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The Effect Of Education And Training On Ship Crew Performance, With Motivation As A Moderating Variable

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Abstract: As a maritime country, Indonesia has great potential in producing professional seafarers. However, many seafaring graduates face unemployment, low soft-skill competency, and unpreparedness to face the challenges of working at sea. Although various education and training programs have been carried out, the gap between training materials and real needs on board still occurs. This study aims to analyze the effect of education and training on seafarer performance with motivation as an intervening variable. The research gap lies in the lack of studies linking motivation with training effectiveness in the unique and stressful work context of seafarers. The results of this study are expected to contribute to the development of a more relevant seafarer training program to improve the overall quality of Indonesian maritime human resources. This study aims to analyze the effect of seafarers' education and training on their performance on board ship, with trainees' motivation as an intervening variable. The background of the study is based on the low quality and readiness of Indonesian seafarers in facing global challenges, including the gap between the training received and the real working conditions at sea. This study adopts a quantitative approach using the SMRT PLS analysis tool, with the research subjects being seafarers currently taking the Seafarer Competency Exam at the Seafarer Competency Exam Board (DPKP) during the second week of June 2025, with a total of 180 participants and a sample size of 30 participants. The results of the study indicate that motivation can mediate the relationship between seafarer education and training and performance onboard.

Keyword: Seafarer Education, Training, Motivation, Performance, Maritime.

INTRODUCTION

As the world's largest archipelago, Indonesia possesses immense potential in maritime human resources, particularly in central and eastern Indonesia, where communities have traditionally depended on the maritime and fisheries sectors for their livelihoods. This situation makes maritime education and training a crucial tool for producing professional, competent seafarers who can compete in both the national and international labor markets. (Transelasi et

al., 2019). In line with the government's agenda, which has prioritized human resource development as a national development priority since 2019, improving the quality of education has become one of the key strategies for enhancing the nation's competitiveness. However, Indonesia's Human Capital Index (HCI), which stood at 0.53 in 2018—ranking 87th out of 157 countries—indicates that the quality of Indonesia's human capital still requires serious attention, particularly in the areas of education and health (Prasetyo & Noor, 2024; Thahir et al., 2021).

From the perspective of human capital theory, education is viewed as an investment that can enhance an individual's knowledge, skills, experience, and competencies, thereby increasing both individual and organizational productivity (Safarida & Siregar, 2020). Therefore, improving the quality of maritime education and training is a strategic effort to produce maritime human resources who are excellent, productive, adaptable to technological developments, and capable of meeting the demands of an increasingly competitive global shipping industry. Although the government, through the Transportation Human Resources Development Agency (BPSDM), has developed various education and training programs based on international standards to produce professional, creative, competitive, and productive seafarers, various challenges still arise in their implementation.

These issues include the low level of soft skills among Indonesian seafarers—such as work ethic, discipline, leadership, communication, and teamwork—as well as their English proficiency, which continues to be a frequent source of complaint among both national and international shipping companies. In addition, there remains a gap between educational and training materials and actual operational conditions on board ships, so graduates often face difficulties in dealing with job challenges, particularly in emergencies, operating new technologies, and resolving operational problems at sea. The inconsistent quality of training providers is also a challenge, as some training institutions still have limited practical facilities, simulators, laboratories, teaching methods, and instructor quality, resulting in graduates with inconsistent competencies.

Seafarers' low motivation to pursue continuing education is also a significant issue, influenced by high tuition costs, minimal employer support, limited opportunities for promotion, and the perception that additional training has not yet had a significant impact on improving their well-being or career prospects. These conditions lead to stagnation in competency, which directly results in declining work performance, low productivity, and an increased risk of workplace accidents on board ships due to a lack of mastery of both technical and non-technical competencies. On the other hand, global demand for seafarers continues to rise, with the global need for seafarers estimated to exceed 65,000 people annually (Djari et al., 2023).

Ironically, Indonesia—which has approximately 101 maritime training institutions—is actually facing an oversupply of seafarers, resulting in many graduates who have not yet secured employment commensurate with their competencies. This situation indicates that the issue at hand is no longer merely the quantity of graduates, but rather the quality of their competencies and the alignment of those competencies with the needs of the national and international shipping industries. To ensure the quality of this education, the Directorate of Shipping and Maritime Affairs (DITKAPEL) periodically monitors the implementation of educational programs in accordance with International Maritime Organization (IMO) standards. At the same time, the Seafarer Competency Examination Board (DPKP) plays a role in maintaining the quality of graduates through a certification mechanism that complies with international regulations.

Various skills training programs, such as Basic Safety Training (BST), Advanced Fire Fighting (AFF), Bridge Resource Management (BRM), Engine Room Resource Management (ERM), Electronic Chart Display and Information System (ECDIS), International Safety Management (ISM) Code, International Maritime Dangerous Goods (IMDG) Code, and tanker

training are forms of competency development that seafarers must possess in accordance with their career levels and the specifications of the vessels on which they work (Syifaul Milah & Syekh Nurjati, 2024). This competency development is not only intended to meet international certification requirements but also to enhance seafarers' readiness to address advancements in maritime technology, the digitization of shipping, and the increasing operational complexity of modern ships.

In practice, the seafaring profession is characterized by a unique work environment, namely working under high-risk conditions, far from family, facing significant psychological pressure, social isolation, a hierarchical work system, and extremely strict safety requirements. These conditions can affect psychological well-being, work motivation, adaptability, communication, teamwork, and compliance with safety procedures, thereby potentially increasing the risk of unsafe behavior and workplace accidents on board ships if not balanced by adequate competencies (Rahman et al., 2021). Therefore, maritime educational institutions are required not only to produce graduates who master technical competencies (hard skills) but also non-technical competencies (soft skills), which include leadership, communication, decision-making, teamwork, stress management, discipline, and the ability to adapt to changes in the work environment.

Various previous studies have shown mixed results regarding the relationship between education, training, motivation, and performance. A study by Herlambang (2021) indicates that education and training have a significant impact on improving employee performance, whereas Purwantomo et al. Purwantomo et al. (2021) state that the quality of maritime education in Indonesia still requires various improvements to produce more professional seafarers. In contrast, a study by Widianingrum & Nurhayati (2017) found that education and training have not had a significant impact on seafarers' performance; In contrast, motivation was found to be a factor that positively influences performance improvement.

The differences in these research findings reveal a research gap, suggesting that the impact of education and training on seafarers' performance likely does not occur directly but rather through a psychological mechanism involving increased motivation among training participants. Therefore, this study develops a model that positions motivation as an intervening variable to explain more comprehensively how education and training can enhance seafarers' performance. Furthermore, this study also considers the characteristics of the Indonesian seafarers' work environment, which involves operational pressures, safety risks, and competency requirements that differ from those of other occupational sectors. It is thus expected to contribute theoretically to the development of human capital theory in the field of maritime education while providing practical recommendations for the government, the Transportation Human Resources Development Agency (BPSDM Perhubungan), maritime education and training institutions, and shipping companies in designing curricula, learning methods, strategies to boost trainees' motivation, and the development of technical and non-technical competencies that are better aligned with the needs of the modern shipping industry. Thus, improvements in the quality of education and training, supported by a high level of motivation to learn, are expected to produce Indonesian seafarers who are professional, globally competitive, and imbued with a strong safety culture, and who are capable of continuously improving the effectiveness, productivity, and operational safety of ships.

METHOD

This study employs a quantitative approach using an associative research method aimed at analyzing the causal relationship between the variables of education, training, motivation, and ship crew performance. The research process began with identifying issues related to seafarers' performance through the collection of primary and secondary data, followed by a literature review of various scientific journals and relevant references to establish a theoretical framework, formulate research hypotheses, determining research variables, defining the

population and sampling techniques, developing research instruments, collecting field data, analyzing data using a Partial Least Squares-based Structural Equation Modeling (SEM-PLS) approach, and finally drawing conclusions and formulating recommendations that can serve as a basis for improving the quality of seafarers' education, training, motivation, and performance.

The research was conducted at the Seafarer Competency Testing Board (DPKP), Directorate General of Maritime Transportation, Ministry of Transportation, located in Central Jakarta, as this agency plays a strategic role in administering and overseeing the Seafarer Competency Examination (UKP) and is responsible for maintaining the quality of Indonesian seafarers' competencies. Data collection was carried out by distributing questionnaires to participants in the Seafarer Competency Examination (UKP) who were attending training to upgrade their Certificate of Competency (COC) for the Nautical Officer (ANT) and Engineering Officer (ATT) levels III, II, and I. The study population consisted of 180 seafarers, and all members of the population were included as respondents using total sampling—a sampling technique that uses the entire population as the study sample—which is expected to yield a high level of data representativeness and minimize sampling error (Lubis, 2021; Rahim, 2020).

Data collection was conducted using several techniques, namely observation to obtain a direct picture of field conditions, the distribution of questionnaires as the primary research instrument, the collection of primary data from respondents, documentation to supplement empirical data, and a literature review to identify theories and previous research findings relevant to the research variables (Rahardjo, 2018; Handayani et al., 2023). The research variables consist of Education (X1), Training (X2), Motivation (Z) as the intervening variable, and Ship Crew Performance (Y) as the dependent variable. Education is defined as a systematic process of developing individual competencies by enhancing knowledge, attitudes, and skills that support seafarers' professionalism (Lotulung et al., 2023; Chastanti et al., 2024; Irwan et al., 2025).

Training is understood as a process of developing both technical and non-technical skills aimed at improving work effectiveness and readiness to meet the demands of jobs in the maritime sector (Armstrong, 2014; Sanghi, 2016; Suseno et al., 2021). Motivation refers to internal and external drives that influence an individual's intensity, direction, and persistence in achieving work goals, thereby playing a crucial role in boosting seafarers' morale, commitment, and productivity (Robbins & Judge, 2013; Lubis et al., 2024). Performance is defined as an individual's work output, as reflected in quality, quantity, timeliness, teamwork, and discipline in carrying out tasks in accordance with the shipping company's operational standards. These four variables were operationalized into 34 indicators developed based on the theoretical dimensions of each variable and measured using a Likert scale.

Before being used as a data collection tool, the research instrument was tested for validity and reliability to ensure that each indicator could measure the research construct accurately and consistently. Next, data analysis was conducted using the SEM-PLS method because this method offers high flexibility in testing relationships among latent variables, does not require a normal data distribution, can be applied to relatively small or medium sample sizes, and is effective for analyzing research models that involve both direct and indirect relationships through mediating variables (Prayitno, 2021; Gevisioner, 2022; Amrita et al., 2023). Model evaluation was conducted through outer model testing, including convergent validity, discriminant validity, Average Variance Extracted (AVE), Cronbach's Alpha, and Composite Reliability, to ensure construct validity and reliability. In contrast, the inner model was evaluated using the coefficient of determination (R^2), predictive relevance (Q^2), path coefficients, and hypothesis testing via the bootstrapping procedure to determine the significance of direct and indirect effects among the study variables.

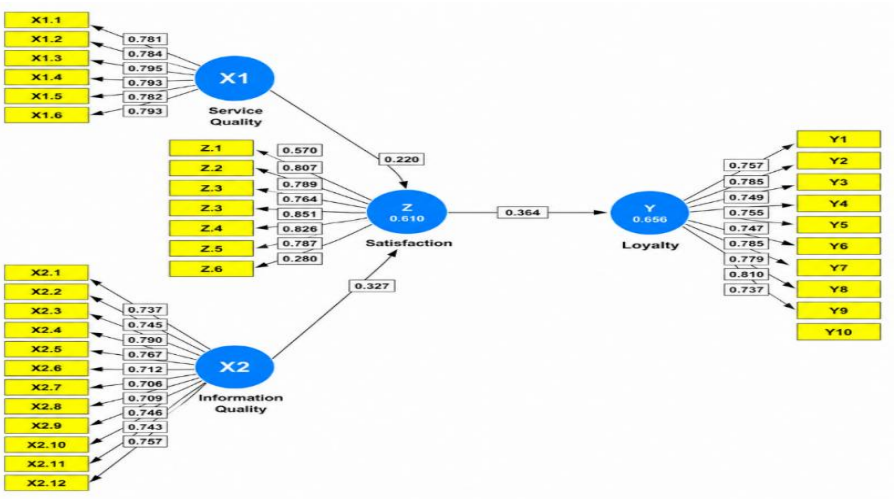
With this approach, the study is expected to provide empirical evidence on the impact of education and training on the performance of ship crews through increased motivation, so

that the research findings can serve as a basis for developing more effective maritime education and training policies, enhancing the competencies of maritime human resources, and strengthening the competitiveness of Indonesian seafarers at both the national and international levels.

RESULTS AND DISCUSSION

Based on the analysis of 180 respondents who met the study criteria, it can be concluded that the respondent population was dominated by male seafarers, totaling 128 individuals (71%). In Contrast, female respondents numbered 52 (29%). In terms of age, the majority of respondents were in the under-25 age group, totaling 112 people (62%), followed by the 26–35 age group with 42 people (23%), and the 36–45 age group with 26 people (14%). These findings indicate that the majority of respondents are seafarers of working age who are still in the early stages of their career development and therefore have significant opportunities to enhance their competencies through education and training. Based on length of service, the majority of respondents—55 people (30%)—had 6–10 years of work experience, followed by 48 respondents (26%) with less than 5 years of service, 42 respondents (23%) with 11–15 years of service, and 40 respondents (22%) with more than 15 years of service.

The data indicates that the majority of respondents have sufficient work experience to provide an objective assessment of education, training, motivation, and performance in the workplace. Meanwhile, based on their positions on board, the respondents were predominantly Deck Officers (ANT), numbering 52 people (29%), followed by Engine Officers (ATT), numbering 47 people (26%), Deck Ratings (39 people, 22%), Engine Ratings (29 people, 16%), and general crew members (13 people, 7%). This composition shows that the majority of respondents are officers, who bear significant responsibilities in ship operations, decision-making, and the implementation of maritime safety procedures. Overall, the respondents' characteristics indicate that this study is dominated by male seafarers who are young, have sufficient work experience, and hold operational and leadership positions on board; thus, these characteristics are considered capable of providing representative information for analyzing the influence of education and training on crew performance through motivation as an intervening variable.

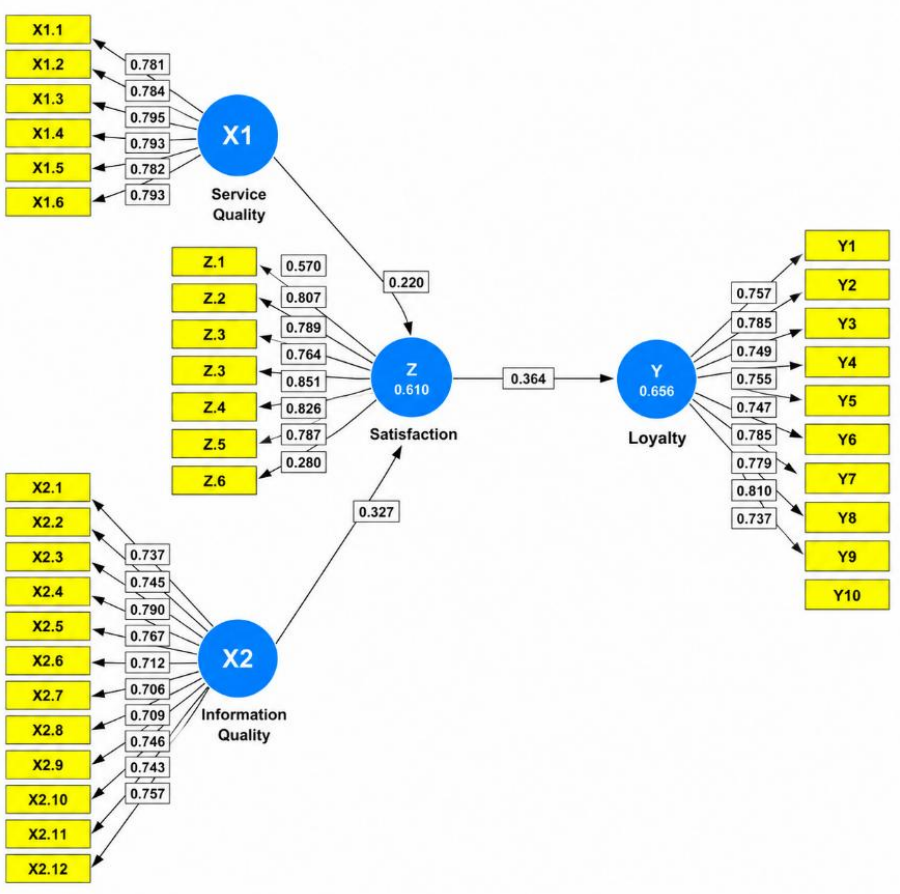


Source: Data analysis results using SmartPLS 4 software

Figure 1: Output results from the Partial Least Squares (PLS) outer model in the appendix page

Based on the results of the outer model evaluation, all indicators for the variables Education, Training, Motivation, and Ship Crew Performance were found to meet the criteria for convergent validity, as each indicator had a factor loading value above 0.50—with the

majority even exceeding 0.70—thereby demonstrating that all indicators effectively reflect the constructs being measured. Furthermore, the discriminant validity test showed that each construct has a good ability to distinguish itself from other constructs, as indicated by the root of the Average Variance Extracted (AVE) being higher than the correlations between constructs; thus, all variables meet the requirements for discriminant validity. The results of the reliability tests also showed that all variables had Cronbach's Alpha and Composite Reliability values above 0.70, as well as AVE values above 0.50, namely Education (CR = 0.908; AVE = 0.621), Training (CR = 0.937; AVE = 0.556), Motivation (CR = 0.917; AVE = 0.647), and Crew Performance (CR = 0.934; AVE = 0.585). The findings indicate that all constructs exhibit excellent levels of internal consistency and reliability, making them suitable for further analysis. Additionally, the multicollinearity test results show that all indicators have a Variance Inflation Factor (VIF) value of less than 5.00, indicating no multicollinearity that could affect the model estimates. Model fit testing also revealed a Standardized Root Mean Square Residual (SRMR) value of 0.057, which is below the maximum threshold of 0.08; thus, the research model is deemed to have a good fit with the empirical data. Overall, the results of the measurement model testing indicate that the research instruments have met all requirements for validity, reliability, and model suitability; therefore, the SEM-PLS model used is deemed suitable to proceed to the structural model evaluation (inner model) and research hypothesis testing stages.



Source: Data analysis results from Smart PLS 4.0

Figure 2 Output results from the Partial Least Squares (PLS) outer model on the appendix page

Based on the results of the internal model evaluation, the coefficient of determination (Adjusted R-Square) indicates that the research model has strong predictive power, with the Ship Crew Performance variable yielding a value of 0.651. This means that 65.1% of the variation in ship crew performance can be explained by the variables Education, Training, and

Motivation, while other factors outside the research model influence the remaining 34.9%. Meanwhile, the Motivation variable has an Adjusted R-Square value of 0.605, indicating that Education and Training can explain 60.5% of the variation in motivation. These results indicate that the research model has a good level of predictive accuracy in explaining the relationships among the variables. Furthermore, the hypothesis testing results show that all proposed hypotheses were accepted.

Education has a positive and significant effect on Crew Performance ($\beta = 0.220$; $p = 0.017$); Training has a positive and significant effect on Crew Performance ($\beta = 0.327$; $p < 0.001$); Education has a positive and significant effect on Motivation ($\beta = 0.570$; $p < 0.001$), training has a positive and significant effect on motivation ($\beta = 0.280$; $p < 0.001$), and motivation has a positive and significant effect on crew performance ($\beta = 0.364$; $p = 0.001$). In addition to direct effects, testing for indirect effects also showed that Motivation acts as a significant intervening variable. Education has a positive effect on Performance through Motivation ($\beta = 0.208$; $p = 0.004$), while Training also has a positive effect on Performance through Motivation ($\beta = 0.102$; $p = 0.011$). These findings indicate that improving the quality of education and training not only directly enhances crew performance but also increases work motivation, which in turn further strengthens performance. Thus, all the relationships hypothesized in this study have been empirically proven, and the model developed successfully explains that education and training are important factors in improving crew performance, both directly and through increased work motivation as an intervening variable.

Based on the results of the study, all proposed hypotheses were accepted, indicating that education, training, and motivation are factors that play a significant role in improving the performance of ship's crew members at the Seafarers' Competency Testing Board (DPKP). Education was found to have a positive and significant effect on performance ($\beta = 0.220$; $p = 0.017$), indicating that the higher the crew's educational level, the better their ability to understand work procedures, apply safety standards, and complete tasks professionally. Furthermore, education also exerts the greatest influence on work motivation ($\beta = 0.570$; $p = 0.000$), indicating that increased knowledge, insight, and competence can foster work enthusiasm, self-confidence, and the drive to improve work performance. These findings are consistent with Herlambang's (2021) study, which states that education has a positive relationship with both employee motivation and performance.

The research results also show that training has a positive and significant effect on crew performance ($\beta = 0.327$; $p = 0.000$) as well as on work motivation ($\beta = 0.280$; $p = 0.000$). This proves that a high-quality training program can improve technical skills, understanding of operational procedures, preparedness for emergencies, and foster a professional attitude among the ship's crew. In addition to enhancing competence, training can also foster motivation by boosting self-confidence, job satisfaction, and commitment to the organization. These findings support the results of Sarifuddin's (2020) study, which states that training has a positive effect on performance, as well as the research by Widianingrum and Nurhayati (2017), which demonstrates that training can increase work motivation.

Furthermore, motivation was found to have a positive and significant effect on crew performance ($\beta = 0.364$; $p = 0.001$). These results indicate that highly motivated crew members tend to work with greater discipline and responsibility, demonstrate strong commitment, and achieve work targets in accordance with maritime safety and professionalism standards. Motivation is a key factor driving improvements in work effectiveness and productivity because it guides individual behavior toward delivering optimal performance. These findings are consistent with Nuryaman's (2023) study, which found that work motivation has a significant relationship with crew performance.

In addition to direct effects, this study also demonstrates indirect effects through motivation. Education has a positive effect on performance through motivation ($\beta = 0.208$; $p = 0.004$), while training also has a positive effect on performance through motivation ($\beta = 0.102$;

p = 0.011). These results indicate that motivation acts as a mediating variable that strengthens the relationship between education and training and the performance of ship crew members. Education and training not only directly improve technical skills but also enhance work motivation, which ultimately drives more optimal performance improvements. Thus, motivation serves as a crucial mechanism that links competency development to improved performance.

Overall, the research findings indicate that education is the strongest factor influencing motivation. In contrast, motivation serves as an effective mediator in strengthening the impact of education and training on crew performance. These findings indicate that improving the quality of human resources within the DPKP requires not only continuous education and training programs but also organizational strategies to boost work motivation through career development, rewards, and the creation of a supportive work environment. Thus, a combination of quality education, effective training, and high work motivation will result in ship crews who are more competent, professional, and productive, and who can optimally meet maritime safety and operational standards.

Table

Table 1 Results of Educational Validity Testing

Dimension/Indicator	Statement	Factor Loading	Remarks
Educational Input	My education is relevant to my field of work as a seafarer	0,781	Valid
	The instructors/teachers in my educational program are highly competent	0,784	Valid
Educational Process	The teaching methods I received support my understanding of seafarer-related material	0,795	Valid
	The educational material I received is relevant to my duties and responsibilities on board a ship	0,793	Valid
Educational Outpu	The education I received has improved my technical skills on the job	0,782	Valid
	I hold a seafarer's certificate in accordance with applicable international standards	0.793	Valid

Source: Data Analysis Results from SmartPLS 4.0

Table 2 Results of Training Validity Testing

Dimension/Indicator	Statement	Factor Loading	Remarks
Training Inputs	The instructor has sufficient knowledge and experience to teach the training material.	**0,737**	**Valid**
	The training material taught is relevant to the work I do.	**0,745**	**Valid**

	The available training facilities are adequate to support the learning process.	**0,79**	**Valid**
	The duration and frequency of the training are appropriate for the material taught.	**0,767**	**Valid**
Training Process	The training methods used were very effective in helping me understand the material.	**0,783**	**Valid**
	During the training, I felt actively engaged in the activities and discussions.	**0,712**	**Valid**
	The assessments conducted during the training provided a clear picture of the extent to which I mastered the material.	**0,706**	**Valid**
	The instructor provided participants with ample opportunity to ask questions and discuss the training material.	**0,709**	**Valid**
Learning Outcomes	This training has improved my skills in my job.	**0,744**	**Valid**
	By completing this training, I obtained the certificate or license required for my job.	**0,746**	**Valid**
	This training has positively contributed to improving my performance in my daily work.	**0,743**	**Valid**
	After completing this training, I feel better prepared to face challenges in the workplace.	**0,757**	**Valid**

Source: Data Analysis Results from SmartPLS 4.0

Table 3 Results of Motivation Validity Testing

Dimension/Indicator	Statement	Factor Loading	Remarks
Individual Needs	I feel that this job provides me with psychological comfort and security.	**0,807**	**Valid**
	This job provides me with opportunities for personal and professional growth.	**0,789**	**Valid**
Expectations and Goals	I am confident that my efforts at work will have a positive impact on my career.	**0,764**	**Valid**

	I have clear career goals and feel that this job helps me achieve them.	**0,851**	**Valid**
Recognition and Appreciation	I feel that my supervisor appreciates my contributions.	**0,826**	**Valid**
	My work achievements are often publicly recognized by the shipping company.	**0,787**	**Valid**

Source: Data Analysis Results from SmartPLS 4.0

Table 4 Results of Performance Validity Testing

Dimension/Indicator	Statement	Factor Loading	Remarks
Work Quality	I always produce work that meets the shipping company's quality standards.	**0,757**	**Valid**
	My work rarely requires revisions from my supervisor.	**0,785**	**Valid**
Work Quantity	I am able to consistently meet my daily work targets.	**0,749**	**Valid**
	I often complete work beyond the set targets.	**0,755**	**Valid**
Timeliness	I always complete tasks before or on schedule.	**0,747**	**Valid**
	I rarely experience delays in completing my work.	**0,785**	**Valid**
Teamwork	I actively contribute to teamwork in the workplace.	**0,745**	**Valid**
	I am able to coordinate with coworkers to achieve common goals.	**0,779**	**Valid**
Discipline	I always arrive on time according to the specified work schedule.	**0,810**	**Valid**
	I comply with all applicable rules and work procedures at the shipping company.	**0,737**	**Valid**

Source: Data Analysis Results from SmartPLS 4.0

Table 5 Discriminant Validity Values

	Crew Performance	Motivation	Training	Education
Crew Performance				
Motivation	0,814			
Training	0,741	0,681		
Education	0,779	0,844	0,684	

Source: Data analysis results from Smart PLS 4.0

Table 6 Reliability Test Results

Variabel	Cronbach's alpha	Composite reliability (rho_a)	Composite reliability (rho_c)	Average variance extracted (AVE)
Education	0,878	0,880	0,908	0,621
Training	0,928	0,935	0,937	0,556
Motivation	0,891	0,893	0,917	0,647
Crew Performance	0,921	0,923	0,934	0,585

Source: Data analysis results from Smart PLS 4.0

Table 7 VIF Value

	VIF
X1.1	1,827
X1.2	3,040
X1.3	4,268
X1.4	1,904
X1.5	2,971
X1.6	4,292
X2.1	2,050
X2.2	1,991
X2.3	2,405
X2.4	4,876
X2.5	4,974
X2.6	2,194
X2.7	2,098
X2.8	2,168
X2.9	3,685
X2.10	3,985
X2.11	2,119
X2.12	2,159
Y1	2,072
Y2	2,440
Y3	2,043
Y4	2,295
Y5	2,082
Y6	2,421
Y7	2,004
Y8	3,563
Y9	4,055
Y10	2,204
Z.1	2,008
Z.2	1,977
Z.3	1,788
Z.4	2,425

Z.5	2,283
Z.6	1,966

Source: Data analysis results from Smart PLS 4.0

Table 8 Model Fit Test

	Model Estimates
SRMR	**0,057**

Source: Data analysis results from Smart PLS 4.0

Table 9 Coefficients of Determination (R^2)

	R-square	R-square adjusted
Crew Performance	0,656	0,651
Motivation	0,610	0,605

Source: Data analysis results from Smart PLS 4.0

Table 10 Testing the Effect of Output Using Partial Least Squares

	Original Sample	*Standard Deviation*	*T Statistics*	*Pvalues (1 Tail)*	Conclusion
Education → Performance **H1**	**0,220**	0,092	2,382	**0,017**	H1 accepted/supported
Training → Performance **H2**	**0,327**	0,082	3,977	**0,000**	H2 accepted/supported
Education → Motivation **H3**	**0,570**	0,068	8,355	**0,000**	H3 accepted/supported
Training → Motivation **H4**	**0,280**	0,071	3,965	**0,000**	H4 accepted/supported
Motivation → Performance **H5**	**0,364**	0,107	3,396	**0,001**	H5 accepted/supported
Education on Interests through Motivation → Performance **H6**	**0,208**	0,071	2,911	**0,004**	H6 accepted/supported
Training on Interests through Motivation → Performance **H7**	**0,102**	0,040	2,540	**0,011**	H7 accepted/supported

Source: Data analysis results from Smart PLS 4.0

CONCLUSION

Based on the results of data analysis using the Partial Least Squares (PLS) method on 180 respondents—ship crew training participants at the Seafarers' Competency Testing Board (DPKP)—this study demonstrates that all proposed hypotheses were accepted. The results show that education, training, and motivation play a crucial role in improving ship crew performance, both through direct effects and through indirect relationships mediated by motivation. Education was found to have a positive and significant effect on ship crew performance, indicating that the higher the educational level, the better the crew's ability to understand operational procedures, apply maritime safety standards, make sound decisions, and perform tasks effectively and efficiently. Education was also found to be the most dominant factor in enhancing work motivation, as it broadens horizons, boosts self-confidence, fosters a

professional mindset, and encourages crew members to develop their competencies and achieve better work performance continuously.

In addition to education, training has also been shown to have a positive and significant impact on the performance and motivation of ship crews. High-quality, ongoing training programs tailored to operational needs can enhance technical skills, the ability to handle emergencies, understanding of safety procedures, and professionalism in performing duties on board. Training not only directly improves work performance but also fosters self-confidence, work enthusiasm, and the crew's commitment to the organization. Thus, training serves as a strategic tool in developing competent, adaptable maritime personnel who are prepared to navigate the dynamics of shipping operations.

This study also demonstrates that work motivation significantly influences improvements in crew performance. Crew members with high motivation tend to exhibit better work discipline, greater responsibility, a commitment to maritime safety, and higher productivity compared to crew members with low motivation. Motivation serves as a driving force that can direct work behavior toward the optimal achievement of organizational goals. Therefore, an organization's success in improving crew performance depends not only on enhancing technical competencies but also on its ability to foster work motivation through reward systems, career development opportunities, a supportive work environment, and supportive leadership.

Furthermore, this study confirms that motivation acts as a mediating variable in the relationship between education and training and crew performance. Better education has been shown to increase work motivation, which in turn has a positive impact on performance improvement. Similarly, effective training not only directly improves technical skills but also builds work motivation, which ultimately enhances crew performance. These findings indicate that improving competencies through education and training will yield more optimal results when accompanied by increased work motivation. Thus, motivation serves as a crucial mechanism that reinforces the relationship between competency development and sustained performance.

The implications of these research findings indicate that both the Seafarers' Competency Testing Board (DPKP) and shipping companies need to prioritize human resource development as a key strategy for improving ship crew performance. These efforts can be achieved by increasing access to formal education and maritime vocational training, conducting ongoing training in line with technological advancements and international shipping regulations, and implementing a human resource management system that enhances work motivation. Training programs should not only focus on improving technical skills but also include the development of soft skills, such as communication, leadership, teamwork, decision-making, and stress management while working on board a ship. In addition, organizations also need to implement reward systems, incentives, and objective performance evaluations, as well as create a safe, fair, and conducive work environment to maintain the crew's work motivation.

Overall, this study makes both theoretical and practical contributions to the development of human resource management in the maritime sector. The findings confirm that education and training are strategic investments that not only enhance the technical competencies of ship crews but also foster work motivation, which is a key factor in improving performance. Therefore, improving the quality of service and maritime safety cannot rely solely on enhancing technical skills; it also requires strategies capable of fostering sustained work motivation. Synergy between quality education, effective training, and high work motivation will produce ship crews who are more professional, productive, disciplined, adaptable to change, and capable of meeting both national and international maritime safety and operational standards. Thus, the results of this study are expected to serve as a foundation for the DPKP, shipping companies, and other stakeholders in formulating more comprehensive human resource development policies aimed at enhancing the competence, professionalism, and global competitiveness of Indonesian ship crews.

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