



Translating Sustainability-Oriented Innovation into Green Employee Performance through Green Employee Engagement in Non-Formal Education

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Abstract

This study examines whether sustainability-oriented innovation contributes to green employee performance through green employee engagement in Indonesian non-formal education. A quantitative explanatory design was employed involving 258 employees in structural and managerial roles at a national non-formal education institution in Indonesia. Respondents were selected through cluster proportional random sampling, data were collected using a structured questionnaire, and the hypotheses were tested using covariance-based structural equation modeling with LISREL. The findings show that sustainability-oriented innovation positively affects green employee engagement and that green employee engagement strongly predicts green employee performance. The structural estimates are also consistent with an indirect pathway in which sustainability-oriented innovation contributes to green employee performance through stronger green employee engagement. These results indicate that sustainability-oriented innovation becomes more effective in improving employee-level environmental performance when it is accompanied by employees' cognitive, emotional, and behavioral engagement with organizational green goals. This study highlights green employee engagement as a key mechanism linking innovation-oriented sustainability efforts to performance in non-formal education.

Transformasi Inovasi Berorientasi Keberlanjutan Menjadi Kinerja Karyawan Hijau melalui Keterlibatan Karyawan Hijau dalam Pendidikan Nonformal

Abstrak

Penelitian ini bertujuan untuk menguji apakah inovasi berorientasi keberlanjutan berkontribusi terhadap kinerja karyawan hijau melalui keterlibatan karyawan hijau pada pendidikan nonformal di Indonesia. Penelitian ini menggunakan desain kuantitatif eksplanatori dengan melibatkan 258 karyawan pada posisi struktural dan manajerial di sebuah lembaga pendidikan nonformal nasional di Indonesia. Responden dipilih melalui cluster proportional random sampling, data dikumpulkan menggunakan kuesioner terstruktur, dan hipotesis diuji dengan covariance-based structural equation modeling menggunakan LISREL. Hasil penelitian menunjukkan bahwa inovasi berorientasi keberlanjutan berpengaruh positif terhadap keterlibatan karyawan hijau dan bahwa keterlibatan karyawan hijau berpengaruh kuat terhadap kinerja karyawan hijau. Estimasi struktural juga konsisten dengan adanya jalur tidak langsung, di mana inovasi berorientasi keberlanjutan berkontribusi terhadap kinerja karyawan hijau melalui penguatan keterlibatan karyawan hijau. Temuan ini menunjukkan bahwa inovasi berorientasi keberlanjutan menjadi lebih efektif dalam meningkatkan kinerja lingkungan pada tingkat karyawan ketika disertai keterlibatan kognitif, emosional, dan perilaku karyawan terhadap tujuan hijau organisasi.

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INTRODUCTION

Sustainability has become an increasingly important managerial concern across sectors, including service-based institutions such as education. Innovation is no longer understood only as a means of improving efficiency and competitiveness, but also as a way of embedding environmental and social considerations into organizational systems, routines, and value creation. In this context, sustainability-oriented innovation refers to innovation that supports economic viability while advancing broader sustainability goals. Recent studies suggest that sustainability-oriented innovation may take the form of redesigned work processes, resource-sensitive practices, stakeholder-oriented systems, and organizational learning mechanisms that strengthen sustainable value creation (Harsanto et al., 2024; Rubio-Andrés & Abril, 2024; Ruiz-Molina et al., 2024; Zhou et al., 2024).

Previous studies have examined green human resource management, green innovation, green leadership, green work engagement, and environmental performance in manufacturing, tourism, corporate, and educational settings (Kuo et al., 2022; Fang et al., 2022; Tandon et al., 2023; Jnaneswar, 2024). However, three gaps remain insufficiently explained. First, the specific relational pathway linking sustainability-oriented innovation, green employee engagement, and green employee performance has received limited empirical attention. Second, the combined use of social exchange theory and the job demands-resources framework to explain how sustainability-oriented innovation becomes employee engagement and green performance remains underdeveloped in service-based educational settings. Third, Indonesian non-formal education remains underrepresented, even though sustainability in such institutions is enacted largely through employees' daily routines, coordination practices, and service behavior.

These gaps are important because sustainability initiatives can only generate employee-level green performance when employees internalize organizational green values and translate them into everyday work behavior.

A relevant mechanism in this respect is green employee engagement. Green employee engagement reflects the extent to which employees are cognitively attentive, emotionally connected, and behaviorally involved in organizational environmental goals. Prior studies indicate that green-oriented organizational practices, leadership, support systems, and human resource policies can strengthen employees' environmental involvement and green behavior (Aboramadan, 2022; Gustiah & Nurhayati, 2023; Tran, 2023; Haque et al., 2024; Gupta & Jangra, 2024). Employees who are more engaged with organizational green goals are more likely to translate those goals into meaningful work behavior and performance. From this perspective, green employee engagement may function as the key mechanism through which sustainability-oriented innovation becomes meaningful at the employee level.

The context of non-formal education deserves particular attention. Unlike production-based organizations, non-formal educational institutions rely heavily on people, routines, coordination, and service interactions. In such settings, sustainability is less likely to be expressed through machinery or capital-intensive technology and more likely to be embedded in work processes, communication patterns, institutional values, and everyday resource use. Despite this relevance, non-formal education remains underrepresented in green management research. Existing studies in educational and Indonesian settings have discussed environmental support, green engagement, empowerment, and green performance, yet the role of sustainability-oriented innovation in shaping employee-level green outcomes remains limited. This makes non-formal education an im-

portant but underexplored setting for examining how sustainability-oriented innovation is translated into green employee performance.

Indonesia provides a relevant context for this study because its non-formal education institutions operate across geographically diverse regions, are coordinated through branch-based service systems, and depend heavily on people-intensive work routines. In such institutions, sustainability-oriented innovation is not only related to formal environmental programs, but also to how employees coordinate services, use resources efficiently, adopt digital work systems, reduce paper and energy-intensive routines, and support continuous service improvement. This context is relevant because the implementation of sustainability in Indonesian non-formal education depends less on capital-intensive technology and more on employee engagement, coordination, and everyday work behavior. Therefore, the Indonesian non-formal education context offers an appropriate setting for examining how sustainability-oriented innovation is translated into green employee engagement and green employee performance.

To avoid a generic interpretation of the focal constructs, this study contextualizes the variables in the non-formal education setting. Sustainability-oriented innovation is understood as the redesign of learning-service routines, branch coordination, digital work systems, and resource-sensitive administrative practices that support sustainable value creation. Green employee engagement refers to employees' cognitive attention, emotional attachment, and behavioral energy toward organizational green goals in daily service and coordination activities. Green employee performance refers to employee-level environmentally responsible work outcomes, such as efficient resource use, paper- and energy-saving routines, responsible digital work practices, and support for sustainability-oriented service im-

provement. The study does not claim that green employee engagement is the only possible mechanism. Green climate, leadership support, and employee capability or self-efficacy may also shape this relationship; however, green employee engagement is examined as the focal behavioral mechanism because the study focuses on how organizational innovation is translated into employee-level outcomes.

The present study is grounded in two complementary perspectives. Social exchange theory suggests that when organizations demonstrate commitment to meaningful and valued goals, employees are more likely to reciprocate through higher engagement and stronger performance (Blau, 1964; Cropanzano & Mitchell, 2005). In parallel, the job demands-resources framework suggests that organizational resources that enhance meaning, support, and involvement can foster engagement, which in turn contributes to positive performance outcomes (Bakker & Demerouti, 2007). In the sustainability context, sustainability-oriented innovation can be understood as an organizational condition that signals value alignment and creates meaningful opportunities for employees to contribute, while green employee engagement represents the psychological and behavioral energy through which this condition is translated into performance.

Based on the preceding discussion, three research gaps are identified. First, prior sustainability-oriented innovation research has focused predominantly on organizational and environmental outcomes, while its relationship with employee-level green performance remains limited. Second, existing green management studies have concentrated largely on manufacturing, tourism, and general corporate settings, leaving non-formal education underexplored. Third, although green employee engagement has been recognized as an important behavioral mechanism, limited evidence explains how sustainabi-

lity-oriented innovation is translated into green employee performance through this pathway. These gaps justify the need for a more focused examination of sustainability-oriented innovation, green employee engagement, and green employee performance in non-formal education.

Accordingly, this study examines whether sustainability-oriented innovation contributes to green employee engagement and whether green employee engagement contributes to green employee performance in Indonesian non-formal education. It also tests whether the relationship is consistent with an indirect pathway from sustainability-oriented innovation to green employee performance through green employee engagement. This study applies a quantitative explanatory design using covariance-based structural equation modeling and is intended to provide both theoretical and managerial insights for sustainability-oriented management in service-based educational institutions.

The novelty of this study lies in its specific focus on sustainability-oriented innovation as an antecedent of green employee engagement and green employee performance in Indonesian non-formal education. More specifically, this study is novel because it examines an engagement-related pathway through which sustainability-oriented innovation is translated into employee-level green performance in a service-based educational context where sustainability is enacted through routines, coordination, digitalized work, and resource-sensitive behavior rather than through capital-intensive production technology.

This study offers three main contributions. First, it extends sustainability-oriented innovation research from predominantly organizational-level outcomes to employee-level green performance. Second, it positions green employee engagement as a mechanism linking sustainability-oriented innovation to green employee performance. Third, it provides empirical

evidence from the underexplored context of Indonesian non-formal education.

Hypothesis Development

Sustainability-Oriented Innovation and Green Employee Engagement

Sustainability-oriented innovation refers to organizational efforts to redesign processes, practices, and systems in ways that simultaneously support economic viability and broader sustainability goals. In service-based organizations, such innovation is not limited to technological change, but also includes resource-sensitive routines, stakeholder-oriented practices, and organizational learning mechanisms that strengthen sustainable value creation (Harsanto et al., 2024; Rubio-Andrés & Abril, 2024; Ruiz-Molina et al., 2024). When sustainability is embedded in innovation, employees are more likely to perceive environmental responsibility as an integral part of organizational priorities rather than as a symbolic or peripheral agenda.

From the perspective of social exchange theory, sustainability-oriented innovation can be interpreted by employees as an organizational signal that environmental responsibility and stakeholder welfare are valued and institutionally supported. Such a signal may encourage employees to reciprocate through stronger cognitive attention, emotional attachment, and behavioral involvement in organizational green goals. From the job demands-resources perspective, sustainability-oriented innovation may also function as a job resource because it provides meaning, goal clarity, supportive routines, and opportunities to participate in sustainability-oriented work improvement. Prior studies have shown that green-oriented organizational systems, leadership, and HR practices can strengthen employee engagement with environmental values and practices (Aboramadan, 2022; Tran, 2023; Haque et al., 2024). Therefore, when innovation is clearly aligned with sustainability

goals, employees are expected to become more cognitively attentive, emotionally connected, and behaviorally involved in those goals. Therefore, based on the theoretical framework and the findings of previous studies, the following hypothesis is proposed:

H1: Sustainability-oriented innovation positively affects green employee engagement.

Green Employee Engagement and Green Employee Performance

Green employee engagement reflects the extent to which employees invest cognitive attention, emotional attachment, and behavioral energy in organizational environmental goals. This concept extends general work engagement into the sustainability domain by emphasizing employees' willingness to support green practices and environmental priorities in their daily work. Employees who are highly engaged with green goals are more likely to translate those goals into meaningful actions, including responsible work conduct, support for sustainability initiatives, and contribution to environmental performance.

The broader engagement literature consistently shows that engaged employees tend to demonstrate higher effort, persistence, and performance (Schaufeli et al., 2002; Christian et al., 2011). In green management research, employee engagement has likewise been linked to pro-environmental behavior and stronger green outcomes (Gustiah & Nurhayati, 2023; Gomes et al., 2024; Jnaneswar, 2024). Theoretically, the job demands-resources framework explains this relationship because engagement represents the motivational state through which organizational resources are converted into stronger work performance. In the green work context, this motivational state becomes relevant because green performance requires employees to pay attention to resource use,

internalize environmental priorities, and consistently express them in service routines. This relationship is especially important in non-formal education, where performance depends heavily on staff behavior, coordination, and interaction rather than on production technology. Thus, green employee engagement is expected to contribute positively to green employee performance. Therefore, based on the theoretical framework and the findings of previous studies, the following hypothesis is proposed:

H2: Green employee engagement positively affects green employee performance.

The Indirect Pathway from Sustainability-Oriented Innovation to Green Employee Performance through Green Employee Engagement

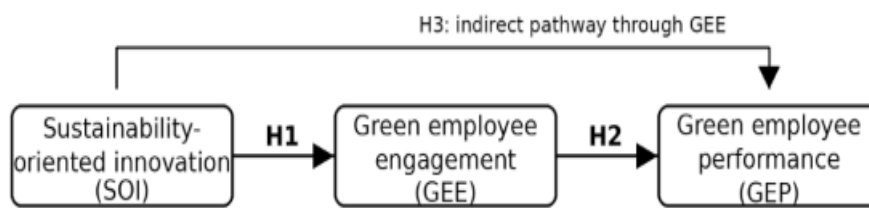
Sustainability-oriented innovation is expected to contribute to employee-level green performance through employees' engagement with organizational green goals. From a social exchange perspective, employees who perceive sustainability-oriented innovation as a meaningful organizational commitment may reciprocate through stronger involvement in green work practices. From a job demands-resources perspective, sustainability-oriented innovation can provide resources such as meaning, direction, participation opportunities, and supportive routines, while green employee engagement represents the motivational state that converts these resources into performance. Thus, organizational innovation may create the conditions for sustainability, but green employee engagement explains how those conditions are translated into employee-level green performance.

Prior studies suggest that green-oriented organizational practices influence employee outcomes through engagement-related mechanisms rather than through direct effects alone (Aboramadan, 2022;

Tran, 2023; Jnaneswar, 2024). In the context of non-formal education, where sustainability is enacted through daily routines, communication patterns, and service practices, the role of green employee engagement becomes especially critical. Employees who perceive sustainability-oriented innovation as meaningful and organizationally supported are more likely to become engaged, and that engagement is expected to strengthen their green performance. Accordingly, the relationship

between sustainability-oriented innovation and green employee performance is expected to operate through green employee engagement. Therefore, based on the theoretical framework and the findings of previous studies, the following hypothesis is proposed:

H3: Sustainability-oriented innovation contributes to green employee performance through green employee engagement.



Note: GEE is the focal engagement-related mechanism.

Figure 1. Research model

Source: Author's conceptual model (2026)

METHOD

This study employed a quantitative explanatory design to examine the relationship among sustainability-oriented innovation, green employee engagement, and green employee performance in Indonesian non-formal education. The research was conducted in a national non-formal education institution operating across Indonesia. The unit of analysis was individual employees occupying structural and managerial roles who had sufficient exposure to organizational systems, innovation practices, and sustainability-related routines. These roles were considered appropriate because they were directly involved in decision making, coordination, implementation, and evaluation of institutional practices relevant to sustainability and performance. The study used cluster proportional random sampling to obtain respondents from the organizational clusters represented in the institution. A total of 258 respondents were included in the fi-

nal analysis. Participation in the study was voluntary, and respondents were informed that their answers would be treated confidentially and reported only in aggregate form.

The population consisted of 723 structural and managerial employees of PT Ganesha Operation across its operational regions in Indonesia. The minimum sample size was determined using Slovin's formula with a 5% margin of error: $n = 723 / (1 + 723 \times 0.05^2) = 257.52$, rounded to 258 respondents. Thus, the final sample represented approximately 35.7% of the total population. Cluster proportional random sampling was applied to ensure proportional representation across the institution's operational clusters: Western Indonesia, Central Indonesia, and Eastern Indonesia. The Western Indonesia cluster consisted of 371 employees and was represented by 133 respondents; the Central Indonesia cluster consisted of 169 employees and was represented by 60 respondents; and the Eastern Indonesia cluster

consisted of 183 employees and was represented by 65 respondents. These clusters refer to the institution's operational regions, not only Java. The Western cluster included Sumatra, DKI Jakarta, and West Java; the Central cluster included Kalimantan, DI Yogyakarta, and Central Java; and the Eastern cluster included East Java, Sulawesi, Maluku Islands, Nusa Tenggara, Bali, and Papua.

The institutional context was characterized by branch-based service delivery, standardized learning programs, intensive coordination among units, and increasing use of digital communication and administrative routines. These contextual features are relevant because sustainability-oriented practices in non-formal education are enacted less through capital-intensive technology and more through everyday service routines, coordination discipline, efficient resource use, and employee participation. Although organizational culture was not modeled as a separate latent construct in this study, the branch-based and service-oriented workplace context was considered in interpreting the results.

Data were collected using a structured questionnaire. The questionnaire was designed to capture the focal constructs examined in this study, namely sustainability-oriented innovation, green employee engagement, and green employee performance. The measurement indicators were adapted and contextualized from established studies relevant to each construct. Sustainability-oriented innovation indicators were adapted from studies on sustainability-oriented innovation and sustainable value creation (Harsanto et al., 2024; Rubio-Andrés & Abril, 2024; Ruiz-Molina et al., 2024; Zhou et al., 2024). Green employee engagement indicators were adapted from work engagement and green work engagement literature (Schaufeli et al., 2002; Aboramadan, 2022; Tran, 2023; Gupta & Jangra, 2024; Haque et al., 2024). Green employee performance indi-

cators were adapted from employee green behavior and green performance studies (Aboramadan, 2022; Gustiah & Nurhayati, 2023; Adu Sarfo et al., 2024; Gomes et al., 2024). The wording of the items was adjusted to fit the context of non-formal education.

All indicators were measured using a five-point Likert scale ranging from strongly disagree to strongly agree. Sustainability-oriented innovation was represented by three indicators reflecting innovation efforts aligned with sustainability goals. Green employee engagement was represented by three indicators reflecting employees' cognitive, emotional, and behavioral involvement in organizational environmental goals. Green employee performance was represented by three indicators reflecting employee-level environmental work outcomes. Before structural testing, the measurement quality of the instrument was assessed through confirmatory factor analysis. Standardized factor loadings, explained variance, composite reliability, and average variance extracted were used to evaluate construct validity and reliability. The reported loading ranges, composite reliability values, and average variance extracted values indicate that the focal constructs were measured adequately and were suitable for further analysis.

Before analysis, responses were screened for completeness and consistency. To minimize potential common method bias, procedural remedies were applied through clear questionnaire instructions, neutral item wording, respondent confidentiality, and separation of measurement sections. The hypotheses were tested using covariance-based structural equation modeling with LISREL. This analytical approach was chosen because it enables simultaneous testing of measurement quality and structural relationships among latent constructs. Model adequacy was evaluated using commonly reported

goodness-of-fit indices, including chi-square probability, root mean square error of approximation, goodness of fit index, adjusted goodness of fit index, normed fit index, non-normed fit index, incremental fit index, and comparative fit index. The analysis focused on three relationships: the effect of sustainability-oriented innovation on green employee engagement, the effect of green employee engagement on green employee performance, and the indirect pathway through which sustainability-oriented innovation contributes to green employee performance via green employee engagement. It should be noted, however, that the focal structural estimates discussed in this article were derived from a broader validated structural model in which sustainability-oriented innovation was estimated together with other antecedents of green employee engagement. Therefore, the reported coefficient for sustainability-oriented innovation should be interpreted as its net effect within the broader structural specification rather than as an estimate from an isolated three-construct model.

RESULT AND DISCUSSION

Respondent Characteristics

The respondents in this study consisted of 258 employees occupying structural and managerial roles in a national non-formal education institution in Indonesia. Female respondents accounted for 54.26%, while male respondents accounted for 45.74%. The respondents were between 25 and 52 years old, with a mean age of 36.4 years and a standard deviation of 6.8. Most respondents held a bachelor's degree or diploma (86.82%), whereas 13.18% held a master's degree. In terms of regional distribution, 51.55% were from Western Indonesia, 23.26% from Central Indonesia, and 25.19% from Eastern Indonesia. Organizational tenure ranged from 2 to 15 years, with a mean of 6.7 years, while managerial experience ranged from 1 to 10 years, with a mean of 4.1 years. These characteristics indicate that the respondents had sufficient institutional familiarity and managerial exposure to evaluate innovation practices, employee engagement, and green employee performance in their organizational context.

Table 1. Respondent Characteristics

Characteristics	Category/Description	N	Percentage (%)
Gender	Male	118	45.74
	Female	140	54.26
Education	Bachelor's degree / Diploma	224	86.82
	Master's degree	34	13.18
Region	Western Indonesia	133	51.55
	Central Indonesia	60	23.26
	Eastern Indonesia	65	25.19
Age	Range: 25–52 years	-	-
	Mean = 36.4; SD = 6.8	-	-
Organizational tenure	Range: 2–15 years	-	-
	Mean = 6.7; SD = 3.2	-	-
Managerial experience	Range: 1–10 years	-	-
	Mean = 4.1; SD = 2.3	-	-

Source: Processed Data (2026)

Measurement Model

The measurement model demonstrated satisfactory validity and reliability for all focal constructs. Sustainability-oriented innovation showed standardized factor loadings ranging from 0.8789 to 0.9140, with t-values ranging from 17.6574 to 18.8559 and explained variance ranging from 0.7725 to 0.8354. Green employee engagement showed standardized factor loadings ranging from 0.8060 to 0.9149, with t-values ranging from 9.6552 to 19.1227 and explained variance ranging from 0.6496 to 0.8370. Green employee performance also showed acceptable measurement properties, with standardized factor loadings ranging from 0.7840 to 0.8736, t-values ranging from 7.9257 to 17.7481, and explained variance ranging

from 0.6147 to 0.7632. These values indicate adequate convergent validity because all loadings exceeded the commonly accepted threshold.

Reliability indicators further support the adequacy of the measurement model. Sustainability-oriented innovation showed composite reliability of 0.922 and average variance extracted of 0.797. Green employee engagement showed composite reliability of 0.889 and average variance extracted of 0.728. Green employee performance showed composite reliability of 0.875 and average variance extracted of 0.700. Overall, these findings indicate that the focal constructs were measured consistently and were suitable for subsequent structural analysis.

Table 2. Measurement Model Summary

Construct	Loading Range	t-value Range	R ² Range	Composite Reliability (CR)	Average Variance Extracted (AVE)
Sustainability oriented innovation	0.8789 – 0.9140	17.6574 – 18.8559	0.7725 – 0.8354	0.922	0.797
Green employee engagement	0.8060 – 0.9149	9.6552 – 19.1227	0.6496 – 0.8370	0.889	0.728
Green employee performance	0.7840 – 0.8736	7.9257 – 17.7481	0.6147 – 0.7632	0.875	0.700

Source: LISREL output (2026)

Structural Model Fit

The structural model demonstrated good overall fit. The chi-square probability was 0.07259, indicating that the discrepancy between the observed and estimated covariance matrices was not statistically significant. The RMSEA value was 0.07375, which falls within the acceptable range. Other fit indices also indicated a satisfactory model fit, including GFI=0.9832, AGFI=0.9363, NFI=0.9767, NNFI=0.9813, IFI=0.9849, and CFI=0.9849. Taken together, these indices indicate that the model was adequate for testing the proposed hypotheses and interpreting the structural relationships

among sustainability-oriented innovation, green employee engagement, and green employee performance.

The structural model also showed substantial explanatory power. The model explained 72.97% of the variance in green employee engagement ($R^2=0.7297$) and 86.45% of the variance in green employee performance ($R^2=0.8645$). In addition, the reduced-form equation linking the exogenous antecedents to green employee performance explained 69.74% of the variance ($R^2=0.6974$). These values indicate that the model has strong explanatory capacity for the focal endogenous constructs examined in this study.

Table 3. Goodness-of-Fit Indices

Fit Index	Cut-off Value	Result	Evaluation
Chi-square probability	> 0.05	0.07259	Good fit
RMSEA	$\leq$ 0.08	0.07375	Good fit
GFI	$\geq$ 0.90	0.9832	Good fit
AGFI	$\geq$ 0.90	0.9363	Good fit
NFI	$\geq$ 0.90	0.9767	Good fit
NNFI	$\geq$ 0.90	0.9813	Good fit
IFI	$\geq$ 0.90	0.9849	Good fit
CFI	$\geq$ 0.90	0.9849	Good fit

Source: LISREL Output (2026)

Hypothesis Testing

The results show that sustainability-oriented innovation positively affects green employee engagement, with a standardized coefficient of 0.3148 and a t-value of 4.7973. Therefore, H1 is supported. This finding indicates that when organizational innovation is aligned with sustainability goals, employees are more likely to become cognitively, emotionally, and behaviorally engaged in green organizational objectives.

Green employee engagement also positively affects green employee performance, with a standardized coefficient of 0.9198 and a t-value of 15.8150. Accordingly, H2 is supported. This result suggests that employees who are more strongly engaged with environmental goals are

more likely to demonstrate stronger green work outcomes and environmentally responsible performance.

The structural estimates further support the proposed indirect pathway from sustainability-oriented innovation to green employee performance through green employee engagement. Based on the product of coefficients, the estimated indirect effect is 0.2896. Therefore, H3 is consistent with the proposed indirect pathway. However, because the direct path from sustainability-oriented innovation to green employee performance was not estimated separately in the final structural model, the result should be interpreted as evidence of a significant indirect pathway rather than as proof of full mediation.

Table 4. Hypothesis Testing Results

Hypothesis	Structural Path	Std. Coefficient	t-value / Basis	Decision
H1	Sustainability-oriented innovation (SOI) → Green employee engagement (GEE)	0.3148	4.7973	Supported
H2	Green employee engagement (GEE) → Green employee performance (GEP)	0.9198	15.8150	Supported
H3	Sustainability-oriented innovation (SOI) → Green employee engagement (GEE) → Green employee performance (GEP)	0.2896*	Product of coefficients; Sobel test	Supported

Source: LISREL output and indirect-effect estimation (2026)

*The indirect effect was calculated from the product of coefficients ($0.3148 \times 0.9198 = 0.2896$) and supplemented by Sobel test ($z=4.59$, $p<0.001$).

The indirect pathway (H3) indicates that sustainability-oriented innovation contributes to green employee performance through an engagement-related pathway, in which employees' cognitive, emotional, and behavioral involvement helps translate sustainability-oriented initiatives into green work outcomes. The indirect effect was calculated using the product-of-coefficients approach. The path coefficient from sustainability-oriented innovation to green employee engagement was 0.3148, and the path coefficient from green employee engagement to green employee performance was 0.9198, resulting in a standardized indirect effect of 0.2896. Because bootstrap confidence intervals were not generated in the LISREL output, a Sobel test was conducted as a supplementary test of the indirect pathway. The Sobel test produced $z=4.59$, $p<0.001$, indicating that the indirect pathway was statistically significant. Therefore, H3 is supported as a significant indirect pathway.

This finding is consistent with prior research suggesting that employee engagement plays an important role in translating organizational sustainability initiatives into employee-level green outcomes (Abdou et al., 2023). The result implies that sustainability-oriented innovation becomes more meaningful when employees are cognitively, emotionally, and behaviorally engaged with organizational green goals. Rather than suggesting that innovation automatically produces green employee performance, the finding highlights green employee engagement as a behavioral mechanism connecting sustainability-oriented innovation with measurable employee-level environmental outcomes.

The findings of this study help explain how sustainability-oriented innovation is translated into employee-level environmental outcomes in Indonesian non-formal education. The positive relationship between sustainability-oriented innovation and green employee engagement indicates that innovation contributes

more than technical or procedural improvement. It also acts as an organizational signal that environmental responsibility is valued and institutionally supported. When employees perceive sustainability as embedded in innovation, they are more likely to become cognitively attentive, emotionally connected, and behaviorally involved in organizational green goals. This interpretation is consistent with the view that sustainability-oriented innovation helps organizations embed environmental and social priorities into systems, routines, and value creation processes (Harsanto et al., 2024; Rubio-Andrés & Abril, 2024; Ruiz-Molina et al., 2024).

The respondent profile and workplace context also help interpret the findings. Respondents occupied structural and managerial roles, had direct exposure to service coordination and performance evaluation, and represented Western, Central, and Eastern operational clusters. In a non-formal education institution, workplace situations are typically shaped by branch routines, service responsiveness, coordination across units, and shared expectations regarding institutional discipline and service quality. Such contextual conditions may make sustainability-oriented innovation more visible to employees and may explain why innovation is associated with stronger cognitive, emotional, and behavioral involvement in green goals. At the same time, because organizational culture, green climate, leadership support, and employee self-efficacy were not directly modeled, they are treated as important boundary conditions for future research rather than as causal explanations in the present model.

The positive effect of sustainability-oriented innovation on green employee engagement also aligns with prior studies showing that green-oriented organizational systems, leadership, and HR practices can strengthen employees' environmental involvement. In other words, employees are more likely to engage with green goals

when they perceive organizational initiatives as meaningful, well supported, and aligned with institutional priorities (Aboramadan, 2022; Tran, 2023; Haque et al., 2024). This finding extends the literature by showing that sustainability-oriented innovation itself can operate as a meaningful organizational condition that stimulates green employee engagement, not merely as a structural or strategic organizational capability.

The strong positive relationship between green employee engagement and green employee performance reinforces the view that employee-level sustainability outcomes depend not only on formal systems and policies, but also on the extent to which employees internalize environmental priorities. In non-formal educational institutions, where sustainability is enacted through routines, coordination, and staff conduct, engagement becomes a critical mechanism for translating environmental values into actual work performance. This finding is in line with prior research showing that green work engagement is associated with pro-environmental behavior, stronger green work outcomes, and sustainability-related performance (Gomes et al., 2024; Jnaneswar, 2024). In this sense, employee engagement is not simply an outcome of organizational sustainability efforts, but an active force through which those efforts become behaviorally meaningful.

The indirect-path result provides an additional theoretical contribution. It suggests that sustainability-oriented innovation alone may not be sufficient to improve green employee performance. Its effect becomes more meaningful when employees experience such innovation as relevant, supported, and worth investing in. This means that green employee engagement operates as the psychological and behavioral bridge connecting innovation-oriented sustainability efforts to employee-level environmental outcomes. Such a finding responds directly to the limited attention

on previously given to employee-level mechanisms in sustainability-oriented innovation research and supports the view that organizational sustainability initiatives need an engagement-based pathway to generate stronger behavioral outcomes (Aboramadan, 2022; Tran, 2023; Jnaneswar, 2024).

This study also broadens the empirical scope of the literature by focusing on non-formal education, a context that has received far less attention than manufacturing, hospitality, and general corporate settings. In non-formal educational institutions, environmental performance is largely enacted through people, service interaction, institutional values, and everyday operational routines rather than through capital-intensive technology. The present findings show that this context is highly relevant for understanding how sustainability-oriented innovation operates because the effectiveness of innovation depends strongly on whether employees become engaged with its environmental purpose. Thus, this study strengthens the argument that sustainability-oriented innovation should be examined not only in production-oriented sectors but also in service-based educational institutions.

From a managerial perspective, the findings imply that non-formal educational institutions should not rely solely on sustainability-oriented innovation as a structural intervention. Innovation initiatives should be accompanied by communication, participation, institutional support, and capability-building efforts that strengthen green employee engagement. Managers need to ensure that sustainability-oriented innovation is visible, meaningful, and actionable for employees so that it can be translated into stronger green performance. This implication is consistent with studies suggesting that organizational support, employee empowerment, and sustainability-oriented management practices help strengthen environmentally responsible work outcomes (Adu Sarfo et

al., 2024; Gomes et al., 2024).

At the same time, these findings should be interpreted with methodological caution. The focal pathway discussed in this article was estimated within a broader validated structural model rather than through a separate parsimonious model containing only the three focal constructs. Therefore, the reported coefficient for sustainability-oriented innovation should be understood as its net effect within the broader structural model. This limitation does not weaken the value of the findings, but it clarifies the boundary of interpretation and points to the need for future research using dedicated models and, where possible, longitudinal or multi-source data.

CONCLUSION AND RECOMMENDATION

This study concludes that sustainability-oriented innovation contributes significantly to green employee engagement, while green employee engagement contributes significantly to green employee performance in the context of Indonesian non-formal education. The findings also indicate that green employee engagement serves as an engagement-related pathway through which sustainability-oriented innovation is translated into green work outcomes. These results suggest that sustainability-oriented innovation becomes more meaningful when employees are cognitively, emotionally, and behaviorally involved in organizational green goals and practices.

Theoretically, this study contributes to the literature on Green Human Resource Management and Green Organizational Behavior by positioning green employee engagement as an intervening mechanism between sustainability-oriented innovation and green employee performance. The study also extends the discussion of sustainability-oriented management into the context of non-formal education, a sector

that has received relatively limited attention in green management research. By focusing on employee-level outcomes, this study shows that sustainability-oriented innovation should not only be understood as an organizational capability, but also as a driver of employee engagement and green performance.

Practically, the findings imply that non-formal education institutions need to integrate sustainability-oriented innovation into human resource policies and daily managerial routines. At the policy level, institutions can include green competencies in recruitment and role descriptions, provide short but regular sustainability-oriented training, embed resource-efficiency behavior in performance appraisal, introduce simple green key performance indicators, and recognize employees or branches that implement practical environmental improvements. At the branch level, management can use short unit briefings, branch-level green routines, peer role modeling, participative problem solving, internal communication campaigns, and simple green performance feedback. These actions should support employees' autonomy, competence, relatedness, and work meaning so that sustainability-oriented innovation is experienced as relevant to daily service responsibilities rather than as an additional administrative burden. Such context-specific practices can help transform innovation-oriented sustainability efforts into more consistent green employee performance.

This study has several limitations. The use of cross-sectional and single-source survey data limits the ability to make strong causal claims and may raise the possibility of common method bias. Although procedural remedies were applied through clear instructions, neutral wording, respondent confidentiality, and separation of measurement sections, future studies are encouraged to apply statistical tests for common method bias, use multi-source data, and adopt longitudinal research designs. Future research may also examine

boundary conditions such as green organizational culture, green psychological climate, leadership support, green competence, and employee self-efficacy. In addition, future studies should consider the possibility that excessive green initiatives without sufficient psychological support, role clarity, and workload adjustment may produce engagement fatigue. This caveat is particularly relevant for non-formal education institutions, where employees often manage multiple service, administrative, and coordination responsibilities simultaneously.

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