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ORIGINAL RESEARCH ARTICLE

Environmental Citizenship Behavior in the Workplace: The Roles of Green HRM and Employee Engagement and Implications for Sustainability Education

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ABSTRACT

Environmental sustainability requires not only organizational policies but also the development of voluntary environmental behaviors that can be strengthened through continuous learning, engagement, and environmentally responsible practices. This study examines the mediating role of Organizational Citizenship Behavior for Environment (OCBE) in the relationships between Green Human Resource Management (GHRM), Employee Engagement, and Employee Performance in the manufacturing sector. Using a quantitative explanatory design, data were collected from 156 permanent employees of manufacturing companies in Cirebon, West Java, Indonesia, selected through purposive sampling. The relationships among the constructs were analyzed using Structural Equation Modeling–Partial Least Squares (SEM-PLS) with SmartPLS 4.0. The findings show that GHRM and Employee Engagement positively and significantly influence OCBE. OCBE also positively influences Employee Performance and partially mediates the relationships between GHRM and Employee Performance and between Employee Engagement and Employee Performance. These findings indicate that structured environmental practices and employee psychological engagement can encourage voluntary pro-environmental behavior as a mechanism linking organizational initiatives with individual performance. From a broader educational perspective, the findings offer conceptual implications for sustainability-oriented learning by demonstrating how environmental values may be reinforced through training, engagement, behavioral modeling, and supportive institutional practices. The study therefore extends the discussion of environmental citizenship beyond organizational performance toward the development of sustainability-oriented behavior relevant to lifelong and transformative environmental learning.

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ABSTRAK

Keberlanjutan lingkungan tidak hanya memerlukan kebijakan organisasi, tetapi juga pengembangan perilaku lingkungan yang bersifat sukarela, yang dapat diperkuat melalui pembelajaran berkelanjutan, keterlibatan, dan praktik-praktik yang bertanggung jawab terhadap lingkungan. Penelitian ini mengkaji peran mediasi *Organizational Citizenship Behavior for Environment* (OCBE) dalam hubungan antara *Green Human Resource Management* (GHRM), Keterlibatan Karyawan (*Employee Engagement*), dan Kinerja Karyawan di sektor manufaktur. Dengan menggunakan desain eksplanatori kuantitatif, data dikumpulkan dari 156 karyawan tetap perusahaan manufaktur di Cirebon, Jawa Barat, Indonesia, yang dipilih melalui teknik *purposive sampling*. Hubungan antar-konstruk dianalisis menggunakan *Structural Equation Modeling–Partial Least Squares* (SEM-PLS) dengan perangkat lunak SmartPLS 4.0. Hasil penelitian menunjukkan bahwa GHRM dan Keterlibatan Karyawan berpengaruh positif dan signifikan terhadap OCBE. OCBE juga berpengaruh positif terhadap Kinerja Karyawan serta memediasi secara parsial hubungan antara GHRM dengan Kinerja Karyawan dan hubungan antara Keterlibatan Karyawan dengan Kinerja Karyawan. Temuan ini mengindikasikan bahwa praktik lingkungan yang terstruktur dan keterlibatan psikologis karyawan dapat mendorong perilaku pro-lingkungan yang sukarela sebagai mekanisme yang menghubungkan inisiatif organisasi dengan kinerja individu. Dari perspektif pendidikan yang lebih luas, temuan ini memberikan implikasi konseptual bagi pembelajaran yang berorientasi pada keberlanjutan dengan menunjukkan bagaimana nilai-nilai lingkungan dapat diperkuat melalui pelatihan, keterlibatan, pemodelan perilaku, dan praktik institusional yang mendukung. Dengan demikian, penelitian ini memperluas pembahasan mengenai kewarganegaraan lingkungan (*environmental citizenship*) melampaui sekadar kinerja organisasi, menuju pengembangan perilaku yang berorientasi pada keberlanjutan yang relevan dengan pembelajaran lingkungan sepanjang hayat dan transformatif..

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1. INTRODUCTION

Environmental sustainability has developed from a primarily organizational concern into a broader global challenge involving the ways institutions cultivate environmentally responsible values and behaviors among individuals. Climate change, environmental degradation, inefficient resource use, and increasing ecological pressures require organizations to integrate sustainability into both operational systems and human behavior rather than relying solely on technical environmental controls (Ahmed et al., 2023; Al Doghan, 2024; Dwumah et al., 2025). Within this transition, Green Human Resource Management (GHRM) has become increasingly important because environmental objectives are embedded in recruitment, training, performance management, reward systems, and other human-resource practices that shape employees' knowledge, motivation, and everyday conduct (Ababneh, 2021; Ren et al., 2021; Dwumah et al., 2025). Recent research indicates that green organizational practices are associated not only with environmental performance but also with employee-level pro-environmental behavior and sustainable performance, demonstrating that organizational sustainability depends substantially on the people who enact environmental values in daily work (Ahmed et al., 2023; Elshaer et al., 2023; Khan et al., 2024). This issue is particularly significant in manufacturing environments, where resource consumption, industrial

waste, energy use, and pollution place substantial pressure on organizations to combine environmental management with sustained voluntary employee participation (Ahmed et al., 2023; Al Doghan, 2024; Dwumah et al., 2025). Accordingly, environmental citizenship in the workplace provides an important behavioral perspective for understanding how institutional sustainability practices may be translated into enduring environmentally responsible conduct.

The principal problem, however, is that the existence of formal green policies does not automatically ensure that employees voluntarily internalize and perform environmentally responsible behaviors. Organizations may establish green recruitment, environmental training, performance standards, and reward mechanisms, yet their environmental outcomes still depend on whether employees willingly translate these systems into discretionary actions beyond formal job requirements (Ababneh, 2021; Afsar & Umrani, 2021; Khan et al., 2024). This challenge is particularly relevant to the Indonesian manufacturing context because environmental responsibilities must coexist with expectations concerning productivity, operational efficiency, and employee performance, creating a need to understand whether sustainability-oriented organizational practices can support rather than compete with individual performance objectives (Ahmed et al., 2023; Al Doghan, 2024; Dwumah et al., 2025). Another challenge concerns employee engagement: environmentally oriented HR practices may provide institutional direction, but employees differ in psychological energy, dedication, involvement, and willingness to adopt organizational values, making engagement a potentially important condition for voluntary environmental behavior (Ababneh, 2021; Alshaabani et al., 2021; Elshaer et al., 2023). Consequently, the central problem is not merely whether organizations implement GHRM, but how GHRM and Employee Engagement become translated into Organizational Citizenship Behavior for Environment (OCBE) and how this voluntary behavior subsequently relates to Employee Performance. This behavioral mechanism remains especially important because structured environmental practices and psychological engagement represent different but potentially complementary routes through which sustainability values are enacted in organizational life (Ababneh, 2021; Afsar & Umrani, 2021; Khan et al., 2024).

Previous research has established important but fragmented relationships among green HR practices, employee psychological conditions, pro-environmental behavior, and organizational outcomes. Research related to GHRM and employee green behavior was conducted by Ababneh (2021), who examined Employee Engagement and personality attributes in explaining employee green behavior, while Afsar and Umrani (2021) investigated thriving and trust in leaders as mechanisms connecting GHRM with pro-environmental behavior; both studies confirm the behavioral importance of green HR practices but emphasize mechanisms other than the integrated OCBE–performance pathway examined here. Research related to GHRM and pro-environmental or creative outcomes was developed by Ahmad et al. (2022), who linked GHRM to green creativity through pro-environmental behavior and ethical leadership, and Elshaer et al. (2023), who examined pro-environmental behavior as a mediator between GHRM and environmental performance in small tourism enterprises; these studies broaden the behavioral explanation of GHRM but use outcomes and organizational contexts different from employee performance in manufacturing. Research related specifically to OCBE was undertaken by Anwar et al. (2021), Khan et al. (2024), and Dwumah et al. (2025), demonstrating the importance of GHRM in cultivating discretionary environmental citizenship behaviors; however, these studies do not simultaneously integrate Employee Engagement, OCBE, and Employee Performance within the Indonesian manufacturing context. Studies by Ahmed et al. (2023) and Al Doghan (2024) further connect GHRM with sustainable performance and green capability, but their explanatory mechanisms differ from the mediation model centered on OCBE used in the present investigation.

The novelty of the present study lies not in introducing entirely new organizational constructs, but in integrating established constructs into a behavioral mechanism that has received comparatively limited simultaneous examination. Existing studies have separately emphasized Employee Engagement in explaining green behavior (Ababneh, 2021; Alshaabani et al., 2021), pro-environmental behavior as a mediator of GHRM-related outcomes (Ahmad et al., 2022; Elshaer et al., 2023), OCBE as an environmental behavioral outcome of green practices (Anwar et al., 2021; Dwumah et al., 2025), and green capability or environmental consciousness as pathways toward sustainable performance (Ahmed et al., 2023; Al Doghan, 2024). By contrast, this study positions GHRM and Employee Engagement as two antecedent mechanisms, OCBE as a specific voluntary environmental-behavior mediator, and Employee Performance as the individual-level outcome within one structural model. This configuration enables the study to investigate whether organizational green practices and psychological engagement are associated with performance both directly and indirectly through voluntary environmental citizenship behavior. A further element of novelty is contextual: the model is examined among permanent employees of manufacturing companies in Cirebon, West Java, thereby contributing evidence from an emerging-economy manufacturing setting rather than reproducing hospitality, tourism, university, or other contexts commonly represented in prior studies (Anwar et al., 2021; Elshaer et al., 2023; Ahmed et al., 2023). Its broader educational relevance is therefore interpretive rather than empirical: the study may inform discussion of sustainability-oriented learning through institutional practice without claiming to have measured students, children, classrooms, or educational interventions.

A more specific research gap emerges from the fragmentation of previous findings. Reviews of GHRM research indicate that the field has increasingly moved from examining direct organizational outcomes toward identifying psychological and behavioral mechanisms through which green HR practices become effective, yet further explanation of these mechanisms remains necessary (Ren et al., 2021; Ahmad et al., 2022; Dwumah et al., 2025). Ababneh (2021) established the importance of Employee Engagement for green behavior, but did not place OCBE between engagement and Employee Performance within the integrated model used here; Afsar and Umrani (2021) emphasized thriving and trust in leadership rather than OCBE as the mediator; Ahmad et al. (2022) concentrated on green creativity and ethical leadership; and Elshaer et al. (2023) analyzed environmental performance in tourism enterprises rather than individual employee performance in manufacturing. Likewise, Anwar et al. (2021) examined GHRM, OCBE, and environmental performance in a university-campus setting, whereas Khan et al. (2024) and Dwumah et al. (2025) reinforce the significance of OCBE but do not resolve the combined relationship involving both GHRM and Employee Engagement as antecedents and Employee Performance as the outcome in the Cirebon manufacturing context. Thus, the research gap is simultaneously relational, contextual, and behavioral: limited evidence explains how structured green HR practices and employees' psychological engagement work together through voluntary environmental citizenship behavior to contribute to employee-level performance within an Indonesian manufacturing setting.

The theoretical explanation of these relationships is grounded primarily in Social Exchange Theory, which explains social and organizational relationships through reciprocal exchanges between organizations and their members; in the environmental context, employees may respond to organizational investment and supportive green practices by reciprocating through voluntary behaviors that benefit organizational sustainability (Afsar & Umrani, 2021; Ababneh, 2021; Dwumah et al., 2025). Applied to GHRM, environmental recruitment, training, performance management, and rewards communicate organizational commitment to sustainability and provide employees with resources, competencies, and recognition that can encourage reciprocal pro-environmental conduct (Alzgool, 2021; Anwar et al., 2021; Dwumah et al., 2025). Employee Engagement complements this logic because employees characterized by greater vigor, dedication, and involvement are more likely to invest discretionary effort in organizational objectives and

internalize sustainability-oriented expectations (Ababneh, 2021; Alshaabani et al., 2021; Elshaer et al., 2023). Within this framework, OCBE becomes the behavioral manifestation of reciprocity: employees voluntarily assist colleagues with environmental issues, participate in environmental initiatives, and propose improvements beyond formal job requirements (Anwar et al., 2021; Khan et al., 2024; Dwumah et al., 2025). The study therefore does not replace the original theoretical foundation with a new educational theory; rather, Social Exchange Theory remains the principal explanatory framework, while recent GHRM and environmental-behavior research supplies contemporary empirical support for its application to sustainability-oriented organizational relationships.

Conceptually, this study connects four constructs already established in the manuscript: Green Human Resource Management, Employee Engagement, Organizational Citizenship Behavior for Environment, and Employee Performance. GHRM represents organizational practices that incorporate environmental objectives into human-resource functions, including green recruitment and selection, green training and development, green performance management, and green compensation or reward practices (Ababneh, 2021; Ren et al., 2021; Al Doghan, 2024). Employee Engagement refers to employees' positive psychological involvement in work, reflected in energy, dedication, and absorption, and recent studies demonstrate that engagement can help translate organizational support and green practices into voluntary employee behavior (Ababneh, 2021; Alshaabani et al., 2021; Elshaer et al., 2023). OCBE represents voluntary, discretionary actions through which employees support environmental objectives beyond formally prescribed duties, and recent empirical studies increasingly identify this construct as a key behavioral link between organizational green practices and sustainability outcomes (Anwar et al., 2021; Khan et al., 2024; Dwumah et al., 2025). Employee Performance remains the individual outcome examined in the original research model, consistent with studies demonstrating that green organizational capability, environmental consciousness, engagement, and sustainability-oriented practices may coexist with performance-related outcomes rather than operating solely as environmental compliance mechanisms (Ahmed et al., 2023; Al Doghan, 2024; Khan et al., 2024). Together, these concepts form a coherent organizational-behavior framework without changing the constructs or empirical relationships originally investigated.

What makes this investigation particularly important is the possibility of explaining sustainability not only as a formal organizational policy but as a behavioral process through which environmental values become enacted voluntarily by employees while remaining connected with work performance. Contemporary research increasingly demonstrates that green HR practices alone do not explain all variation in environmental outcomes; psychological involvement, pro-environmental behavior, environmental consciousness, organizational capability, leadership, and voluntary citizenship mechanisms can substantially shape whether organizational sustainability initiatives are translated into actual conduct (Ababneh, 2021; Ahmad et al., 2022; Ahmed et al., 2023; Al Doghan, 2024). The manufacturing setting makes this relationship especially relevant because organizational sustainability must operate alongside productivity and employee-performance demands, rather than being treated as an isolated environmental program (Ahmed et al., 2023; Khan et al., 2024; Dwumah et al., 2025). Furthermore, studying OCBE is important because discretionary environmental behavior reflects a deeper level of participation than rule compliance alone, making it useful for understanding how institutional environmental values can become normalized through repeated practices, engagement, peer assistance, and individual initiative (Anwar et al., 2021; Afsar & Umrani, 2021; Dwumah et al., 2025). In this sense, the study provides a cautious conceptual bridge to sustainability-oriented learning: the workplace may function as one institutional environment where environmental values are reinforced through training, participation, modeling, and repeated behavior, although the present study does not directly measure learning, school education, or child outcomes.

Accordingly, this study aims to examine the mediating role of Organizational Citizenship Behavior for Environment in the relationships between Green Human Resource Management, Employee Engagement, and Employee Performance among permanent employees working in manufacturing companies in Cirebon, West Java, Indonesia. Specifically, it investigates whether GHRM influences OCBE and Employee Performance, whether Employee Engagement influences OCBE and Employee Performance, whether OCBE influences Employee Performance, and whether OCBE mediates the GHRM–Employee Performance and Employee Engagement–Employee Performance relationships. These objectives retain the original seven relational questions and do not introduce any additional empirical variable or alter the population, context, or measured constructs of the research. The model responds to recent calls to move GHRM research beyond direct-effect explanations by examining behavioral mechanisms that connect organizational green practices with individual outcomes (Ren et al., 2021; Ahmad et al., 2022; Khan et al., 2024; Dwumah et al., 2025). It also extends research showing that Employee Engagement, environmental consciousness, green capability, and voluntary environmental behavior can play important roles in translating sustainability-oriented institutional practices into employee outcomes (Ababneh, 2021; Ahmed et al., 2023; Al Doghan, 2024). Therefore, the study's contribution remains empirically centered on manufacturing employees, while its implication for sustainability education is framed cautiously as a broader conceptual interpretation concerning how environmental values may be reinforced through institutional practices, engagement, and repeated voluntary behavior.

2. RESEARCH METHODS

This Study employed a quantitative explanatory research approach to examine the relationships among Green Human Resource Management (GHRM), Employee Engagement, Organizational Citizenship Behavior for Environment (OCBE), and Employee Performance in manufacturing companies located in Cirebon, West Java, Indonesia. The methodological process was organized sequentially from the formulation of the research problem and theoretical framework to the development of seven research questions and hypotheses, selection of the research design, determination of the population and sample, questionnaire administration, measurement-model assessment, structural-model assessment, mediation testing, and interpretation of the findings. This sequence was designed to maintain consistency between the conceptual model, measurement instruments, and statistical analysis. The study used cross-sectional survey data collected from permanent manufacturing employees and analyzed the relationships among latent variables through Partial Least Squares Structural Equation Modeling (PLS-SEM) using SmartPLS 4.0. The analytical procedure followed two principal stages: evaluation of the measurement model and evaluation of the structural model. This approach enabled the study to assess both the adequacy of the measurement properties and the hypothesized direct and indirect relationships among the constructs (Hair et al., 2022; Hair & Alamer, 2022; Sarstedt et al., 2022)..

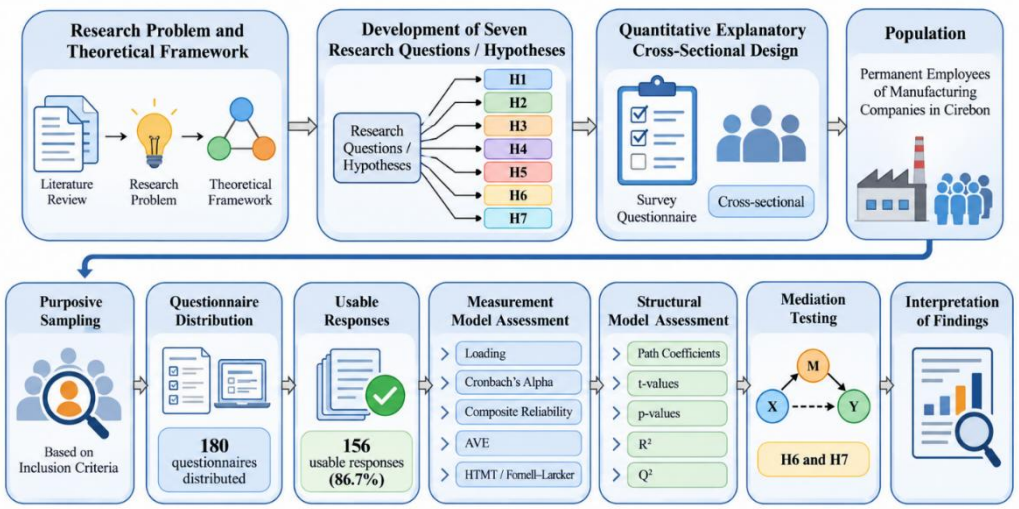


Figure 1. Overall Research Process from Research Design to Structural Model Evaluation

Figure 1 illustrates The research process began with the identification of the research problem and theoretical framework, followed by the development of seven research questions and hypotheses. A quantitative explanatory cross-sectional design was then applied to permanent employees of manufacturing companies in Cirebon. Respondents were selected using purposive sampling according to predetermined inclusion criteria. A total of 180 questionnaires were distributed, from which 156 usable responses were obtained, representing a response rate of 86.7%. The analytical stage began with measurement-model assessment using indicator loadings, Cronbach's alpha, composite reliability, Average Variance Extracted (AVE), HTMT, and the Fornell–Larcker criterion. After the measurement requirements were satisfied, the structural model was assessed using path coefficients, t-values, p-values, R^2, and Q^2. Finally, mediation testing was conducted for H6 and H7 before the findings were interpreted. This sequence is consistent with the recommended PLS-SEM procedure in which measurement quality is established before structural relationships are interpreted (Hair et al., 2022; Hair & Alamer, 2022; Sarstedt et al., 2022).

2.1. Research Design

This study employed a quantitative explanatory research design using a cross-sectional survey approach. The design was intended to examine theoretically specified relationships among GHRM, Employee Engagement, OCBE, and Employee Performance through hypothesis testing. Data were collected from respondents at a single period of observation rather than through repeated longitudinal measurements. The research model included GHRM and Employee Engagement as exogenous constructs, OCBE as a mediating construct, and Employee Performance as the principal endogenous construct. Seven hypotheses were formulated, comprising five direct-effect relationships and two mediation relationships. The explanatory design was appropriate because the study sought to estimate the strength and direction of relationships among several latent constructs while evaluating the mediating role of OCBE. Cross-sectional designs are suitable for examining contemporaneous relationships among multiple variables, although temporal causality must be interpreted cautiously because the variables are measured within the same observation period (Savitz & Wellenius, 2022; Hair & Alamer, 2022). PLS-SEM was selected because the model incorporates multiple latent variables and mediation pathways and requires simultaneous evaluation of both measurement and structural relationships (Hair et al., 2022; Sarstedt et al., 2022). The correspondence between the research questions and the analytical procedures is presented in Table 1.

Table 1. Research Questions and Types of Analysis

No.	Research Question	Type of Analysis
RQ1	Does Green HRM influence Organisational Citizenship Behavior for the Environment?	Direct-effect structural path: GHRM → OCBE
RQ2	Does Employee Engagement influence Organizational Citizenship Behavior for Environment?	Direct-effect structural path: EE → OCBE
RQ3	Does Green HRM influence Employee Performance?	Direct-effect structural path: GHRM → EP
RQ4	Does Employee Engagement influence Employee Performance?	Direct-effect structural path: EE → EP
RQ5	Does Organizational Citizenship Behavior for Environment influence Employee Performance?	Direct-effect structural path: OCBE → EP
RQ6	Does OCBE mediate the relationship between Green HRM and Employee Performance?	Indirect-effect/mediation analysis: GHRM → OCBE → EP
RQ7	Does OCBE mediate the relationship between Employee Engagement and Employee Performance?	Indirect-effect/mediation analysis: EE → OCBE → EP

Table 1 shows that RQ1–RQ5 were analyzed through direct structural paths, whereas RQ6 and RQ7 were evaluated through indirect mediation pathways. This analytical mapping ensured that each research question was directly connected to the corresponding statistical procedure in the PLS-SEM model.

2.2 Population, Sample, Research Subjects, and Study Location

The target population comprised permanent employees working in manufacturing companies located in Cirebon, West Java, Indonesia. The manufacturing sector was selected because of its environmental footprint and the relevance of green human-resource practices to operational activities. Approximately 45 medium- and large-scale manufacturing companies operate in the region. The sample size was determined using the PLS-SEM guideline applied in this study, which considers ten times the largest number of structural paths directed toward a particular construct. With seven structural paths in the model, the minimum required sample was 70 respondents. To increase the size of the available dataset, the study targeted 160 respondents. Purposive sampling was used with three inclusion criteria: permanent employment status with a minimum tenure of one year, involvement in operational activities relevant to environmental management, and willingness to participate voluntarily. Questionnaires were distributed to 180 potential respondents, and 156 completed questionnaires were considered usable for analysis, resulting in a response rate of 86.7%. The respondents therefore represented employees who had sufficient organizational exposure to assess HR practices, work engagement, environmental citizenship behavior, and work performance. The characteristics of the population and sample are summarized in Table 2.

Table 2. Population and Sample Characteristics

Component	Original Study Specification
Study area	Cirebon, West Java, Indonesia
Organizational context	Manufacturing companies
Approximate company population	45 medium and large manufacturing companies
Target participants	Permanent employees
Sampling technique	Purposive sampling
Minimum tenure	1 year
Other inclusion criterion	Involved in operational activities relevant to environmental management
Participation	Voluntary
Minimum sample used in planning	70
Targeted sample	160
Questionnaires distributed	180
Usable responses	156
Response rate	86.7%

Table 2 indicates that the unit of analysis was the individual permanent employee working within the manufacturing sector in Cirebon. The sampling procedure was aligned with the study's objective of examining organizational practices, psychological engagement, environmental citizenship behavior, and employee performance within a specific industrial context.

2.3 Research Instruments and Construct Operationalization

Data were collected using a structured questionnaire consisting of demographic information and four sections measuring the study constructs. All items were measured using a five-point Likert scale ranging from 1 (strongly disagree) to 5 (strongly agree). The questionnaire was originally developed in English and translated into Bahasa Indonesia using a back-translation procedure to maintain conceptual equivalence. GHRM was measured using 12 items adapted from Dumont et al. (2017) and Tang et al. (2018), covering green recruitment and selection, green training and development, green performance management, and green compensation and reward. Employee Engagement was measured using the nine-item Utrecht Work Engagement Scale (UWES-9), comprising vigor, dedication, and absorption. OCBE was measured using 10 items covering eco-helping, eco-civic engagement, and eco-initiatives, adapted from Boiral and Paillé (2012) and Lamm et al. (2015). Employee Performance was measured using eight items covering task performance and contextual performance, adapted from Williams and Anderson (1991) and Koopmans et al. (2011). The use of multi-item measures allowed each latent construct to be represented through theoretically defined indicators and dimensions. Table 3 presents the operationalization without altering the original indicator structure.

Table 3. Research Instrument and Construct Operationalization

Construct	Dimension/Sub-indicator	No. of Items	Main Source
Green HRM	Green recruitment and selection	3	Dumont et al. (2017); Tang et al. (2018)
	Green training and development	3	Dumont et al. (2017); Tang et al. (2018)
	Green performance management	3	Dumont et al. (2017); Tang et al. (2018)
	Green compensation and reward	3	Dumont et al. (2017); Tang et al. (2018)
Employee Engagement	Vigor	3	Schaufeli et al. (2006)
	Dedication	3	Schaufeli et al. (2006)
	Absorption	3	Schaufeli et al. (2006)
OCBE	Eco-helping	3	Boiral & Paillé (2012); Lamm et al. (2015)
	Eco-civic engagement	4	Boiral & Paillé (2012); Lamm et al. (2015)
	Eco-initiatives	3	Boiral & Paillé (2012); Lamm et al. (2015)
Employee Performance	Task performance	4	Williams & Anderson (1991); Koopmans et al. (2011)
	Contextual performance	4	Williams & Anderson (1991); Koopmans et al. (2011)
Total		**39 items**	

Table 3 shows that the research instrument contained 39 substantive measurement items distributed across the four constructs. The structure of the questionnaire was retained consistently throughout data collection and analysis.

2.4 Instrument Adaptation and Data Collection Procedure

Data collection was conducted over three months from March to May 2025. Before questionnaire distribution, permission was obtained from company management. Respondents who met the purposive-sampling criteria were then invited to participate voluntarily. The questionnaires were distributed through two channels. First, printed questionnaires were delivered directly to employees after obtaining permission

from company management. Second, online questionnaires were distributed through Google Forms via company HR departments. Respondents were informed that participation was voluntary and that their responses would remain confidential and anonymous. Printed questionnaires were returned in sealed envelopes, while online questionnaires were submitted electronically. After the collection period, returned questionnaires were screened for usability before being included in the final dataset. Of 180 questionnaires distributed, 156 responses were retained for analysis, resulting in an 86.7% response rate. The sequence is summarised in Table 4.

Table 4. Data Collection Procedure

Stage	Procedure
1	Obtain permission from company management
2	Identify respondents meeting the purposive-sampling criteria
3	Inform respondents about voluntary participation and confidentiality
4	Distribute paper questionnaires and/or Google Forms through HR departments
5	Collect sealed paper responses or electronic submissions
6	Screen returned questionnaires for usability
7	Retain 156 usable responses for analysis

Table 4 demonstrates that data collection followed a sequential process from organizational permission and respondent selection to questionnaire administration, response screening, and preparation of the final dataset..

2.5 Validity and Reliability Assessment

The measurement model was evaluated before the structural relationships were interpreted. Indicator reliability was assessed through outer loadings, with values above 0.70 considered acceptable. Internal consistency reliability was evaluated using Cronbach's alpha and composite reliability, with values above 0.70 indicating adequate reliability. Convergent validity was assessed using Average Variance Extracted (AVE), with values above 0.50 indicating that the construct explained an adequate proportion of variance in its indicators. Discriminant validity was assessed using the Fornell–Larcker criterion and the Heterotrait–Monotrait ratio (HTMT). These procedures are consistent with current PLS-SEM recommendations that measurement quality should be established before examining structural relationships (Hair et al., 2022; Hair & Alamer, 2022; Sarstedt et al., 2022). The resulting measurement-model criteria provided the basis for determining whether the four constructs could be used reliably in the subsequent structural-model analysis. The assessment criteria are summarised in Table 5.

Table 5. Measurement Model Evaluation Criteria

Assessment	Indicator	Criterion Used in Original Study
Indicator reliability	Outer loading	> 0.70
Internal consistency	Cronbach's alpha	> 0.70
Internal consistency	Composite reliability	> 0.70
Convergent validity	AVE	> 0.50
Discriminant validity	Fornell–Larcker criterion	Square root of AVE greater than relevant inter-construct correlations
Discriminant validity	HTMT	Original method: <0.90; observed results: <0.85

Table 5 provides the criteria used to evaluate whether the measurement properties were sufficiently reliable and valid before proceeding to hypothesis testing.

2.6 Data Analysis Technique

Data analysis was performed using Partial Least Squares Structural Equation Modeling (PLS-SEM) with SmartPLS 4.0. PLS-SEM was selected because the study involved several latent constructs, direct structural relationships, and mediation pathways within a single analytical model. The analysis followed two sequential stages. The first stage involved measurement-model evaluation through indicator loadings, Cronbach's alpha, composite reliability, AVE, the Fornell–Larcker criterion, and HTMT. The second stage involved structural-model evaluation through path coefficients (β), t-statistics, p-values, the coefficient of determination (R^2), and Stone–Geisser's Q^2. Statistical inference was generated using bootstrapping with 5,000 resamples. The direct relationships represented H1–H5, while mediation analysis was used to evaluate H6 and H7 through indirect effects and bootstrap confidence intervals. This analytical procedure is consistent with PLS-SEM recommendations for evaluating direct, indirect, explanatory, and predictive relationships among latent constructs (Hair et al., 2022; Hair & Alamer, 2022; Sarstedt et al., 2022). The analysis sequence is visualized in Figure 2.

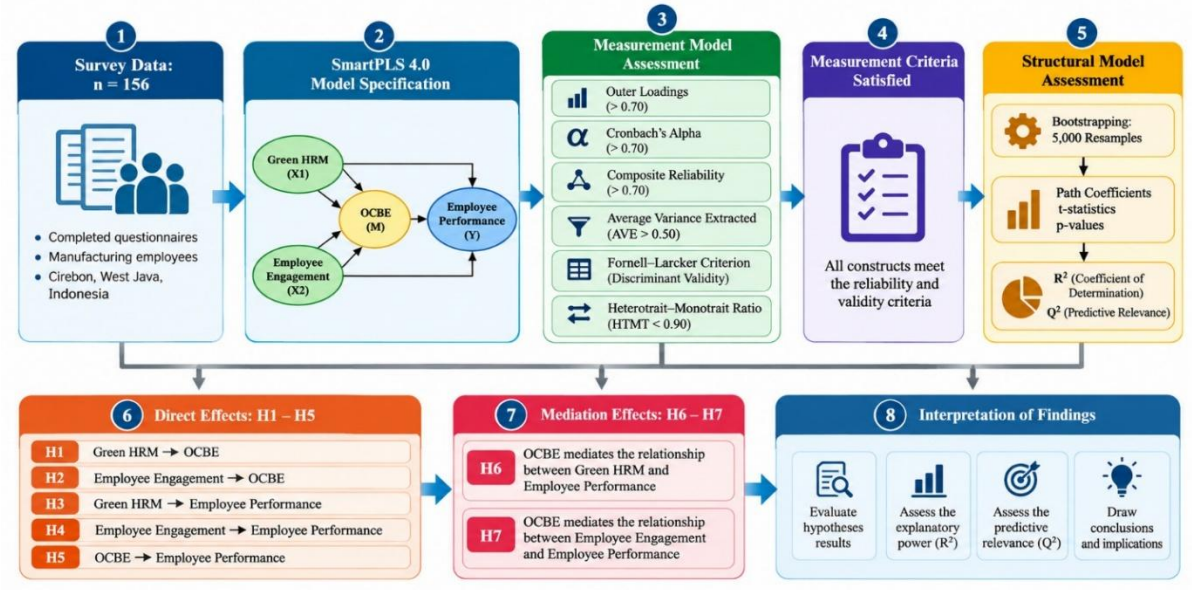


Figure 2. Sequential Measurement and Structural Model Evaluation Using SmartPLS 4.0

Figure 2 illustrates that the statistical analysis proceeded from measurement-model assessment to structural-model evaluation. This sequencing ensured that the hypothesized relationships were evaluated only after the reliability and validity of the measurement model had been established. The structural-model indicators are summarized in Table 6.

Table 6. Structural Model Analysis

Analysis Component	Statistical Evidence	Function
Direct relationship	Path coefficient (β)	Direction and magnitude of relationship
Statistical inference	t-statistic, p-value	Significance assessment
Resampling	5,000 bootstrap resamples	Inferential estimation
Explanatory power	R^2	Variance explained in endogenous constructs
Predictive relevance	Q^2	Predictive relevance of the model
Mediation	Bootstrapped indirect effect/confidence interval	Evaluation of H6 and H7

Table 6 shows that each hypothesis was evaluated using statistical evidence appropriate to its structural function, with direct effects assessed separately from indirect mediation effects.

2.7 Ethical Considerations

The study adhered to ethical research principles throughout participant recruitment, questionnaire administration, and data handling. Participation was voluntary, and informed consent was obtained from all respondents. Participants were informed that their responses would remain confidential and anonymous and would be used solely for academic purposes. Permission was obtained from company management before data collection began. Respondents were also informed of their right to withdraw from the study at any time without consequences. Printed questionnaires were collected in sealed envelopes, while online responses were submitted electronically, thereby supporting the confidentiality and anonymity of participant responses. These procedures were intended to protect participants while ensuring that their participation was based on informed and voluntary decision-making.

3. RESULTS

The results are presented hierarchically according to the analytical sequence established in the research model. The presentation begins with the characteristics of the 156 respondents, followed by evaluation of the measurement model, assessment of direct structural relationships, examination of the explanatory and predictive power of the model, mediation testing, and an integrated summary of the empirical findings. This ordering enables the seven research questions to be answered systematically without separating the statistical findings from their respective structural pathways. The results section reports only evidence generated from the empirical data and does not introduce additional constructs beyond Green Human Resource Management (GHRM), Employee Engagement (EE), Organizational Citizenship Behavior for Environment (OCBE), and Employee Performance (EP). Interpretation of broader theoretical and educational implications is reserved for the discussion section.

3.1 Respondent Characteristics

A total of 156 usable responses were included in the final analysis. The demographic profile shows that 67.3% of respondents were male and 32.7% were female. The largest reported age category was 31–40 years, representing 52.6% of the sample. In terms of educational background, 48.7% of respondents held senior high school qualifications, 32.1% held bachelor's degrees, and 19.2% held diploma qualifications. Regarding organizational tenure, 44.2% had worked for 2–5 years, 35.9% for 6–10 years, and 19.9% for more than 10 years. Thus, all respondents reported in the tenure distribution had at least two years of organizational experience. The characteristics indicate that the analyzed sample consisted predominantly of employees with sustained exposure to their organizations and workplace practices. Because the available age data identify only the dominant 31–40-year category, no additional age categories are introduced into the results. The demographic information is summarized in Table 1 to provide a concise representation of the respondent profile.

Table 1. Demographic Characteristics of Respondents

Characteristic	Category	Percentage
Gender	Male	67.3%

	Female	32.7%
Age	31–40 years	52.6%
Education	Senior high school	48.7%
	Bachelor's degree	32.1%
	Diploma	19.2%
Tenure	2–5 years	44.2%
	6–10 years	35.9%
	>10 years	19.9%

Table 1 shows that the sample was heterogeneous in educational background and length of service, while the 31–40-year age group constituted the largest reported age category. These characteristics provide the empirical context for the subsequent measurement and structural analyses.

3.2 Measurement Model Evaluation

The measurement model was evaluated before the structural relationships were examined. All item loadings exceeded 0.70, indicating that the indicators met the loading criterion specified for the study. Internal consistency was assessed using Cronbach's alpha and composite reliability, while convergent validity was assessed using Average Variance Extracted (AVE). As shown in Table 2, Cronbach's alpha values ranged from 0.865 to 0.914, and composite reliability values ranged from 0.894 to 0.931. All values therefore exceeded the 0.70 threshold. AVE values ranged from 0.611 to 0.672, exceeding the minimum criterion of 0.50 and supporting convergent validity (Hair et al., 2022; Hair & Alamer, 2022). OCBE produced the highest internal consistency values, with Cronbach's alpha of 0.914 and composite reliability of 0.931, while Employee Performance recorded the lowest values, although these remained above the required threshold. Discriminant validity was additionally evaluated using the Fornell–Larcker criterion and HTMT. The square root of the AVE for each construct exceeded its corresponding inter-construct correlations, and all HTMT values were below 0.85, indicating adequate discriminant validity.

Table 2. Reliability and Convergent Validity

Construct	Cronbach's Alpha	Composite Reliability	AVE
Green HRM	0.892	0.913	0.647
Employee Engagement	0.876	0.901	0.623
OCBE	0.914	0.931	0.672
Employee Performance	0.865	0.894	0.611

Table 2 demonstrates that the four constructs satisfied the internal consistency and convergent-validity requirements. Because the measurement requirements were fulfilled, the analysis proceeded to evaluation of the structural model.

3.3 Direct Structural Relationships

After confirmation of the measurement model, the structural model was evaluated to answer RQ1–RQ5. Table 3 presents the five direct structural relationships. GHRM had a positive and statistically significant relationship with OCBE ($\beta = 0.342$, $t = 4.892$, $p < 0.001$), supporting H1. Employee Engagement was also positively related to OCBE ($\beta = 0.398$, $t = 5.214$, $p < 0.001$), supporting H2. For Employee Performance, GHRM showed a positive significant relationship ($\beta = 0.189$, $t = 2.341$, $p = 0.019$), thereby supporting H3. Employee Engagement was positively and significantly related to Employee Performance ($\beta = 0.267$, $t = 3.456$, $p = 0.001$), supporting H4. Finally, OCBE was positively and significantly associated with Employee Performance ($\beta = 0.357$, $t = 4.678$, $p < 0.001$), supporting H5. Thus, all five direct hypotheses were empirically supported at the 0.05 significance level. Numerically, Employee Engagement produced the largest coefficient among the two predictors of OCBE, whereas OCBE showed the largest coefficient

among the three direct predictors of Employee Performance. These comparisons describe the observed coefficients and do not imply a separate statistical test of coefficient differences.

Table 3. Direct Effect Hypothesis Testing

Hypothesis	Structural Path	β	t-statistic	p-value	Result
H1	GHRM → OCBE	0.342	4.892	<0.001	Supported
H2	EE → OCBE	0.398	5.214	<0.001	Supported
H3	GHRM → EP	0.189	2.341	0.019	Supported
H4	EE → EP	0.267	3.456	0.001	Supported
H5	OCBE → EP	0.357	4.678	<0.001	Supported

Note. GHRM = Green Human Resource Management; EE = Employee Engagement; OCBE = Organizational Citizenship Behavior for Environment; EP = Employee Performance.

Table 3 confirms that both organizational green practices and employee psychological engagement were significantly associated with OCBE and Employee Performance, while OCBE itself was significantly related to Employee Performance. To provide a visual representation of the direct structural relationships, Figure 3 should display the standardized path coefficients together with the explained variance of the endogenous constructs.

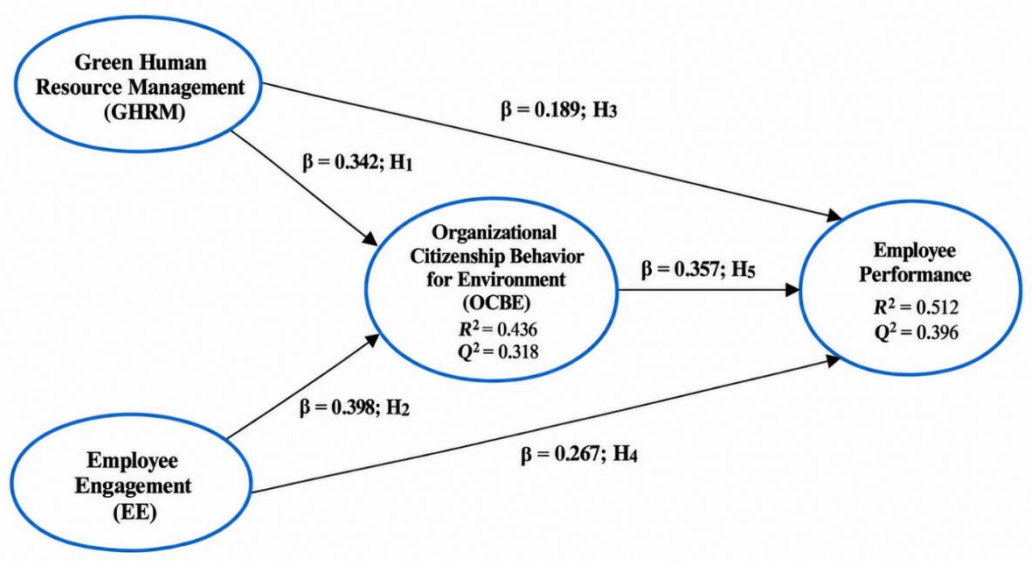


Figure 3. Structural Model and Standardized Path Coefficients

Figure 3 summarizes the empirical pattern obtained from the structural model. Both GHRM and Employee Engagement were directly related to OCBE and Employee Performance, while OCBE additionally contributed directly to Employee Performance. The model therefore contained simultaneous direct and mediated pathways, which were subsequently examined through R^2, Q^2, and indirect-effect analysis.

3.4 Explanatory Power and Predictive Relevance

The explanatory power of the structural model was evaluated using the coefficient of determination (R^2), while predictive relevance was assessed through Stone–Geisser's Q^2. Table 4 shows that the R^2 value for OCBE was 0.436. Accordingly, GHRM and Employee Engagement jointly accounted for 43.6% of the observed variance in OCBE. The R^2 value for Employee Performance was 0.512, indicating that GHRM, Employee Engagement, and OCBE together accounted for 51.2% of the variance in Employee Performance. The remaining variance in the two endogenous constructs was attributable to factors outside

the specified model. Predictive relevance was positive for both endogenous constructs: $Q^2 = 0.318$ for OCBE and $Q^2 = 0.396$ for Employee Performance. Because both Q^2 values were greater than zero, the model demonstrated predictive relevance for the two endogenous variables. These results complement the path-coefficient findings because they show not only that the individual relationships were statistically significant but also that the combined predictor structure accounted for a substantial proportion of variation in both OCBE and Employee Performance.

Table 4. Explanatory Power and Predictive Relevance

Endogenous Construct	R^2	Variance Explained	Q^2
OCBE	0.436	43.6%	0.318
Employee Performance	0.512	51.2%	0.396

Table 4 indicates that Employee Performance had the larger R^2 and Q^2 values, while both endogenous constructs exhibited positive predictive relevance. These findings provide the basis for evaluating whether OCBE additionally functions as an indirect mechanism connecting the two antecedent variables with Employee Performance.

3.5 Mediation Effects of OCBE

The mediation analysis addressed RQ6 and RQ7 by examining the indirect pathways through OCBE. The results are presented in Table 5. For H6, the indirect effect of GHRM on Employee Performance through OCBE was positive and statistically significant ($\beta = 0.122$, $t = 3.456$, $p = 0.001$). The 95% bootstrap confidence interval ranged from 0.067 to 0.189 and therefore did not include zero. This result supports the indirect GHRM → OCBE → Employee Performance pathway. Because the corresponding direct relationship between GHRM and Employee Performance also remained statistically significant ($\beta = 0.189$, $p = 0.019$), the observed pattern is consistent with partial mediation. For H7, the indirect effect of Employee Engagement on Employee Performance through OCBE was also positive and significant ($\beta = 0.142$, $t = 4.123$, $p < 0.001$), with a 95% confidence interval of 0.089–0.211. The confidence interval again excluded zero. Since the direct Employee Engagement → Employee Performance relationship was simultaneously significant, this pattern is also consistent with partial mediation. Thus, H6 and H7 were both supported.

Table 5. Mediation Effect Hypothesis Testing

Hypothesis	Indirect Path	β	t-statistic	p-value	95% CI Lower	95% CI Upper	Result
H6	GHRM → OCBE → EP	0.122	3.456	0.001	0.067	0.189	Supported; Partial Mediation
H7	EE → OCBE → EP	0.142	4.123	<0.001	0.089	0.211	Supported; Partial Mediation

Note. GHRM = Green Human Resource Management; EE = Employee Engagement; OCBE = Organizational Citizenship Behavior for Environment; EP = Employee Performance.

Table 5 shows that neither indirect-effect confidence interval crossed zero, providing bootstrap-based evidence for both mediation pathways. The mediation structure can be presented visually in Figure 4 to show how OCBE connects each antecedent with Employee Performance.

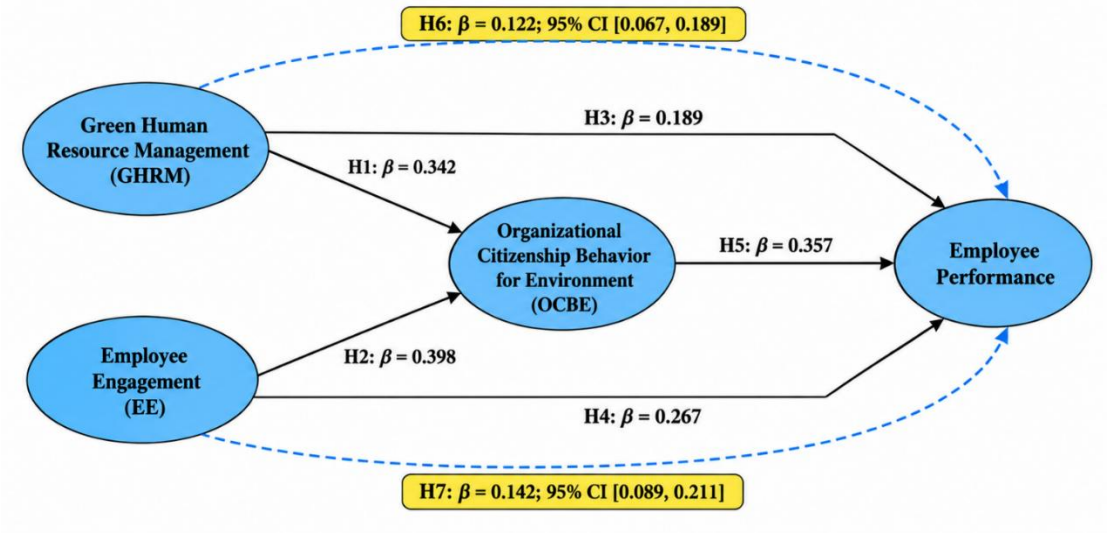


Figure 4. Mediation Pathways of OCBE between GHRM, Employee Engagement, and Employee Performance

Figure 4 illustrates that OCBE does not replace the direct relationships of GHRM and Employee Engagement with Employee Performance. Rather, both antecedents maintain statistically significant direct associations with Employee Performance while also operating through a statistically significant indirect OCBE pathway. This simultaneous direct-and-indirect pattern corresponds to the partial mediation results reported in Table 5.

3.6 Integrated Empirical Findings across the Seven Research Questions

The complete set of empirical findings provides a coherent answer to the seven research questions. First, GHRM was positively associated with OCBE, thereby answering RQ1 and supporting H1. Second, Employee Engagement was positively associated with OCBE, answering RQ2 and supporting H2. Third and fourth, GHRM and Employee Engagement each demonstrated significant direct relationships with Employee Performance, answering RQ3 and RQ4 and supporting H3 and H4. Fifth, OCBE was positively associated with Employee Performance, answering RQ5 and supporting H5. Sixth, OCBE significantly transmitted part of the relationship between GHRM and Employee Performance, answering RQ6 and supporting H6. Seventh, OCBE also transmitted part of the relationship between Employee Engagement and Employee Performance, answering RQ7 and supporting H7. The integrated pattern therefore indicates that the structural model contains two parallel antecedent routes to OCBE, three direct routes to Employee Performance, and two significant indirect routes through OCBE. Table 6 consolidates these findings without introducing additional variables or interpretations beyond the empirical model.

Table 6. Summary of Research Questions and Empirical Findings

Research Question	Empirical Finding	Statistical Evidence	Decision
RQ1	GHRM was positively related to OCBE	$\beta = 0.342$; $p < 0.001$	H1 Supported
RQ2	Employee Engagement was positively related to OCBE	$\beta = 0.398$; $p < 0.001$	H2 Supported
RQ3	GHRM was positively related to Employee Performance	$\beta = 0.189$; $p = 0.019$	H3 Supported
RQ4	Employee Engagement was positively related to Employee Performance	$\beta = 0.267$; $p = 0.001$	H4 Supported
RQ5	OCBE was positively related to Employee Performance	$\beta = 0.357$; $p < 0.001$	H5 Supported

RQ6	OCBE partially mediated GHRM → Employee Performance	β = 0.122; 95% CI [0.067, 0.189]	H6 Supported
RQ7	OCBE partially mediated EE → Employee Performance	β = 0.142; 95% CI [0.089, 0.211]	H7 Supported

Table 6 shows that all seven hypothesized relationships were empirically supported. The findings also reveal that the model explained 43.6% of the variance in OCBE and 51.2% of the variance in Employee Performance, while both endogenous constructs demonstrated positive predictive relevance. Accordingly, the empirical evidence establishes the complete statistical pattern required for the subsequent discussion of the relationships among GHRM, Employee Engagement, OCBE, and Employee Performance.

4. DISCUSSION

The discussion is organized around the research objectives rather than around a repetition of statistical outputs. The central issue is not merely whether the hypothesized relationships were significant, but how organizational green practices, psychological engagement, voluntary environmental behavior, and employee performance become connected within the manufacturing context of Cirebon. The analytical thread therefore proceeds from the antecedents of OCBE, to the direct performance pathways, to the mediating function of OCBE, and finally to the broader implications for organizational practice, sustainability-oriented learning, and theory. Such an approach is necessary because the empirical model suggests a layered mechanism rather than a single linear effect: formal institutional practices provide environmental structure, employee engagement reflects psychological involvement in organizational life, and OCBE represents voluntary enactment of environmental values. This layered reading is more informative than a simple confirmation of hypotheses because recent green HRM studies increasingly demonstrate that organizational sustainability outcomes depend on intervening behavioral and psychological processes rather than on HR practices alone (Ababneh, 2021; Afsar & Umrani, 2021; Ahmad et al., 2022; Ahmed et al., 2023; Elshaer et al., 2023; Al Doghan, 2024; Dwumah et al., 2025). The present evidence adds an Indonesian manufacturing perspective to this conversation while remaining cautious about causality because the study employed a cross-sectional design.

4.1 Green HRM and Employee Engagement as Antecedents of OCBE

The first two research objectives concern why Green Human Resource Management and Employee Engagement are associated with Organizational Citizenship Behavior for Environment. The most plausible interpretation is that these two antecedents operate through different but complementary mechanisms. GHRM provides a formal institutional architecture for environmental responsibility through recruitment, training, performance management, and reward practices, whereas Employee Engagement reflects an employee's psychological investment in work and organizational goals. Social Exchange Theory is particularly useful for interpreting the GHRM–OCBE pathway because green HR practices communicate that the organization invests resources, expectations, and recognition in environmentally responsible conduct. Employees may reciprocate such organizational investment through discretionary actions that exceed formal role requirements. In this sense, OCBE can be understood as one behavioral form of reciprocal exchange rather than as a mechanical response to policy. Afsar and Umrani (2021) similarly interpret pro-environmental behavior through a social-exchange lens, while Ababneh (2021) demonstrates that green HR practices do not act independently of employee psychological engagement. Ren et al. (2021)

further argue that contemporary GHRM research must move beyond direct associations and examine the mechanisms through which environmental HR systems become translated into employee behavior.

The present findings importantly refine this literature. Ababneh (2021) positioned Employee Engagement as a mediating process between green HRM and individual green behavior in the hospitality context, whereas the present model treats GHRM and Employee Engagement as parallel antecedents of OCBE. Dwumah et al. (2025), studying manufacturing firms in Ghana, similarly found that green HRM practices influence OCBE and that employee engagement plays a critical behavioral role, but their model emphasizes engagement as a mediator between specific green HR practices and OCBE. The Cirebon pattern is therefore not a direct replication of that architecture. It suggests that engagement itself may have an independent association with voluntary environmental citizenship alongside formal green HR systems. This distinction matters because it implies that organizations may not generate discretionary environmental behavior merely by introducing environmental HR procedures; employees must also be psychologically connected enough to notice, internalize, and enact those environmental signals. Ahmad et al. (2022) reinforce this broader argument by showing that pro-environmental behavior functions as a mechanism connecting green HRM with green creativity, while Elshaer et al. (2023) identify pro-environmental behavior as a mediator between GHRM and environmental performance in tourism enterprises. Across these studies, the recurring pattern is that employee behavior operates as the transmission mechanism between institutional green practices and broader organizational outcomes.

The Cirebon manufacturing context adds another layer to this interpretation. Manufacturing environments typically integrate environmental responsibility into concrete operational routines involving waste, energy, production processes, and resource use rather than treating sustainability as an abstract organizational value. This operational visibility may make the environmental meaning of HR practices more salient to employees. Al Doghan (2024), working in a manufacturing context, shows that green skill development, motivation, involvement, and empowerment are associated with green capability and green performance, suggesting that environmental HR practices gain significance when employees encounter sustainability directly through work processes. Ahmed et al. (2023) similarly emphasize environmental consciousness and green intellectual capital as mechanisms linking GHRM with sustainable performance. The present findings complement these studies by locating OCBE at the behavioral level: employees' voluntary environmental actions may represent the point at which formal green systems become personally enacted. The implication is not that engagement is statistically "stronger" than GHRM in a formal comparative sense, because the study did not test coefficient differences; rather, the observed pattern suggests that psychological involvement may be at least as consequential as formal environmental systems in explaining discretionary environmental behavior. This interpretation shifts the managerial problem from "implementing green HRM" to "creating conditions in which employees actively appropriate and enact green HRM."

4.2 Direct Relationships with Employee Performance

The next set of research objectives concerns the direct relationships of GHRM, Employee Engagement, and OCBE with Employee Performance. These relationships suggest that environmental management and performance should not be treated as competing organizational agendas. A narrow efficiency perspective might assume that voluntary environmental activities divert attention from core production tasks, especially in manufacturing settings where output, quality, and operational discipline are central. The present pattern points in the opposite direction: environmentally structured HR practices, psychological engagement, and voluntary environmental citizenship coexist with higher employee performance. The most defensible interpretation is not that environmental activity automatically produces superior productivity, but that the competencies, motivational signals, and discretionary behaviors embedded in green organizational systems are compatible with broader performance processes. Anwar et al. (2021), for example, found that GHRM

contributes to OCBE and environmental performance in a university setting, while Ahmed et al. (2023) connect GHRM with sustainable performance through environmental consciousness and green intellectual capital. Al Doghan (2024) extends this line of inquiry in manufacturing by showing that green HRM dimensions are associated with green capability and green performance. The present study differs by using Employee Performance rather than environmental or organizational performance as the individual-level outcome, thereby demonstrating that sustainability-related practices can be discussed within the same model as conventional performance outcomes.

The Employee Engagement pathway requires a somewhat different theoretical interpretation. Engagement is not best treated as a social-exchange outcome in itself; it functions more plausibly as a psychological condition that enables employees to invest sustained attention, energy, and commitment in organizational tasks. Recent green-behavior research supports the proposition that engagement is consequential for sustainability-related conduct. Ababneh (2021) shows that employee engagement helps transmit green HRM into individual green behavior, while Dwumah et al. (2025) identify engagement as part of the process through which specific green HR practices generate OCBE in manufacturing. The present evidence extends this conversation by showing that engagement is connected not only with environmental citizenship but also directly with Employee Performance. This dual relationship matters because it suggests that engagement may bridge conventional work objectives and environmental values rather than requiring employees to choose between them. An engaged employee can simultaneously invest effort in task completion and participate in discretionary green action. Such a configuration is especially relevant in manufacturing, where sustainability practices must be embedded in ongoing work rather than performed as occasional symbolic activities.

The direct relationship between OCBE and Employee Performance is analytically significant because it challenges the assumption that voluntary environmental behavior sits outside the productive core of work. OCBE includes eco-helping, eco-civic engagement, and eco-initiatives, all of which involve discretionary contribution rather than mandatory compliance. Khan et al. (2024) similarly emphasize OCBE as an important mediating mechanism within GHRM relationships, while Dwumah et al. (2025) show that OCBE is increasingly central to explaining how green HR practices operate in manufacturing organizations. Ahmad et al. (2022) demonstrate a related mechanism by showing that pro-environmental behavior helps translate green HRM into green creativity. The important distinction is that the present study connects environmental citizenship to general Employee Performance rather than to green creativity or environmental performance alone. This suggests that OCBE may overlap conceptually with broader contextual-performance orientations because both involve discretionary contribution, initiative, and support for organizational functioning. Such an interpretation should remain carefully bounded: the study did not separately measure problem-solving skill development, collegial trust, or motivational meaning. It is therefore inappropriate to claim that OCBE caused those outcomes. What can be argued is that employees who voluntarily enact environmental responsibility may also be demonstrating forms of discretionary participation compatible with broader performance behavior. The theoretical significance lies in this compatibility rather than in an unsupported causal chain.

4.3 OCBE as a Behavioral Mediating Mechanism

The mediation findings represent the most analytically important contribution of the study because they explain why the relationships between GHRM, Employee Engagement, and Employee Performance cannot be reduced to direct effects. The partial mediation pattern indicates that OCBE carries part, but not all, of the association between each antecedent and Employee Performance. This distinction matters. If mediation had been complete, one could argue that green HR practices and engagement affect performance only through voluntary environmental behavior. The partial pattern instead suggests multiple pathways. Formal

HR systems may be associated with performance through competence development, performance expectations, recognition, or other processes not represented in the model, while engagement may also relate to performance through effort, persistence, and task involvement. OCBE constitutes one specific behavioral pathway within this wider network. This interpretation is more theoretically defensible than treating OCBE as the sole mechanism linking green organizational practices with employee outcomes.

The GHRM–OCBE–performance pathway speaks directly to the "black box" problem identified in contemporary GHRM research. Ren et al. (2021) argue that green HRM scholarship needs stronger explanations of the psychological and behavioral processes connecting HR systems with outcomes. Afsar and Umrani (2021) addressed this problem through thriving and trust in leadership; Ababneh (2021) emphasized employee engagement; Ahmad et al. (2022) used pro-environmental behavior to explain green creativity; Ahmed et al. (2023) introduced environmental consciousness and green intellectual capital; Al Doghan (2024) examined green capability; Khan et al. (2024) focused specifically on OCBE; and Dwumah et al. (2025) combined green HRM, engagement, personality, and OCBE. The present model contributes to this literature by placing OCBE between GHRM and an individual performance outcome while simultaneously retaining Employee Engagement as a parallel antecedent. Its contribution is therefore not the discovery that behavior matters—previous studies have already established that—but the integration of institutional, psychological, and behavioral layers within a single employee-level model in an Indonesian manufacturing setting.

The engagement–OCBE–performance pathway produces a particularly interesting theoretical tension. If engagement were simply another organizational outcome, its role would end with improved performance. Instead, the mediation pattern suggests that psychologically engaged employees may express part of their engagement through voluntary environmental conduct before that conduct becomes associated with performance. This interpretation extends the logic of Ababneh (2021) and Dwumah et al. (2025), although the causal ordering differs across models. In Ababneh's framework, engagement mediates the green HRM–green behavior relationship; in Dwumah et al. (2025), engagement mediates relationships between selected green HR practices and OCBE. In the present model, engagement precedes OCBE and contributes to performance both directly and indirectly. This difference should not be treated as contradiction because the studies use different theoretical architectures and contexts. Rather, it highlights that engagement may occupy different positions depending on whether the analytical focus is organizational practices, green behavior, or performance. The broader implication is that Employee Engagement is not merely an endpoint of good HR practice; it may function as a psychological resource that enables employees to convert organizational values into discretionary action. That possibility deserves longitudinal testing because the cross-sectional design cannot determine whether engagement precedes OCBE temporally, whether voluntary environmental participation strengthens engagement, or whether the relationship is reciprocal.

4.4 Practical and Sustainability-Oriented Learning Implications

The practical significance of the findings lies in how they reposition environmental management within everyday organizational practice. A compliance-oriented strategy would focus narrowly on environmental rules, targets, and sanctions. The present evidence suggests that such a strategy may be insufficient because OCBE is inherently discretionary. Employees cannot be ordered to display genuine citizenship behavior in the same way that they can be required to follow safety procedures. Green HR systems therefore need to create conditions that make environmental participation credible, supported, and meaningful. Research by Alzgool (2021), Ababneh (2021), Ahmad et al. (2022), Ahmed et al. (2023), Elshaer et al. (2023), Al Doghan (2024), and Dwumah et al. (2025) collectively shows that environmental training, green capability, engagement, supportive leadership, pro-environmental behavior, and organizational green practices operate through interconnected rather than isolated mechanisms. For manufacturing firms in Cirebon, this implies

that environmental criteria should not be confined to recruitment documents or periodic training events. They need to become visible in performance expectations, recognition systems, opportunities for employee input, peer collaboration, and management behavior. The practical shift is from "green HRM as policy" to "green HRM as an institutional learning environment."

This distinction creates a legitimate, but carefully bounded, bridge to sustainability-oriented learning. The study did not measure students, teachers, classrooms, learning outcomes, or formal sustainability education, so its findings cannot be presented as evidence of educational effectiveness. Their relevance is conceptual. Workplace environmental behavior illustrates how sustainability values may be reinforced through repeated institutional cues, behavioral participation, peer interaction, and opportunities to act voluntarily. Such mechanisms are relevant to broader discussions of transformative environmental learning because learning does not occur only through formal curricular instruction; adults also learn norms, values, and practices through participation in institutional routines. Dwumah et al. (2025) is particularly informative here because its manufacturing evidence shows that green training and development can strengthen engagement, which in turn supports OCBE. Al Doghan (2024) similarly emphasizes green skill development and involvement as components of capability formation. These studies suggest that environmental competence is partly developed through structured experience, not merely through awareness campaigns.

For sustainability-oriented education, the conceptual implication is that environmental citizenship may require more than transferring ecological knowledge. Institutions may need to create repeated opportunities for individuals to practice environmental responsibility, observe behavioral models, collaborate with peers, and exercise agency in sustainability decisions. The workplace evidence from Cirebon therefore contributes indirectly to pedagogical debates about the formation of environmental citizenship: values become more durable when they are enacted rather than merely communicated. This does not mean that a manufacturing workplace can be equated with a school or that employee behavior can be generalized directly to children aged 0–18. The contribution is narrower and more defensible: the study identifies institutional conditions—structured environmental practices, engagement, voluntary participation, and behavioral reinforcement—that may inform future educational research on sustainability-oriented learning. For CEJ, this distinction is essential. The manuscript can contribute to the journal's interest in transformative pedagogy and resilient learning by offering an institutional-behavior perspective, but future studies would need to test these mechanisms directly among students, teachers, schools, or non-formal educational settings before educational effectiveness could be claimed.

4.5 Theoretical Contributions and Boundary Conditions

The principal theoretical contribution lies in the integration of three analytical layers: organizational structure, psychological involvement, and voluntary environmental behavior. Social Exchange Theory provides a useful explanation for the first transition because GHRM signals organizational investment in environmental values, resources, and expectations, which employees may reciprocate through OCBE. Yet the findings also reveal the limits of a pure exchange explanation. Employee Engagement is not simply an exchange transaction; it represents a psychological state through which employees become more willing to invest themselves in organizational activities. OCBE, meanwhile, is not merely compliance with a reciprocal obligation because it is defined by voluntary behavior beyond formal requirements. The integrated model therefore suggests that Social Exchange Theory explains part of the process but should not be treated as an exhaustive account of environmental citizenship. This more modest theoretical position is preferable to claiming that the study "extends Social Exchange Theory" in a wholly novel direction, because Afsar and Umrani (2021) and related green-behavior research have already applied exchange logic to environmental contexts.

The study also contributes by clarifying the position of OCBE relative to other mechanisms proposed in recent literature. Ababneh (2021) foregrounds engagement and personality; Afsar and Umrani (2021) emphasize thriving and trust; Ahmad et al. (2022) focus on pro-environmental behavior and ethical leadership; Ahmed et al. (2023) highlight environmental consciousness and green intellectual capital; Elshaer et al. (2023) analyze pro-environmental behavior as a mediator; Al Doghan (2024) introduces green capability; Khan et al. (2024) positions OCBE as a mediating mechanism; and Dwumah et al. (2025) integrates green HRM, engagement, personality traits, and OCBE in manufacturing. Rather than displacing these explanations, the present study shows that OCBE can function as one behavioral pathway connecting both institutional and psychological antecedents with individual performance. The partial mediation pattern is especially important because it prevents theoretical overreach: OCBE matters, but it does not explain everything. Other mechanisms remain plausible and empirically untested within the current model.

The Indonesian manufacturing context provides a further boundary condition. Much green HRM evidence has been generated in hospitality, tourism, universities, or manufacturing settings outside Indonesia. Cirebon firms operate within their own industrial, institutional, and workforce conditions, which may shape how employees interpret environmental expectations and discretionary participation. The present findings should therefore be understood as contextually informative rather than universally generalizable. One possible contextual explanation for the simultaneous importance of structured HR practices and engagement is that manufacturing employees encounter environmental issues through tangible production processes—waste handling, energy use, material efficiency, and operational discipline—making environmental norms less abstract than in settings where sustainability is primarily symbolic or service-oriented. This proposition remains interpretive rather than directly measured, but it offers a productive direction for future comparative research. Taken together, the theoretical contribution is best described as integrative rather than revolutionary. The study provides additional support for Social Exchange Theory in environmental organizational contexts, positions Employee Engagement as a psychological enabling condition, identifies OCBE as a partial behavioral mediator, and links these mechanisms to individual Employee Performance in an Indonesian manufacturing setting. Its broader relevance to sustainability-oriented learning arises from the same layered logic: institutional structures can provide opportunities and signals, psychological engagement can sustain participation, and voluntary behavior can embody internalized environmental values. Future longitudinal, multilevel, and educational studies are needed to determine whether this sequence holds over time, whether relationships are reciprocal, and whether similar mechanisms operate in formal and non-formal learning environments.

5. CONCLUSION

5.1. Conclusions

The most significant finding of this study is that Organizational Citizenship Behavior for Environment (OCBE) partially mediates the relationships between Green Human Resource Management (GHRM), Employee Engagement, and Employee Performance among manufacturing employees in Cirebon, West Java, Indonesia. This finding indicates that voluntary environmental behavior represents an important, but not exclusive, behavioral pathway linking environmentally oriented organizational practices and employee engagement with individual performance. The partial mediation pattern further suggests that GHRM and

Employee Engagement are associated with Employee Performance through both direct relationships and indirect relationships involving OCBE. Thus, environmentally responsible organizational practices and employee performance should not be understood as competing priorities; instead, their relationship can be explained partly through employees' voluntary participation in environmental initiatives beyond formal job requirements.

The principal theoretical contribution of this study lies in integrating institutional, psychological, and behavioral perspectives into a single explanatory framework. GHRM represents the organizational structures and practices supporting environmental responsibility, Employee Engagement reflects employees' psychological involvement in their work, and OCBE captures the voluntary behavioral expression of environmental commitment. By demonstrating the partial mediating role of OCBE, the study extends the understanding of how sustainability-oriented human resource practices and employee engagement are associated with performance outcomes. Rather than treating environmental management as a purely formal organizational responsibility, the findings offer a complementary perspective in which discretionary employee behavior constitutes an important mechanism connecting organizational sustainability initiatives with individual performance. Empirically, the study contributes context-specific evidence from manufacturing employees in Cirebon, enriching the understanding of sustainability-related organizational behavior within an Indonesian manufacturing setting.

These conclusions should be interpreted in light of several methodological and contextual limitations. The cross-sectional research design does not establish temporal ordering or causal relationships among the variables. Reliance on employee self-report questionnaires may introduce common method variance, while the geographical and sectoral concentration on manufacturing employees in Cirebon limits the generalizability of the findings. Furthermore, although OCBE demonstrates partial mediation, the study does not identify all potential psychological and organizational mechanisms that may explain the remaining relationships. The absence of moderating variables and qualitative evidence also restricts understanding of the organizational conditions under which green HR practices and employee engagement are translated into voluntary environmental behavior.

Future research should employ longitudinal, multi-source, and mixed-method designs to examine the stability and potential causal direction of these relationships. Comparative studies involving different industries, organizational characteristics, and geographical regions are recommended to assess the transferability of the proposed model. Further investigations should explore additional mediating and moderating mechanisms, including green self-efficacy, perceived organizational support, environmental leadership, and organizational culture. Although the findings also provide a conceptual perspective relevant to sustainability-oriented learning, their educational implications require direct empirical investigation involving educational institutions, teachers, learners, or professional training environments. Such research would help establish whether institutional environmental practices, psychological engagement, and voluntary environmental participation operate through comparable mechanisms beyond the manufacturing workplace.

5.2 Limitations and Future Research Directions

Several limitations should be considered when interpreting the findings. First, the study employed a cross-sectional design in which all variables were measured within the same general observation period. This design is appropriate for examining structural associations but does not provide strong evidence regarding temporal ordering or long-term causal processes. Future studies could employ longitudinal designs to examine how GHRM, Employee Engagement, OCBE, and Employee Performance develop over time and

to strengthen temporal inference regarding the sequence among organizational practices, psychological engagement, voluntary environmental behavior, and performance. Second, the data were obtained primarily from employees using self-report questionnaires. Although this approach enabled the study to capture employee perceptions of HR practices, engagement, environmental citizenship, and performance, reliance on a single respondent source may increase susceptibility to common method variance. Future research could strengthen measurement validity by combining employee self-reports with supervisor evaluations, objective performance indicators, environmental performance records, or other independent data sources. Multi-source designs would also make it possible to distinguish more clearly between perceived organizational practices and independently observed performance outcomes. Third, the study was conducted specifically among manufacturing employees in Cirebon, West Java. The environmental and operational characteristics of manufacturing organizations may differ substantially from those of service, hospitality, healthcare, educational, or public-sector organizations. The findings should therefore be interpreted as contextually specific rather than universally generalizable. Future research could test the model across different industries, organizational sizes, and geographical regions to determine whether the relationships remain stable under different institutional and environmental conditions.

Fourth, OCBE was examined as the principal behavioral mediator, but the partial mediation pattern indicates that other mechanisms may also connect GHRM and Employee Engagement with Employee Performance. Future studies could examine alternative or complementary mediators such as green self-efficacy, environmental consciousness, green passion, perceived organizational support for the environment, green psychological climate, or pro-environmental attitudes. Such extensions would help clarify whether OCBE represents a dominant behavioral pathway or one component within a broader set of psychological and behavioral mechanisms. Fifth, the current model did not examine potential moderating conditions. Leadership style, organizational culture, environmental values, perceived organizational support, job characteristics, and green psychological climate may strengthen or weaken the relationships identified in the study. Future studies could investigate these boundary conditions to determine when and under what organizational circumstances GHRM and Employee Engagement are more likely to be translated into voluntary environmental behavior and performance outcomes.

Sixth, the study used a quantitative approach exclusively. Future research could incorporate qualitative or mixed-method designs to explore how employees interpret green HR practices, why some employees engage more actively in voluntary environmental behavior than others, and how environmental norms are negotiated within manufacturing workplaces. Interviews, focus groups, ethnographic observations, or case studies could provide deeper insight into the institutional and cultural processes that are not fully captured through structured questionnaires. Finally, future research should examine whether the institutional mechanisms identified in this study also operate within educational settings. Structured environmental practices, psychological engagement, peer-supported environmental behavior, and repeated opportunities for voluntary participation may have relevance for sustainability-oriented learning, but this proposition requires direct empirical testing among students, teachers, schools, vocational institutions, or non-formal learning environments. Such studies would be necessary before organizational findings could be generalized to educational practice.

5.3 Practical and Policy Recommendations

For manufacturing organizations, the findings suggest that environmental sustainability should be embedded across the employee-management system rather than treated as a separate environmental program. Green recruitment, environmental training, sustainability-related performance expectations, recognition mechanisms, and opportunities for employee participation should function as interconnected

practices. The practical value of GHRM is likely to be greater when employees encounter consistent environmental signals across multiple organizational processes rather than isolated initiatives. Manufacturing firms should also create channels through which employees can propose environmental improvements, participate voluntarily in green initiatives, and support colleagues in environmentally responsible work practices. Such mechanisms are especially important because OCBE represents behavior that cannot be produced solely through formal rules or compliance requirements. Employee Engagement should also be treated as a strategic condition for environmental participation rather than only as a general HR outcome. Organizations should create work environments that support meaningful participation, recognition, involvement, and opportunities for employees to contribute to sustainability-related decisions. Environmental initiatives are less likely to become embedded in everyday practice when employees experience them as externally imposed obligations. A more sustainable approach is to connect environmental goals with meaningful work, employee agency, and visible organizational support so that voluntary participation becomes part of normal organizational life.

For HR practitioners, the findings imply that environmental objectives should be integrated into broader employee-development and engagement strategies. Training should not be restricted to technical environmental knowledge but should also create opportunities for employees to translate that knowledge into workplace action. Recognition systems should acknowledge voluntary environmental contributions without turning OCBE into a purely compliance-based activity. HR practitioners should also monitor whether environmental policies are experienced as supportive opportunities or as additional work demands, because the psychological meaning of green practices may influence how employees respond to them. For policymakers, the findings support the development of organizational frameworks that encourage companies to integrate environmental responsibility into workforce management. Policy initiatives may include guidance on environmentally responsible HR practices, incentives for employee participation in sustainability programs, and mechanisms for sharing effective practices across manufacturing organizations. Any attempt to translate these findings into vocational or educational policy should remain cautious, because the present study did not directly examine educational outcomes. Nevertheless, the institutional mechanisms identified here may provide a useful basis for future policy-oriented research examining how workplace environmental behavior can inform sustainability training and professional development.

5.4 Implications for Sustainability-Oriented Learning

The study offers a conceptual contribution to sustainability-oriented learning by showing that environmental values can be associated with institutional practices, psychological engagement, and voluntary behavioral enactment. From this perspective, sustainability learning may be more effective when individuals are not only exposed to environmental information but also provided with repeated opportunities to participate, observe institutional commitment, collaborate with peers, and exercise agency in environmentally responsible activities. The workplace evidence suggests that environmental citizenship is strengthened when environmental expectations are embedded in everyday routines and supported by structures that encourage participation rather than merely prescribe compliance. These implications should not be interpreted as direct evidence of educational effectiveness. The study did not measure pedagogical interventions, student learning, teacher practices, or child outcomes. Its contribution lies in identifying mechanisms that may be relevant to future educational research. Sustainability-oriented learning environments may benefit from examining how institutional consistency, engagement, peer interaction, behavioral modeling, and voluntary participation contribute to the internalization of environmental values over time. Future studies in schools, universities, vocational institutions, and non-formal education settings

are needed to determine whether the mechanisms observed in the manufacturing context operate similarly in educational environments.

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Ethical & Author Statements

CRediT Statement: Eteh Resa Asyifa: Conceptualization, Methodology, Formal Analysis, Writing – Original Draft, Project Administration; Dian Sudiantini: Validation, Investigation, Resources, Writing – Review & Editing, Supervision; Azlan Bin Saflie: Investigation, Resources, Validation, Writing – Review & Editing..

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Data Availability Statement (Data Policy): The data analyzed in this study were obtained from questionnaire responses provided by permanent employees of manufacturing companies in Cirebon, West Java, Indonesia. Due to confidentiality and anonymity considerations, the raw dataset is not publicly available. Supporting data may be made available by the corresponding author upon reasonable request and subject to applicable confidentiality requirements..

AI Policy: Artificial Intelligence (AI) tools, including large language models, were used solely for linguistic consistency, language refinement, and grammar improvement. All research design decisions, data collection, statistical analysis, interpretation of findings, theoretical reasoning, and conclusions remain the responsibility of the authors. The authors have reviewed the final manuscript and take full responsibility for the accuracy, originality, integrity, and scholarly content of the article.

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