Available on: https://jmrr.ep-journals.org/ E-ISSN: 3051-3588, P-ISSN: 3051-357X

Journal of Management Research and Review

Volume: 02 Issue: 10 October-2026

The Influence of Green Human Resource Management Practices on Green Work Engagement: The Mediating Role of Green Knowledge Sharing

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Published Date: October 07, 2026 **Article DOI: 10.65150/EP-jmrr/V2E10/2026-04**

ABSTRACT: This study examines the direct effect of green human resource management practices (GHRM) on green work engagement (GWE) and clarifies the mediating role of green knowledge sharing (GKS) among micro, small, and medium-sized enterprises in the food manufacturing and processing sector in Ho Chi Minh City. A dataset comprising 302 observations and 19 measurement items rated on a five-point Likert scale was analysed using PLS-SEM. The results show that GHRM positively affects GKS and that GKS positively affects GWE. The indirect effect of GHRM on GWE through GKS was $\beta = 0.183$, with a 95% confidence interval of [0.117, 0.257], indicating complementary mediation. Firms should implement GHRM in an integrated manner alongside knowledge-sharing mechanisms with clear routines, responsibilities, and monitoring indicators.

KEYWORDS: Green human resource management, Green knowledge sharing, Green work engagement.

1. INTRODUCTION

Green transformation in manufacturing enterprises is not merely a matter of investing in treatment equipment, changing fuels, or automating operations. The value of technology is realised only when employees understand environmental objectives, know how to adjust their work practices, and are willing to sustain new standards in their daily work. This is particularly evident in food manufacturing and processing, where operators' decisions directly affect water and energy use, raw-material losses, by-product generation, waste segregation, packaging control, line sanitation, and cold-chain efficiency. Human resource management is therefore an integral component of environmental capability, rather than a support function external to production.

However, issuing policies does not ensure that employees know what to do in specific situations. In processing facilities, much environmental knowledge is tacit and context dependent: recognising signs of leakage, selecting the optimal time for cleaning, calibrating equipment to reduce losses, organising by-product segregation flows, or addressing temperature deviations in cold storage. When this experience remains dispersed across individuals, green programmes can easily become rhetorical. Green knowledge sharing is thus the mechanism that converts managerial signals into usable resources, enabling employees to learn from one another, reduce trial and error, and recognise the significance of their individual contributions.

In Vietnam, Tran (2023) provides initial evidence of the effects of GHRM and green leadership on GWE in the agricultural-products sector, with green organisational culture as a mediator. Nevertheless, industry-specific research on the GHRM-GKS-GWE relationship in food-processing enterprises remains limited. Small and medium-sized enterprises (SMEs) typically have fewer formalised resources than large firms, human resource activities are often undertaken by line managers in addition to their operational responsibilities, and operational knowledge is transmitted through direct interaction. These characteristics make GKS potentially highly valuable, yet readily disrupted by time constraints, insufficient recognition, or staff turnover.

This study has four objectives: (1) to assess the quality of the GHRM, GKS, and GWE measurement scales; (2) to test the direct effects of GHRM on GKS and GWE; (3) to test the effect of GKS on GWE; and (4) to determine the mediating role of GKS in the GHRM-to-GWE relationship. Theoretically, the model integrates social exchange theory with the Job Demands-Resources model. Managerially, the findings are translated into recommendations that can be implemented at costs appropriate for SMEs, with emphasis on sharing routines, knowledge standardisation, and measurement of intermediate behaviours rather than only ultimate environmental outcomes.

2. THEORETICAL BACKGROUND AND HYPOTHESIS DEVELOPMENT

2.1. Research constructs

2.1.1. Green human resource management practices

GHRM is a system of human resource policies and practices that integrates environmental objectives into how an organisation attracts, develops, appraises, recognises, and empowers employees. Its essence is not the relabelling of existing HR processes as "green", but the

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incorporation of environmental criteria as observable and accountable elements of the human resource management cycle. Renwick et al. (2013) emphasised the alignment of green capability development, green motivation, and opportunities for participation, whereas Arulrajah et al. (2015) systematised environmentally oriented practices from recruitment through employee relations and disciplinary management.

2.1.2. Green knowledge sharing

GKS is the process through which members exchange environmental information, experience, skills, and problem-solving approaches to improve shared understanding and collective action. The construct includes both proactive sharing of knowledge acquired from external sources and internal exchange to address operational problems. Khan et al. (2022) regard GKS as a social resource that can strengthen green outcomes by disseminating knowledge and creating opportunities for learning at work.

2.1.3. Green work engagement

GWE is a positive psychological state associated with environmental tasks, manifested in energy, enthusiasm, pride, concentration, and persistence. The concept draws on the vigour, dedication, and absorption dimensions of work engagement (Schaufeli et al., 2006), while directing the referent towards green goals and tasks. Delimiting the content domain distinguishes GWE from general job satisfaction or organisational commitment.

2.2. Theoretical foundations

2.2.1. Social exchange theory

Social exchange theory explains employment relationships through reciprocal interactions and obligations that develop over time. When organisations invest in training, recognise contributions, and empower employees, employees may interpret these actions as signals of support; reciprocal responses need not take the form of immediate transactions, but may be expressed through knowledge sharing, effort, and engagement (Cropanzano & Mitchell, 2005).

2.2.2. The Job Demands-Resources model

The Job Demands-Resources (JD-R) model posits that job resources support task completion, foster learning, and sustain motivation, whereas job demands deplete energy when prolonged or unsupported by compensatory resources (Bakker & Demerouti, 2007). Resources may be organisational, social, psychological, or technical, and are especially valuable when they fit the specific requirements of the job.

Combining SET and JD-R enables the model to explain both why employees wish to reciprocate and which resources enable them to sustain engagement. SET highlights signals and reciprocal obligations; JD-R highlights resource-generation processes. GKS lies at their intersection: it is both a reciprocal response to the organisation and an additional social resource for knowledge recipients.

2.3. Previous research and research gaps

The first stream of research treats GHRM as an antecedent of engagement. Alshaabani et al. (2021) surveyed 238 employees in renewable-energy departments in Hungary and found that practices such as green rewards, training, and performance management predicted GWE. Baykal and Bayraktar (2022), using a sample of 255 office employees in Turkey's manufacturing sector, showed that GHRM increased work engagement through psychological ownership. Gomes et al. (2023) likewise confirmed the relationship between GHRM and engagement and showed that biospheric values may alter its strength.

Haque et al. (2024) is closest to the present model. Their study of 392 managers in Bangladesh's garment industry found that green competence building directly affected GWE, whereas performance management and participation had no significant direct paths; nevertheless, GKS mediated the relationships between the three practice bundles and GWE. This heterogeneity indicates the need to report direct and indirect effects simultaneously and to avoid interpreting "GHRM is effective" as a unitary conclusion without a mechanism.

First, GWE is a psychological outcome proximal to implementation behaviour but has received less attention than green behaviour and environmental performance. Second, many models focus on the direct effect of GHRM without clarifying how knowledge is transferred from HR systems into practice. Third, evidence on GKS is concentrated in garments, energy, or broad manufacturing sectors, whereas food processing has distinctive operating characteristics. Fourth, SMEs require recommendations that can be implemented with limited resources, while many prior implications remain at the level of "increase training" or "encourage sharing".

2.4. Hypothesis development

When firms embed environmental objectives in recruitment, work design, training, feedback, and participation, employees receive supportive signals and resources for addressing green tasks. Under SET, they are likely to reciprocate by investing greater energy; under JD-R, resources increase their capacity to sustain vigour and dedication. The initial findings of Alshaabani et al. (2021), Baykal and Bayraktar (2022), Gomes et al. (2023), and Tran (2023) support the expectation of a positive relationship.

H1: Green human resource management practices positively affect employees' green work engagement.

GHRM also facilitates GKS by providing a shared language, topics for sharing, channels for participation, and signals that environmental knowledge is valued. Training increases the stock of shareable knowledge; appraisal and recognition create motivation; and open participation creates space for employee exchange. Findings from Khan et al. (2022) and Haque et al. (2024) indicate significant links between GHRM and GKS in models of green outcomes.

H2: Green human resource management practices positively affect green knowledge sharing.

GKS gives employees access to validated practices, rapid feedback, and less ambiguity in environmental tasks. Once knowledge becomes a readily available resource, employees have a basis for confidence, concentration, and sustained effort. Under JD-R, this social resource facilitates the motivational process; under SET, knowledge exchange strengthens supportive relationships among members.

H3: Green knowledge sharing positively affects employees' green work engagement.

If GHRM both creates formal resources and encourages employee exchange, part of its effect on GWE will be transmitted through GKS. Haque et al. (2024) provides direct evidence for this mechanism. Following Nitzl et al. (2016), mediation is inferred from the significance of the $a \times b$ product through bootstrapping; the direct path need not become insignificant.

H4: Green knowledge sharing mediates the relationship between green human resource management practices and green work engagement.

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Table 1. Summary of research hypotheses

Hypothesis	Relationship	Expected direction
H1	GHRM → GWE	+
H2	GHRM → GKS	+
H3	GKS → GWE	+
H4	GHRM → GKS → GWE	+

Source: Proposed by the author

2.5. Proposed research model

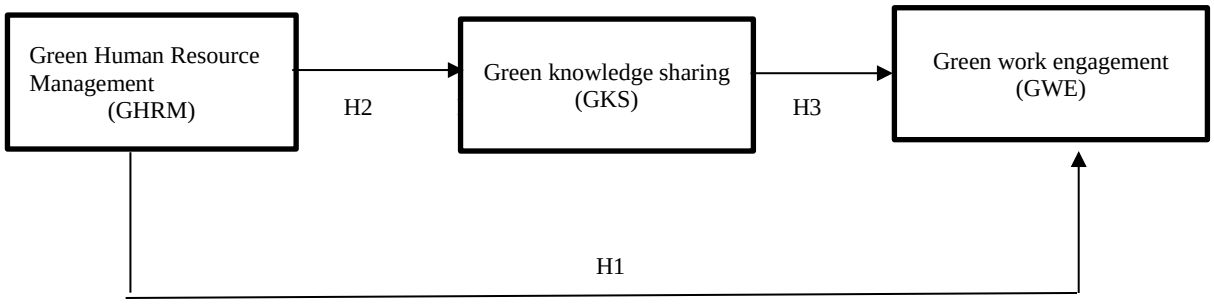


Figure 1. Proposed research model
Source: Proposed by the author

3. RESEARCH METHODOLOGY

3.1. Research design, population, and scope

The study employed a quantitative design oriented towards explanation and prediction. The unit of analysis was the individual employee. The design followed the sequence of scale synthesis, translation and back-translation, expert discussion, cognitive interviewing, pilot testing, and the main survey. The dataset used a five-point Likert scale, ranging from 1 = strongly disagree to 5 = strongly agree.

The research focused on the relationships among GHRM, GKS, and GWE. The study context comprised permanent employees with at least six months of tenure at food manufacturing and processing establishments in Ho Chi Minh City. The industry scope was defined as the level-2 sector "Food manufacturing and processing" in the current Vietnam Standard Industrial Classification, issued with Decision No. 36/2025/QD-TTg and effective from 15 November 2025.

3.2. Sampling and data cleaning

A total of 410 questionnaires were distributed and 368 were returned; after excluding responses that did not meet the requirements, 302 valid questionnaires remained.

3.3. Measurement scales

The questionnaire comprised 19 observed variables: eight for GHRM, five for GKS, and six for GWE. The content was adapted from research streams on GHRM, GKS, and green work engagement, particularly Haque et al. (2024), Khan et al. (2022), Renwick et al. (2013), and Schaufeli et al. (2006). Adaptation to the food-processing context preserved the original conceptual domain and was assessed through cognitive interviews before the main survey.

Table 2. Measurement-scale structure

Construct	Item code	No. of items	Measurement content	Adapted from
GHRM	GHRM1-GHRM8	8	Recruitment, job responsibilities, training, implementation, appraisal, recognition, initiatives, and participation	Renwick et al. (2013); Haque et al. (2024)
GKS	GKS1-GKS5	5	Sharing information sources and experience; problem solving; resource saving; and benefits of sharing	Khan et al. (2022); Haque et al. (2024)
GWE	GWE1-GWE6	6	Inspiration, energy, enthusiasm, pride, concentration, and persistence	Schaufeli et al. (2006); Haque et al. (2024)

Source: Proposed by the author

3.4. Data analysis

The analysis comprised five layers. First, missing data, value ranges, duplicates, quality flags, and descriptive distributions were examined. Second, Cronbach's alpha and exploratory factor analysis (PCA with Varimax rotation) were used as preliminary checks, not as replacements for the PLS measurement model. Third, the reflective measurement model was assessed using outer loadings, alpha, rho_A, rho_C, AVE, and HTMT.

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Fourth, the structural model was assessed using inner variance inflation factors (VIF), path coefficients, R^2, f^2, SRMR, and predictive Q^2. Fifth, bootstrapping with 5,000 resamples and two-tailed tests at the 5% level was used to infer path effects and mediation.

PLS-SEM is appropriate for a prediction-oriented objective and a model with latent variables measured by multiple indicators. The algorithm used path weighting, standardised indicators, reflective Mode A measurement, and a convergence criterion of 10^{-10}. Interpretive thresholds followed Hair et al. (2021): outer loadings preferably ≥ 0.708; alpha, rho_A, and rho_C generally between 0.70 and 0.95; AVE ≥ 0.50; and HTMT < 0.85 under the strict criterion. rho_A was calculated following Dijkstra and Henseler (2015), and HTMT following Henseler et al. (2015).

Mediation was assessed following Nitzl et al. (2016) using the a × b product and a 95% bootstrap confidence interval. When the direct effect c′ and indirect effect are both significant and point in the same direction, the model exhibits complementary mediation. The VAF ratio is reported to describe the proportion of the total effect that operates through GKS, rather than as the sole criterion for determining mediation.

4. RESULTS

4.1. Characteristics of the simulated sample

The analytical sample comprised 302 responses. Women accounted for 55.30%, men for 42.72%, and other/no-response participants for 1.99%. The 25-34 and 35-44 age groups together represented 69.87%, indicating a concentration in the core working-age population. In terms of education, university degrees accounted for 44.37%, college qualifications for 27.48%, upper-secondary or vocational-secondary qualifications for 24.50%, and postgraduate qualifications for 3.64%.

Table 3. Sample characteristics (n = 302)

Characteristic	Category	Frequency	Percentage (%)
Gender	Female	167	55.30
	Male	129	42.72
	Other/no response	6	1.99
Age group	Under 25	45	14.90
	25–34	127	42.05
	35–44	84	27.81
	45 and over	46	15.23
Education	Vocational secondary	74	24.50
	College	83	27.48
	University	134	44.37
	Postgraduate	11	3.64
Tenure	0.5–<2 years	62	20.53
	2–<5 years	110	36.42
	5–<10 years	87	28.81
	10 years and over	43	14.24
Position	Direct employee	123	40.73
	Office employee	98	32.45
	Team leader/supervisor	55	18.21
	Middle manager	26	8.61
Firm size by headcount	Micro (<10)	27	8.94
	Small (10–<50)	123	40.73
	Medium (50–200)	152	50.33

Source: Compiled by the author

4.2. Descriptive statistics and preliminary checks

The mean scores of all three constructs exceeded the scale midpoint: GHRM = 3.577, GKS = 3.592, and GWE = 3.606. Standard deviations of approximately one indicate the necessary dispersion in the data. Mild negative skewness, ranging from −0.438 to −0.293, reflects a tendency towards agreement without extreme distortion. Correlations among construct means ranged from 0.542 to 0.573, were consistent with the hypothesised model, and did not suggest serious conceptual overlap.

Cronbach's alpha was 0.923 for GHRM, 0.876 for GKS, and 0.883 for GWE. The lowest corrected item-total correlations were 0.703, 0.682, and 0.675, respectively; alpha after deletion of any item was lower than the alpha for the relevant scale. These preliminary results supported retaining all indicators before PLS-SEM assessment.

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4.3. Measurement model assessment

Figure 2 presents the PLS algorithm results, including outer loadings on indicator links, path coefficients between constructs, and R^2 values within endogenous constructs. All outer loadings ranged from 0.769 to 0.860, exceeding the preferred threshold of 0.708. Bootstrap t-values for the outer loadings ranged from 29.185 to 56.368, all with $p < 0.001$. Thus, each indicator shared a substantial proportion of variance with its measured construct.

Cronbach's alpha, rho_A, and rho_C all ranged from 0.876 to 0.937, exceeding 0.70 but remaining below 0.95. AVE ranged from 0.632 to 0.669, indicating that each construct explained more than 50% of its indicators' variance. Accordingly, internal consistency and convergent validity were satisfactory, without indications of excessive indicator redundancy.

HTMT values were 0.637 for GHRM-GKS, 0.629 for GHRM-GWE, and 0.615 for GKS-GWE, all below 0.85. In addition, the square root of each construct's AVE was greater than its correlations with the other constructs. Both checks supported discriminant validity. This result is especially important because all three concepts contain "green" content and were measured from the same respondents; without evidence of discriminance, structural paths could merely reflect similarity in wording.

Table 4. Reliability, convergent validity, and discriminant validity

Construct	Outer loading range	Cronbach's α	rho_A	rho_C	AVE	Highest HTMT
GHRM	0.773-0.860	0.923	0.925	0.937	0.652	0.637
GKS	0.798-0.835	0.876	0.878	0.910	0.669	0.637
GWE	0.770-0.818	0.883	0.886	0.911	0.632	0.629

Source: Compiled by the author

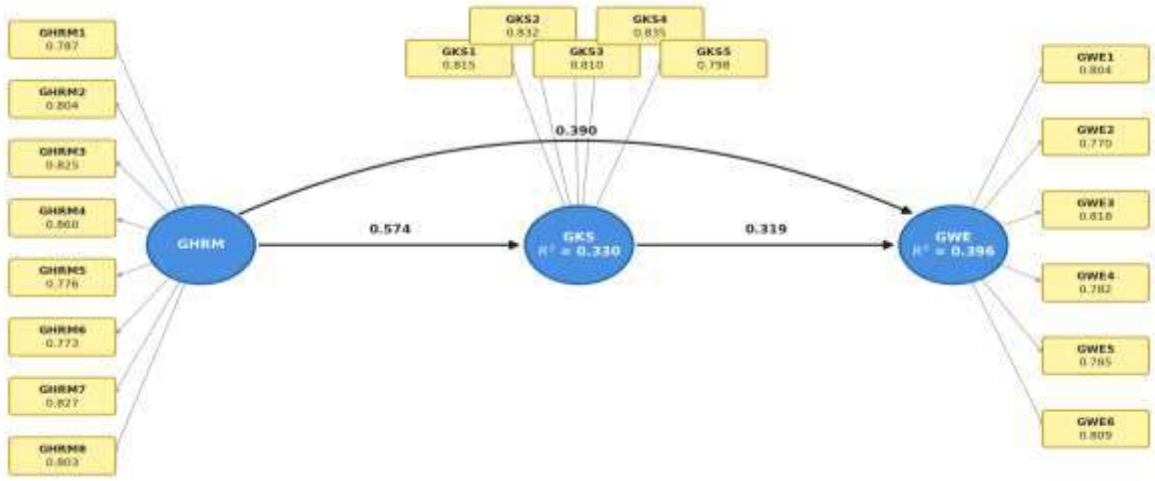


Figure 2. PLS results for the research model
Source: Compiled by the author

4.4. Structural model assessment and hypothesis testing

Before interpreting path coefficients, multicollinearity between GHRM and GKS in the GWE equation was assessed. The inner VIF was 1.492, below 3, indicating that standard errors were not materially inflated by predictor overlap. SRMR = 0.047, below the descriptive benchmark of 0.08; this index provides supplementary information on the average discrepancy between observed and model-implied correlation matrices.

Bootstrapping with 5,000 resamples produced t-values for structural paths and outer loadings. All three direct paths were positive, had 95% confidence intervals that excluded zero, and had $p < 0.001$. GHRM → GKS was the strongest path ($\beta = 0.574$; $t = 14.120$), followed by GHRM → GWE ($\beta = 0.390$; $t = 7.084$) and GKS → GWE ($\beta = 0.319$; $t = 5.589$). Accordingly, H1, H2, and H3 were supported in the simulated data.

GHRM explained 32.98% of the variance in GKS; GHRM and GKS together explained 39.64% of the variance in GWE. From a pragmatic perspective, this explanatory power is moderate for workplace psychological states, as GWE is also shaped by leadership, production pressure, individual resources, team climate, and job characteristics. Predictive Q^2 was 0.323 for GKS and 0.385 for GWE, both above zero; the model outperformed the average-prediction benchmark in internal holdout procedures.

Table 5. Direct-effect test results

Hypothesis	Path	β	SE	t	p	95% confidence interval	f^2
H1	GHRM → GWE	0.390	0.055	7.084	< 0.001	[0.282, 0.497]	0.168
H2	GHRM → GKS	0.574	0.041	14.120	< 0.001	[0.495, 0.654]	0.492
H3	GKS → GWE	0.319	0.057	5.589	< 0.001	[0.207, 0.429]	0.113

Source: Compiled by the author

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4.5. Testing the mediating role of green knowledge sharing

Figure 3 isolates the mediation model to show path a (GHRM → GKS), path b (GKS → GWE), the direct path c′ (GHRM → GWE), and the a × b product. The indirect effect was β = 0.183, SE = 0.036, t = 5.107, and p < 0.001; its 95% bootstrap confidence interval [0.117, 0.257] was entirely positive. Therefore, H4 was supported.

The direct effect c′ remained positive and significant (β = 0.390; 95% CI [0.282, 0.497]), while the indirect effect was also positive and significant. Under the classification of Nitzl et al. (2016), this is complementary mediation: GHRM affects GWE both directly and through GKS. The total effect was β = 0.573; VAF = 0.183/0.573 = 32.0%. VAF indicates that approximately one-third of the total association in the model operates through GKS, while about two-thirds is represented by the direct path or other unmeasured mechanisms.

The results do not support the view that knowledge sharing can substitute for the HR system. If firms merely create sharing channels without recruitment, training, appraisal, recognition, and participatory rights, the knowledge base may lack quality or sustained motivation. Conversely, if GHRM is issued without a sharing routine, part of its value is not converted into actionable knowledge. The two layers of intervention should be designed concurrently.

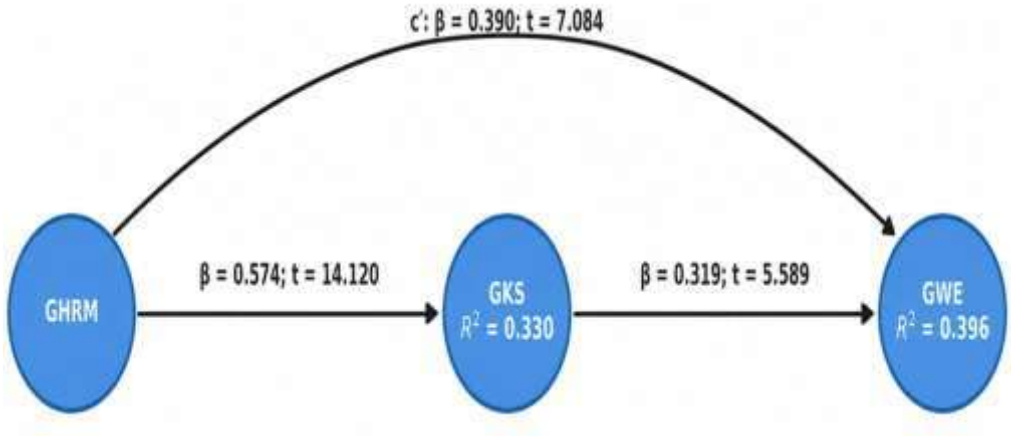


Figure 3. Bootstrap results for testing the mediating role
Source: Compiled by the author

Table 6. Mediation-effect test results

Effect	β	SE	t	p	95% confidence interval
GHRM → GKS → GWE	0.183	0.036	5.107	< 0.001	[0.117, 0.257]
GHRM → GWE (direct)	0.390	0.055	7.084	< 0.001	[0.282, 0.497]
GHRM → GWE (total)	0.573	0.036	16.011	< 0.001	[0.503, 0.645]

Source: Compiled by the author

4.6. Sensitivity analysis

Three observations (KS124, KS139, and KS265) selected score 5 for all 19 indicators but had reasonable completion times and passed the attention check. To ensure that the decision to retain or exclude these cases did not drive the results, the model was re-estimated with 299 observations. The direction and ranking of paths were unchanged: GHRM → GKS declined from 0.574 to 0.565; GHRM → GWE from 0.390 to 0.386; GKS → GWE from 0.319 to 0.315; and the indirect effect from 0.183 to 0.178.

5. DISCUSSION

The H1 result is consistent with SET and JD-R reasoning: when employees perceive that the organisation invests in green capability, feedback, recognition, and participation opportunities, they tend to invest more energy in environmental tasks. The coefficient β = 0.390 and f^2 = 0.168 indicate that GHRM is not only statistically significant but also makes an independent, medium-sized contribution to GWE after GKS is included in the equation. The direction of the finding is consistent with Alshaabani et al. (2021), Baykal and Bayraktar (2022), Gomes et al. (2023), and Tran (2023), notwithstanding differences in industry, measurement scales, and mediating variables.

H2 had the largest coefficient and f^2 = 0.492, suggesting that GHRM's most immediate mechanism in the model is enabling knowledge sharing. From a SET perspective, training, recognition, and empowerment signal that the organisation values green contributions, thereby increasing the obligation to reciprocate through sharing. From a JD-R perspective, GHRM creates both knowledge content to be shared and channels through which it can be shared. The result is aligned with the links between green practices and GKS reported by Khan et al. (2022) and with the antecedent role of GHRM bundles in Haque et al. (2024).

H4 shows that part of GHRM's effect on GWE is transmitted through GKS. This result is close to Haque et al. (2024), in which GKS was an important mechanism between green practices and GWE. However, the present model uses a first-order GHRM construct rather than three practice

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bundles; it therefore cannot identify which group of practices produces the strongest mediation. Complementary mediation also suggests the presence of other mechanisms, such as meaningful work, psychological ownership, green culture, organisational identification, or leadership support, as suggested by Baykal and Bayraktar (2022), Gomes et al. (2023), and Tran (2023).

The study's contribution is to distinguish three layers: GHRM policy, GKS knowledge, and GWE motivational state. This distinction avoids circular recommendations such as "increase engagement to make employees engaged". Managers can intervene in policy and sharing infrastructure, then monitor leading indicators of GKS and GWE before waiting for ultimate environmental outcomes such as water, energy, or waste intensity.

6. MANAGERIAL IMPLICATIONS

H2 had the strongest effect in the model (GHRM → GKS: $\beta = 0.574$; $f^2 = 0.492$). The practical implication is that firms should not treat knowledge sharing as an unstructured activity following training. Each green HR practice should generate a knowledge output that can be found, understood, and applied: training should end with operating guidance; performance appraisal with feedback and lessons learned; initiatives with standardisation; and incidents with a record of cause, action, and outcome.

For food-processing facilities, a minimum routine can include a ten-minute green meeting at the beginning of one shift each week, handover of anomalies between shifts, daily incident review, and a 30-minute cross-sharing session each month. Content should be drawn from operational data: water per unit of product, electricity per machine-running hour, raw-material loss rates, correct segregation rates, temperature-related losses, repeat-cleaning frequency, defective packaging volume, and recovered by-product mass. Each session should address only one specific issue and record one tested practice, the responsible person, and the review date.

H1 shows that GHRM still directly affects GWE after controlling for GKS ($\beta = 0.390$; $f^2 = 0.168$). Firms should therefore improve the HR system itself rather than merely establish discussion groups. A minimum GHRM package should connect six touchpoints: recruitment and onboarding, job descriptions, training, goals and feedback, recognition, and participation. Each touchpoint should use the same set of environmental priorities so that employees receive consistent signals.

In appraisal and recognition, green goals should fall within the position's sphere of control. Operators can be accountable for compliance with control points, recording anomalies, and implementing approved improvements; supervisors for response time, action closure, and shift performance; and managers for resources and for resolving conflicts between production and environmental objectives. Recognition should prioritise rapid feedback, public lessons learned, authority to lead pilots, or team rewards; it should not be based solely on reduced consumption when data are affected by output volume, product mix, or raw-material quality.

H3 was supported with $\beta = 0.319$ and $f^2 = 0.113$. The smaller effect relative to H1 and H2 indicates that increasing the number of sharing activities does not necessarily generate commensurate engagement unless knowledge is translated into capacity for action. GKS quality should be designed around four criteria: the right problem, the right person, the right time, and feedback on results.

H4 yielded an indirect effect of $\beta = 0.183$, a 95% CI of [0.117, 0.257], and VAF = 32.0%, while the direct path remained significant. The central implication is to allocate interventions across two levels. The foundational level comprises GHRM policies, roles, capabilities, feedback, and fairness; the transmission level comprises GKS routines, channels, content, and verification. Removing either level would forgo part of the mechanism represented by the model.

For measurement, a dashboard should connect three levels of indicators. The GHRM level tracks training coverage, the proportion of green objectives receiving feedback, proposal-processing time, and perceived fairness. The GKS level tracks the quality, speed, and usability of lessons. The GWE level uses brief periodic pulse surveys of energy, enthusiasm, pride, concentration, and persistence. Ultimate environmental outcomes, such as kWh/tonne, m^3 water/tonne, loss rates, and landfill waste, should be standardised by output and product mix to avoid misleading assessment.

7. LIMITATIONS AND DIRECTIONS FOR FUTURE RESEARCH

The study is limited by its cross-sectional design, which entails risks of common-method bias, reverse causality, and the influence of transient states. Future research should separate measurement occasions, obtain GHRM from employees, GKS from networks or interaction logs, GWE at a later point, and environmental outcomes from operational data. The model includes only three variables; future studies may incorporate additional variables to test the extent of GHRM's effects.

8. CONCLUSION

The study tested GHRM's effects on GWE directly and indirectly through GKS. Data from 302 observations met reliability, convergent-validity, and discriminant-validity criteria. All four hypotheses were supported: GHRM → GWE, GHRM → GKS, GKS → GWE, and the mediated effect GHRM → GKS → GWE were all positive and statistically significant in bootstrap testing.

GHRM creates organisational resources and signals; GKS converts part of those resources into understanding that can be used at work; and GWE reflects the energy employees invest in environmental tasks. The model explained 39.64% of the variance in GWE and produced positive predictive Q^2, providing a basis for a field-based confirmatory study.

ETHICS AND RESEARCH TRANSPARENCY STATEMENTS

Originality and similarity statement. The authors confirm that this manuscript is original, free from plagiarism, and not under simultaneous consideration by another publication. The manuscript has undergone similarity checking, and the similarity index does not exceed the journal's 15% requirement.

Conflict of interest statement. The authors declare no conflicts of interest related to this study, the data-analysis process, or publication of this article.

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Funding statement. This research received no funding from any funding agency, commercial organisation, or not-for-profit organisation.

Ethics approval and consent to participate. This study used an anonymous, voluntary survey of adults. It involved no interventions or procedures involving humans or animals and collected neither biological samples nor personally identifiable information. Before participation, respondents were informed of the research purpose, voluntary nature of participation, right to decline or discontinue, and data confidentiality arrangements; completion of the questionnaire was regarded as consent to participate. Separate ethics approval was not applicable to this anonymous, non-interventional survey design.

Compliance with ethical standards. The study was conducted in accordance with principles of respect for participants, voluntariness, confidentiality, and data use solely for research purposes. Statements concerning originality, conflicts of interest, and funding are fully disclosed to ensure research integrity and transparency.

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