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The Effect of Green Human Resource Management on Green Work Performance in Manufacturing Enterprises in Ho Chi Minh City

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ABSTRACT: This study examines the effect of green human resource management on green work performance (GWP) and the mediating role of green work engagement (GWE) in manufacturing enterprises in Ho Chi Minh City. The model was developed from the Ability-Motivation-Opportunity framework and social exchange theory. Following data screening and cleaning, 305 valid observations were retained and analyzed using partial least squares structural equation modeling (PLS-SEM). The findings emphasize that green human resource policies generate sustainable performance value only when they are translated into employees' vigor, dedication, and absorption in environmental tasks.

KEYWORDS: Green human resource management, Green work engagement, Green work performance, Manufacturing enterprises.

1. INTRODUCTION

The green transition is changing how manufacturing enterprises design processes, assess performance, and develop their workforce. Clean technologies, environmental standards, and equipment investments produce results only when employees understand the objectives, possess the capabilities required for implementation, and proactively integrate environmental requirements into their daily work. Accordingly, the managerial issue is not merely whether an enterprise has green policies, but whether those policies are translated into employee-level behaviors and work outcomes. Within this logic, green human resource management (GHRM) serves as a mechanism linking environmental strategy with recruitment, training, performance appraisal, rewards, and employee participation (Renwick et al., 2013; Tang et al., 2018).

GHRM is understood as a system of human resource policies and practices designed to build employees' abilities, motivation, and opportunities to contribute to organizational environmental objectives. Common practices include incorporating green criteria into recruitment, providing environmental knowledge and skills training, integrating green targets into performance appraisal, recognizing resource-saving initiatives, and creating channels through which employees can participate in solving environmental problems. Unlike stand-alone communication programs, GHRM simultaneously influences employees' capacity, motivation, and opportunity to perform green behaviors. This systems approach is particularly appropriate for manufacturing enterprises, where environmental performance depends on numerous small but recurrent decisions concerning operations, maintenance, energy and material use, waste sorting, and defect control.

Prior studies indicate that GHRM is positively associated with in-role and extra-role green behavior, environmental commitment, green innovation, and sustainable outcomes (Chen et al., 2021; Dumont et al., 2017; Khaskhely et al., 2022; Tirno et al., 2023). However, these effects do not arise mechanically. An employee may understand the relevant regulations yet comply only minimally; conversely, an employee who is engaged with green objectives is likely to invest more energy, attend more closely to detail, and persist in seeking improvements. Green work engagement is therefore an important psychological link explaining why the same GHRM system may yield different levels of green work performance across units and individuals.

Ho Chi Minh City provides a meaningful research context because it is a major economic center with a diverse ecosystem of manufacturing enterprises, ranging from small firms to organizations employing hundreds of workers. Pressures related to cost, productivity, quality, and delivery time may cause environmental objectives to be treated as additional requirements unless they are integrated into core work. An employee-level investigation shifts the focus from policy statements to implementation mechanisms: how employees perceive GHRM, the extent to which they are engaged in green work, and how these perceptions relate to their self-rated green work performance (GWP).

First, many studies measure organization-level outcomes such as environmental performance, sustainable performance, or green innovation. Although these outcomes are important, they are affected by technology, capital, supply chains, and industry structure, making the distinct contribution of employees difficult to identify. At the individual level, GWP focuses on the extent to which employees fulfill environmental tasks embedded in their job requirements, thereby narrowing the gap between human resource policies and implementation effectiveness.

Second, evidence regarding mediating mechanisms remains fragmented. Some studies emphasize psychological green climate, green commitment, psychological ownership, or organizational identification (Baykal & Bayraktar, 2022; Dumont et al., 2017; Yang & Li, 2023). Research on green work engagement (GWE) is expanding and suggests that GHRM can strengthen engagement; however, relatively few studies

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have simultaneously tested GHRM, GWE, and GWP in a parsimonious model within manufacturing settings. Ababneh (2021) and Aboramadan (2022) identify engagement as a mechanism linking GHRM to green behavior, but differences in industry contexts and outcome types warrant further examination.

Third, research in Vietnam has begun to examine GHRM and green engagement, yet context-specific evidence remains limited. Tran (2023) confirms that GHRM contributes to GWE in Vietnam's agricultural sector while highlighting the role of green culture. Nevertheless, there is insufficient evidence to generalize this mechanism to manufacturing enterprises in Ho Chi Minh City, where firm size, technology, and operational pressures vary considerably. This gap creates a need for an individual-level model that examines both the direct effect of GHRM on GWP and the psychological pathway through GWE.

This study pursues four objectives: (1) to assess the direct effect of GHRM on GWP; (2) to assess the effect of GHRM on GWE; (3) to assess the effect of GWE on GWP; and (4) to test the mediating role of GWE in the relationship between GHRM and GWP. Correspondingly, the study investigates whether a green human resource system improves employees' green task performance and, if so, what proportion of the effect is transmitted through green work engagement.

Theoretically, the study integrates the AMO framework with social exchange theory to connect two levels of explanation: GHRM provides ability, motivation, and opportunity, whereas GWE reflects employees' positive responses to signals of organizational support and green values. Empirically, the study focuses on GWP rather than the overly broad concept of sustainable performance. From a managerial perspective, the findings provide a basis for prioritizing practices that both standardize environmental requirements and enhance employees' sense of meaning, energy, and opportunities for participation.

2. LITERATURE REVIEW

2.1. Theoretical Foundations of the Study

The Ability-Motivation-Opportunity framework posits that employee performance is highest when employees possess the necessary abilities, are motivated to act, and have opportunities to participate. Renwick et al. (2013) applied this framework to systematize GHRM. Ability is developed by selecting suitable employees and providing green knowledge and skills training. Motivation is strengthened through environmentally aligned goals, feedback, appraisal, and rewards. Opportunity arises when employees are empowered, participate in improvement teams, propose initiatives, and gain access to the necessary resources. If any of the three components is absent, green policies may remain symbolic: employees may have ability but lack motivation, possess motivation but lack the authority or opportunity to act, or have opportunities but lack the necessary skills.

Social exchange theory adds a psychological mechanism grounded in the norm of reciprocity. When employees perceive that the enterprise makes a genuine investment in capability development, provides support, and recognizes green contributions, they tend to reciprocate with greater dedication and effort (Cropanzano & Mitchell, 2005). GWE represents a positive form of reciprocity: employees not only comply but also mobilize energy and attention for green tasks. Thus, the two theoretical foundations are complementary. AMO explains the resources and conditions created by the human resource system, whereas social exchange theory explains how employees interpret those conditions and translate them into engagement.

2.2. Green Human Resource Management

GHRM integrates environmental objectives throughout the human resource management cycle. Renwick et al. (2013) conceptualized it as the intersection of human resource management and environmental management, whereas Tang et al. (2018) developed a scale encompassing green recruitment, green training, green performance management, green compensation and rewards, and green involvement. The construct can be modeled as a system of practices because its effects typically arise from consistency across practices rather than from any single activity.

In manufacturing enterprises, GHRM performs at least four functions. First, it clarifies expectations by incorporating green criteria into job descriptions, performance standards, and appraisal. Second, it builds capability by helping employees identify waste, risks, and more environmentally friendly operating alternatives. Third, it creates motivation by using feedback, recognition, and rewards to increase the salience of green outcomes. Fourth, it creates opportunities by enabling employees to propose and test improvements. Empirical research links these practices to green behavior, green innovation, and sustainable outcomes across industries (Chen et al., 2021; Khaskhely et al., 2022; Tirno et al., 2023).

Nevertheless, GHRM should be distinguished from green communication or a green image. An environmental message that is not accompanied by job criteria, training, resources, and recognition mechanisms may increase employee skepticism. Conversely, a coherent system enables employees to recognize that environmental objectives are a substantive part of how the organization recruits, develops, and evaluates its workforce. Perceived consistency is therefore a prerequisite for GHRM to influence engagement and performance.

2.3. Green Work Engagement

Work engagement is commonly described as a positive, fulfilling, work-related state characterized by vigor, dedication, and absorption (Schaufeli et al., 2006). GWE retains this structure but focuses specifically on the environmental content of work. Green vigor reflects energy and persistence in performing environmental tasks; green dedication reflects a sense of meaning, pride, and commitment; and green absorption reflects concentration on activities aimed at environmental improvement.

GWE is not synonymous with a general pro-environmental attitude. An individual may hold strong green values yet exhibit low engagement when resources are insufficient or environmental objectives appear unrelated to the job. In contrast, GWE is a state tied to a specific work role and can be fostered through the design of the human resource system. Baykal and Bayraktar (2022) show that GHRM enhances engagement through perceived psychological ownership; Gupta and Jangra (2024) emphasize how employees attribute the purpose and quality of GHRM practices; and Noor et al. (2023) report a positive relationship in the green banking context.

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2.4. Green Work Performance

In this study, GWP refers to the extent to which employees effectively fulfill the environmental responsibilities and tasks associated with their jobs. The construct emphasizes in-role performance and is distinct from voluntary green behavior that extends beyond the job description. For example, complying with material-saving procedures, controlling losses, sorting waste correctly, or meeting environmental targets constitutes in-role performance, whereas voluntarily encouraging colleagues to participate in an environmental campaign may constitute extra-role behavior. This distinction prevents all positive behaviors from being conflated with task performance.

GWP is influenced by both technical and psychological factors. Processes and capabilities determine whether employees know how to perform correctly, whereas engagement determines how much energy, attention, and persistence they invest. Research on the broader relationship between work engagement and job performance indicates that engagement is generally positively associated with outcomes, although very high levels may produce a nonlinear relationship under certain conditions (Yao et al., 2022). Within the present linear model and the observed range of engagement, it is reasonable to expect GWE to enhance GWP.

2.5. Relationship between GHRM and GWP

According to the AMO framework, GHRM directly enables employees to complete green tasks. Appropriate recruitment and job assignment strengthen the capability base; training provides knowledge and techniques; performance management clarifies standards; rewards shape priorities; and participation allows employees to address problems at their source. Therefore, even before GWE is considered, a well-designed GHRM system can enhance GWP by reducing role ambiguity and strengthening employees' capacity for implementation.

Dumont et al. (2017) found that GHRM predicted workplace green behavior; Chen et al. (2021) showed that perceived GHRM was associated with proactive green behavior; and Khaskhely et al. (2022) reported a positive effect on sustainable performance in the manufacturing sector. Although the dependent variables and contexts are not identical, these findings converge on the argument that GHRM establishes a foundation for employee-level green action.

H1: Green human resource management positively affects employees' green work performance.

2.6. Relationship between GHRM and GWE

GHRM can enhance GWE through three channels. First, training and feedback strengthen employees' sense of competence, thereby increasing their confidence to invest energy in green tasks. Second, green goals and recognition enhance the meaningfulness of work and reinforce dedication. Third, opportunities for participation increase autonomy and psychological ownership of environmental outcomes. From a social exchange perspective, employees interpret these investments as signals of organizational support and commitment, which activate a reciprocal response in the form of engagement.

The empirical evidence is relatively consistent. Baykal and Bayraktar (2022) confirmed that GHRM enhances work engagement in manufacturing enterprises; Alshaabani et al. (2021) reported a positive relationship with GWE in the renewable energy sector; Noor et al. (2023) found that GHRM promotes engagement in banking; and Tran (2023) provided evidence from Vietnam. The following hypothesis is therefore proposed.

H2: Green human resource management positively affects employees' green work engagement.

2.7. Relationship between GWE and GWP

Highly engaged employees tend to sustain effort for longer periods, concentrate more intensively, and regard work goals as meaningful. In green tasks, these characteristics enable them to notice minor deviations, comply consistently with procedures, and proactively adjust operations to reduce waste. Vigor supplies the intensity of effort, dedication maintains goal orientation, and absorption reduces distraction. GWE is therefore expected to be a proximal antecedent of GWP.

Ababneh (2021) showed that engagement with environmental initiatives transmits the effect of GHRM to green behavior; Aboramadan (2022) confirmed the role of GWE in both in-role and extra-role green behavior. More broadly, Yao et al. (2022) demonstrated a significant relationship between work engagement and job performance. This evidence supports the expectation that green engagement will translate into green work outcomes.

H3: Green work engagement positively affects employees' green work performance.

2.8. Mediating Role of GWE

The effect of GHRM on GWP may comprise two components. The direct component arises from standards, skills, and performance management mechanisms. The indirect component operates through a psychological state: employees perceive green policies as credible and meaningful, become more engaged, and subsequently demonstrate higher task performance. If both the direct and indirect effects are positive, GWE serves as a complementary mediator; if the direct effect becomes nonsignificant after GWE is introduced into the model, full mediation may occur (Zhao et al., 2010).

Testing mediation has clear managerial significance. If only a direct effect exists, enterprises may focus on processes and control. If GWE mediates the relationship, enterprises must also attend to the employee experience, work meaningfulness, opportunities for participation, and feedback quality. Studies by Ababneh (2021), Aboramadan (2022), and Baykal and Bayraktar (2022) collectively suggest that engagement is an important explanatory mechanism linking green human resource practices to behavioral outcomes.

H4: Green work engagement mediates the relationship between green human resource management and green work performance.

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2.9. Research Model

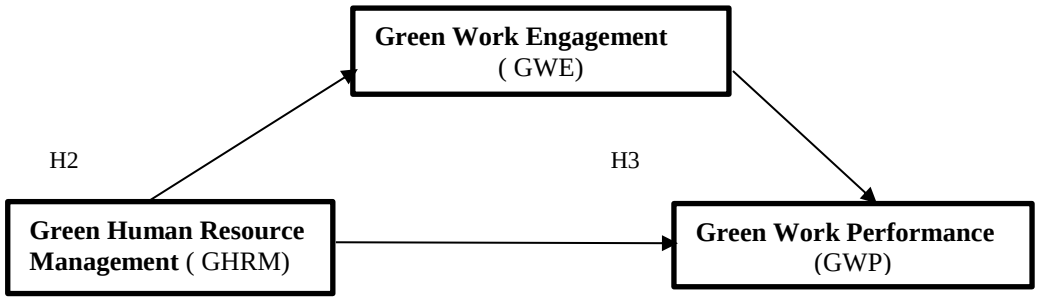


Figure 1. Research Model
(Source: Proposed by the authors)

3. RESEARCH METHODOLOGY

3.1. Research Design, Participants, and Scope

The study employed a cross-sectional quantitative design and surveyed employees working in manufacturing enterprises in Ho Chi Minh City. This approach is appropriate for testing the relationships among employees' perceptions of GHRM, their GWE, and their GWP at a single point in time. Respondents were employees capable of observing human resource practices and assessing their own performance of green tasks at work.

The source dataset comprised 400 distributed questionnaires, of which 365 were returned; 60 responses were excluded during data cleaning, leaving 305 valid responses. The response rate was 91,25%; the valid-response rate among returned questionnaires was 83,56%; and the valid-response rate among distributed questionnaires was 76,25%. The sample size of 305 met requirements based on the number of paths directed toward the endogenous constructs and was appropriate for the parsimonious three-construct model. Rather than relying solely on the 10-times rule, however, the study referred to the recommendation of evaluating sample size on the basis of statistical power and expected path coefficients provided by Kock and Hadaya (2018).

3.2. Measurement Scales

The questionnaire used a five-point Likert scale ranging from 1 = strongly disagree to 5 = strongly agree. Each construct was measured using six observed variables: GHRM1-GHRM6, GWE1-GWE6, and GWP1-GWP6.

Table 1. Measurement Scale Structure and Sources

Construct	Variable Code	Items	Source
Green human resource management (GHRM)	GHRM1–GHRM6	6	Tang et al. (2018); Dumont et al. (2017)
Green work engagement (GWE)	GWE1–GWE6	6	Schaufeli et al. (2006); Aboramadan (2022)
Green work performance (GWP)	GWP1–GWP6	6	Dumont et al. (2017); Chen et al. (2021)

(Source: Compiled by the authors)

3.3. Data Analysis Procedure

The analysis proceeded in four stages. First, the data were screened and the sample was described. Second, factorability was assessed using the KMO measure and Bartlett's test, and common method bias was preliminarily examined using the percentage of variance explained by Harman's single factor. Third, the reflective measurement model was assessed using outer loadings, Cronbach's alpha, composite reliability (CR), average variance extracted (AVE), indicator VIF, cross-loadings, the Fornell-Larcker criterion, and HTMT. Fourth, the structural model was evaluated using inner VIF, path coefficients, R^2, f^2, SRMR, and bootstrapping with 5.000 subsamples.

The following thresholds were applied in accordance with PLS-SEM guidelines: outer loadings should preferably be at least 0,708; indicators with loadings of approximately 0,40-0,70 should be removed only if their deletion increases CR or AVE without compromising content validity; alpha and CR should be at least 0,70; AVE should be at least 0,50; HTMT should be below the conservative threshold of 0,85; VIF should be below 3-5 depending on the diagnostic purpose; and t-values should exceed 1,96 for a two-tailed test at the 5% level (Hair et al., 2019, 2022; Henseler et al., 2015). Mediation was supported when the bootstrap confidence interval for the indirect effect did not include zero (Zhao et al., 2010).

4. RESEARCH RESULTS

4.1. Sample Characteristics

The sample comprised 305 respondents. Men accounted for 53,77%, women for 45,90%, and other/no-response participants for 0,33%. The 26-35 age group was the largest (43,28%), followed by the 36-45 age group (27,87%). In terms of tenure, 31,48% had worked for at least five years, 29,84% for one to less than three years, and 25,57% for three to less than five years. Nearly 40% of respondents worked in enterprises with

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at least 300 employees. This distribution indicates that the sample covered multiple career stages and a range of firm sizes within Ho Chi Minh City's manufacturing sector.

4.2. Descriptive Statistics and Preliminary Data Screening

The mean score was 3,356 for GHRM (SD = 0,583), 3,364 for GWE (SD = 0,590), and 3,343 for GWP (SD = 0,601). Skewness coefficients ranged from -0,173 to -0,010, while excess kurtosis ranged from -0,248 to 0,007. The distributions of the composite scores therefore showed no serious deviations.

The KMO value was 0,926, indicating that the correlations among the indicators were sufficiently strong for factor analysis. Bartlett's test yielded $\chi^2(153) = 2.512,872$; $p < 0,001$, rejecting the null hypothesis that the correlation matrix is an identity matrix. The first three factors explained 60,245% of the total variance. Harman's single factor explained 40,124%, below the conventional 50% threshold. Although this result does not indicate that common method bias dominated the data, it cannot substitute for procedural remedies such as anonymity, separation of data sources, or temporal separation of measurements (Podsakoff et al., 2003).

Table 2. Descriptive Statistics

Indicator	Value
GHRM: Mean; SD	3,356; 0,583
GWE: Mean; SD	3,364; 0,590
GWP: Mean; SD	3,343; 0,601
KMO	0,926
Bartlett χ^2; df; p	2.512,872; 153; <0,001
Variance explained by three factors	60,245%
Harman's first factor	40,124%

(Source: Compiled by the authors)

4.3. Measurement Model Assessment

The outer loadings of the 18 indicators ranged from 0,687 to 0,809. GHRM4 had a loading of 0,687, slightly below the 0,708 benchmark but above 0,60. Retaining the indicator did not reduce CR or AVE and helped preserve the construct's content domain. All outer loadings had t-values greater than 20 and $p < 0,001$. Indicator VIF values ranged from 1,516 to 1,986, indicating no concerning multicollinearity within the measurement blocks.

Table 3. Outer Loadings, t-Values, and Indicator VIF

Indicator	Construct	Outer Loading	t	p	VIF
GHRM1	GHRM	0.746	24.090	<0,001	1.639
GHRM2	GHRM	0.772	29.645	<0,001	1.814
GHRM3	GHRM	0.795	36.868	<0,001	1.853
GHRM4	GHRM	0.687	20.891	<0,001	1.516
GHRM5	GHRM	0.780	33.575	<0,001	1.755
GHRM6	GHRM	0.759	28.591	<0,001	1.739
GWE1	GWE	0.809	39.225	<0,001	1.938
GWE2	GWE	0.762	27.685	<0,001	1.798
GWE3	GWE	0.796	36.341	<0,001	1.910
GWE4	GWE	0.784	34.569	<0,001	1.832
GWE5	GWE	0.771	29.118	<0,001	1.857
GWE6	GWE	0.743	23.922	<0,001	1.664
GWP1	GWP	0.781	30.992	<0,001	1.850
GWP2	GWP	0.772	30.663	<0,001	1.786
GWP3	GWP	0.809	43.571	<0,001	1.986
GWP4	GWP	0.804	34.893	<0,001	1.984

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Indicator	Construct	Outer Loading	t	p	VIF
GWP5	GWP	0.787	32.511	<0,001	1.917
GWP6	GWP	0.759	29.286	<0,001	1.753

(Source: Compiled by the authors)

Cronbach's alpha values for GHRM, GWE, and GWP were 0,851, 0,869, and 0,876, respectively. CR ranged from 0,889 to 0,906, exceeding 0,70 without reaching excessively high levels that might indicate indicator redundancy. AVE values were 0,573, 0,605, and 0,617, respectively, all above 0,50. Thus, all three scales demonstrated internal consistency and convergent validity.

Table 4. Reliability and Convergent Validity

Construct	Items	Cronbach α	CR	AVE
GHRM	6	0.851	0.889	0.573
GWE	6	0.869	0.902	0.605
GWP	6	0.876	0.906	0.617

(Source: Compiled by the authors)

Discriminant validity was assessed using two criteria. In the Fornell-Larcker matrix, the square roots of AVE on the diagonal (0,757-0,785) exceeded the correlations between each pair of constructs (0,467-0,563). HTMT values were 0,535 for GHRM-GWE, 0,557 for GHRM-GWP, and 0,640 for GWE-GWP, all below the 0,85 threshold. Each indicator also loaded most strongly on its intended construct. Taken together, the evidence indicates that the three constructs are related but distinct (Henseler et al., 2015).

Table 5. Discriminant Validity: Fornell-Larcker Criterion and HTMT

Criterion/Pair	GHRM	GWE	GWP	HTMT
GHRM	0,757			–
GWE	0,467	0,778		GHRM–GWE: 0,535
GWP	0,489	0,563	0,785	GHRM–GWP: 0,557
				GWE–GWP: 0,640

(Source: Compiled by the authors)

4.4. Structural Model Assessment

The inner VIF values for the two predictors of GWP were both 1,278, while the VIF for the GHRM → GWE path was 1,000. Thus, the path estimates were not materially affected by multicollinearity. SRMR was 0,057, below the commonly referenced threshold of 0,08, indicating a low standardized discrepancy between the observed and model-implied correlation matrices. Nevertheless, as noted by Hair et al. (2019), model-fit criteria in PLS-SEM should be interpreted cautiously; the primary emphasis remains on measurement quality, path significance, and explanatory power.

GHRM explained 21,8% of the variance in GWE, while GHRM and GWE jointly explained 38,2% of the variance in GWP. In individual-level behavioral research, these values indicate meaningful explanatory power, although substantial variance remains attributable to other factors such as green leadership, psychological green climate, job design, technical resources, personal values, and production pressures.

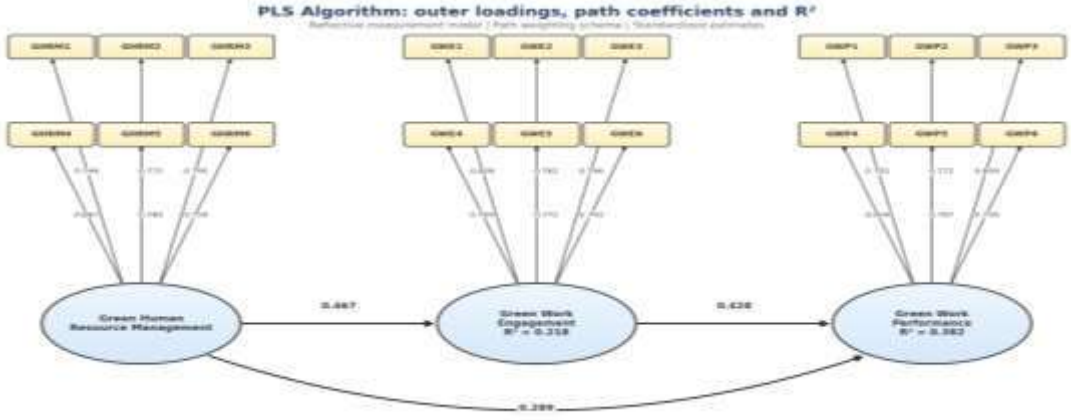


Figure 2. PLS Algorithm Results: Outer Loadings, Path Coefficients, and R^2
(Source: Results of PLS-SEM data analysis)

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4.5. Hypothesis Testing

The bootstrap results confirmed all three direct effects. GHRM positively affected GWP (β = 0,289; SE = 0,049; t = 5,910; p < 0,001; 95% confidence interval [0,192; 0,385]), supporting H1. GHRM positively affected GWE (β = 0,467; SE = 0,046; t = 10,220; p < 0,001; confidence interval [0,380; 0,556]), supporting H2. GWE positively affected GWP (β = 0,428; SE = 0,047; t = 9,164; p < 0,001; confidence interval [0,334; 0,517]), supporting H3.

Regarding effect sizes, the f^2 value was 0,278 for GHRM on GWE and 0,231 for GWE on GWP, both representing medium effects according to the benchmarks of 0,02, 0,15, and 0,35. The f^2 value for GHRM on GWP was 0,106, representing a small but meaningful effect. These results indicate that GHRM's most prominent contribution lies not only in its direct path to GWP but also in its capacity to activate GWE.

Table 6. Structural Model Results and Hypothesis Testing

Hyp.	β	SE	t	p	CI 95%	f^2
H1	0,289	0,049	5,910	<0,001	[0,192; 0,385]	0,106
H2	0,467	0,046	10,220	<0,001	[0,380; 0,556]	0,278
H3	0,428	0,047	9,164	<0,001	[0,334; 0,517]	0,231

(Source: Compiled by the authors)

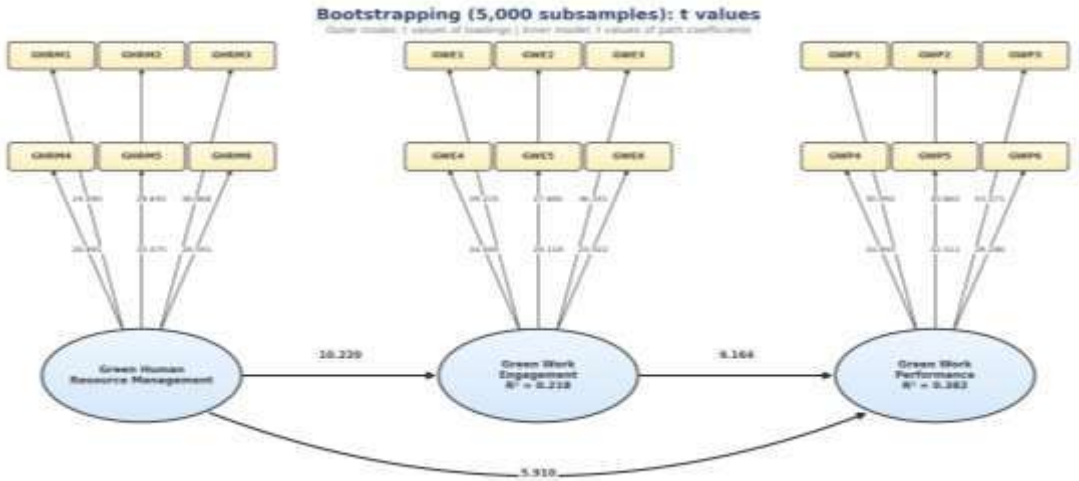


Figure 3. Bootstrapping Results: t-Values for Outer Loadings and Path Coefficients
(Source: Results of PLS-SEM data analysis)

4.6. Mediation Analysis

The indirect effect of GHRM → GWE → GWP was 0,200 (SE = 0,028; t = 7,038; p < 0,001). The 95% confidence interval [0,149; 0,261] did not include zero, supporting H4. The direct effect of GHRM → GWP remained positive and significant after GWE was included in the model. This pattern represents partial complementary mediation (Zhao et al., 2010).

The total effect of GHRM on GWP was 0,489 (= 0,289 + 0,200). The variance accounted for (VAF) through GWE was 40,82%. In other words, approximately two-fifths of the overall relationship between GHRM and GWP in the dataset was explained by variation in GWE; the remainder reflected the direct pathway and may include other mechanisms not incorporated into the model.

Table 7. Mediation Analysis Results

Effect	Estimate	SE	t	p	CI 95%	VAF
Direct: GHRM → GWP	0,289	0,049	5,910	<0,001	[0,192; 0,385]	–
Indirect: GHRM → GWE → GWP	0,200	0,028	7,038	<0,001	[0,149; 0,261]	40,82%
Total Effect	0,489	–	–	–	–	100%

Source: Compiled by the authors.

5. DISCUSSION

H1 was supported, indicating that GHRM has a positive direct effect on GWP. This finding is consistent with the AMO argument: a green human resource system clarifies expectations, develops skills, and aligns motivation, thereby enabling employees to perform environmental tasks more

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effectively. In manufacturing settings, such clarity is especially important because green performance often depends on standardized operations, operational discipline, and rapid responses to deviations. A generic training program is unlikely to generate results if green criteria are absent from individual objectives, feedback, and recognition. The finding is consistent with Dumont et al. (2017), Chen et al. (2021), and Tirno et al. (2023), although prior studies generally examined green behavior rather than GWP. The present study differs by emphasizing in-role tasks: GHRM not only encourages goodwill but also links environmental objectives to performance standards. However, $f^2 = 0,106$ represents only a small effect, which is reasonable because GWP also depends on equipment, technology, processes, direct supervision, and material resources. GHRM should therefore be coordinated with operations management rather than treated as a stand-alone solution.

H2 received strong support, with $\beta = 0,467$ and $f^2 = 0,278$. This path had the largest coefficient originating from GHRM, implying that employees respond strongly at the psychological level when they perceive green human resource practices as coherent. From a social exchange perspective, training, support, feedback, and recognition signal that the organization values both employees and environmental objectives; employees reciprocate with greater vigor, dedication, and absorption. From an AMO perspective, GHRM also reduces feelings of helplessness by providing employees with the tools and authority to participate, thereby encouraging them to invest energy. The finding is consistent with Baykal and Bayraktar (2022), Alshaabani et al. (2021), Noor et al. (2023), Gupta and Jangra (2024), and Tran (2023). In particular, Tran's (2023) evidence from Vietnam indicates that GHRM and green leadership can foster GWE through green culture. The present study further shows that even in a parsimonious model that excludes culture, GHRM explains 21,8% of the variance in GWE. The unexplained variance suggests potential roles for direct leadership, work meaningfulness, workload, autonomy, and psychological green climate.

H3 was supported, with $\beta = 0,428$ and $f^2 = 0,231$. This coefficient indicates that engagement is an important proximal antecedent of GWP. Employees with vigor sustain effort in tasks requiring discipline; dedicated employees regard green outcomes as meaningful; and absorbed employees attend more closely to parameters and deviations. GWE therefore translates general motivation into specific implementation quality. The finding is consistent with Aboramadan (2022), who reported that GWE is associated with both in-role and extra-role green behavior. It is also compatible with broader evidence on work engagement and performance (Yao et al., 2022). Nevertheless, the result should not be interpreted as a mandate to increase engagement at any cost. Sustainable engagement requires adequate resources, autonomy, and appropriate job design; if green objectives merely add responsibilities without adjustments to workload, the positive effect may weaken.

H4 was supported by an indirect effect of 0,200 and a confidence interval that excluded zero. The VAF of 40,82% indicates that GWE is not the only mechanism, but it is a pivotal one. This finding explains why procedurally oriented GHRM implementation may have limited effects: if employees do not perceive meaning, lack energy, or are not given opportunities to participate, the engagement pathway will not be activated. Partial mediation also suggests two complementary avenues for intervention. The first concerns system design: clear green criteria, training, feedback, rewards, and resources. The second concerns experience building: fostering meaningfulness, ownership, voice, and a sense of progress. The finding is broadly consistent with Ababneh (2021) and Aboramadan (2022), but rather than examining green behavior in general, the present study links GWE to green task performance. This is an important contribution because enterprises require work-related implementation outcomes, not merely favorable attitudes.

6. CONCLUSION

This study tested the GHRM → GWE → GWP model among employees of manufacturing enterprises in Ho Chi Minh City using PLS-SEM. All four hypotheses were supported. GHRM enhanced both GWE and GWP; GWE enhanced GWP and partially mediated the relationship between GHRM and GWP. The model explained 21,8% of the variance in GWE and 38,2% of the variance in GWP. The central message is that green human resource policies are more effective when they not only prescribe what employees must do but also build their capabilities, foster meaningfulness, provide voice, and motivate employees to invest energy in green tasks.

7. MANAGERIAL IMPLICATIONS

Based on the results of the hypothesis tests, the authors propose the following managerial implications:

First, enterprises should translate environmental objectives into observable job requirements. Job descriptions, appraisal criteria, and feedback should clearly specify green behaviors or outcomes for each position. Targets should remain within employees' control and be linked to operational data such as loss rates, consumption levels, sorting errors, or procedural compliance. This approach reinforces the direct effect of GHRM on GWP.

Second, green training should be grounded in actual tasks and operational problems rather than slogans. Content may be organized around a cycle of identifying waste, analyzing causes, testing improvements, and measuring results. Line managers should provide brief, frequent, evidence-based feedback. When employees see that their skills enable them to solve problems more effectively, their sense of competence and GWE will increase.

Third, recognition mechanisms should balance outcomes and processes. Rewards based solely on final results may be inequitable when equipment conditions differ, whereas rewarding ideas alone may not encourage implementation. Enterprises should recognize compliance, improvement quality, knowledge sharing, and measurable impact. Nonfinancial recognition, opportunities to present initiatives, and leadership feedback can strengthen the meaningfulness of work.

Fourth, enterprises must create genuine opportunities for participation. Green improvement teams should be authorized to propose small-scale experiments, access data, and receive feedback within a clearly defined period. If employees submit initiatives but receive no response, GHRM may be perceived as symbolic and engagement may decline. With a VAF of 40,82%, measures that strengthen GWE are not decorative additions; they constitute a pathway accounting for nearly half of the observed total effect.

Fifth, enterprises should develop a balanced dashboard that combines system and experience indicators. System indicators may include the proportion of positions with green criteria, task-based training hours, the rate of timely performance feedback, and the proportion of initiatives processed. Experience indicators should capture green vigor, dedication, and absorption. Outcome indicators should include GWP or appropriate

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operational measures. Monitoring all three levels helps identify whether bottlenecks arise from inadequate policies, insufficiently activated engagement, or technical conditions that impede performance.

Research Limitations. This study has several limitations. First, its cross-sectional, self-report design is susceptible to common method bias. Second, convenience sampling and the focus on a single locality limit generalizability. Third, GWP was self-assessed; the findings may differ if managerial evaluations or operational data are used. Fourth, the model includes only three variables and therefore does not fully capture all factors that may influence the phenomenon under investigation.

Directions for Future Research. Future research should collect multisource, longitudinal data and combine self-assessments with managerial evaluations and operational indicators. Stratified samples could be drawn across manufacturing industries and enterprise sizes. Extended models should examine green leadership or psychological green climate as moderators and compare parallel mediating mechanisms.

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