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Green human resource management and green transformational leadership as sustainable employee performance: The mediating effect of organizational agility

Abstract

Increasing sustainability demands encourage energy-intensive industrial companies to integrate environmentally oriented management and leadership practices. This study aims to analyze the effect of Green Human Resource Management and Green Transformational Leadership on Sustainable Employee Performance with Organizational Agility as a mediating variable at PT Semen Indonesia (Persero) Tbk – Tuban Plant. The research employed a causal associative quantitative approach using a survey of 104 unit leaders and Partial Least Square–Structural Equation Modeling (PLS-SEM) analysis. The results indicate that Green Human Resource Management has no significant effect on Sustainable Employee Performance, while Green Transformational Leadership significantly affects Sustainable Employee Performance. Furthermore, both Green Human Resource Management and Green Transformational Leadership significantly influence Organizational Agility. Organizational Agility also affects Sustainable Employee Performance and mediates the relationship between the independent variables and sustainable performance. These findings highlight the importance of organizational adaptive capability in supporting sustainable employee performance within environmentally oriented manufacturing industries.

Keywords: Green human resource management; green transformational leadership; organizational agility; sustainable employee performance.

Abstrak

Meningkatnya tuntutan keberlanjutan mendorong perusahaan industri yang intensif energi untuk mengintegrasikan praktik manajemen dan kepemimpinan yang berorientasi lingkungan. Studi ini bertujuan untuk menganalisis pengaruh Manajemen Sumber Daya Manusia Hijau dan Kepemimpinan Transformasional Hijau terhadap Kinerja Karyawan Berkelanjutan dengan Agilitas Organisasi sebagai variabel mediasi di PT Semen Indonesia (Persero) Tbk – Pabrik Tuban. Penelitian ini menggunakan pendekatan kuantitatif asosiatif kausal dengan menggunakan survei terhadap 104 pemimpin unit dan analisis Partial Least Square–Structural Equation Modeling (PLS-SEM). Hasil penelitian menunjukkan bahwa Manajemen Sumber Daya Manusia Hijau tidak berpengaruh signifikan terhadap Kinerja Karyawan Berkelanjutan, sedangkan Kepemimpinan Transformasional Hijau berpengaruh signifikan terhadap Kinerja Karyawan Berkelanjutan. Lebih lanjut, baik Manajemen Sumber Daya Manusia Hijau maupun Kepemimpinan Transformasional Hijau berpengaruh signifikan terhadap Agilitas Organisasi. Agilitas Organisasi juga berpengaruh terhadap Kinerja Karyawan Berkelanjutan dan memediasi hubungan antara variabel independen dan kinerja berkelanjutan. Temuan ini menyoroti pentingnya kemampuan adaptif organisasi dalam mendukung kinerja karyawan berkelanjutan dalam industri manufaktur yang berorientasi lingkungan.

Kata Kunci: Manajemen sumber daya manusia hijau; kepemimpinan transformasional hijau; agilitas organisasi; kinerja karyawan berkelanjutan.

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1. Introduction

The contemporary global business landscape increasingly emphasizes the integration of sustainability principles across organizational systems, particularly within energy-intensive manufacturing industries (Skoczkowski et al., 2025). International sustainability agendas highlight the urgency of transitioning toward environmentally responsible economic models and achieving long-term net-zero emission targets, which remain especially challenging for developing economies with strong dependence on industrial production (Kumari et al., 2025). Consequently, organizations are reallocating strategic resources toward environmentally oriented capability development, workforce reskilling, and sustainable operational transformation.

Within this global transition, energy-intensive sectors such as cement manufacturing play a dual and paradoxical role. On one hand, these industries are among the largest contributors to carbon emissions; on the other, they are strategically essential for national infrastructure and economic growth (Sharif & Tauqir, 2021). Indonesia therefore faces a structural sustainability dilemma: maintaining industrial competitiveness while simultaneously accelerating environmental responsibility. As a leading national cement producer, PT Semen Indonesia (Persero) Tbk – Tuban Plant demonstrates measurable sustainability commitments through emission-intensity reduction, alternative fuel utilization, post-mining land reclamation, and green-industry certification. These initiatives position the organization as a relevant empirical setting for examining sustainability-oriented management and leadership mechanisms at the operational level (Nguyen, 2025).

Despite strong corporate sustainability policies, the translation of environmental strategy into daily employee behavior depends largely on organizational leadership and human-resource systems (Pellegrini et al., 2018). This highlights the strategic importance of green human resource management (GHRM) and green transformational leadership (GTL) as structural and behavioral drivers of sustainable performance (Weber & Kassab, 2024). GHRM embeds environmental values through recruitment, training, performance management, and reward systems, while GTL shapes employee meaning, motivation, and pro-environmental commitment through vision, inspiration, and role modeling (Alkandi, 2025; Fitanto, 2026).

To strengthen the theoretical positioning, this study integrates three complementary theoretical perspectives. First, Ability–Motivation–Opportunity (AMO) Theory explains how GHRM enhances employee sustainability behavior by developing green competencies, intrinsic motivation, and participative opportunities (Iftikar et al., 2022; Sibian & Ispas, 2021). Second, transformational leadership theory clarifies how environmentally oriented leadership directly influences employee attitudes, engagement, and sustainability-related performance (Alkandi, 2025). Third, dynamic capability theory positions organizational agility (OA) as an adaptive mechanism enabling organizations to reconfigure resources, respond to environmental change, and translate sustainability intentions into measurable performance outcomes (Cui, 2025).

Although prior empirical studies report positive associations between green management, leadership, and sustainability performance, several critical gaps remain. First, a theoretical integration gap persists, as limited research simultaneously combines AMO, transformational leadership, and dynamic capability perspectives within a unified sustainability framework (Waseem et al., 2025). Second, a contextual gap exists because most empirical evidence originates from service, education, or low-emission sectors,

leaving energy-intensive manufacturing underexplored. Third, a mechanism gap concerns the insufficient examination of organizational agility as a dynamic capability mediator that operationalizes green management systems into sustainable employee performance. Addressing these gaps, the present study investigates the influence of green human resource management and green transformational leadership on sustainable employee performance, with organizational agility functioning as a mediating dynamic capability, within the context of PT Semen Indonesia (Persero) Tbk – Tuban Plant.

This research contributes theoretically by integrating multi-theoretical sustainability mechanisms linking HR systems, leadership behavior, and adaptive organizational capability. Empirically, it extends green management literature into the energy-intensive cement manufacturing sector, providing deeper understanding of how sustainability is operationalized at the employee-performance level. Practically, the study offers insights for organizations seeking to strengthen adaptive capability, environmentally oriented leadership, and sustainable workforce performance in support of long-term ecological and economic resilience.

2. Literature review

2.1 Sustainable employee performance

Sustainable Employee Performance (SEP) has emerged as a significant construct within the domain of sustainable human resource management and organizational sustainability scholarship (Kumar & Tarkar, 2025; Obeidat et al., 2025). Unlike traditional performance paradigms, which predominantly emphasize short-term productivity, efficiency, and task completion, SEP is conceptualized as the long-term capacity of employees to maintain high levels of performance while simultaneously preserving psychological well-being, ecological responsibility, and adaptive capability (Ahsan & Khawaja, 2024). This perspective reflects a paradigmatic shift from performance maximization to performance sustainability, recognizing employees as renewable yet vulnerable human capital resources.

Conceptually, SEP is a multidimensional construct encompassing sustained task effectiveness, contextual and citizenship performance, pro-environmental work behaviors, and the preservation of employee well-being over time (Ari et al., 2020; Siddiqui & Salleh, 2024). It integrates economic, social, and environmental dimensions of sustainability at the individual level, thereby aligning employee contributions with the broader triple-bottom-line orientation of contemporary organizations. Sustainable performance, therefore, is not merely the continuity of output, but the capacity to generate consistent value without depleting employees' psychological, physical, and cognitive resources (de Jonge & Peeters, 2019).

Recent literature emphasizes that Sustainable Human Resource Management (S-HRM) practices play a central role in fostering SEP. These practices include long-term oriented recruitment strategies, developmental training programs, fair and sustainability-based performance appraisal systems, health-promoting work designs, and environmentally responsible HR policies (Hernita et al., 2021; Chaudhry, 2025). Through such integrative mechanisms, organizations can simultaneously enhance employee engagement, resilience, and organizational commitment while mitigating burnout and resource depletion. The Job Demands–Resources (JD–R) model provides a

useful theoretical lens to explain this process, suggesting that adequate job resources buffer the adverse effects of job demands and foster sustainable motivation and performance over time (Tremblay & Messervey, 2011). Similarly, Social Exchange Theory explains how supportive and sustainability-oriented HR practices generate reciprocal employee behaviors that reinforce long-term performance stability (Garcia, 2025).

Furthermore, employee well-being is increasingly recognized as a mediating mechanism linking sustainable HRM practices and enduring performance outcomes (Lu et al., 2025). Psychological well-being, emotional stability, and adaptive competence contribute to employees' ability to cope with dynamic organizational environments characterized by technological disruption, environmental uncertainty, and increasing performance expectations (Vaidya et al., 2020; Volderauer et al., 2024). Without safeguarding well-being, short-term performance gains may ultimately lead to exhaustion, disengagement, and declining productivity, thereby undermining organizational sustainability objectives. In addition, Green Human Resource Management (GHRM) extends the conceptualization of SEP by embedding pro-environmental behaviors into routine job performance (Zaman et al., 2025; Al-Sabi et al., 2024). Through green training, environmentally aligned reward systems, and leadership support for sustainability initiatives, employees internalize ecological responsibility as part of their performance role. Consequently, SEP reflects not only sustained productivity but also sustained contribution to environmental stewardship and organizational resilience.

2.2 Green human resource management and sustainable employee performance

From the perspective of Ability–Motivation–Opportunity (AMO) Theory, human resource practices enhance performance by systematically developing employees' competencies, strengthening intrinsic and extrinsic motivation, and providing structured opportunities for meaningful participation. Within sustainability-oriented organizations, Green Human Resource Management (GHRM) operationalizes these AMO mechanisms by embedding environmental criteria into recruitment and selection, integrating sustainability-focused training and development, aligning green performance appraisal systems, and designing reward structures that reinforce pro-environmental behaviors. Through this integrative architecture, GHRM fosters employees' environmental knowledge (ability), cultivates ecological commitment and moral motivation (motivation), and enables participative green initiatives (opportunity), thereby creating the behavioral and psychological conditions necessary for Sustainable Employee Performance (SEP). Recent empirical evidence suggests that GHRM positively predicts sustainable performance outcomes by enhancing employee engagement, resilience, and green creativity, which collectively sustain productivity without depleting employee well-being (Pham et al., 2023; Singh et al., 2024). Moreover, the Job Demands–Resources (JD–R) model explains how green HR practices function as strategic job resources that buffer strain and promote enduring performance capacity (Amrutha & Geetha, 2023). However, the effectiveness of GHRM in producing SEP is often contingent upon contextual enablers such as green transformational leadership and organizational sustainability culture, which strengthen internalization of environmental values and long-term behavioral consistency (Aboramadan et al., 2022; Miah et al., 2024). Therefore,

while the relationship between GHRM and SEP is theoretically grounded in AMO and social exchange mechanisms, its magnitude may vary across organizational contexts. Accordingly, this study proposes:

H1: Green human resource management positively influences sustainable employee performance.

2.3 Green transformational leadership and sustainable employee performance

Transformational Leadership Theory posits that leaders influence followers through idealized influence, inspirational motivation, intellectual stimulation, and individualized consideration, thereby fostering higher levels of commitment, creativity, and performance beyond transactional exchanges (Muzakki et al., 2026). When embedded within an environmental orientation, Green Transformational Leadership (GTL) extends this framework by articulating a compelling sustainability vision, modeling pro-environmental values, stimulating innovative ecological problem-solving, and providing individualized support for environmentally responsible behaviors (Muzakki & Christina, 2021). Through these mechanisms, GTL facilitates the internalization of sustainability goals, strengthens employees' environmental self-efficacy, and enhances their intrinsic motivation to contribute to long-term organizational sustainability. Empirical evidence indicates that GTL positively predicts employee green behavior, environmental commitment, and sustainable performance outcomes by shaping both cognitive and affective engagement with sustainability initiatives (Chen & Chang, 2013; Robertson & Barling, 2017). More recent studies further demonstrate that GTL enhances sustainable employee performance (SEP) by promoting psychological empowerment, green creativity, and adaptive capability, which are critical for maintaining high performance without compromising well-being (Afsar et al., 2022; Mittal & Dhar, 2023; Wang et al., 2024). Unlike structural HR mechanisms that operate through formal systems and incentives, GTL functions at psychological and cultural levels, directly influencing value internalization and normative commitment toward sustainability objectives. Drawing on Social Learning Theory, employees emulate leaders' environmentally responsible behaviors, thereby reinforcing consistent and enduring performance aligned with ecological and organizational goals. Consequently, GTL is theoretically and empirically positioned as a critical antecedent of SEP. Accordingly, this study proposes:

H2: Green transformational leadership positively influences sustainable employee performance.

2.4 Green management practices and organizational agility

Grounded in Dynamic Capability Theory, organizational competitiveness in turbulent and sustainability-driven environments depends on the capacity to sense environmental shifts, seize emerging green opportunities, and reconfigure internal resources accordingly (Teece, 2018). In the context of sustainability transformation, Organizational Agility (OA) reflects this higher-order adaptive capability, enabling firms to respond swiftly to regulatory pressures, stakeholder expectations, technological change, and ecological challenges while maintaining operational continuity and innovation momentum. Organizational agility encompasses strategic responsiveness, process flexibility, learning

orientation, and rapid decision-making, all of which are critical for embedding sustainability into routine organizational activities rather than treating it as an episodic initiative.

Within this framework, Green Human Resource Management (GHRM) and Green Transformational Leadership (GTL) operate as complementary micro-foundations of dynamic capabilities. GHRM enhances structural readiness by developing green competencies, fostering continuous learning, and institutionalizing environmentally aligned performance systems that facilitate resource reconfiguration (Miah et al., 2024; Singh et al., 2024). Simultaneously, GTL strengthens strategic agility by articulating a compelling sustainability vision, encouraging experimentation, and stimulating proactive problem-solving behaviors that accelerate adaptive responses (Mittal & Dhar, 2023; Wang et al., 2024). Empirical research further suggests that sustainability-oriented HR systems and leadership jointly enhance innovation speed, organizational flexibility, and resilience under uncertainty (Amrutha & Geetha, 2023). Therefore, drawing on Dynamic Capability Theory, both GHRM and GTL are theoretically positioned as antecedents of organizational agility. Accordingly, this study proposes:

H3: Green human resource management positively influences organizational agility.

H4: Green transformational leadership positively influences organizational agility.

2.5 Organizational agility and sustainable employee performance

From a dynamic capability outcome perspective, Organizational Agility (OA) represents a higher-order capability that enables firms to continuously align internal processes, human resources, and strategic priorities with rapidly evolving environmental and market demands. Drawing upon Dynamic Capability Theory (Teece, 2018), agile organizations possess superior sensing, seizing, and reconfiguring capacities, allowing them to translate sustainability strategies into adaptive operational routines rather than static policy statements. In sustainability-oriented contexts, agility facilitates rapid learning, cross-functional coordination, and iterative process innovation, which collectively create a supportive environment for sustained employee contribution. When organizational systems are flexible and responsive, employees experience greater role clarity, psychological safety, and access to resources—conditions that enhance engagement, resilience, and long-term performance continuity (Sherehiy & Karwowski, 2014). Moreover, agile organizations are better equipped to balance ecological objectives with productivity demands, thereby preventing resource strain and performance decline associated with rigid structures or excessive job demands. Empirical studies further suggest that agility strengthens adaptive performance, innovative work behavior, and sustained task effectiveness, which are core dimensions of Sustainable Employee Performance (SEP) (Clauss et al., 2021; Zhang & Wu, 2023). By fostering rapid problem-solving and continuous improvement, OA enables employees to maintain high performance levels while adapting to sustainability-related changes in technology, regulation, and stakeholder expectations. Consequently, Organizational Agility functions not merely as a strategic capability but as an enabling context that sustains employee effectiveness over time. Accordingly, this study proposes:

H5: Organizational agility positively influences sustainable employee performance.

2.6 Mediating role of organizational agility

Building upon Dynamic Capability Theory, managerial systems and leadership mechanisms rarely influence performance outcomes in a direct and linear manner; rather, their effects are transmitted through higher-order adaptive capabilities that enable organizations to reconfigure resources and routines in response to environmental change (Teece, 2018). In sustainability-driven contexts, Organizational Agility (OA) represents such a translating mechanism, functioning as an organizational-level capability that converts green strategic intentions into sustained employee-level outcomes. Specifically, Green Human Resource Management (GHRM) develops green competencies, embeds environmental values into HR architectures, and institutionalizes sustainability-oriented routines. However, without agility—manifested in rapid decision-making, flexible work processes, and continuous learning—these structural investments may remain symbolic rather than transformative. Organizational agility enables the effective deployment and recombination of green human capital, thereby facilitating adaptive work systems that support continuous employee contribution and well-being preservation (Clauss et al., 2021; Miah et al., 2024). Similarly, Green Transformational Leadership (GTL) influences employee attitudes and sustainability commitment at the psychological and cultural levels, yet its long-term performance impact depends on whether the organization can strategically sense opportunities, seize green innovations, and reconfigure operational processes accordingly. GTL stimulates strategic responsiveness and experimentation, which enhance organizational agility; in turn, agility provides the contextual support that sustains adaptive performance and ecological–productivity balance over time (Mittal & Dhar, 2023; Wang et al., 2024). Empirical research increasingly supports the mediating role of agility in linking sustainability-oriented leadership and HR systems to innovation speed, resilience, and sustainable performance outcomes (Zhang & Wu, 2023). Therefore, Organizational Agility serves as a dynamic conduit that transforms green managerial inputs into Sustainable Employee Performance (SEP) by aligning structural readiness, leadership vision, and adaptive execution capacity. Accordingly, this study proposes:

H6: Organizational agility mediates the relationship between green human resource management and sustainable employee performance.

H7: Organizational agility mediates the relationship between green transformational leadership and sustainable employee performance.

3. Method

3.1 Research design and context

This study employed a causal associative quantitative research design to empirically examine both the direct and indirect structural relationships among green human resource management (GHRM), green transformational leadership (GTL), organizational agility (OA), and sustainable employee performance (SEP). A quantitative explanatory approach was deemed appropriate because it enables systematic measurement of latent constructs, rigorous hypothesis testing, and statistical generalization within an organizational context. By utilizing theory-driven model specification grounded in Ability–Motivation–Opportunity (AMO) Theory and Dynamic Capability Theory, the research design facilitates the assessment of predictive relationships and mediating mechanisms through multivariate statistical techniques, thereby enhancing internal validity and theoretical

robustness. Such a design is particularly suitable for testing mediation hypotheses (H6–H7) and assessing the magnitude and significance of both direct and indirect effects among sustainability-oriented managerial variables.

The empirical setting of this study is PT Semen Indonesia (Persero) Tbk – Tuban Plant, an energy-intensive manufacturing organization operating within the cement industry, which is widely recognized as one of the most carbon-intensive industrial sectors globally. As a state-owned enterprise and a leading cement producer in Indonesia, the organization has implemented various environmental sustainability initiatives, including carbon emission reduction programs, energy efficiency improvements, waste heat recovery systems, and green supply chain integration. This context provides a highly relevant and theoretically meaningful setting for examining sustainability-oriented management practices, as firms in high environmental-impact industries face substantial regulatory pressure, stakeholder scrutiny, and ecological accountability. Consequently, analyzing how green HR systems, sustainability-oriented leadership behaviors, and adaptive organizational capabilities interact within this setting offers a robust empirical basis for understanding the micro- and meso-level mechanisms that shape Sustainable Employee Performance in resource-intensive industries undergoing sustainability transformation.

3.2 Population, sampling technique, and sample size adequacy

The target population comprised organizational unit leaders—including supervisors, foremen, and structural officials—who are directly responsible for translating sustainability policies into operational routines, supervising employee behavior, and evaluating performance outcomes. These managerial actors occupy critical boundary-spanning roles in sustainability implementation, functioning as intermediaries between strategic environmental intentions and day-to-day operational execution. Their inclusion is theoretically justified because sustainability-oriented HR practices and green leadership mechanisms are enacted and reinforced primarily at the supervisory level, where behavioral monitoring and performance alignment occur. Accordingly, purposive sampling was employed to ensure respondent relevance and theoretical fit, consistent with recommendations for explanatory organizational research that prioritizes information-rich cases aligned with conceptual constructs (Hair et al., 2022).

A total of 104 unit leaders participated in the survey. This sample size satisfies established methodological adequacy criteria for Partial Least Squares–Structural Equation Modeling (PLS-SEM). First, it meets the widely cited “10-times rule,” which requires the minimum sample size to exceed ten times the maximum number of structural paths directed at any endogenous construct (Hair et al., 2022). Second, statistical power analysis guidelines indicate that a sample above 100 observations is sufficient to detect medium effect sizes ($f^2 \approx 0.15$) in predictive structural models at a 5% significance level (Cohen, 1988; Hair et al., 2022). Recent methodological scholarship further supports the suitability of moderate samples for PLS-SEM, particularly when models emphasize prediction and theory development rather than covariance reproduction (Sarstedt et al., 2022). Therefore, the sample is considered methodologically robust for estimating direct and mediated relationships in the proposed structural model.

3.3 Data collection and measurement instrument

Primary data were collected using a structured self-administered questionnaire developed from validated theoretical constructs and prior empirical studies to ensure conceptual rigor and measurement validity. Construct operationalization followed established multidimensional frameworks. Green Human Resource Management (GHRM) was measured through indicators capturing green recruitment and selection, green training and development, green performance management, green compensation and rewards, and green employee involvement, consistent with sustainability-oriented HRM scholarship (Miah et al., 2024). Green Transformational Leadership (GTL) was operationalized using the four classical transformational dimensions—idealized influence, inspirational motivation, intellectual stimulation, and individualized consideration—adapted to an environmental leadership context (Robertson & Barling, 2017). Organizational Agility (OA) was measured through proactiveness, responsiveness, radicalness, and adaptiveness, reflecting dynamic capability dimensions associated with sensing, seizing, and reconfiguring capacities (Clauss et al., 2021). Sustainable Employee Performance (SEP) captured sustainable task performance and contextual sustainability behavior, integrating productivity continuity with ecological responsibility (Singh et al., 2024). All indicators were measured using reflective Likert-scale items, which are appropriate when latent constructs are conceptualized as underlying causes of observed indicators. This specification aligns with PLS-SEM requirements for reflective measurement models (Hair et al., 2022).

3.4 Common method bias assessment

Given that all variables were obtained from single-source self-report data collected at one point in time, potential Common Method Bias (CMB) was explicitly assessed. First, Harman's Single-Factor Test was conducted, confirming that no single factor accounted for the majority of total variance. Second, a full collinearity variance inflation factor (VIF) assessment was applied, with all values below the conservative threshold of 3.3, indicating that CMB is unlikely to threaten model validity (Kock, 2020). These procedural and statistical remedies enhance confidence in the robustness of the empirical findings.

3.5 Data analysis technique

Hypothesis testing was conducted using Partial Least Squares–Structural Equation Modeling (PLS-SEM). PLS-SEM is particularly appropriate for predictive and exploratory causal modeling, complex mediation structures, moderate sample sizes, and tolerance of non-normal data distributions (Hair et al., 2022; Sarstedt et al., 2022). The analysis followed a two-stage evaluation procedure to ensure methodological rigor and analytical transparency. Measurement Model Evaluation included assessment of convergent validity (outer loadings > 0.70 ; AVE > 0.50), discriminant validity (cross-loadings and HTMT comparison), and internal consistency reliability (composite reliability > 0.70). Structural Model Evaluation involved examining the coefficient of determination (R^2) to assess explanatory power, predictive relevance (Q^2) to evaluate out-of-sample prediction capability, and path coefficients (β), t-values, p-values, and

confidence intervals to determine hypothesis significance. Mediation testing was conducted by assessing the indirect effect significance of Organizational Agility (OA) using bootstrapping procedures, consistent with contemporary PLS-SEM mediation guidelines (Hair et al., 2022). This sequential analytical procedure strengthens internal validity, predictive accuracy, and theoretical interpretability of the proposed sustainability framework.

4. Results

4.1 Respondent profile

A total of 104 unit leaders from PT Semen Indonesia (Persero) Tbk – Tuban Plant participated in this study. Respondents were selected using purposive sampling due to their strategic involvement in supervising employees, translating environmental policies into operational practice, and evaluating sustainability-related performance outcomes. This managerial-level representation ensures that the data reflect informed perspectives from decision-makers who actively shape sustainability implementation within an energy-intensive manufacturing context.

The demographic composition of respondents indicates strong managerial authority, extensive organizational tenure, and substantial leadership maturity. A majority of participants occupy managerial positions (59.62%), followed by senior managers (23.08%) and supervisors (17.30%), confirming that the sample is heavily concentrated among individuals with strategic and operational responsibility for sustainability governance. In terms of tenure, 94.2% of respondents have more than ten years of service, demonstrating deep organizational embeddedness, institutional knowledge, and long-term exposure to evolving environmental policies and operational systems. Age distribution further reinforces leadership maturity, with 60.6% of respondents above 50 years old and 22.1% between 46–50 years, suggesting substantial professional experience in decision-making processes. Gender distribution shows that 78.8% of respondents are male and 21.2% female, reflecting the male-dominated leadership structure commonly observed in heavy manufacturing industries such as cement production (See Table 1).

Table 1. Demographic Profile of Respondents (n = 104)

Category	Subcategory	Frequency	Percentage
Position	Senior Manager	24	23.08%
	Manager	62	59.62%
	Supervisor	18	17.30%
Length of Service	1–5 years	1	1.0%
	6–10 years	5	4.8%
	>10 years	98	94.2%
Age	25–35 years	4	3.8%
	36–45 years	14	13.5%
	46–50 years	23	22.1%
	>50 years	63	60.6%
Gender	Male	82	78.8%
	Female	22	21.2%

Source: Authors' own work (2025)

4.2 Measurement and structural model evaluation

4.2.1 Convergent validity

Convergent validity was assessed by examining outer loadings and Average Variance Extracted (AVE) values. All indicator loading factors exceeded the recommended threshold of 0.70, indicating strong indicator reliability and satisfactory item–construct convergence. Furthermore, all AVE values surpassed the minimum criterion of 0.50, confirming that each latent construct explains more than 50% of the variance in its respective indicators, thereby demonstrating adequate convergent validity. The AVE values for each construct are presented in Table 2.

Table 2. Convergent validity results

Construct	Indicator	Loading	AVE
Green Human Resource Management (GHRM)	GHRM1	0.711	0.656
	GHRM2	0.816	
	GHRM3	0.867	
	GHRM4	0.840	
	GHRM5	0.754	
	GHRM6	0.862	
Green Transformational Leadership (GTL)	GTL1	0.777	0.698
	GTL2	0.803	
	GTL3	0.878	
	GTL4	0.899	
	GTL5	0.812	
	GTL6	0.838	
Organizational Agility (OA)	OA1	0.776	0.635
	OA2	0.800	
	OA3	0.792	
	OA4	0.840	
	OA5	0.750	
	OA6	0.821	
Sustainable Employee Performance (SEP)	SEP1	0.944	0.854
	SEP2	0.913	
	SEP3	0.901	
	SEP4	0.936	

Source: Authors' own work (2025)

Notably, Sustainable Employee Performance (AVE = 0.854) exhibits particularly strong convergent validity, suggesting high internal coherence among its measurement indicators. Overall, these results confirm that the reflective measurement model meets established reliability and validity standards for PLS-SEM estimation.

4.2.2 Discriminant validity

Discriminant validity was evaluated through cross-loading analysis, ensuring that each indicator loads highest on its corresponding latent construct relative to other constructs. The results demonstrate satisfactory discriminant validity across all variables, indicating that the constructs are empirically distinct and conceptually non-redundant.

Consequently, the measurement model is considered statistically sound, reliable, and appropriate for subsequent structural model analysis.

4.2.3 Structural model evaluation

Although PLS-SEM primarily emphasizes prediction rather than global goodness-of-fit, model fit indices were assessed to ensure overall adequacy. The Standardized Root Mean Square Residual (SRMR) value of 0.070 falls below the conservative threshold of 0.08, indicating acceptable model fit. The Normed Fit Index (NFI) value of 0.794 suggests marginal but acceptable fit for predictive modeling purposes. While the NFI value does not indicate excellent fit, it remains within an acceptable range for complex predictive structural models.

Table 3. Coefficient of Determination (R²)

Indicator	Value	Interpretation
SRMR	0.070	Acceptable fit
NFI	0.794	Marginal but acceptable

Source: Authors' own work (2025)

The R² value of 0.517 indicates that Green Human Resource Management and Green Transformational Leadership jointly explain 51.7% of the variance in Organizational Agility, reflecting moderate explanatory power. Similarly, 58.4% of the variance in Sustainable Employee Performance is explained by the predictor variables, demonstrating substantial theoretical relevance. These findings suggest that green management practices and leadership mechanisms play a meaningful role in shaping both adaptive capability and long-term employee performance outcomes.

4.2.4 Predictive relevance (Q²)

Predictive relevance was examined using the blindfolding procedure to obtain Q² values.

Table 4. Predictive relevance

Variable	Q ²	Interpretation
Organizational Agility	0.517	Strong
Sustainable Employee Performance	0.584	Strong
Organizational Agility	0.489	Strong
Sustainable Employee Performance	0.489	Strong

Source: Authors' own work (2025)

Both constructs demonstrate strong predictive relevance (Q² > 0.35), indicating substantial out-of-sample predictive capability. This result confirms that the model not only explains variance but also possesses meaningful predictive strength, reinforcing its robustness within a sustainability-oriented organizational context.

4.3 Hypothesis testing results

Hypothesis testing was conducted using bootstrapping procedures in PLS-SEM to assess the significance of both direct and indirect relationships. The statistical significance criteria followed conventional thresholds, where a relationship is considered significant when $p < 0.05$ and $t\text{-value} > 1.96$ (two-tailed test). This approach ensures rigorous evaluation of structural path coefficients and mediation effects. To enhance clarity and

analytical coherence, the direct and indirect effects are consolidated into a single table (Table 6).

Table 6. Summary of direct and indirect effects

Hypothesis	Relationship	Effect Type	Result	Conclusion
H1	GHRM → SEP	Direct	Not significant	Rejected
H2	GTL → SEP	Direct	Significant positive	Supported
H3	GHRM → OA	Direct	Significant positive	Supported
H4	GTL → OA	Direct	Significant positive	Supported
H5	OA → SEP	Direct	Significant positive	Supported
H6	GHRM → OA → SEP	Indirect (Mediation)	Significant mediation	Supported
H7	GTL → OA → SEP	Indirect (Mediation)	Significant mediation	Supported

Source: Authors' own work (2025)

The structural model reveals several theoretically meaningful insights. First, Green Transformational Leadership (GTL) demonstrates a significant and positive direct effect on Sustainable Employee Performance (SEP), confirming that environmentally oriented leadership behaviors directly enhance long-term employee effectiveness. In contrast, Green Human Resource Management (GHRM) does not exhibit a significant direct effect on SEP, suggesting that structural green HR practices alone may not immediately translate into sustained employee performance outcomes without an enabling organizational mechanism. Second, both GHRM and GTL significantly and positively influence Organizational Agility (OA), indicating that sustainability-oriented HR systems and leadership behaviors strengthen adaptive capability within the organization. This finding supports the Dynamic Capability perspective, which positions managerial systems and leadership as micro-foundations of agility. Third, Organizational Agility significantly enhances Sustainable Employee Performance, demonstrating that adaptive capacity, responsiveness, and flexibility are critical drivers of long-term productivity and ecological responsibility. Most importantly, mediation analysis confirms that Organizational Agility serves as a significant mediating mechanism between (1) GHRM and SEP and (2) GTL and SEP. This indicates that green management intentions are translated into sustainable employee outcomes primarily through the development of adaptive organizational capability. In practical terms, while green HR systems establish structural readiness and green leadership shapes psychological commitment, it is organizational agility that operationalizes these inputs into sustained performance outcomes.

5. Discussion

The present study provides robust empirical evidence concerning the mechanism through which sustainability-oriented management and leadership shape Sustainable Employee Performance (SEP) in an energy-intensive manufacturing context. Rather than operating as isolated predictors, Green Human Resource Management (GHRM) and Green Transformational Leadership (GTL) influence SEP through a systemic pathway in which Organizational Agility (OA) functions as a dynamic capability mechanism. This finding strengthens the argument of Dynamic Capability Theory that organizational performance outcomes are contingent upon the firm's ability to integrate, reconfigure, and deploy internal and external competencies in response to environmental change (Teece, Pisano, & Shuen, 1997; Teece, 2007).

The absence of a significant direct relationship between GHRM and SEP suggests that sustainability-oriented HR practices alone are insufficient to produce enduring employee performance outcomes. From the Ability–Motivation–Opportunity (AMO) framework, HR systems enhance employee capability, motivation, and participation (Appelbaum et al., 2000), yet these elements require organizational processes and contextual reinforcement before translating into sustained performance behaviors. This supports prior studies arguing that GHRM often operates as an enabling infrastructure rather than a direct behavioral driver (Renwick, Redman, & Maguire, 2013; Jabbour & Santos, 2008). In complex manufacturing environments characterized by production pressure, technological rigidity, and hierarchical coordination, HR practices may not immediately shape operational behavior without adaptive support mechanisms. Sustainability research further emphasizes that green HR initiatives generate performance effects when embedded within broader organizational systems and leadership alignment (Paillé et al., 2014). Thus, the present findings reposition GHRM as a structural antecedent whose effectiveness depends on the organization’s adaptive capacity rather than functioning independently.

In contrast, GTL demonstrates a significant positive direct effect on SEP, highlighting the central role of leadership in sustainability transformation. Transformational Leadership Theory posits that leaders influence followers through inspirational motivation, intellectual stimulation, individualized consideration, and idealized influence (Bass, 1985; Bass & Avolio, 1994). When these behaviors are oriented toward environmental values, leaders foster pro-environmental cognition, emotional commitment, and behavioral internalization (Graves, Sarkis, & Zhu, 2013; Robertson & Barling, 2013). Unlike HR systems that operate structurally, transformational leadership functions at the psychological and cultural level, enabling immediate behavioral alignment. This is particularly salient in energy-intensive industries, where daily operational decisions significantly affect environmental outcomes and leadership visibility strongly shapes compliance and innovation behavior. The direct significance of GTL confirms that sustainability leadership acts as a primary behavioral catalyst for sustainable employee performance.

Both GHRM and GTL significantly enhance Organizational Agility, reinforcing the Dynamic Capability perspective that adaptive capacity is built upon managerial systems and leadership behavior (Teece, 2007). Organizational agility reflects a firm’s ability to sense environmental shifts, seize opportunities, and reconfigure resources efficiently (Sambamurthy, Bharadwaj, & Grover, 2003; Overby, Bharadwaj, & Sambamurthy, 2006). GHRM contributes to agility through competence development, participative decision-making, and green skill formation, while GTL strengthens strategic responsiveness and change-oriented culture. These complementary roles support the notion that managerial practices and leadership behaviors serve as micro-foundations of dynamic capabilities (Felin, Foss, Heimeriks, & Madsen, 2012). Therefore, green management does not merely promote environmental awareness; it cultivates the adaptive infrastructure necessary for sustainability execution.

The most critical contribution of this study is the confirmation that OA significantly influences SEP and mediates both GHRM and GTL effects. This finding provides strong empirical support for Dynamic Capability Theory by demonstrating that sustainability performance emerges from the organization’s capacity to adapt and operationalize sustainability within everyday processes (Teece et al., 1997). In energy-intensive manufacturing settings—where regulatory compliance, efficiency optimization, and

technological innovation must coexist—agility becomes the operational bridge translating sustainability strategy into measurable employee performance. Thus, OA is not merely an organizational characteristic but the central mechanism of sustainability realization. The mediation results indicate that sustainability initiatives yield performance outcomes when embedded within adaptive systems capable of rapid learning, coordination, and resource reconfiguration.

Synthesizing the findings reveals a multi-level sustainability architecture: GHRM → OA → SEP, and GTL → OA → SEP, with GTL also exerting a direct influence on SEP. This integrated structure demonstrates that sustainable employee performance arises from the interaction between structural systems (HRM), behavioral leadership forces, and adaptive organizational capability. By situating the analysis within an energy-intensive manufacturing context, this study extends sustainability management literature beyond its traditional service-sector focus and highlights agility as a crucial mechanism in operationally complex industries.

6. Conclusion

This study provides comprehensive empirical evidence regarding the structural and behavioral mechanisms through which sustainability-oriented management practices shape Sustainable Employee Performance (SEP) within an energy-intensive manufacturing context, specifically PT Semen Indonesia (Persero) Tbk – Tuban Plant. By integrating Green Human Resource Management (GHRM), Green Transformational Leadership (GTL), and Organizational Agility (OA) into a unified explanatory framework, the research advances a systemic understanding of how sustainability performance is operationalized at the employee level.

The findings demonstrate that sustainability outcomes do not emerge from isolated managerial interventions but from an integrated capability-building process. First, the absence of a significant direct relationship between GHRM and SEP indicates that green HR practices function primarily as enabling structural mechanisms rather than immediate performance drivers. While GHRM contributes to green competence development, motivation alignment, and participative engagement, its impact on sustainable performance materializes only when supported by adaptive organizational processes. This reinforces the view that HR systems create readiness conditions that require translation through dynamic organizational mechanisms before generating observable long-term performance effects. Second, GTL exerts a significant and positive direct influence on SEP, underscoring the pivotal role of leadership in sustainability transformation. Transformational leaders who articulate a compelling environmental vision, model sustainable behavior, and inspire pro-environmental commitment act as direct behavioral catalysts. In operationally complex and energy-intensive environments, leadership visibility and strategic direction strongly shape daily employee conduct, explaining why GTL emerges as the most immediate determinant of sustainable employee performance.

Third, both GHRM and GTL significantly enhance Organizational Agility, confirming their joint role as micro-foundations of dynamic capability. Through competence-building systems (GHRM) and change-oriented leadership behaviors (GTL), organizations develop the capacity to sense environmental demands, seize sustainability opportunities, and reconfigure internal resources effectively. This adaptive capability becomes particularly critical in industries characterized by regulatory pressure, technological intensity, and environmental accountability. Fourth, Organizational Agility

significantly improves SEP and mediates the influence of both GHRM and GTL. This mediation effect constitutes the central contribution of the study. It confirms that sustainable employee performance is realized through the organization's ability to adapt, integrate, and operationalize sustainability principles within everyday work processes. Sustainability policies and visionary leadership, without adaptive execution mechanisms, are insufficient to produce enduring performance outcomes. Thus, OA functions as the core translating dynamic capability that converts sustainability orientation into measurable employee-level results. Overall, the study concludes that sustainable employee performance in energy-intensive manufacturing is constructed through the integrated interaction of structural HR systems, transformational sustainability leadership, and dynamic organizational agility. Sustainability performance is therefore not merely a function of policy compliance or symbolic leadership commitment, but a multi-level, adaptive, and leadership-driven phenomenon embedded within organizational capability architecture.

7. Theoretical and practical contribution

This study advances sustainability management literature by integrating AMO Theory, Transformational Leadership Theory, and Dynamic Capability Theory into a unified, multi-level framework explaining Sustainable Employee Performance (SEP). The findings reposition Green Human Resource Management (GHRM) as an enabling structural mechanism that creates sustainability readiness but does not independently generate performance outcomes. Instead, its impact depends on complementary leadership influence and adaptive organizational processes. Most importantly, the study empirically validates Organizational Agility (OA) as the central mediating dynamic capability that translates green systems and leadership intentions into measurable employee-level sustainability performance. By situating the analysis within an energy-intensive manufacturing context, the research broadens theoretical generalizability and demonstrates that sustainability performance is systemic, capability-driven, and contingent upon organizational adaptation.

Managerially, the results emphasize that sustainability transformation requires systemic alignment rather than fragmented green initiatives. Organizations should strengthen adaptive organizational capability to operationalize sustainability strategies, cultivate green transformational leadership competencies to directly influence employee behavior, and integrate HR sustainability systems with agility-driven processes. Without such integration, green practices risk remaining symbolic or compliance-oriented rather than performance-generating. Therefore, sustainable employee performance should be pursued through coordinated capability development that aligns structural HR systems, leadership behavior, and organizational agility within a unified sustainability architecture.

8. Limitations and future research directions

This study is subject to several limitations that provide avenues for future research. First, the cross-sectional design limits causal inference, and future studies should employ longitudinal or time-lagged approaches to better capture the dynamic evolution of sustainability capabilities and employee performance. Second, the research was conducted within a single energy-intensive manufacturing organization, which may constrain generalizability; subsequent research should examine multiple firms across different industrial sectors and cultural contexts to enhance external validity. Third,

reliance on self-reported survey data may introduce common method bias, suggesting that future studies incorporate multi-source data, objective performance indicators, or mixed-method designs. Finally, future research may explore additional mediating or moderating variables—such as organizational culture, environmental strategy, digital transformation, or regulatory pressure—to further refine the understanding of how green management practices translate into sustainable employee performance.

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