter coefficient of 0.622, a t-statistic of 6.052, greater than the t-Tabel of 1.64, and a p-value of 0.000 which is smaller than 0.05. The dimension that best reflects the safety technology variable is the IoT system with a loading factor of 0.968, and the dominant indicator is X5 (the Internet of Things (IoT) system used to assist in the operational supervision of the DP2 ship) with a loading factor of 0.968.

Training is also proven to have a positive and significant influence on human resource competence on the Dynamic Positioning 2 ship with a parameter coefficient of 0.177, t-statistic 2.005, greater than t-Tabel 1.64, and a p-value of 0.045 which is smaller than 0.05. The dimension that best reflects the human resource competence variable is team collaboration with a loading factor of 0.975, while the dominant indicator is Y4 (I always collaborate with other team members on the DP2 ship to achieve common goals) with a loading factor of 0.975.

Safety technology has a positive and significant effect on human resource competence with a parameter coefficient of 0.286, t-statistic of 2.449, greater than t-Tabel 1.64, and a p-value of 0.015 which is smaller than 0.05. The dimension that best reflects this variable is the surveillance system with a loading factor of 0.968, and the dominant indicator is X5 (the Internet of Things (IoT) system used to assist in the operational supervision of the DP2 ship) with a loading factor of 0.968.

The performance of ship officers also has a positive and significant influence on human resource competence with a parameter coefficient of 0.493, t-statistic 3.887, greater than t-Tabel 1.64, and a p-value of 0.000 which is smaller than 0.05. The dimension that best reflects the performance variable of ship officers is user satisfaction with a loading factor of 0.963, while the dominant indicator is Y6 (My work on the DP2 ship always provides satisfaction for service users) with a loading factor of 0.963.

There is a positive and significant indirect effect of training on human resource competency through the performance of ship officers with a parameter coefficient of 0.171, t-statistic 2.042, greater than t-Tabel 1.64, and a p-value of 0.042 which is smaller than 0.05. The most influential training dimension is the relevance of the material, while the most dominant dimension of ship officer performance is service user satisfaction with a loading factor of 0.963.

A positive and significant indirect effect was also found from safety technology on human resource competency through the performance of ship officers with a parameter coefficient of 0.306, t-statistic 3.624, greater than t-Tabel 1.64, and a p-value of 0.000 which is smaller than 0.05. The most influential safety technology dimension is the IoT system, while the dominant ship officer performance dimension is service user satisfaction with a loading factor of 0.963.

Suggestion

The statement with the lowest loading factor is Y12: "I use different problem-solving approaches in my work." Recommendation: To improve employees' ability to use various problem-solving approaches, companies should encourage innovation and creativity in the workplace. One way to do this is to organize special training programs that focus on improving creative problem-solving skills. That way, ship officers can be more flexible and ready to face various challenges that may arise during operations. Example: The company can hold a workshop on "Innovative Approaches to Operational Problem Solving" which teaches new methods such as design thinking or lean problem-solving. This workshop will help ship officers develop the ability to use various approaches to solve different problems while working on the DP2 ship.

The statement with the lowest loading factor was X14: "Training uses a problem-based approach that is relevant to the situation on board DP2."Suggestion: Companies should review their training curriculum and integrate more simulations or case studies based on real-life situations encountered in daily operations on board ships. This will allow trainees to be more involved in the training and help them understand how to handle problems that may occur during ship operations. Example: Companies can create training modules that cover specific scenarios, such as handling ship technical problems or extreme weather disturbances, where trainees are required to collaborate in finding effective and efficient solutions, similar to situations they encounter in the field.

The statement with the lowest loading factor was X9: “Satellite communication technology on board the DP2 helps ensure sTabel connections at sea.”Suggestion: Companies need to focus on improving the reliability of satellite communication systems on DP2 vessels, especially when the vessel is operating in remote areas or in bad weather conditions. This is important to ensure that all communications remain sTabel and smooth during vessel operations. Routine maintenance and upgrading of communication technology should also be a priority.Example: Companies can invest in dual satellite communication or mesh network technology to improve connection stability, so that ships remain connected to the operations center on land even in extreme weather conditions or locations far from network coverage.

The statement with the lowest loading factor is Y11: "I am able to generate new and creative ideas." Recommendation: The company should encourage ship officers to participate in creativity development programs that involve regular brainstorming sessions and recognition of innovative ideas. By creating a culture of innovation, ship officers will feel more motivated to think creatively and contribute to improving performance. Example: The company can organize a monthly competition where ship officers are invited to propose new ideas to improve operational efficiency or safety on board. The best ideas can be implemented in practice, and the winners will receive awards in recognition of their contributions.

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