



The Influence of ISM Code-Based E-Learning on Ship Crew Performance with E-Filling Digital Platform as a Mediating Variable

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ABSTRACT

This study investigates the influence of ISM Code-based E-Learning on ship crew performance, with the E-Filling digital platform as a mediating variable at PT Manalagi Surabaya. Using a quantitative causal-comparative approach, data were collected from 80 crew members through saturated sampling and analyzed using SEM-PLS. The results demonstrate that ISM Code-based E-Learning positively and significantly affects crew performance ($\beta=0.422$; $p=0.001$). The E-Filling digital platform also significantly influences performance ($\beta=0.530$; $p=0.000$). Furthermore, E-Learning significantly affects E-Filling platform utilization ($\beta=0.676$; $p=0.000$). Most importantly, the E-Filling platform partially mediates the relationship between E-Learning and crew performance ($\beta=0.359$; $p=0.000$). The model exhibits strong predictive relevance ($Q^2=0.871$) and explains 76.2% of performance variance ($R^2=0.762$). These findings integrate Social Learning Theory, Human Capital Theory, and the Technology Acceptance Model, confirming that digital training enhances both technological competence and operational performance. This study contributes to maritime HRM literature by demonstrating the mediating mechanism through which E-Learning improves performance via digital platform utilization. Practical implications suggest that shipping companies should prioritize integrated E-Learning programs combined with digital platform optimization to enhance crew competence and safety compliance.

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INTRODUCTION

The rapid advancement of information and communication technology in the digital transformation era has fundamentally reshaped organizational operations across various sectors, including the maritime transportation and shipping industry. Digitalization has evolved from administrative support into a strategic organizational component for enhancing effectiveness, efficiency, and competitiveness. In the shipping industry, this transformation is manifested through integrated information systems supporting vessel operations, document management, safety oversight, and human resource competency development. These changes compel shipping companies to adapt their work systems toward greater reliance on digital technology as part of effective corporate governance implementation.

One rapidly growing form of digital transformation is electronic-based learning (E-Learning), which provides flexibility for trainees to access materials without spatial or temporal constraints, enabling

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continuous competency development. Clark (2016) defined E-Learning as a learning method utilizing digital media to enhance learning quality through structured, interactive, and outcome-oriented content presentation. Theoretically, its effectiveness in enhancing human resource competency is explained through Bandura's (1977) Social Learning Theory, which posits that individuals learn through observational learning, modeling, and interactions among personal, environmental, and behavioral factors. Digital media-based learning has greater potential because it can present simulations, illustrations, videos, and procedural examples repeatedly, accelerating knowledge transfer and behavioral change.

In the maritime context, this theory is highly relevant as ship crew competencies are developed through continuous learning of operational standards and safety procedures. Through ISM Code-based E-Learning systems, crew members gain opportunities to study safety procedures, understand emergency response mechanisms, and observe best practices, extending learning beyond knowledge enhancement to behavioral changes that improve safety compliance and performance. Similarly, the E-Filling digital platform serves as an organizational learning environment facilitating documentation, information storage, and operational reporting, enabling E-Learning outcomes to be consistently applied in vessel operations. Internal audit results at PT Manalagi Surabaya during 2025 revealed Non-Conformity (NC) findings concentrated on Element 5 (Captain's Responsibility), Element 8 (Emergency Preparedness), and Element 10 (Ship Maintenance), indicating that safety procedure implementation requires continuous competency enhancement through more effective digital learning processes.

Based on empirical phenomena at PT Manalagi Surabaya, theoretical foundations, and identified research gaps, the objective of this research is to analyze the direct effect of ISM Code-based E-Learning on ship crew performance and to evaluate the mediating mechanism of the E-Filling digital platform in this relationship. Specifically, this study aims to examine whether digital training methodologies directly translate into improved crew operational compliance and whether administrative digitalization via E-Filling serves as an essential bridging process that converts learned safety knowledge into consistent workplace behavior. The novelty of this study lies in two main aspects. First, while existing maritime literature predominantly focuses on either theoretical compliance (Hamad et al., 2019) or isolated digital competence (Putra, 2022), this research introduces an integrative operational model combining ISM Code-based E-Learning with the E-Filling digital platform as a functional mediating variable. Second, this study bridges the gap between digital competency acquisition and onboard operational execution by empirically operationalizing the triadic reciprocal determinism of Social Learning Theory within a real-world national shipping company environment. By examining how an administrative E-Filling platform captures and reinforces E-Learning outcomes, this study provides a novel framework for understanding digital transformation in maritime safety management.

.LITERATURE REVIEW

Social Learning Theory

Social Cognitive Theory, initially conceptualized by Bandura (1977) and continuously validated in modern organizational learning literature, posits that human behavior is acquired through observational learning, cognitive processing, and environmental interactions. In contemporary corporate contexts, observational learning is significantly mediated through digital instructional design and simulation platforms (Gagné et al., 2022). Rather than relying solely on trial-and-error, individuals process observed behaviors from structured digital mediums, converting observational data into actionable cognitive frameworks and standard operational procedures (Sailer et al., 2021).

In the maritime context, Social Learning Theory provides a robust theoretical foundation for explaining how digital training tools shape behavioral compliance aboard vessels. Modern maritime studies demonstrate that digital environments—incorporating interactive modules, procedural simulations, and video demonstrations—enhance cognitive retention and procedural modeling among seafarers (Rana et

al., 2021; Shimazu et al., 2019). The four foundational mechanisms of Social Learning Theory operate sequentially in digital maritime training: (1) Attention, driven by interactive and realistic e-learning content; (2) Retention, reinforced through digital repositories and repeated access to safety protocols; (3) Reproduction, manifested through daily vessel operations and administrative execution via platforms such as E-Filling; and (4) Motivation, fostered by organizational safety feedback and reduced risk of non-conformity findings (Kim, 2018; Van den Broeck et al., 2016). Thus, Social Learning Theory explains how ISM Code-based E-Learning translates into enhanced operational discipline when supported by structured digital work environments.

Ship Crew Performance

Employee performance represents a measure of individuals' ability to meet organizational goals or targets, encompassing both quality and quantity aspects of work outcomes. Shakhoni et al. (2025) explained that employee performance results from individual efforts in organizations to perform specific tasks according to established standards, measurable both quantitatively and qualitatively. In this study's context, ship crew performance refers to individuals' ability to execute operational tasks aboard vessels, including safety procedure compliance, task execution accuracy, and effectiveness in supporting voyage operations.

Key performance indicators for crew members include: (1) Work quality — accuracy, thoroughness, and quality of work produced; (2) Work quantity — amount of work or output completed within specific timeframes; (3) Work effectiveness — extent to which work results contribute to overall organizational goal achievement; and (4) Procedure compliance — extent to which employees adhere to established company rules and work procedures (Rihi et al., 2020).

ISM Code-Based E-Learning

The International Safety Management (ISM) Code, established by the International Maritime Organization (IMO), provides an international standard for the safe operation of ships and pollution prevention. In the era of digital transformation, shipping companies increasingly adopt web-based and mobile Learning Management Systems (LMS) to deliver ISM Code compliance training to geographically dispersed crews (Thai & Vu, 2020; Theotokas & Progoulaki, 2020). ISM Code-based E-Learning is defined as a technology-mediated instructional delivery method designed to enhance crew understanding, mastery, and continuous adherence to safety management systems (SMS) without temporal or spatial restrictions (Thompson & Glasø, 2018).

Recent empirical research in maritime human resource management highlights that e-learning effectiveness is contingent upon system accessibility, interactivity, content relevance, and continuous feedback mechanisms (Shimazu et al., 2019). Modern e-learning systems allow seafarers to review safety procedures, analyze emergency response scenarios, and internalize safety culture before and during voyage deployments (Rana et al., 2021). Furthermore, integrating ISM Code training with real-time operational platforms ensures that theoretical safety knowledge is directly applicable to daily administrative and operational duties, thereby mitigating non-conformity risks during internal and external safety audits (Kim, 2018; Thai & Vu, 2020).

E-Filling Digital Platform

The E-Filling digital platform in this research context is a digital-based system enabling users to input, store, access, and manage data and documents in a structured and integrated manner. As a digital

platform supporting interaction and information management (Natania & Dwijayanti, 2024), E-Filling serves as a tool facilitating more effective and efficient administrative processes. Platform utilization can minimize data management errors while improving information accuracy and transparency.

Key indicators for measuring E-Filling digital platform effectiveness include: (1) Interactivity — platform's ability to enable user interaction or collaboration with the system or others; (2) Security — data protection and security level offered, including sensitive data protection and user data integrity; (3) Ease of use — platform usability, designed for easy understanding and operation by all employees regardless of experience; and (4) Functionality — features and tools enabling users to complete tasks efficiently and effectively (Kurniaputri et al., 2020).

Theoretical Framework Integration

This study integrates three complementary theoretical perspectives. First, Human Capital Theory posits that investment in training and development enhances individual knowledge, skills, and abilities, ultimately improving performance. ISM Code-based E-Learning represents organizational investment in human resource quality enhancement, particularly regarding safety and operational aspects. Second, Social Learning Theory explains that effective digital learning processes accelerate knowledge transfer and information retention, supporting more optimal work performance. Third, the Technology Acceptance Model (TAM) explains that perceived ease of use and perceived usefulness of technology influence acceptance and usage levels, ultimately affecting individual performance. The E-Filling digital platform, when perceived as easy to use, secure, and functional, enhances crew work efficiency and effectiveness.

Research Hypotheses

Based on theoretical foundations and empirical research gaps, the following hypotheses were developed:

H1: ISM Code-based E-Learning has a positive and significant effect on ship crew performance at PT Manalagi Surabaya.

H2: The E-Filling digital platform has a positive and significant effect on ship crew performance at PT Manalagi Surabaya.

H3: ISM Code-based E-Learning has a positive and significant effect on the E-Filling digital platform utilization among ship crew at PT Manalagi Surabaya.

H4: The E-Filling digital platform mediates the relationship between ISM Code-based E-Learning and ship crew performance at PT Manalagi Surabaya.

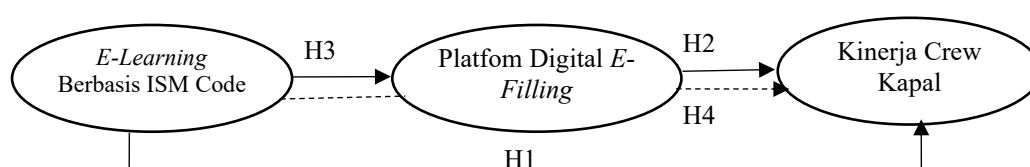


Figure 1. Research Framework

METHOD

This study employs a quantitative approach with a causal-comparative research design to examine the cause-and-effect relationships between ISM Code-based E-Learning (exogenous variable), the E-Filling digital platform (mediating variable), and ship crew performance (endogenous variable), based

on the integration of Human Capital Theory, Social Learning Theory, and the Technology Acceptance Model. The population comprised all 80 ship crew members of PT Manalagi Surabaya, and a saturated sampling technique was employed, making the entire population the respondents, representing various positions including Mater, Chief Officers, Second Officers, Chief Engineers, and Second Engineers. Primary data were collected through a closed-ended questionnaire using a 5-point Likert scale, consisting of 12 items measuring ISM Code-based E-Learning (accessibility, interactivity, content quality, feedback), the E-Filling Digital Platform (interactivity, security, ease of use, functionality), and Ship Crew Performance (work quality, work quantity, work effectiveness, procedure compliance), while secondary data were obtained from company documents including ISM Code internal audit reports and non-conformity findings. The questionnaire was distributed via Google Forms with mandatory completion of all items to ensure data completeness, and the instrument was validated through content and construct validity testing, with reliability confirmed through Cronbach's Alpha values exceeding 0.70 for all constructs. Data were analyzed using Structural Equation Modeling-Partial Least Squares (SEM-PLS) with SmartPLS 4.0 software, proceeding through measurement model evaluation (convergent validity with outer loadings >0.70 and AVE >0.50 , discriminant validity through Fornell-Larcker criterion, cross-loadings, and HTMT <0.90 , and reliability with Cronbach's Alpha and Composite Reliability >0.70), structural model evaluation (R-square, Q-square for predictive relevance, F-square for effect size, and hypothesis testing through bootstrapping with 5,000 subsamples at $p < 0.05$ significance), and model fit evaluation using the Goodness of Fit (GoF) index and Standardized Root Mean Square Residual (SRMR) with a threshold of <0.08 .

RESULT

Respondent Characteristics

The respondent profile reveals that all 80 respondents were male (100%), consistent with the male-dominated nature of the seafaring profession. The majority of respondents were aged 36-40 years (25.0%), followed by 41-45 years (16.25%). Most respondents (63.75%) had more than 3 years of work experience. In terms of position, respondents comprised Captains (25.0%), Chief Officers (25.0%), Chief Engineers (25.0%), Second Officers (12.5%), and Second Engineers (12.5%). Respondents were evenly distributed across 20 vessels, with 4 respondents per vessel (5.0% each).

Table 1. Descriptive Statistics of Research Variables.

Variable	Mean	Std. Deviation	Category
ISM Code-Based E-Learning	4.097	0.905	Very High
E-Filling Digital Platform	4.034	0.875	Very High
Ship Crew Performance	4.103	0.906	Very High

All three variables were rated in the "Very High" category, indicating positive perceptions among crew members toward E-Learning implementation, digital platform utilization, and their performance levels.

Outer model evaluation

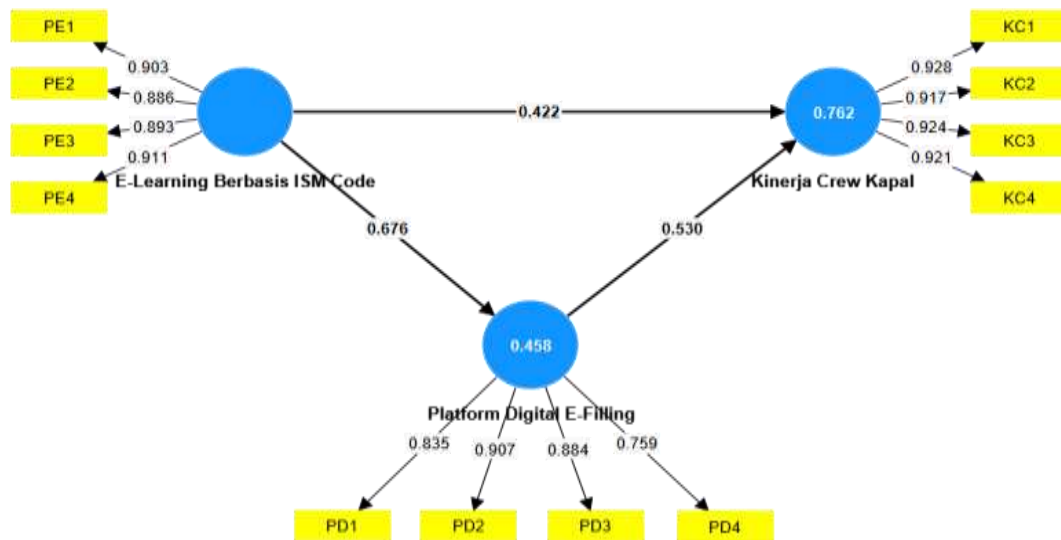


Figure 2. Outer Model

According to Figure 2, the purpose of this external model test is to assess the validity and reliability of the employed constructs or indicators. Validity and reliability tests are employed to assess the indicated measurement model. The results of factor loadings, Cronbach's alpha, composite factors, and Average Variance Extracted (AVE) from this study are displayed in Figure 2.

Table 2. Test Outer Model

Variable	Item	Outer loadings	Cronbach's Alpha	Composite Reliability	AVE
ISM Code-Based E-Learning	PE1	0.903	0,920	0,943	0.807
	PE2	0.886			
	PE3	0.893			
	PE4	0.911			
E-Filling Digital Platform	PD1	0.835	0,869	0,911	0.719
	PD2	0.907			
	PD3	0.884			
	PD4	0.759			
Ship Crew Performance	KC1	0.928	0,942	0,958	0.851
	KC2	0.917			
	KC3	0.924			
	KC4	0.921			

Table 2 presents the measurement model evaluation (*outer model*) assessing the validity and reliability of the research instrument for four variables: Intrinsic Motivation, Extrinsic Motivation, Situational Leadership, and Crew Performance.

All indicators exhibit *outer loading* values exceeding 0.70, ranging from 0.738 to 0.962, confirming that each indicator strongly correlates with its respective latent construct. The highest loading is observed in MI4 (0.962) for Intrinsic Motivation, indicating this indicator most dominantly reflects its construct. The *Average Variance Extracted* (AVE) values for all variables exceed the 0.50 threshold, ranging from 0.678 (Extrinsic Motivation) to 0.881 (Intrinsic Motivation), confirming that more than 50% of indicator variance is explained by the latent construct, thus meeting convergent validity criteria. *Cronbach's Alpha* and *Composite Reliability* values for all variables exceed 0.70, demonstrating good internal consistency and reliability. The highest *Composite Reliability* is found in Intrinsic Motivation (0.967), followed by Situational Leadership (0.927), Crew Performance (0.902), and Extrinsic Motivation (0.894). Overall, these results confirm that all indicators in the research model are valid and reliable, making them suitable for further analysis in the structural model.

The following are the results of the Fornell-Lacker validity test:

Table 3. Fornell-Lacker Validity Test

Variable	Kinerja Crew Kapal	E-Learning berbasis ISM Code	Platform Digital <i>E-Filling</i>
Kinerja Crew Kapal	0,923		
E-Learning berbasis ISM Code	0,781	0,898	
Platform Digital <i>E-Filling</i>	0,816	0,676	0,676

Table 3 presents the results of the discriminant validity test using the Fornell-Larcker criterion. This test aims to ensure that each latent construct is empirically distinct and does not overlap with other constructs in the research model. Discriminant validity is established when the square root of AVE (diagonal values in bold) for each construct is greater than the correlations between that construct and other constructs (off-diagonal values). In other words, each construct should correlate more strongly with its own indicators than with other constructs.

Ship Crew Performance has a square root of AVE of 0.923, which is greater than its correlations with ISM Code-based E-Learning (0.781) and the E-Filling Digital Platform (0.816), confirming that this construct is statistically distinct. ISM Code-based E-Learning has a square root of AVE of 0.898, exceeding its correlations with Ship Crew Performance (0.781) and the E-Filling Digital Platform (0.676), demonstrating good discriminant validity. E-Filling Digital Platform has a square root of AVE of 0.848, greater than its correlations with Ship Crew Performance (0.816) and ISM Code-based E-Learning (0.676), also meeting the discriminant validity criteria.

All constructs in this study satisfy the Fornell-Larcker criterion, confirming that Ship Crew Performance, ISM Code-based E-Learning, and the E-Filling Digital Platform are empirically distinct constructs with no conceptual overlap issues. Thus, the research instrument demonstrates good discriminant validity and is suitable for further structural model analysis.

The next is HTMT validity test. The requirement is met when the numbers in the table do not exceed 0.90. The results of the HTMT test are as follows:

Table 4. HTMT Validity Test

Variable	Kinerja Crew Kapal	E-Learning berbasis ISM Code	Platform Digital <i>E-Filling</i>
Kinerja Crew Kapal			
E-Learning berbasis ISM Code	0,837		
Platform Digital <i>E-Filling</i>	0,895	0,741	

Table 4 presents the results, all HTMT values are below 0.90, confirming that the three constructs ISM Code-based E-Learning, the E-Filling Digital Platform, and Ship Crew Performance possess good discriminant validity. In other words, each variable is empirically distinct from one another with no conceptual overlap issues. This confirms that the research instrument meets discriminant validity criteria and is suitable for further structural model analysis.

Inner Model Evaluation

The structural model (inner model) is evaluated using the coefficient of determination Q-square, F-square, and significance tests. In SEM analysis, the influence of determination analysis is used to determine how much the exogenous variables influence the endogenous variables. R-squared is determined by the coefficient of determination (R²). The results of the coefficient of determination (R-squared) for this study are as follows:

Table 5. R-Square Test

Endogenous Variable	R Square	R Square Adjusted
E-Filling Digital Platform	0.458	0.451
Ship Crew Performance	0.762	0.756

Table 5 presents the results, The R^2 value for Ship Crew Performance (0.762) indicates that ISM Code-based E-Learning and the E-Filling digital platform jointly explain 76.2% of the variance in crew performance, classified as a strong (substantial) model. The R^2 for E-Filling Digital Platform (0.458) indicates that 45.8% of platform utilization variance is explained by ISM Code-based E-Learning, classified as moderate.

An F-square test is then used to ascertain how much the latent predictor variables contribute to the model's influence at the structural level. This impact falls into four categories: very little, small, medium, and large. The following thresholds are used to classify these impacts: A: $F^2 < 0.02$ indicates a very little influence, $0.02 < F^2 < 0.15$ indicates a small effect, $0.15 < F^2 < 0.35$ indicates a medium effect, and $F^2 > 0.35$ indicates a large effect. The findings of the F-square test were as follows:

Table 6. F-Square Test

Variable	F^2	Interpretation
E-Learning → E-Filling Digital Platform	0.845	large
E-Filling Digital Platform → Performance	0.327	medium
E-Learning → Performance	0.197	medium

Table 6 presents the *effect size* (f^2) test results, which measure the relative contribution or practical significance of each predictor variable to the endogenous variables in the structural model. This test complements significance testing (p-value) by indicating the practical magnitude of effects. E-Learning → E-Filling Digital Platform ($f^2 = 0.845$): The large effect size (0.845) is the strongest in the model, confirming that ISM Code-based E-Learning substantially enhances crew members' ability and readiness to adopt and utilize the E-Filling digital platform. E-Filling Digital Platform → Performance ($f^2 = 0.327$): The medium effect indicates that the E-Filling platform contributes meaningfully to crew performance improvement, though not as strongly as E-Learning's effect on platform utilization itself. E-Learning → Performance ($f^2 = 0.197$): The medium effect shows that ISM Code-based E-Learning has a meaningful direct contribution to crew performance. However, the indirect effect through platform mediation ($0.845 \times 0.327 = 0.276$) is larger than the direct effect (0.197), confirming the important mediating role.

Hypothesis Test

To test the hypothesis, the coefficient value for each line will be ascertained. In this analysis, a significance level of 0.05 is accepted. The direct effect hypothesis and indirect effect hypothesis tests presented the following results:

Table 7. Direct effect hypothesis

Hypothesis	Original Sample	T Statistics	P Values	Result
ISM Code E-Learning → Ship Crew Performance	0.422	3.422	0.001	Accepted
E-Filling Digital Platform → Ship Crew Performance	0.530	4.675	0.000	Accepted
ISM Code E-Learning → E-Filling Digital Platform	0.676	9.328	0.000	Accepted

Table 7 presents the direct effect hypothesis testing results between exogenous, mediating, and endogenous variables in the research model. Testing was conducted using bootstrapping procedures in SEM-PLS to determine whether relationships among variables are statistically significant.

ISM Code E-Learning → Ship Crew Performance (Accepted) $\beta = 0.422$, $T = 3.422$, $p = 0.001$: Confirms that effective ISM Code-based E-Learning directly enhances crew performance through improved safety procedure understanding, technical competence, and operational standard compliance.

E-Filling Digital Platform → Ship Crew Performance (Accepted) $\beta = 0.530$ (strongest direct effect), $T = 4.675$, $p = 0.000$: Confirms that effective, secure, and user-friendly E-Filling platform utilization directly improves crew work efficiency, accuracy, and quality through streamlined administration, reporting, and operational document management.

ISM Code E-Learning → E-Filling Digital Platform (Accepted) $\beta = 0.676$ (strongest overall relationship), $T = 9.328$, $p = 0.000$: Confirms that effective E-Learning enhances crew understanding, skills, and confidence in operating digital platforms, driving more optimal E-Filling system utilization in supporting operational work.

Table 8. Indirect effect hypothesis

Hypothesis	Original Sample	T Statistics	P Values	Result
E-Learning → E-Filling Platform → Performance	0.359	4.438	0.000	Accepted

Table 8 presents the indirect effect or mediation effect test results of the E-Filling Digital Platform in the relationship between ISM Code-based E-Learning and Ship Crew Performance.

E-Learning → E-Filling Platform → Ship Crew Performance (Accepted) $\beta = 0.359$ (positive and significant): ISM Code-based E-Learning influences crew performance through enhanced E-Filling digital platform utilization. $T = 4.438$ (> 1.96) and $p = 0.000$ (< 0.05): Confirms statistically significant mediation at 99% confidence level.

DISCUSSION

The Influence of ISM Code-Based E-Learning on Ship Crew Performance (H1)

The results demonstrate that ISM Code-based E-Learning significantly and positively influences ship crew performance ($\beta=0.422$; $p=0.001$), confirming Hypothesis H1. This finding indicates that structured digital training enhances crew competence, safety understanding, and operational effectiveness. The E-Learning system's accessibility (mean 4.14), interactivity (4.07), content quality (4.04), and feedback mechanisms (4.14) all contributed to this positive effect. Theoretically, these findings align with Human Capital Theory, which posits that investment in training and development enhances individual knowledge, skills, and abilities, ultimately improving performance. ISM Code-based E-Learning represents organizational investment in human resource quality, particularly regarding maritime safety and operational aspects. Furthermore, Bandura's Social Learning Theory explains that effective digital learning, through interactive and flexible media, accelerates knowledge transfer and information retention, supporting more optimal work performance. Practical implications suggest that crew members who receive continuous training through digital platforms develop better procedural understanding, enhanced decision-making capabilities, and improved safety compliance. The E-Learning system's ability to update materials according to changing regulations ensures that crew members always access current information relevant to their duties. This condition improves work readiness and reduces potential errors in task execution, ultimately contributing to overall performance enhancement. These findings corroborate Chen et al. (2020), who found that ISM Code-based learning implementation improves crew safety procedure compliance and internal audit efficiency. Similarly, Purwanto and Suratman (2022) confirmed that E-Learning-based training positively and significantly affects employee performance enhancement.

The Influence of E-Filling Digital Platform on Ship Crew Performance (H2)

The results show that the E-Filling digital platform significantly and positively influences ship crew performance ($\beta=0.530$; $p=0.000$), confirming Hypothesis H2. This represents the strongest direct effect

in the model. Platform interactivity (4.10), security (4.01), ease of use (3.91), and functionality (4.11) collectively contribute to performance improvement. Theoretically, this finding aligns with the Technology Acceptance Model (TAM), which states that perceived ease of use and perceived usefulness influence technology acceptance and usage, ultimately affecting individual performance. The E-Filling platform's functionality enables crews to manage documents and reports more structurally, accurately, and in real-time, supporting faster and more precise decision-making. Empirically, the platform facilitates coordination and communication among relevant parties, enabling more efficient task completion. Integrated systems minimize manual errors, optimize work quality, and improve operational transparency. Crew members who effectively utilize the platform demonstrate higher productivity and better adherence to established company procedures. These findings are consistent with Priatna et al. (2022), who found that digital platform utilization positively and significantly affects employee performance. Widjaja and Ginanjar (2022) also confirmed that digital transformation improves operational efficiency, reduces human error, and enhances work quality.

The Influence of ISM Code-Based E-Learning on E-Filling Digital Platform Utilization (H3)

The results demonstrate that ISM Code-based E-Learning significantly influences E-Filling digital platform utilization ($\beta=0.676$; $p=0.000$), confirming Hypothesis H3. This represents the strongest relationship in the model with a large effect size ($f^2=0.845$). Theoretically, this finding integrates Social Learning Theory and the Technology Acceptance Model. E-Learning enhances crew understanding, skills, and confidence in operating digital systems. Through effective training, crew members become more familiar with platform features and functions, increasing their usage intensity and quality. Structured and continuous learning strengthens individuals' ability to master technology. ISM Code-based E-Learning provides opportunities for crew members to learn independently and repeatedly, reinforcing their understanding of digital systems used in daily work. Empirically, effective training reduces technology adoption barriers, such as operational errors or procedural inconsistencies. Enhanced digital competence leads to more efficient, accurate, and compliant platform utilization. These findings align with Alkashami (2021), who found that technology-based training significantly influences digital system acceptance and usage within organizations. Effective training improves user readiness in adopting technology and maximizing its utilization to support performance.

The Mediating Role of E-Filling Digital Platform (H4)

The results confirm that the E-Filling digital platform mediates the relationship between ISM Code-based E-Learning and ship crew performance ($\beta=0.359$; $p=0.000$), with partial mediation (VAF=46.0%). The total effect of E-Learning on performance (0.781) comprises direct effect (0.422) and indirect effect through platform mediation (0.359). Theoretically, this finding integrates Human Capital Theory and the Technology Acceptance Model. E-Learning as human resource investment enhances digital knowledge and skills. Improved capabilities encourage technology acceptance and utilization (E-Filling platform), which subsequently impacts performance improvement. The digital platform serves as an intermediary mechanism bridging training outcomes with performance outputs. From the Social Learning Theory perspective, effective training enhances crew ability to understand and operate the E-Filling system. Enhanced platform utilization positively impacts work efficiency, reporting accuracy, and procedure compliance. These conditions ultimately drive overall crew performance improvement. These findings support Mijaya (2022), who found that digital technology utilization mediates the relationship between training and employee performance. Training becomes more effective in enhancing performance when supported by adequate technology systems optimally utilized by users.

Integration of Theoretical Frameworks

This study successfully integrates three complementary theoretical perspectives. First, Human Capital Theory confirms that ISM Code-based E-Learning as organizational investment enhances crew knowledge, skills, and safety understanding, directly improving performance (H1). Second, Social Learning Theory explains the learning mechanisms through observation and modeling, where structured E-Learning enables effective knowledge transfer and work behavior formation. Third, the Technology Acceptance Model clarifies how perceived usefulness and ease of use of the E-Filling platform influence adoption and subsequent performance improvement (H2). The mediation analysis (H4)

demonstrates the integrative mechanism through which E-Learning enhances performance by improving digital platform utilization capability, confirming the theoretical synergy among these frameworks in the maritime human resource management context.

CONCLUSIONS

This study investigated the influence of ISM Code-based E-Learning on ship crew performance with the E-Filling digital platform as a mediating variable at PT Manalagi Surabaya. The findings yield several important conclusions. First, ISM Code-based E-Learning has a positive and significant effect on ship crew performance. Structured, accessible, and relevant training materials enhance crew competence and understanding in executing duties. Better E-Learning quality leads to higher crew performance.

Second, the E-Filling digital platform positively and significantly affects ship crew performance. Effective, secure, and user-friendly digital platform utilization enhances crew work efficiency, accuracy, and quality. Optimal platform utilization leads to improved crew performance.

Third, ISM Code-based E-Learning significantly affects E-Filling digital platform utilization. Training enhances crew understanding and skills in using digital systems, encouraging more optimal platform utilization in supporting work activities.

Fourth, the E-Filling digital platform mediates the relationship between ISM Code-based E-Learning and ship crew performance. E-Learning affects performance not only directly but also indirectly through enhanced digital platform utilization. This demonstrates that technology utilization strengthens the impact of training on performance improvement.

Fifth, the research model demonstrates strong predictive relevance ($Q^2=0.871$) and high explanatory power, with E-Learning and the E-Filling platform jointly explaining 76.2% of crew performance variance ($R^2=0.762$) and E-Learning explaining 45.8% of platform utilization variance.

RECOMMENDATIONS

Based on the findings, several practical recommendations are proposed for PT. Salam Pacific Indonesia Lines management. First, the company should continuously enhance ISM Code-based training quality by improving accessibility, interactivity, content relevance, and feedback mechanisms—particularly given that feedback exhibited the highest loading factor (0.911)—with training materials tailored to crew operational needs and regular evaluations to ensure effective learning and performance improvement. Second, the company should optimize digital platform utilization, with priority attention to ease of use (PD3) which received the lowest mean score (3.913), alongside enhancing interactivity, strengthening system security, and expanding functionality to support all crew administrative and reporting needs. Third, the company should integrate training with daily digital technology usage by combining theoretical instruction with practical system application, enabling crews to directly apply digital systems in their work and maximizing returns on both investments through their significant interrelationship. Fourth, given the strong mediating role of the digital platform, the company should strengthen its strategic positioning as part of performance improvement initiatives, encouraging all crew members to actively use the system while providing ongoing training to enhance utilization effectiveness in supporting work productivity.

RESEARCH LIMITATION AND FUTURE RESEARCH

RESEARCH LIMITATION

This study has several limitations, including questionnaire completion constraints due to limited work time, respondent reachability issues arising from irregular crew schedules, non-response problems, and potential distractions from dynamic work environments during data collection. Additionally, the model's explanatory capability remains limited, as indicated by the R^2 values for the E-Filling platform (45.8%) and ship crew performance (76.2%), demonstrating that substantial variation is influenced by

factors outside the model. Future research should incorporate additional relevant variables to enhance the model's comprehensive explanatory power.

FUTURE RESEARCH

Future research should expand the scope across multiple shipping companies and maritime sectors, incorporate additional variables (leadership style, safety culture, work motivation, job satisfaction, technology readiness) to address the 54.2% and 23.8% unexplained variances, employ mixed-methods or qualitative approaches for deeper user experience insights, and utilize longitudinal designs to establish causal relationships and capture dynamic changes over time.

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