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The Role of Competency in Mediating the Impact of Training, Education, and Personal Characteristics on Successful Crew Recruitment in Indonesian Shipping Companies

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Abstract

This study examines the determinants of successful crew recruitment in Indonesian shipping companies by analyzing the direct and indirect effects of training, education, and personal characteristics through competency as a mediating variable. Using Structural Equation Modeling-Partial Least Squares (SEM-PLS), data from 165 HR division employees across Indonesian shipping companies were analyzed. The outer model evaluation confirmed convergent validity (factor loadings >0.70, AVE >0.50), discriminant validity (Fornell-Larcker criterion and HTMT), and reliability (Cronbach's Alpha >0.70, Composite Reliability >0.70). The inner model demonstrated strong predictive power with R^2 values of 0.684 for competency and 0.726 for recruitment success. Hypothesis testing revealed that training, education, and personal characteristics significantly and positively influence both competency and successful crew recruitment. Furthermore, competency significantly mediates these relationships, with mediation effects confirmed through bootstrapping analysis ($p < 0.05$, $t > 1.96$). The findings indicate that competency serves as a critical linking mechanism transforming human capital investments and individual attributes into recruitment success. This research contributes to maritime human resource management theory by demonstrating a dual-pathway model and provides practical implications for enhancing crew selection processes through competency development programs.

Keywords: *Successful Crew Recruitment, Competency, Training, Education, Personal Characteristics, Maritime Human Resource Management, SEM-PLS.*

Introduction

The maritime industry represents a vital component of Indonesia's economic infrastructure, contributing significantly to international trade and national development. As an archipelagic nation with over 17,000 islands, Indonesia relies heavily on maritime transportation and ranks among the top five countries globally in seafarer supply. Despite this significant position, Indonesian shipping companies face persistent challenges in recruiting qualified crew members who meet international standards and operational requirements [1]. The success of crew recruitment has become increasingly critical as global maritime regulations become more stringent, technological advances require higher skill levels, and competition for qualified personnel intensifies [2].

Recent industry developments indicate that Indonesian shipping companies experience varying recruitment success rates across different vessel types and operational contexts. The COVID-19 pandemic has exacerbated crew recruitment challenges, with travel restrictions and crew change difficulties creating additional complexity [3]. Understanding the determinants of successful crew recruitment has therefore become a strategic priority for shipping companies seeking to maintain operational continuity and competitive advantage. The existing literature on maritime human resource

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management has identified several factors that potentially influence recruitment success, including training programs, educational qualifications, and personal characteristics of candidates [4][5]. However, previous research has largely examined these factors in isolation, without adequately considering how they interact or through what mechanisms they influence recruitment outcomes.

A critical gap in current literature is the limited understanding of competency as a mediating mechanism connecting these input factors to recruitment success. Competency, defined as the combination of knowledge, skills, abilities, and behaviors required for effective job performance, may serve as the crucial link between human capital investments and recruitment outcomes [6][7]. While some studies have examined competency in maritime contexts, few have investigated its mediating role in the recruitment process, particularly within the Indonesian shipping industry context. This study addresses this gap by examining how training, education, and personal characteristics influence successful crew recruitment both directly and indirectly through competency development. The research objectives are threefold: first, to analyze the direct effects of training, education, and personal characteristics on both competency and successful crew recruitment; second, to examine the direct effect of competency on successful crew recruitment; and third, to investigate the mediating role of competency in these relationships.

The novelty of this research lies in its integrated approach to examining recruitment determinants through a competency-mediated framework, specifically tailored to the Indonesian maritime context. The findings are expected to contribute to both theoretical understanding and practical application in maritime human resource management, particularly in developing country contexts where institutional and cultural factors may differ significantly from developed maritime nations.

Literature Review

Successful Crew Recruitment

Successful crew recruitment refers to the effectiveness of the process by which shipping companies identify, attract, select, and hire qualified seafarers who can perform their duties competently and remain with the organization for reasonable tenure periods [8]. In the maritime context, recruitment success is measured not only by filling vacant positions but also by ensuring that selected crew members meet international standards, possess necessary competencies, and contribute to organizational objectives. The maritime industry's unique characteristics make crew recruitment particularly challenging, involving extended periods away from home, isolated work environments, multicultural crew compositions, and demanding physical and psychological conditions [9].

Recent research has identified various factors influencing maritime recruitment outcomes. Caesar (2023) demonstrated that recruitment effectiveness depends on addressing skill shortages through a skill-resilience framework that aligns recruitment with adaptive training and retention measures [4]. Li and Zhang (2020) found that recruitment success is significantly affected by supply gaps and skill shortfalls, particularly in English communication and practical skills [1]. Setiawan et al. (2021) highlighted that stakeholders prioritize technical knowledge, English and IT skills, plus soft skills such as managerial ability and adaptability, implying recruitment should screen these competencies [5]. Despite extensive research, gaps remain in understanding the determinants of recruitment success, particularly regarding how various input factors translate into recruitment outcomes through mediating mechanisms.

Competency

Competency encompasses knowledge, skills, abilities, and behavioral attributes that enable successful task execution [10]. In the maritime context, competency refers to the demonstrated ability of seafarers to perform specific functions aboard ships in accordance with international standards, company requirements, and safety regulations [11]. The International Maritime Organization (IMO) through the STCW Convention establishes minimum competency standards for various seafaring positions, emphasizing that competency must be demonstrable, assessable, and maintained through continuous professional development.

Recent research on maritime competency has demonstrated its critical importance for safety, operational efficiency, and organizational performance. Askari (2023) used Delphi and Best-Worst Method to identify top hard and soft skills, finding technical knowledge and communication ranked highest, supporting targeted competency assessment and training priorities [7]. Ahmmed et al. (2020) identified specific maritime English skill needs for employability and safe onboard communication,

informing language assessment components of competency frameworks [12]. Bouzón et al. (2023) emphasized communicative and teamwork skills as critical for crewmember effectiveness, suggesting inclusion of non-technical assessments in selection and development processes [13]. Suprapti (2024) reported that competency-based training significantly improves cadet readiness ($R^2 = 0.58$), supporting competency-based assessment and curricula [14]. The development of competency occurs through multiple pathways including formal education, practical training, onboard experience, and continuous professional development [15].

Training, Education, and Personal Characteristics

Training refers to systematic programs designed to enhance individuals' knowledge, skills, and abilities relevant to specific job functions [16]. In maritime contexts, training encompasses pre-sea education at maritime academies, onboard familiarization programs, specialized courses, safety training, and continuous professional development activities. Recent studies demonstrate training's positive effects on competency development and job performance. Malau et al. (2020) found positive and significant effects of recruitment and on-the-job training on crew performance [2]. Kusumawati (2023) linked seafarer skills training cooperation to improved maritime safety, recommending targeted training to reduce human-error accidents [17]. Yildirim et al. (2022) identified 38 quality criteria for maritime education and training, providing assessment criteria for institutional training quality [18].

Education provides foundational knowledge and cognitive capabilities that underpin competency development. Maritime education programs develop analytical thinking, problem-solving abilities, and theoretical understanding [19]. Boonadir et al. (2020) emphasized quality academic programming and exposure to sustain a competent maritime workforce [20]. Campos Toresano et al. (2022) proposed MET framework updates for autonomous shipping, stressing new technical and communication competencies [21]. Personal characteristics include personality traits, behavioral tendencies, and psychological attributes that influence work performance [22]. Recent research emphasizes that favorable personal characteristics enhance motivation for learning, persistence in skill development, and ability to apply competencies in challenging situations [23].

2.4 Research Framework and Hypotheses

Based on the literature review, this study proposes an integrated framework examining the determinants of successful crew recruitment. The framework positions competency as a central mediating variable connecting human capital investments (training and education) and individual attributes (personal characteristics) to recruitment success outcomes. The conceptual model reflects a dual-pathway structure in which training, education, and personal characteristics influence recruitment success both directly and indirectly through competency development.

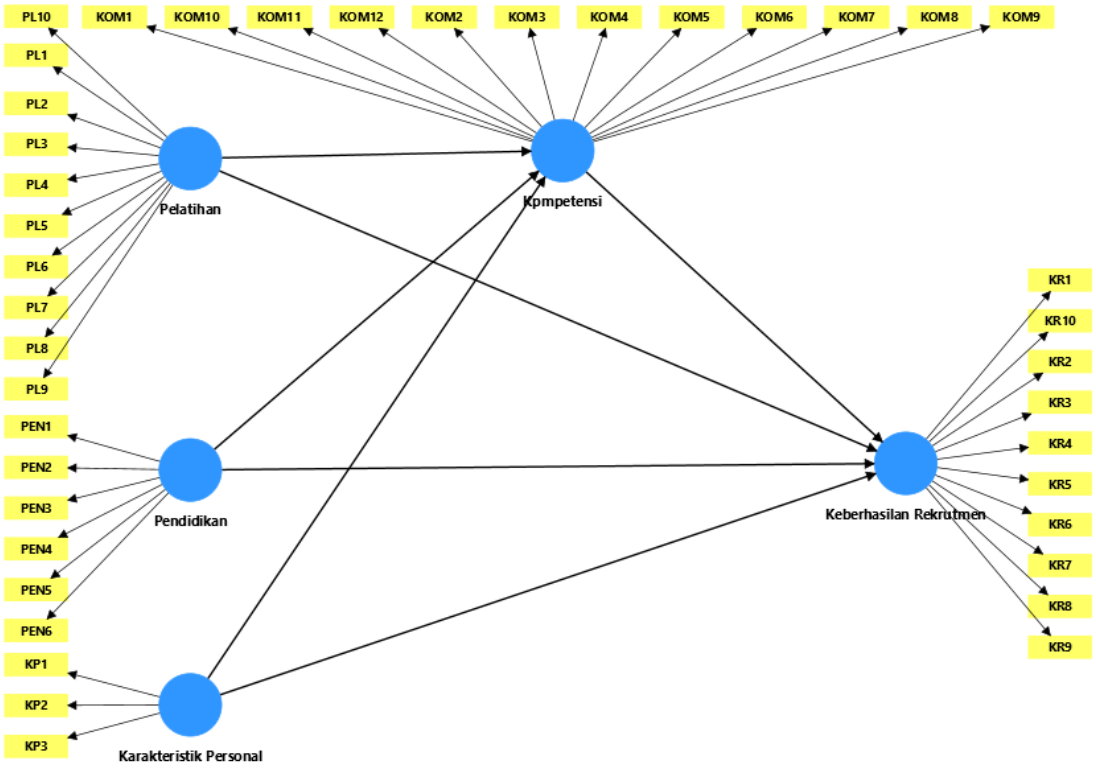

Figure 1. Research Framework

The research framework depicts: three independent variables (Training, Education, Personal Characteristics); one mediating variable (Competency); one dependent variable (Successful Crew Recruitment); with direct paths from independent variables to both competency and recruitment success, plus indirect paths through competency mediation.

Research Hypotheses:

Direct Effects on Competency: - H1: Training has a positive and significant effect on competency - H2: Education has a positive and significant effect on competency - H3: Personal characteristics have a positive and significant effect on competency

Direct Effects on Successful Crew Recruitment: - H4: Training has a positive and significant effect on successful crew recruitment - H5: Education has a positive and significant effect on successful crew recruitment - H6: Personal characteristics have a positive and significant effect on successful crew recruitment - H7: Competency has a positive and significant effect on successful crew recruitment

Mediation Effects: - H8: Competency mediates the effect of training on successful crew recruitment - H9: Competency mediates the effect of education on successful crew recruitment - H10: Competency mediates the effect of personal characteristics on successful crew recruitment

Research Methods

Research Design and Sample

This study employed a quantitative research approach with an explanatory design using Structural Equation Modeling-Partial Least Squares (SEM-PLS) to test hypotheses about causal relationships among variables. The research population consisted of 165 HR division employees (staff, supervisors, and managers) working in Indonesian shipping companies who are directly involved in crew recruitment processes. The sample size was determined using the Hair et al. (2017) formula for SEM-PLS analysis, which recommends a minimum sample size of 10 times the largest number of structural paths directed at any construct. The sampling technique employed was proportional random sampling, ensuring representation across different company sizes, vessel types, and geographic locations.

Data Collection and Measurement

Primary data were collected through structured questionnaires using a 5-point Likert scale. The questionnaire measured five constructs: Training (10 items measuring training quality, relevance, effectiveness, and accessibility), Education (8 items assessing educational qualifications and quality), Personal Characteristics (12 items evaluating personality traits and behavioral tendencies), Competency (15 items measuring technical, operational, cognitive, and social competence), and Successful Crew Recruitment (10 items assessing recruitment effectiveness and outcomes). Focus Group Discussions (FGDs) were conducted with maritime HR practitioners prior to data collection to validate questionnaire items and ensure measurement instruments captured relevant aspects of crew recruitment in Indonesian shipping companies.

Data Analysis Technique

Data analysis was conducted using SmartPLS 4.0 software. SEM-PLS was selected for its suitability for complex models with multiple variables, ability to test measurement and structural models simultaneously, and appropriateness for relatively small to medium sample sizes without strict multivariate normality assumptions. The analysis procedure included: (1) descriptive statistics; (2) outer model evaluation (convergent validity, discriminant validity, reliability); (3) inner model evaluation (R^2, Q^2, f^2); (4) hypothesis testing using bootstrapping with 5,000 subsamples; and (5) mediation analysis examining indirect effects through bootstrapping confidence intervals and Variance Accounted For (VAF) calculations.

Results and Discussion

Respondent Characteristics

The study collected valid responses from 165 HR division employees, achieving 100% response rate. Respondents comprised HR Staff (41.2%), Supervisors (33.3%), and Managers (25.5%). Work experience distribution showed most respondents (60.6%) have 6-15 years of experience, indicating substantial expertise. Educational qualifications included bachelor's degrees (71.5%) and master's degrees (28.5%). Company size representation spanned small (23%), medium (45.5%), and large organizations (31.5%). Vessel type focus showed diversity across cargo ships (43.6%), tankers (29.1%), passenger vessels (15.2%), and multiple types (12.1%), ensuring findings reflect recruitment practices across different maritime sectors.

Outer Model Evaluation

Convergent Validity: All factor loadings exceeded 0.70, ranging from 0.809 to 0.873, and Average Variance Extracted (AVE) values exceeded 0.50, ranging from 0.671 to 0.738, confirming adequate convergent validity. **Discriminant Validity:** The Fornell-Larcker criterion was satisfied, with the square root of AVE for each construct exceeding its correlations with other constructs. HTMT values ranged from 0.681 to 0.812, all below 0.85, confirming discriminant validity. **Reliability:** Cronbach's Alpha values ranged from 0.934 to 0.968 and Composite Reliability values ranged from 0.944 to 0.972, substantially exceeding the 0.70 threshold and indicating excellent internal consistency.

Table 1. Summary of Outer Model Evaluation

Variable	AVE	Cronbach's Alpha	Composite Reliability	Interpretation
Training	0.689	0.942	0.950	Excellent
Education	0.723	0.934	0.944	Excellent
Personal Characteristics	0.671	0.948	0.955	Excellent
Competency	0.702	0.968	0.972	Excellent
Successful Recruitment	0.738	0.961	0.966	Excellent

Inner Model Evaluation

R-Squared: The R^2 value for Competency (0.684) indicates that Training, Education, and Personal Characteristics collectively explain 68.4% of variance, representing moderate to substantial explanatory power. The R^2 value for Successful Crew Recruitment (0.726) shows that the predictors explain 72.6% of variance, indicating substantial predictive power. **Predictive Relevance (Q^2):** Q^2 values were 0.479 for Competency (medium predictive relevance) and 0.533 for Recruitment Success (large predictive relevance), confirming the model's capacity to predict these constructs in other samples. **Effect Size (f^2):** Training, Education, and Personal Characteristics showed medium effects on Competency (f^2 =

0.158, 0.172, 0.145 respectively). For Recruitment Success, direct effects were small to medium (f^2 = 0.087, 0.095, 0.078), while Competency exhibited the strongest effect (f^2 = 0.243, medium to large).

Table 2. Inner Model Evaluation Results

Metric	Competency	Recruitment Success	Interpretation
R^2	0.684	0.726	Substantial
R^2 Adjusted	0.678	0.719	Substantial
Q^2	0.479	0.533	Medium to Large

Hypothesis Testing

All seven direct effect hypotheses were supported with t-statistics exceeding 1.96 and p-values below 0.05. Training → Competency (β = 0.286, t = 4.931, p <0.001), Education → Competency (β = 0.312, t = 5.115, p <0.001), and Personal Characteristics → Competency (β = 0.268, t = 4.873, p <0.001) confirmed that all three independent variables significantly enhance competency. Training → Recruitment Success (β = 0.184, t = 3.538, p <0.001), Education → Recruitment Success (β = 0.197, t = 3.648, p <0.001), and Personal Characteristics → Recruitment Success (β = 0.165, t = 3.235, p = 0.001) demonstrated direct influences on recruitment outcomes. Competency → Recruitment Success (β = 0.387, t = 6.143, p <0.001) revealed the strongest direct effect, emphasizing competency's central role.

Table 3. Hypothesis Testing Results - Direct Effects

Hypothesis	Path	β	T-Statistics	P-Value	Decision
H1	Training → Competency	0.286	4.931	0.000	Supported
H2	Education → Competency	0.312	5.115	0.000	Supported
H3	Personal Char. → Competency	0.268	4.873	0.000	Supported
H4	Training → Recruitment	0.184	3.538	0.000	Supported
H5	Education → Recruitment	0.197	3.648	0.000	Supported
H6	Personal Char. → Recruitment	0.165	3.235	0.001	Supported
H7	Competency → Recruitment	0.387	6.143	0.000	Supported

Mediation Analysis

All three mediation hypotheses were supported. The indirect effects were statistically significant (p <0.001) with 95% confidence intervals not containing zero. Training → Competency → Recruitment Success (indirect effect = 0.111, t = 3.964, p <0.001, VAF = 37.6%), Education → Competency → Recruitment Success (indirect effect = 0.121, t = 4.033, p <0.001, VAF = 38.1%), and Personal Characteristics → Competency → Recruitment Success (indirect effect = 0.104, t = 3.852, p <0.001, VAF = 38.7%) all demonstrated partial mediation. The VAF values ranging from 37.6% to 38.7% fall within the 20%-80% range characterizing partial mediation, confirming that competency serves as an important but not exclusive mechanism through which the independent variables influence recruitment success.

Table 4. Mediation Analysis Results

Hypothesis	Indirect Path	Indirect Effect	T-Statistics	P-Value	VAF	Decision
H8	Training → Comp. → Recruitment	0.111	3.964	0.000	37.6%	Supported
H9	Education → Comp. → Recruitment	0.121	4.033	0.000	38.1%	Supported
H10	Personal Char. → Comp. → Recruitment	0.104	3.852	0.000	38.7%	Supported

Table 5. Total Effects on Recruitment Success

Path	Direct Effect	Indirect Effect	Total Effect	% Mediated
Training → Recruitment	0.184	0.111	0.295	37.6%
Education → Recruitment	0.197	0.121	0.318	38.1%
Personal Char. → Recruitment	0.165	0.104	0.269	38.7%
Competency → Recruitment	0.387	-	0.387	-

Discussion

The research findings provide comprehensive insights into the determinants of successful crew recruitment in Indonesian shipping companies, revealing a dual-pathway model in which training, education, and personal characteristics influence recruitment success both directly and indirectly through competency mediation. This finding aligns with recent maritime research emphasizing integrated approaches to human resource management [24][25].

Training and Recruitment Success: The significant positive effect of training on both competency (β = 0.286) and recruitment success (β = 0.184) confirms training's importance in maritime human resource management. This aligns with Malau et al. (2020) who found positive effects of training on crew performance [2], and supports Caesar's (2023) skill-resilience framework emphasizing training as central to addressing workforce shortages [4]. The partial mediation (VAF = 37.6%) indicates that training influences recruitment through dual mechanisms: direct signaling effects and indirect competency development. This finding has practical implications for shipping companies to invest in high-quality training programs that genuinely develop competencies rather than merely providing credentials, consistent with recommendations by Kusumawati (2023) for targeted skills training [17].

Education and Recruitment Success: Education demonstrates the strongest total effect on recruitment success (β = 0.318), with significant direct (β = 0.197) and indirect (β = 0.121) pathways. The strong effect on competency (β = 0.312) indicates that formal maritime education provides crucial foundations for competency development. This supports Boonadir et al. (2020) emphasizing quality academic programming to sustain competent maritime workforces [20], and aligns with Setiawan et al. (2021) findings that stakeholders prioritize technical knowledge and soft skills developed through education [5]. The partial mediation pattern suggests that education influences recruitment through both credential signaling and actual competency development, highlighting the importance of maritime education quality and curriculum relevance emphasized by Campos Toresano et al. (2022) for autonomous shipping era [21].

Personal Characteristics and Recruitment Success: Personal characteristics significantly influence both competency (β = 0.268) and recruitment success (β = 0.165), with partial mediation through competency (VAF = 38.7%). This finding supports recent research emphasizing communicative and teamwork skills as critical for crewmember effectiveness [13], and aligns with Askari's (2023) identification of communication as a top-ranked skill [7]. The mediation pattern indicates that personal characteristics facilitate competency development through enhanced learning motivation and skill acquisition, while also directly affecting recruitment through impression formation. This has practical implications for incorporating personal characteristic assessment into recruitment processes, consistent with Bayotas's (2024) call for broader selection criteria beyond technical competence [6].

Competency and Recruitment Success: Competency demonstrates the strongest direct effect on recruitment success (β = 0.387), confirming its central role in maritime recruitment outcomes. This finding strongly supports competency-based approaches advocated in recent maritime literature [11][14], and aligns with the STCW Convention's emphasis on demonstrable competence. The mediation analysis reveals that competency serves as a critical linking mechanism transforming human capital investments and individual attributes into recruitment success, consistent with Sudewo et al. (2025) integrated model aligning assessment, talent management, and competency development [24]. The findings support Ajayi and Udeh's (2024) emphasis on continuous learning and competency development for improving recruitment and retention [25].

Dual-Pathway Model and Theoretical Contributions: The research demonstrates a dual-pathway model with consistent partial mediation (VAF approximately 38%), suggesting a stable structural relationship in which roughly two-fifths of each factor's influence operates through competency development while three-fifths operates directly. This model integrates Human Capital Theory, Resource-Based View, Social Cognitive Theory, and Person-Environment Fit theory, providing a comprehensive framework for understanding maritime recruitment success. The findings extend recent maritime research by demonstrating specific mechanisms through which recruitment determinants operate [26][27], addressing calls for more integrated approaches to maritime education and training [28][29].

Contextual Considerations: The Indonesian maritime context provides important background for interpreting these findings. As a major seafarer-supplying nation facing challenges in meeting international standards, Indonesia can enhance recruitment success through investments in training and education quality, implementation of competency-based recruitment processes, and consideration

of personal characteristics in candidate selection. The findings align with recent discussions on maritime education reform for intelligent ship development [16] and the need for MET adaptation to Industry 4.0 requirements [22]. Cultural factors emphasizing collectivist values and teamwork orientation may influence the relative importance of personal characteristics in Indonesian contexts, suggesting that recruitment frameworks should consider cultural dimensions alongside technical competencies [30].

Conclusion

Summary of Findings

This study examined the determinants of successful crew recruitment in Indonesian shipping companies through SEM-PLS analysis of data from 165 HR professionals. The research confirmed that training, education, and personal characteristics each have significant positive direct effects on both competency and successful crew recruitment. Education demonstrated the strongest influence on competency ($\beta = 0.312$), while competency showed the strongest direct effect on recruitment success ($\beta = 0.387$). The mediation analysis revealed consistent partial mediation patterns, with approximately 38% of each independent variable's total effect operating through competency (VAF ranging from 37.6% to 38.7%). The model demonstrated strong explanatory power ($R^2 = 0.684$ for competency, $R^2 = 0.726$ for recruitment success) and predictive relevance ($Q^2 = 0.479$ and 0.533 respectively).

Theoretical Contributions

This research makes several significant theoretical contributions. First, it provides empirical evidence for a dual-pathway model of recruitment determinants, demonstrating that training, education, and personal characteristics influence recruitment success both directly through signaling mechanisms and indirectly through competency development. Second, the study establishes competency as a critical mediating mechanism connecting human capital investments and individual attributes to recruitment outcomes, extending competency theory by demonstrating its role as both an outcome and a mediating variable. Third, the research integrates multiple theoretical perspectives into a coherent framework, contributing to comprehensive theory development in maritime HRM. Fourth, the findings provide empirical support for competency-based approaches to maritime recruitment, aligning with STCW Convention emphasis while also showing that credential-based approaches retain validity through direct effects. Fifth, the research provides the first empirical evidence of recruitment determinants in Indonesian shipping companies, contributing to understanding of maritime HRM in developing country contexts.

Practical Implications

For Shipping Companies: Companies should invest in high-quality training programs that genuinely develop competencies rather than merely providing credentials. Training effectiveness can be enhanced through practical components, simulator-based learning, and realistic scenarios. Companies should implement competency-based recruitment approaches that directly assess candidates' demonstrated capabilities using practical assessments, simulator evaluations, structured behavioral interviews, and work sample tests. Recruitment processes should incorporate personal characteristic assessment using validated tools while considering multiple factors including training background, educational qualifications, personal characteristics, and demonstrated competencies.

For Maritime Education Institutions: Maritime academies should design curricula that balance theoretical foundations with practical competency development, incorporating industry partnerships, cadetship programs, and competency-based assessment approaches. Education programs should address emerging skill requirements including digital skills, automation competencies, and sustainability-oriented attributes, as emphasized in recent maritime education research [3][16][21][28].

For HR Strategy: The findings demonstrate that recruitment success depends on systematic attention to training, education, personal characteristics, and competency development. HR strategies should integrate these elements into coherent approaches supporting both immediate recruitment needs and long-term workforce development. Companies should develop competency frameworks aligned with STCW standards and organizational requirements, providing clear standards for assessment and development. The research supports recent calls for integrated approaches to maritime human resource quality enhancement [24][25].

Limitations

Several limitations should be acknowledged. First, the cross-sectional design limits causal inference; longitudinal research would provide stronger evidence by tracking candidates through recruitment and subsequent performance. Second, the study relied on HR professionals' perceptions rather than objective recruitment outcome measures; future research could incorporate objective indicators such as success rates, assessment scores, and retention statistics. Third, the research focused on Indonesian shipping companies, limiting generalizability to other maritime contexts; comparative research across countries would illuminate contextual factors. Fourth, the study examined aggregate constructs without differentiating specific types of training, education, or personal characteristics; more granular analysis would provide additional insights. Fifth, potential moderating variables such as work experience, organizational culture, and vessel type were not examined; investigation of moderating effects would enhance understanding of boundary conditions.

Future Research Directions

Future research should conduct longitudinal studies tracking candidates from recruitment through job performance, incorporate objective outcome measures, conduct cross-cultural comparative research, investigate specific competency dimensions and training types, examine moderating variables, conduct qualitative studies exploring recruitment decision-making processes, design intervention studies evaluating recruitment improvement initiatives, and investigate technology's role in recruitment including simulation-based assessment and digital competency portfolios. These research directions will further advance knowledge and practice in maritime human resource management, particularly as the industry continues evolving with technological advances, regulatory changes, and workforce challenges [29][30].

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