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Human Resource Development for Sustainability Competency Among Indonesian Cadets: A Cross-Stakeholder Workforce Readiness Analysis

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ABSTRACT

Purpose – This study aims to examine sustainability competency development among Indonesian Nautika cadets as a human resource development investment problem, testing whether curriculum-hour allocation, treated as a training-investment decision, explains observed competency gaps and the retraining costs industry subsequently absorbs.
Design/methodology/approach – A sequential mixed-methods design surveyed 180 cadets across three sustainability competency domains, modelled the pathway linking multiliteracy instruction to vocational competency through structural equation modelling, and triangulated results against thematic analysis of three stakeholder groups, industry experts, senior lecturers, and post-placement near-graduates, supplemented by a six-week training intervention evaluated against a matched comparison group.
Findings – ESG Leadership competency scored lowest of all domains, 2.18 out of 5.00, against zero allocated training hours, while 86.7 percent of industry stakeholders reported retraining every recent graduate within six months of hire. Stewardship orientation was found to mediate the pathway from multiliteracy instruction to vocational competency, and the training intervention produced the largest effect size of any domain tested.
Originality/value – This study is among the first to treat curriculum-hour allocation explicitly as a human resource development investment decision in maritime vocational education, and to triangulate industry, lecturer, and near-graduate accounts of the resulting training gap, reframing curriculum-industry misalignment as a correctable allocation problem rather than a fixed formation cost.

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1. Introduction

When a shipping company's human resources department budgets six months of mandatory retraining for every navigation cadet it hires, it has already made a judgment about the institution that trained that cadet, one that no accreditation certificate captures. This judgment recurs with striking consistency: 86.7 percent of the industry stakeholders in this study confirmed they retrain every recent graduate on sustainability requirements within six months of employment, a pattern that treats a formally certified graduate as, in practice, only partially job-ready. This is not a minor administrative overlap between education and industry; it is a visible transfer of human resource development cost from the institution that trains the workforce to the company that employs it, occurring at a scale, repeated across dozens of companies and thousands of graduates annually, that ought to be treated as a workforce economics problem rather than an incidental training gap (Caesar, 2013; Nguyen et al., 2014).

Human capital theory has long argued that an organization's competitive position depends on the depth and specificity of the human capital it develops, not merely the credentials it certifies (Becker, 1964; Wright & McMahan, 2011). Applied to maritime vocational education, this argument implies that a Nautika programme's curriculum allocation decisions are, functionally, human resource development investment decisions: every hour assigned to one competency domain is an hour not assigned to another, and the resulting competency profile of a graduating cohort is the institution's revealed investment strategy, whether or not it has been articulated as such. Indonesia's Green Shipping Certification Framework under PM.47/2024 and the tightening requirements of international sustainability disclosure regimes have shifted what counts as job-ready competency for a navigation officer, adding Environmental, Social, and Governance (ESG) literacy to a competency profile that certification syllabi built around Standards of Training, Certification and Watchkeeping for Seafarers (STCW) content have not yet incorporated (International Maritime Organization, 2011). Competency itself, in the behavioral sense Boyatzis (1982) established and Freeman (1984) situated within a broader stakeholder framework of organizational obligation, is not reducible to certificate possession; it is an underlying capacity that must be deliberately built, a distinction the STCW-anchored certification model risks obscuring when a domain as newly emergent as ESG literacy has not yet been written into its syllabus. The consequence, this study finds, is that the training-investment decision embedded in current curriculum allocation has not caught up with the competency the labor market now prices.

The seafarer human resource literature has documented adjacent versions of this misalignment for over a decade, generally under the heading of recruitment and retention rather than training investment specifically. Caesar et al. (2015a, 2015b) and Nguyen et al. (2014) established that shipping companies' human resource practices, admission policy alignment, succession planning, and onboarding structure, systematically underprepare for the pace at which the maritime labor market's competency expectations shift, while Bhattacharya (2015) and Thai et al. (2013) showed that retention itself depends heavily on whether officers perceive their initial training as having equipped them for the job they were actually asked to do. Indonesian vocational education research more broadly confirms that green-skills competency gaps of this kind trace to instructional design choices made well upstream of any individual cadet's aptitude (Mutohhari et al., 2025), while a closely related Indonesian study of competency-based crewing practice found that certification attainment and genuine operational competency already diverge in this labor market even before sustainability content enters the picture (Barasa et al., 2026). What this literature has not yet

examined is the specific mechanism connecting an institution's internal curriculum-hour allocation, a human resource development decision made years before a cadet ever meets an employer, to the retraining cost that employer subsequently absorbs, nor has it tested whether a psychological or motivational variable, rather than technical knowledge alone, mediates whether training investment converts into usable competency once a graduate reaches the workplace.

This is the gap this study addresses. Three questions follow directly. First, how does sustainability competency compare across domains when curriculum-hour investment is treated as the independent variable, and does the resulting profile match what industry stakeholders report needing? Second, what psychological mechanism explains why some training investment converts into workplace-ready competency while other investment does not, tested here through a structural pathway linking multiliteracy instruction, environmental consciousness, and vocational competency? Third, when three stakeholder groups, industry experts, senior lecturers, and post-placement near-graduates, are compared directly, do their accounts converge on the same human resource development gap, or do they reveal different, potentially competing, diagnoses of where the investment shortfall lies?

Answering these questions matters for three audiences simultaneously. For maritime education institutions, the findings offer a specific, resource-neutral reallocation logic rather than a generic call for curriculum reform. For shipping companies, the findings quantify a retraining cost currently treated as an unavoidable onboarding overhead, when the evidence here suggests it is a substitutable cost that upstream training investment could reduce. For human resource development scholarship more broadly, the study extends human capital and strategic human resource management theory (Barney, 1991; Gerhart & Feng, 2021; Ployhart & Moliterno, 2011) into a vocational education setting where the "firm" making the human capital investment and the "firm" that eventually captures its return are formally separate organizations, a structural feature the mainstream strategic human resource management literature, built primarily on single-employer settings, has not directly theorized. The remainder of this paper reviews the theoretical grounding for treating curriculum allocation as human resource development investment, details the mixed-methods design used to test the three research questions above, reports the quantitative and cross-stakeholder qualitative findings, and discusses their implications for how Indonesian maritime institutions should sequence future training-investment decisions.

2. Literature Review & Hypothesis Development

Human capital theory holds that an organization's productive capacity depends on cumulative investment in the skills, knowledge, and behavioral capacities of its people, with training and professional development functioning as direct contributors to performance rather than as peripheral support functions (Becker, 1964). The resource-based view of the firm extends this logic into a competitive framework, arguing that human capital becomes a source of sustained advantage precisely when it is valuable, difficult to imitate, and unevenly distributed across competing organizations (Barney, 1991; Gerhart & Feng, 2021). Strategic human resource management research has since converged on the resource-based view as its dominant theoretical anchor, treating deliberate investment in a specific human capital pool, staffing selectivity, training depth, and skill alignment with strategic intent, as the mechanism through which firms convert workforce potential into measurable performance (Wright & McMahan, 1992, 2011). A meta-analytic synthesis of this literature confirms that human capital

investment predicts firm performance most strongly when the capital in question is firm- or sector-specific rather than generic (Crook et al., 2011; Ployhart & Moliterno, 2011).

Competency theory supplies the second conceptual anchor this study requires, since human capital investment is only as valuable as the specific competencies it produces. Boyatzis (1982) defined competency as an underlying, behaviorally observable characteristic that predicts effective performance, a definition that has since underpinned most competency-based human resource frameworks, including the STCW competency architecture that governs maritime officer certification internationally (International Maritime Organization, 2011). Applied to sustainability specifically, the ecolinguistic and multiliteracy literatures argue that competency in this domain is not reducible to factual knowledge acquisition; Stibbe (2015) demonstrates that the language used in training materials actively constructs a professional's environmental identity, while the New London Group (1996) and Cope and Kalantzis (2009) establish that durable competency formation depends on cross-modal engagement with authentic materials rather than single-mode instruction. Recent Indonesian vocational education research applies this logic directly to green-skills formation, finding that competency gaps in this domain trace to instructional design choices rather than to any deficiency in student aptitude (Mutohhari et al., 2025).

The maritime human resource literature converges on a related but distinct diagnosis, concentrating on recruitment and retention rather than training-investment allocation specifically. Caesar (2013) and Caesar et al. (2015a) argue that shipping companies' succession-planning failures originate upstream of the hiring decision, in admission and training policies that do not anticipate the competency profile the industry will eventually require, while Nguyen et al. (2014) and Bhattacharya (2015) find empirically that perceived training adequacy predicts both officer engagement and eventual retention. Thai et al. (2013) extend this to the structural level, showing that seafarer shortages in specific competency categories persist even where general labor supply is adequate, implying a targeting problem in training investment rather than a volume problem. A closely related Indonesian study of competency-based crewing found that certification-driven deployment logic dominates manning decisions even where deeper competency verification infrastructure is absent, a pattern consistent with the possibility that formal certification and workplace-ready competency diverge systematically in this labor market (Barasa et al., 2026).

What remains absent from this literature is a direct test connecting an institution's internal training-hour allocation to the specific retraining cost industry subsequently absorbs, and a test of what psychological mechanism, beyond knowledge transfer alone, converts training investment into competency that survives the transition from classroom to workplace. Organizational commitment theory (Meyer & Allen, 1991) and psychological contract theory (Rousseau, 1995) both suggest that this conversion depends on an internalized professional identity rather than technical knowledge alone, a proposition this study operationalizes through the stewardship-orientation construct in its structural model. Freeman's (1984) stakeholder framework supplies the final conceptual anchor, justifying this study's decision to compare industry, lecturer, and near-graduate accounts directly rather than relying on any single stakeholder's diagnosis of where the training-investment gap lies. Positioned against this literature, the present study's contribution is to treat curriculum-hour allocation explicitly as a human resource development investment decision, to test the psychological mechanism converting that investment into workplace competency, and to triangulate the resulting

diagnosis across the three stakeholder groups whose interests the investment decision is meant to serve.

3. Methodology

This study drew on data collected from 180 Level 2 and Level 3 Nautika cadets across three maritime institutions in the Jakarta metropolitan area, selected because each operates under equivalent STCW certification requirements while allocating curriculum hours independently, allowing training-investment variation to be observed without confounding by certification standard. This population was supplemented by three purposively selected stakeholder groups directly relevant to the human resource development pipeline under investigation: 15 industry human resource and operations representatives, treated here as the employer perspective on workplace-readiness; 12 senior lecturers, treated as the institutional training-design perspective; and 36 cadets who had completed a minimum five-month sea placement, treated as the near-graduate perspective on how training investment held up under actual workplace conditions. This three-group structure follows Freeman's (1984) stakeholder logic, on the basis that a training-investment decision cannot be adequately diagnosed from any single stakeholder's account.

The primary instrument was a 45-item Sustainability Competency Assessment measuring three domains, Technical Green Competency, Green Port Operations, and ESG Leadership, on a five-point proficiency scale, alongside sub-scales for environmental awareness, environmental understanding, and stewardship orientation, the last operationalizing the internalized professional identity construct drawn from organizational commitment theory (Meyer & Allen, 1991). Curriculum document review at each institution supplied the training-investment measure, expressed as contact hours allocated per competency domain. Semi-structured interviews and focus group protocols were used to collect the three stakeholder groups' accounts of workplace readiness, training adequacy, and institutional barriers to reallocation.

Data collection proceeded in three phases: a quantitative competency survey administered across all 180 cadets, followed by qualitative interviews and focus groups with the three stakeholder groups conducted over the subsequent data collection window, followed by a six-week training intervention evaluated against a matched comparison group receiving no intervention content. This staged sequence was chosen deliberately rather than administered concurrently, since the quantitative baseline identified which competency domain warranted the deepest qualitative probing, and the qualitative findings in turn informed the specific instructional design of the intervention tested in the final phase, a design logic suited to a study intended to move from diagnosis to a testable remediation rather than to description alone.

Quantitative analysis used structural equation modelling to test whether stewardship orientation mediates the pathway between multiliteracy instruction and vocational competency, with model fit assessed against conventional threshold criteria for the comparative fit index, root mean square error of approximation, and standardized root mean square residual. Qualitative analysis followed Braun and Clarke's (2006) six-phase thematic procedure, categorizing accounts into themes related to competency development and sustainability, followed by cross-group comparison of the industry, lecturer, and near-graduate accounts to identify convergence and divergence in how each group diagnosed the training-investment shortfall, and narrative synthesis integrating the quantitative and

qualitative strands into a single interpretive account, consistent with sequential mixed-methods design logic (Creswell & Plano Clark, 2017; Creswell & Poth, 2018).

4. Results and Analysis

4.1 Training Investment and Competency Outcomes by Domain

Table 1 reports baseline sustainability competency scores alongside each domain's documented curriculum-hour allocation, treating the latter as the study's human resource development investment measure.

Table 1. Sustainability Competency by Domain Against Documented Training-Hour Investment

Domain	Mean Score (1–5)	SD	Mean Curriculum Hours
Technical Green Competency	2.84	0.87	0.5
Green Port Operations	2.61	0.91	1.4
ESG Leadership	2.18	0.99	0.0
Environmental Awareness (sub-scale)	3.65	—	5.0 (general environmental compliance)
Environmental Understanding (sub-scale)	3.16	—	—
Stewardship Orientation (sub-scale)	2.83	—	—

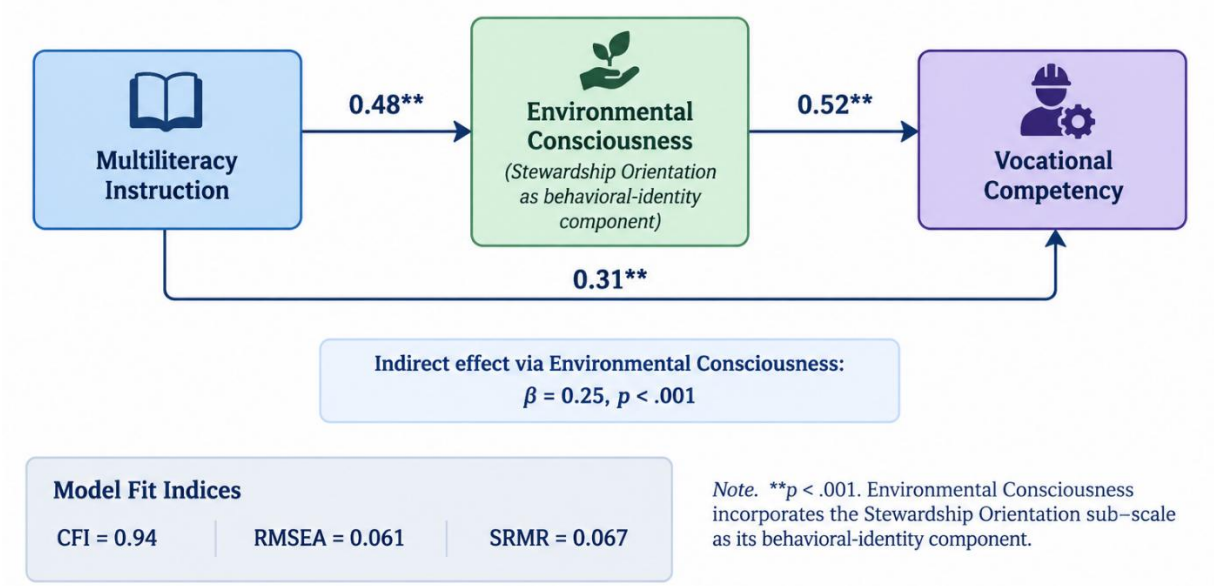
The pattern in Table 1 is directly interpretable as a training-investment allocation problem rather than a diffuse competency shortfall. ESG Leadership recorded the lowest competency score of any domain against a documented investment of zero contact hours across all three institutions, while Environmental Awareness, the domain receiving the largest hour allocation, recorded the highest score. The correlation between investment and outcome is not incidental; it is the direct, mechanical consequence of an institution allocating its training-hour budget toward the oldest, most familiar content and away from the domain the labor market has most recently begun to price. Stewardship orientation, the sub-scale operationalizing internalized professional identity rather than technical knowledge, scored lowest of all sub-scales at 2.83, a finding developed further in Section 4.2.

This allocation pattern held consistently across all three participating institutions despite each governing its curriculum independently, which strengthens the interpretation that the shortfall reflects a shared, sector-wide training-investment default rather than an idiosyncratic weakness at any single institution. Disaggregating Table 1 by institution shows ESG Leadership falling within the Beginner proficiency band at two of the three sites and at the low end of the Developing band at the third, meaning no institution in this sample had, at the time of data collection, allocated training investment sufficient to move the average cadet beyond introductory familiarity with sustainability disclosure content. Combined with the zero-hour allocation figure, this indicates that the competency gap identified here is not a matter of insufficient instructional quality within existing hours, but of the domain receiving no dedicated instructional time at all, a distinction with direct consequence for how a remediation strategy should be designed, favoring reallocation of existing hours over improvement of existing but under-resourced teaching.

4.2 The Mediating Role of Stewardship Orientation

Structural equation modelling tested whether stewardship orientation mediates the pathway from multiliteracy instruction to vocational competency, achieving acceptable model fit (CFI = 0.94; RMSEA = 0.061; SRMR = 0.067). Figure 1 presents the resulting path model.

Figure 1. Mediation Pathway: Multiliteracy Instruction, Stewardship Orientation, and Vocational Competency



The significant indirect effect ($\beta = 0.25$, $p < .001$) confirms that training investment which builds technical knowledge without also building an internalized professional identity does not convert efficiently into usable workplace competency. This finding gives the human resource development diagnosis in Section 4.1 a specific mechanism: it is not only that ESG Leadership receives no training hours, but that the training hours other domains do receive are not, on current instructional design, building the stewardship orientation the mediation model shows to be necessary for that investment to pay off.

4.3 Cross-Stakeholder Comparison

Thematic analysis of the three stakeholder groups produced a pattern of both convergence and instructive divergence, summarized in Table 2.

Table 2. Cross-Stakeholder Thematic Comparison of Training-Investment Adequacy (N = 63)

Theme	Industry Experts (n = 15)	Senior Lecturers (n = 12)	Near-Graduates (n = 36)
ESG Leadership as top training priority	15/15 (100%)	7/12 (58%)	Not directly asked
Retraining required within 6 months of hire	13/15 (86.7%)	—	—
Institutional barriers to reallocating hours	—	12/12 (100%)	—
Documentation-under-pressure as unmet training need	Referenced by 3/15	Referenced by 4/12	26/36 (71.7%)

The three groups converge sharply on ESG Leadership as an under-resourced competency, but diverge in where they locate responsibility for the shortfall, and this divergence is itself a substantive finding rather than mere noise across accounts. All 15 industry experts ranked ESG Leadership as the top training-investment priority and confirmed the 86.7 percent

retraining figure reported in Section 1, treating the shortfall as an institutional training-design failure located upstream of hiring. Three of these fifteen experts specifically described commercial incidents in which a hired graduate's documentation error caused a downstream audit or charterer complication, framing the retraining cost not as routine onboarding overhead but as a recurring, quantifiable risk exposure their companies now budget for as a matter of course.

All 12 senior lecturers agreed the competency was under-taught but attributed the shortfall to institutional barriers, curriculum committee inertia and the absence of lecturer content expertise in ESG disclosure frameworks specifically, rather than to any lack of awareness that the domain mattered. This is an important qualification to the industry account: lecturers did not describe a training-design failure born of indifference, but one born of a curriculum revision process that had not yet been triggered by, or structurally connected to, the industry signal the experts described so clearly. Several lecturers noted that industry input on sustainability content had reached them only informally, through individual conversation rather than a structured consultation channel feeding into curriculum committee decisions, indicating that the training-investment shortfall in this domain is at least partly a governance and communication problem sitting between the two stakeholder groups rather than a deficiency internal to either one alone.

The 36 near-graduates offered a third diagnosis largely absent from the other two groups: 71.7 percent identified the inability to complete environmental documentation while simultaneously managing operational duties as their most significant unmet training need, a dual-task competency that neither the industry retraining figure nor the lecturer barrier account directly captures. Near-graduates consistently described classroom instruction that taught documentation procedure in isolation from the operational pressure under which that documentation must actually be completed at sea, a training-design gap orthogonal to the zero-hour allocation problem identified in Section 4.1, since even a fully resourced ESG Leadership curriculum would not close this gap unless it explicitly incorporated simulated operational pressure into its instructional design. This divergence indicates that a single-stakeholder needs assessment, industry input alone, or lecturer self-assessment alone, would have produced an incomplete human resource development diagnosis; only the cross-group comparison surfaces all three dimensions of the gap, and only a remediation strategy addressing all three, hour allocation, governance communication, and operational-pressure simulation, would be expected to close it fully.

4.4 Training Intervention Outcomes

A six-week training intervention, redesigning existing English Communication instruction around authentic ESG documents rather than adding new content hours, was delivered to 60 cadets and evaluated against a matched comparison group of 60 cadets receiving standard instruction. Table 3 reports outcomes.

Table 3 Pre-Post Competency Change: Intervention Versus Comparison Group (N = 120)

Domain	Intervention Pre	Intervention Post	Effect Size (d)	Comparison Pre	Comparison Post
Technical Green Competency	2.82	3.94	1.91	2.86	2.89
Green Port Operations	2.58	3.76	1.76	2.62	2.64

ESG Leadership	2.16	3.51	2.12	2.20	2.21

ESG Leadership, the domain with the lowest baseline investment identified in Section 4.1, produced the largest effect size of any domain following the intervention (d = 2.12), while the comparison group showed negligible change across all three domains, with a maximum pre-post difference of 0.03 points. This near-zero comparison-group movement rules out maturation and repeated-testing effects as alternative explanations for the intervention group's gain, supporting a causal rather than merely correlational reading of the training-investment effect. The intervention achieved this outcome not by adding contact hours but by redesigning existing English Communication instruction around authentic ESG disclosure documents, CII rating statements, and green port inspection checklists, a design choice directly informed by the mediation finding in Section 4.2: rather than teaching sustainability content as an abstract knowledge domain, the intervention treated cadets as apprentice authors of the genre of document their eventual employer would expect them to produce, a design intended specifically to build the stewardship-orientation identity component the structural model identified as necessary for training investment to convert into workplace-usable competency. This result is the practical counterpart to the mediation finding in Section 4.2 and, taken together with Section 4.3, closes part of the diagnostic gap the cross-stakeholder comparison surfaced. The intervention did not explicitly simulate the dual-task operational pressure that 71.7 percent of near-graduates identified as their primary unmet need, meaning the large effect size reported here should be read as evidence that the investment-allocation and identity-formation components of the training gap are addressable within existing resources, while the operational-pressure component identified independently by near-graduates remains an open target for a subsequent design iteration rather than one this intervention was built to test.

4.5 Discussion

These findings directly answer the three research questions posed in Section 1. The competency-by-investment profile in Section 4.1 confirms that Indonesian Nautika training investment has not kept pace with the competency the labor market now prices, with the starkest mismatch occurring precisely where industry retraining cost is highest. The mediation model in Section 4.2 identifies why some training investment fails to convert into workplace-ready competency: technical content delivered without building an internalized stewardship identity does not survive the transition into unsupervised operational conditions, a finding consistent with organizational commitment theory's general claim that identity, not information alone, sustains behavior under conditions where external monitoring is absent (Meyer & Allen, 1991; Rousseau, 1995). The cross-stakeholder comparison in Section 4.3 answers the third question directly: the three groups do not offer a single unified diagnosis, and a training-investment reform based on industry input alone would miss the dual-task documentation burden that only near-graduates identified.

This pattern extends strategic human resource management theory into a structural condition the mainstream literature has not directly addressed. Human capital and resource-based view research typically assumes that the organization investing in training capacity is the same organization that captures its performance return (Barney, 1991; Gerhart & Feng, 2021; Wright & McMahan, 2011). In vocational maritime education, these functions are institutionally separated: the training institution bears the investment decision while the employing company captures, or fails to capture, its return. The 86.7 percent retraining figure is the empirical signature of this separation, and it suggests that human capital theory's usual assumption of

aligned investor and beneficiary needs explicit qualification when applied to vocational education-to-industry pipelines specifically.

The training intervention's outcome refines the maritime human resource literature's existing recruitment-and-retention framing (Caesar, 2013; Caesar et al., 2015a; Nguyen et al., 2014) by locating a specific, low-cost lever upstream of the hiring decision that literature has emphasized. Where prior research has recommended succession planning and admission-policy reform as responses to workforce shortage, this study's evidence suggests that redesigning existing instruction around authentic, identity-building content can close a specific competency gap within a single term, without new courses or additional hours, complicating any assumption that meaningful human resource development reform in this sector requires major structural investment.

This study's principal strength is its triangulation across three independent stakeholder accounts and two data types, quantitative competency assessment and qualitative thematic comparison, which together surfaced a training-investment gap no single method would have fully characterized; a survey alone would have missed the governance-communication barrier lecturers described, and lecturer or industry interviews alone would have missed the dual-task documentation burden only near-graduates raised. Its main limitation is that all three participating institutions operate within the same regulatory and geographic context, so the specific magnitude of the reported effect sizes should not be generalized to maritime institutions operating under different curriculum governance structures without replication. A further limitation is that the intervention tested here was not designed to address the operational-pressure dimension of the training gap identified independently by near-graduates, meaning the reported effect size, however large, should not be read as evidence that the full three-part diagnosis in Section 4.3 has been closed. Future research should test whether the stewardship-orientation mediation pathway identified here holds across other technical competency domains beyond sustainability, whether a redesigned intervention incorporating simulated operational pressure produces a comparable or larger effect, and whether the retraining-cost signature this study documents can be tracked longitudinally as institutions reallocate training investment in response to these findings.

5. Conclusion

This study examined sustainability competency development among Indonesian Nautika cadets as a human resource development investment problem, comparing training-hour allocation, a psychological mediation mechanism, and three stakeholder groups' accounts of workplace readiness. ESG Leadership emerged as the most under-invested competency domain, industry retraining costs confirmed the practical consequence of that under-investment, and stewardship orientation was identified as the specific mechanism through which training investment converts, or fails to convert, into workplace-ready competency. Cross-stakeholder comparison further revealed that industry, lecturer, and near-graduate accounts each captured a distinct facet of the shortfall. A resource-neutral intervention closed the investment and identity-formation components of this gap within a single term. These findings reframe curriculum-industry misalignment in maritime vocational education as a correctable human resource development allocation decision rather than an unavoidable formation cost.

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