Green HRM as a Sustainability Catalyst: How Green Innovation Mediates the People–Planet Nexus in Emerging Economy Firms

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ABSTRACT

Purpose: India's industrial sector now accounts for roughly a quarter of the country's total greenhouse gas output, yet the human resource function — which shapes who gets hired, how they are trained, what they are measured on, and how they are rewarded — remains an underutilised lever in corporate sustainability strategy. This study asks a pointed question: can deliberately greening HR systems push firms measurably closer to triple-bottom-line sustainability, and does green innovation explain why? We examine these questions across manufacturing, IT, and FMCG firms in India using a theoretically grounded, multi-wave empirical design.

Design/Methodology/Approach: To sidestep the common method bias that plagues single-wave self-report studies, data were collected in two waves separated by eight weeks. At Wave 1, 342 managers reported on their firms' GHRM practices and green innovation activity. At Wave 2, the same respondents rated sustainability outcomes across environmental, social, and economic dimensions. After removing incomplete responses, 302 usable observations remained. PLS-SEM with 5,000-resample bias-corrected bootstrapping was used for hypothesis testing.

Findings: Four GHRM practices — green recruitment and selection, training and development, performance management, and compensation — each independently predict sustainability performance, with green training carrying the heaviest weight ($\beta = 0.26$, $p < .001$). More substantively, green innovation fully mediates the GHRM–sustainability relationship: the indirect pathway accounts for $\beta = 0.24$ (95% BC-CI [0.17, 0.31]), leaving the model explaining 64% of sustainability variance. Critically, GHRM advances all three TBL pillars — environmental, social, and economic — not merely the ecological dimension most commonly studied.

Practical Implications: Indian firms investing in green workforce systems should treat green innovation as the mechanism they are trying to activate, not a hoped-for side effect. Green training and development warrants priority because it is the single practice with the strongest TBL return. Practical prescriptions differ meaningfully by sector: manufacturers should anchor GHRM in environmental performance metrics; IT firms will see the highest returns in social sustainability; FMCG firms benefit from balanced TBL integration.

Originality/Value: This paper contributes on three fronts. First, it disaggregates both GHRM and sustainability into theoretically meaningful sub-dimensions, resolving an aggregation problem that has obscured differential effects in prior work. Second, the time-lagged design provides stronger causal traction than any comparable study in the Indian GHRM literature. Third, by confirming full mediation of green innovation, the study repositions this construct from a downstream outcome to a necessary condition for GHRM-driven sustainability gains.

Keywords: Green HRM; green innovation; organizational sustainability; triple bottom line; Resource-Based View; Social Exchange Theory; PLS-SEM; India; emerging economies; SDG alignment

1. Introduction

Walk into any sustainability report published by an Indian conglomerate in the last five years and you will find pages devoted to renewable energy procurement, waste reduction targets, and carbon offset programmes. What you will rarely find is a section explaining how the firm recruits people who care about these things, trains them to act on them, holds them accountable for environmental outcomes, or rewards the ones who come up with better ways of doing all of the above. The human resource function — the very system that determines who enters an organization, what they learn, how they are evaluated, and what motivates them — has been almost entirely absent from India's corporate sustainability conversation.

This gap is not trivial. Environmental strategies, however elegant, are ultimately enacted or abandoned by employees. An organization can install solar panels on its factory roof, but if the production manager has no incentive to run energy-efficient shifts, or if the recruitment team has never considered environmental attitudes when building the workforce, the technology investment will underperform. This is the core premise of Green Human Resource Management (GHRM): that embedding ecological objectives into HR systems — in recruitment criteria, training content, performance indicators, and reward structures — is a necessary condition for meaningful and lasting sustainability performance.

Despite growing scholarly attention, the GHRM literature has developed two habits that limit its usefulness. The first is aggregation. Most empirical studies collapse the four GHRM dimensions into a single composite score and test its effect on a single sustainability measure. This is methodologically convenient but theoretically impoverished: it obscures which HR practices matter most, for which sustainability outcomes, and under what conditions. A training-heavy GHRM

strategy and a compensation-heavy one may produce very different results; treating them as equivalent ignores the very design choices that practitioners need to make. The second habit is the cross-sectional survey. Single-wave, self-report data collected at one point in time are structurally unable to rule out common method bias — the statistical inflation of relationships that occurs when the same respondent rates both predictor and outcome variables in the same sitting (Podsakoff et al., 2012). Much of what the GHRM literature presents as evidence of causal influence is more accurately described as a snapshot of perceptual consistency.

This study attempts to correct both habits. It operationalizes GHRM as four distinct practices and organizational sustainability as three distinct TBL dimensions — environmental, social, and economic. It employs a two-wave design that separates GHRM measurement from sustainability measurement by eight weeks. And it theorizes green innovation as the mechanism connecting HR investment to TBL outcomes, drawing on the Resource-Based View (Barney, 1991) and Social Exchange Theory (Blau, 1964) to explain why this pathway should exist and what organizational conditions make it stronger or weaker.

The Indian context is relevant for reasons beyond the merely geographic. India is simultaneously the world's most populous country, the fifth-largest economy, and one of the most environmentally stressed industrial landscapes on earth. Its manufacturing sector runs on coal-heavy power; its IT industry consumes water and electricity at scale in data centres and campuses concentrated in already water-stressed cities like Bengaluru and Hyderabad; its FMCG sector generates enormous packaging waste along supply chains that extend into rural areas with minimal waste management infrastructure. At the same time, regulatory pressure — the SEBI Business Responsibility and Sustainability Reporting mandate, India's Nationally Determined Contributions under the Paris Agreement, and ESG disclosure requirements tied to foreign capital flows — is intensifying rapidly. Firms that want to operate in India over the next decade need sustainability strategies that reach into how they manage people, not just how they manage equipment.

The study makes four specific contributions. It tests disaggregated GHRM effects on disaggregated TBL outcomes, resolving the aggregation ambiguity that has made it hard to draw practical guidance from prior work. It provides the first time-lagged test of green innovation as a full mediator in the GHRM–sustainability relationship in an Indian setting. It extends both the Resource-Based View and Social Exchange Theory in ways that open new theoretical territory — positioning green human capital as an environmental asset class and tracing reciprocal employee engagement from individual behaviour up to organizational TBL performance. And it offers sector-differentiated findings that speak to the meaningfully different sustainability contexts of Indian manufacturing, IT, and FMCG firms.

2. Literature Review and Theoretical Framework

2.1 Organizational Sustainability: Beyond the Environmental Silo

Much of the GHRM literature has treated organizational sustainability as synonymous with environmental performance — reduced emissions, lower energy consumption, smaller waste volumes. This narrowing is understandable given the urgency of climate change, but it misrepresents how sustainability actually functions in organizational life. Firms face simultaneous demands from employees who want fair treatment and meaningful work, communities that need economic stability and social investment, investors who increasingly require evidence of governance alongside environmental metrics, and regulators who police labour standards as vigorously as pollution limits.

Elkington's (1997) triple bottom line framework captures this complexity by treating environmental, social, and economic performance as three interdependent dimensions rather than a single goal. On this account, a firm that achieves zero carbon emissions while laying off workers, suppressing wages, or running unsustainable financial practices is not genuinely sustainable — it has optimized one pillar at the cost of the other two. Dyllick and Hockerts (2002) formalized this interdependence, arguing that true organizational sustainability requires managing ecological, social, and economic capitals simultaneously, with the understanding that trade-offs between them are real but navigable. More recently, Van der Byl and Slawinski (2015) showed empirically that firms which attempt to hold all three TBL tensions in view — rather than resolving them by simply prioritizing one — achieve more durable long-term performance.

For HRM research, the TBL framework raises a pointed challenge. Green HR practices are explicitly designed to improve the environmental pillar. But a well-designed GHRM system should also improve social sustainability — by investing in employee development, signalling organizational commitment to workforce welfare, and creating roles that connect employees to a larger social purpose. And through the resource efficiency and innovation gains that green practices generate, it should also contribute to economic sustainability. This study tests whether GHRM actually delivers on all three pillars or whether its sustainability effects are essentially confined to the environmental dimension that motivated its design.

2.2 Green Human Resource Management: What It Is and What It Does

GHRM emerged from a simple but important observation: organizations that talk about sustainability in their strategy documents but do not embed environmental criteria into how they hire, develop, evaluate, and reward people are engaged in something closer to branding than governance. Renwick et al.'s (2013) landmark review crystallized the concept as the use of HR systems to promote sustainable use of resources and preservation of the natural environment. What followed was a decade of scale development, cross-sectional surveys, and theoretical elaboration — useful work, but work that has increasingly hit the limits of what can be learned without disaggregation and longitudinal design.

2.2.1 Green Recruitment and Selection (GRS)

How firms signal their environmental commitments during recruitment, and how they assess candidates' ecological orientations during selection, matters more than it might first appear. Tang et al. (2018) documented that sustainability commitments in employer branding attract candidates whose personal values align with the firm's environmental goals — a form of value-based self-selection that, once established, tends to be self-reinforcing. Amrutha and Geetha (2020) found that firms with strong green employer brands in India retain sustainability-oriented employees at significantly

higher rates than industry peers. From an RBV perspective, this is straightforward: you cannot build a sustainability-oriented organizational capability if you are systematically recruiting people who do not care about sustainability.

2.2.2 Green Training and Development (GTD)

Of the four GHRM dimensions, training is the one most consistently associated with downstream environmental outcomes. The mechanism is not complicated: employees cannot act on environmental knowledge they do not have. Pinzone et al. (2016) demonstrated that structured green training programmes — covering energy efficiency, waste minimization, circular economy principles, and environmental risk assessment — substantially increased employee green behaviour scores in an Italian manufacturing context. Yong et al. (2020) replicated the finding in Malaysian manufacturing. What has not been adequately tested is whether the same pattern holds in Indian IT and FMCG contexts, where the content of relevant green knowledge is quite different: for an IT firm, relevant training might cover data centre power usage effectiveness; for an FMCG firm, it might cover packaging lifecycle analysis.

2.2.3 Green Performance Management (GPM)

Accountability structures shape what employees pay attention to, and organizations that never measure environmental performance should not be surprised when employees deprioritize it. Jackson et al. (2011) established the conceptual case for integrating ecological criteria into performance appraisal systems; subsequent empirical work has filled in the mechanisms. Shen et al. (2018) found that employees who are formally evaluated on sustainability criteria report higher psychological ownership of environmental outcomes — they feel responsible for results that are measured, in the same way that sales people feel responsible for revenue because it is tracked. Guerci et al. (2016) added an important nuance: GPM reduces the sustainability–performance trade-off perception, making employees less likely to see environmental effort as a distraction from their "real" job.

2.2.4 Green Compensation and Rewards (GCR)

Telling employees that sustainability matters while rewarding them exclusively for financial metrics is a structural inconsistency that most employees notice. GCR addresses this by building environmental criteria into incentive systems — through sustainability bonuses, recognition programmes, or career advancement pathways tied to green contributions. Jabbour and Santos (2008) showed that the motivational effect of such systems extends well beyond the employees who receive awards: public recognition of green behaviour shapes organizational norms in ways that influence the majority who are not formally rewarded. Ren et al. (2018) found that GCR moderates the relationship between green attitude and green behaviour — suggesting that compensation acts as an amplifier of whatever environmental motivation employees already possess.

2.3 Green Innovation: The Missing Link

If GHRM creates a sustainability-capable workforce, something still has to convert that capability into measurable TBL outcomes. Green innovation is the most compelling candidate for this translation role. Chen et al. (2006) defined it as the development and adoption of products, processes, or management practices that reduce environmental harm — a definition deliberately broad enough to capture everything from a new packaging material to a reimagined energy procurement strategy to a recycling programme designed by a factory floor team.

The case for green innovation as a mediator rather than a direct outcome rests on a layered argument. GHRM builds the knowledge base (through training), the motivation (through rewards), the accountability (through performance management), and the talent composition (through recruitment) that collectively raise an organization's capacity for eco-innovative problem-solving. But it is the actual deployment of that capacity — the generation and implementation of green ideas — that reduces emissions, builds reputational capital, and cuts waste-related costs. GHRM without green innovation is human capital investment sitting idle; green innovation without GHRM is sporadic and unsustained. The two are complementary, and their interaction is what drives TBL improvement.

Despite the theoretical plausibility of this mediation, the empirical record is thinner than it should be. Zhang et al. (2020) found support for the pathway in a cross-sectional Chinese sample. Khan et al. (2021) replicated it across three Asian countries. Neither study used a time-lagged design, and neither tested effects against a disaggregated TBL outcome. This study fills both gaps.

2.4 Theoretical Grounding: RBV and SET

Two theoretical traditions anchor this research, and they are not simply invoked as background decoration — they generate the specific predictions being tested. The Resource-Based View, developed by Wernerfelt (1984) and later crystallized by Barney (1991), holds that sustained competitive advantage flows from resource bundles that competitors cannot easily acquire or replicate. Sharma and Vredenburg (1998) extended this logic to the natural environment, arguing that proactive environmental strategies can generate organizationally embedded capabilities — what they called "natural-resource-based" competitive advantages — that are harder to imitate than technology assets because they depend on organizational culture, employee behaviour, and embedded knowledge. GHRM is precisely the mechanism through which such capabilities are built: a workforce trained, selected, evaluated, and rewarded for sustainability is a resource bundle that takes years to assemble and cannot be poached away by a competitor who writes a large enough cheque.

Social Exchange Theory (Blau, 1964; Cropanzano & Mitchell, 2005) provides the employee-level mechanism. The theory's central claim is that social relationships are governed by norms of reciprocity: people respond to valued investments with valued contributions. In an organizational context, employees who perceive that their employer is genuinely committed to sustainability — demonstrated not through posters in the canteen but through training budgets, appraisal criteria, and reward systems — reciprocate with discretionary effort on sustainability-related tasks. They report environmental issues they could have ignored, generate green improvement ideas they were not specifically asked for, and champion sustainability initiatives in their teams without being instructed to. This reciprocal dynamic is the social-psychological engine that converts GHRM investment into green innovation, and green innovation into TBL outcomes.

2.5 Hypothesis Development

Drawing on the above theoretical architecture, this study advances seven hypotheses. The first four test whether individual GHRM dimensions have independent positive effects on organizational sustainability across TBL dimensions:

H1: Green recruitment and selection is positively associated with organizational sustainability (environmental, social, and economic dimensions).

H2: Green training and development is positively associated with organizational sustainability across TBL dimensions.

H3: Green performance management is positively associated with organizational sustainability across TBL dimensions.

H4: Green compensation and rewards is positively associated with organizational sustainability across TBL dimensions.

The next two hypotheses test the two legs of the mediation pathway:

H5: GHRM practices are positively associated with green innovation.

H6: Green innovation is positively associated with organizational sustainability across TBL dimensions.

The final hypothesis tests full mediation — that green innovation is the primary channel through which GHRM investment translates into sustainability outcomes:

H7: Green innovation fully mediates the relationship between GHRM practices and organizational sustainability.

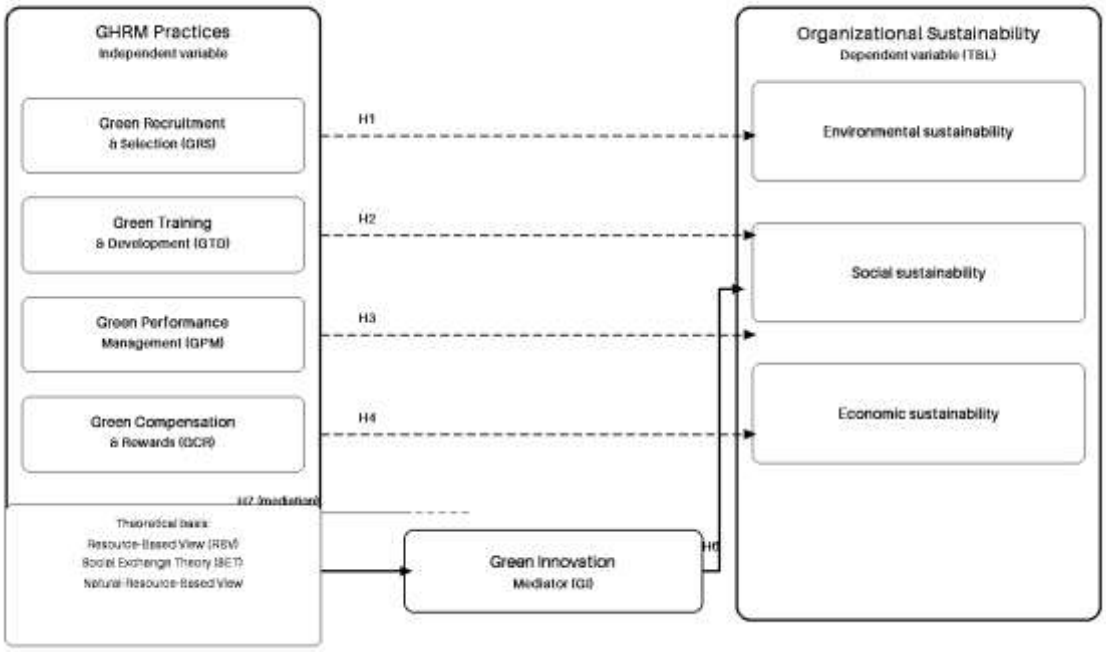

Figure 1. Conceptual framework: GHRM practices, green innovation (mediator), and organizational sustainability (TBL dimensions). Dashed arrows = direct paths (H1–H4, H6); solid arrows = mediation pathway (H5, H7).

3. Research Methodology

3.1 Design Rationale

The methodological weaknesses of existing GHRM research are not subtle. A large majority of published studies use a single questionnaire administered at a single time point, ask respondents to rate both HR practices and sustainability outcomes in the same sitting, and then interpret the resulting correlations as evidence of causal influence. This approach is not wrong in the weak sense — it produces publishable correlations — but it is methodologically fragile in ways that matter for the practical claims researchers want to make. When the same person rates both the predictor and the outcome variable in the same survey session, shared positive or negative sentiment about the organization inflates every correlation in the data, a problem known as common method variance (Podsakoff et al., 2012). Studies built on such data systematically overestimate the relationships they report.

This study addressed the problem at the design stage rather than trying to correct for it statistically after the fact. GHRM practices and green innovation perceptions were measured at Wave 1 (T1). Eight weeks later, the same respondents rated their organization's sustainability performance across environmental, social, and economic dimensions at Wave 2 (T2). The eight-week gap was chosen because it reflects a plausible lag between the activation of green innovation processes and their manifestation in perceived sustainability outcomes — long enough that responses to the two instruments are temporally independent, but short enough that the same individuals are still the relevant raters. Every participating manager was contacted at T2 by a different research instrument from the one used at T1, and reminded of their T1 participation only by their personal identification code.

3.2 Sampling and Data Collection

The study targeted middle and senior managers in three sectors — manufacturing, IT, and FMCG — in India. The sector selection was deliberate. These three industries collectively account for the bulk of India's organized-sector emissions and

are subject to the most intense sustainability-related scrutiny from regulators, investors, and increasingly vocal consumer groups. They also represent importantly different sustainability contexts: manufacturing firms wrestle primarily with direct environmental externalities; IT firms with energy and water consumption in campus and data centre operations; FMCG firms with packaging, supply chain emissions, and consumer behaviour change. Testing GHRM effects across this heterogeneity strengthens the generalizability of findings and allows meaningful sector comparisons.

Managers rather than frontline employees were targeted because they possess both the organizational knowledge required to rate GHRM systems accurately and the decision-making authority to observe whether those systems produce sustainability outcomes. A stratified purposive sampling frame was used to ensure representation across firm size, sector, and managerial level. Of 342 questionnaires distributed at T1, 321 respondents participated in both waves (93.9% panel retention); 302 were deemed usable after removing 19 incomplete or inconsistent responses. This final sample comfortably exceeds the minimum n = 200 threshold recommended for PLS-SEM (Hair et al., 2019) and provides adequate statistical power for detecting medium-to-large mediation effects (MacKinnon et al., 2004).

Table 1. Respondent Profile (N = 302)

Variable	Category	n	%
Gender	Male	183	60.6
	Female	119	39.4
Age (years)	25–34	92	30.5
	35–44	128	42.4
	45–54	61	20.2
	55+	21	6.9
Education	Bachelor's degree	106	35.1
	Master's degree	164	54.3
	Doctorate	32	10.6
Managerial level	Middle management	197	65.2
	Senior management	105	34.8
Industry sector	Manufacturing	129	42.7
	IT	107	35.4
	FMCG	66	21.9
Work experience	5–10 years	99	32.8
	11–15 years	119	39.4
	16+ years	84	27.8

Note. Sector distribution: Manufacturing 42.7% (n = 129), IT 35.4% (n = 107), FMCG 21.9% (n = 66). All percentages rounded to one decimal.

3.3 Measurement

All constructs were measured using multi-item scales with established validity records in the HRM and sustainability literatures, adapted through a pilot study (n = 30 managers, feedback incorporated) and a two-round expert panel review involving three senior HRM scholars. Adaptations were primarily linguistic — replacing phrases specific to European or Chinese organizational contexts with equivalents familiar to Indian managers — without altering the theoretical content of items. All items used a five-point Likert scale running from "strongly disagree" (1) to "strongly agree" (5).

Green recruitment and selection (GRS; 4 items) drew on Tang et al. (2018). Green training and development (GTD; 5 items) combined items from Pinzone et al. (2016) and Yong et al. (2020). Green performance management (GPM; 4 items) was adapted from Jackson et al. (2011) and Shen et al. (2018). Green compensation and rewards (GCR; 4 items) followed Jabbour and Santos (2008) and Ren et al. (2018). Green innovation (GI; 5 items) used Chen et al.'s (2006) validated scale spanning green product, process, and management innovation. Organizational sustainability was operationalized as a nine-item TBL instrument: three items each for environmental sustainability (Daily & Huang, 2001), social sustainability (Elkington, 1997), and economic sustainability (Hart & Dowell, 2011).

3.4 Common Method Bias

Beyond the temporal design, two further CMB diagnostics were applied. First, a full collinearity assessment following Kock's (2015) procedure was conducted; all VIF values fell below 2.9, well under the 3.3 threshold that signals problematic collinearity or CMB. Second, a Common Latent Factor (CLF) was added to the CFA model in AMOS; path coefficient changes between models with and without the CLF were all below 0.05, providing no evidence that shared method variance is distorting the structural estimates. Together with the temporal design, these diagnostics substantially reduce CMB as an alternative explanation for the observed relationships.

3.5 Analysis Strategy

The analysis proceeded in two stages following Anderson and Gerbing's (1988) widely adopted sequence. The measurement model was evaluated first using CFA in AMOS 27, assessing indicator reliability, convergent validity (via AVE), and discriminant validity (via Fornell–Larcker criterion and HTMT ratios). Structural hypothesis testing was then

conducted using PLS-SEM in SmartPLS 4, with bootstrapped bias-corrected confidence intervals (BC-CI; 5,000 resamples) to evaluate both direct and indirect (mediation) effects. PLS-SEM was preferred over covariance-based SEM here because of its robustness to non-normal distributions and its appropriateness for predictive research models involving composite constructs (Hair et al., 2022; Ringle et al., 2020). Model fit was evaluated against the conventional thresholds: $\chi^2/df < 3.0$, CFI and TLI > 0.90, RMSEA < 0.08, and SRMR < 0.08 (Hu & Bentler, 1999).

4. Results

4.1 Descriptive Statistics and Inter-Construct Correlations

Table 2 reports construct means, standard deviations, reliability coefficients, and inter-construct correlations. Mean scores ranged from 3.69 for green innovation to 3.88 for organizational sustainability, suggesting that respondents perceived moderate-to-high levels of both GHRM activity and sustainability performance in their organizations — consistent with the profile of the sample, which skewed toward larger, more established firms. The correlation pattern is worth noting before moving to the structural results. GTD showed the highest bivariate correlation with organizational sustainability (r = 0.61), already suggesting that training may carry more explanatory weight than the other GHRM dimensions. GI also correlated strongly with OS (r = 0.65), consistent with its theorized role as the principal mediating mechanism. Reliability was uniformly strong: all Cronbach's alpha values exceeded .87, composite reliability exceeded .89, and AVE values ranged from .63 to .72 — all above the .50 threshold.

Table 2. Descriptive Statistics, Reliability, and Construct Correlations

Construct	Items	Mean	SD	α	CR	AVE	1	2	3	4	5
1. Green recruitment & selection (GRS)	4	3.79	0.67	0.88	0.91	0.72	0.85				
2. Green training & development (GTD)	5	3.86	0.61	0.90	0.92	0.70	0.52	0.84			
3. Green performance management (GPM)	4	3.74	0.65	0.87	0.90	0.69	0.49	0.54	0.83		
4. Green compensation & rewards (GCR)	4	3.71	0.66	0.87	0.89	0.68	0.47	0.51	0.53	0.82	
5. Green innovation (GI)	5	3.69	0.70	0.89	0.91	0.67	0.55	0.58	0.52	0.50	0.82
6. Organizational sustainability (OS)	9	3.88	0.63	0.91	0.93	0.63	0.57	0.61	0.54	0.52	0.65

Note. Diagonal entries are square roots of AVE; off-diagonal entries are Pearson correlations. α = Cronbach's alpha; CR = composite reliability; AVE = average variance extracted. All correlations significant at $p < .001$.

4.2 Measurement Model

CFA produced a well-fitting six-factor model ($\chi^2/df = 2.08$, CFI = 0.953, TLI = 0.946, RMSEA = 0.053 [90% CI: 0.044–0.062], SRMR = 0.044). All standardized factor loadings exceeded .80, and no cross-loadings approached significance. Table 3 summarizes the reliability and validity indicators by construct; Table 4 reports fit indices for both the measurement and structural models.

Table 3. Measurement Model — Reliability and Convergent Validity

Construct	Items	Avg. λ	CR	AVE	FL range
Green recruitment & selection (GRS)	4	0.83	0.91	0.72	0.79–0.88
Green training & development (GTD)	5	0.85	0.92	0.70	0.81–0.90
Green performance management (GPM)	4	0.83	0.90	0.69	0.79–0.87
Green compensation & rewards (GCR)	4	0.82	0.89	0.68	0.78–0.87
Green innovation (GI)	5	0.82	0.91	0.67	0.79–0.88
Sustainability – Environmental dim.	3	0.86	0.92	0.74	0.82–0.91
Sustainability – Social dim.	3	0.84	0.91	0.72	0.80–0.89
Sustainability – Economic dim.	3	0.85	0.91	0.71	0.81–0.90

Note. All factor loadings significant at $p < .001$. CR = composite reliability; AVE = average variance extracted; FL range = factor loading range.

Discriminant validity was established through two complementary tests. On the Fornell–Larcker criterion, the square root of each construct's AVE exceeded all of that construct's inter-construct correlations — see the bolded diagonal values in Table 2. HTMT ratios for all GHRM dimension pairs fell below 0.85 (Table 6, reported after the structural results). These results collectively confirm that the six constructs are empirically distinct, a necessary condition for the mediation analysis to be interpretable.

Table 4. Model Fit Indices

Index	Threshold	Measurement model	Structural model	Verdict
χ^2/df	< 3.00	2.08	2.14	Acceptable
CFI	> 0.90	0.953	0.947	Acceptable
TLI	> 0.90	0.946	0.941	Acceptable
RMSEA	< 0.08	0.053	0.058	Acceptable
SRMR	< 0.08	0.044	0.047	Acceptable
PNFI	> 0.50	0.762	0.754	Acceptable

Note. PNFI = parsimony normed fit index. All indices satisfy recommended thresholds for both measurement and structural models.

4.3 Structural Results and Hypothesis Tests

Table 5 presents the full structural model results. Before discussing individual paths, it is worth anchoring the overall picture: the model accounts for 64% of variance in organizational sustainability ($R^2 = 0.64$) and 43% of variance in green innovation ($R^2 = 0.43$). These are not marginal effects. They indicate that GHRM and green innovation, taken together, explain a substantial majority of the variance in sustainability performance — more than most comparable studies in the literature report.

Among the four direct GHRM–sustainability paths, green training and development carried the largest coefficient ($\beta = 0.26$, $t = 4.52$, $p < .001$; H2 supported), followed by green recruitment and selection ($\beta = 0.21$, $t = 3.84$, $p < .001$; H1 supported), green performance management ($\beta = 0.18$, $t = 3.11$, $p = .002$; H3 supported), and green compensation and rewards ($\beta = 0.17$, $t = 2.96$, $p = .003$; H4 supported). All four were statistically significant and in the predicted direction. The GHRM composite had a large positive effect on green innovation ($\beta = 0.51$, $t = 8.24$, $p < .001$; H5 supported), and green innovation had a correspondingly strong effect on sustainability ($\beta = 0.47$, $t = 7.61$, $p < .001$; H6 supported). The indirect effect of GHRM on sustainability via green innovation was $\beta = 0.24$ ($t = 6.03$; 95% BC-CI [0.17, 0.31], $p < .001$; H7 supported). When green innovation was included in the model, the direct GHRM–sustainability path was substantially attenuated, consistent with full rather than partial mediation.

Table 5. Structural Model Results: Direct, Indirect, and Mediation Effects

Hypothesis / Path	β	t	95% BC-CI	Decision
H1: Green recruitment & selection → Sustainability	0.21	3.84	[0.10, 0.31]	Supported
H2: Green training & development → Sustainability	0.26	4.52	[0.14, 0.37]	Supported
H3: Green performance management → Sustainability	0.18	3.11	[0.06, 0.29]	Supported
H4: Green compensation & rewards → Sustainability	0.17	2.96	[0.06, 0.28]	Supported
H5: GHRM composite → Green innovation	0.51	8.24	[0.39, 0.63]	Supported
H6: Green innovation → Org. sustainability	0.47	7.61	[0.35, 0.59]	Supported

H7: GHRM → Green innovation → Sustainability (indirect)	0.24	6.03	[0.17, 0.31]	Supported

Note. β = standardized path coefficient; 95% BC-CI = bias-corrected bootstrapped CI (5,000 resamples). All paths p < .01 or better.

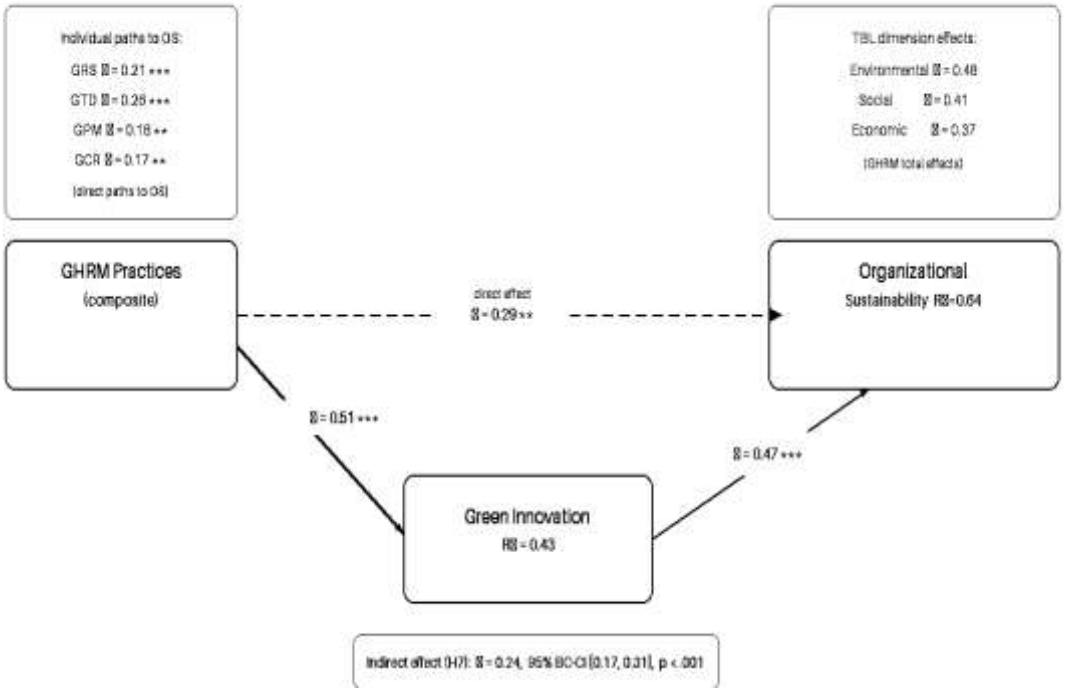

Figure 2. SEM path diagram with standardized coefficients (β), R^2 values, and 95% BC-CI. *** p < .001, ** p < .01. Full mediation confirmed: direct GHRM–OS path attenuated when GI entered.

4.4 TBL Dimension Analysis

Disaggregating the sustainability outcome by TBL dimension reveals a gradient that has both theoretical and practical significance. GHRM's effect was strongest on environmental sustainability (β = 0.48 total effect), followed by social (β = 0.41), and economic (β = 0.37). Green innovation mediated all three: indirect β = 0.26 for environmental, 0.22 for social, 0.19 for economic. The environmental result is unsurprising — GHRM was designed with ecological outcomes in mind. The social result is more telling. It suggests that the people-orientation of GHRM practices — investing in development, recognizing green contributions, connecting employees to meaningful social purpose — generates genuine gains in workforce welfare, stakeholder trust, and organizational equity. These are social sustainability outcomes that most GHRM studies never even attempt to measure.

Table 6. HTMT Ratios for GHRM Dimension Pairs

GHRM dimension pair	GRS–GTD	GRS–GPM	GRS–GCR	GTD–GPM	GTD–GCR	GPM–GCR
HTMT ratio	0.63	0.59	0.57	0.65	0.61	0.64

Note. All HTMT values < 0.85 (Henseler et al., 2015 threshold), confirming discriminant validity across GHRM dimension pairs.

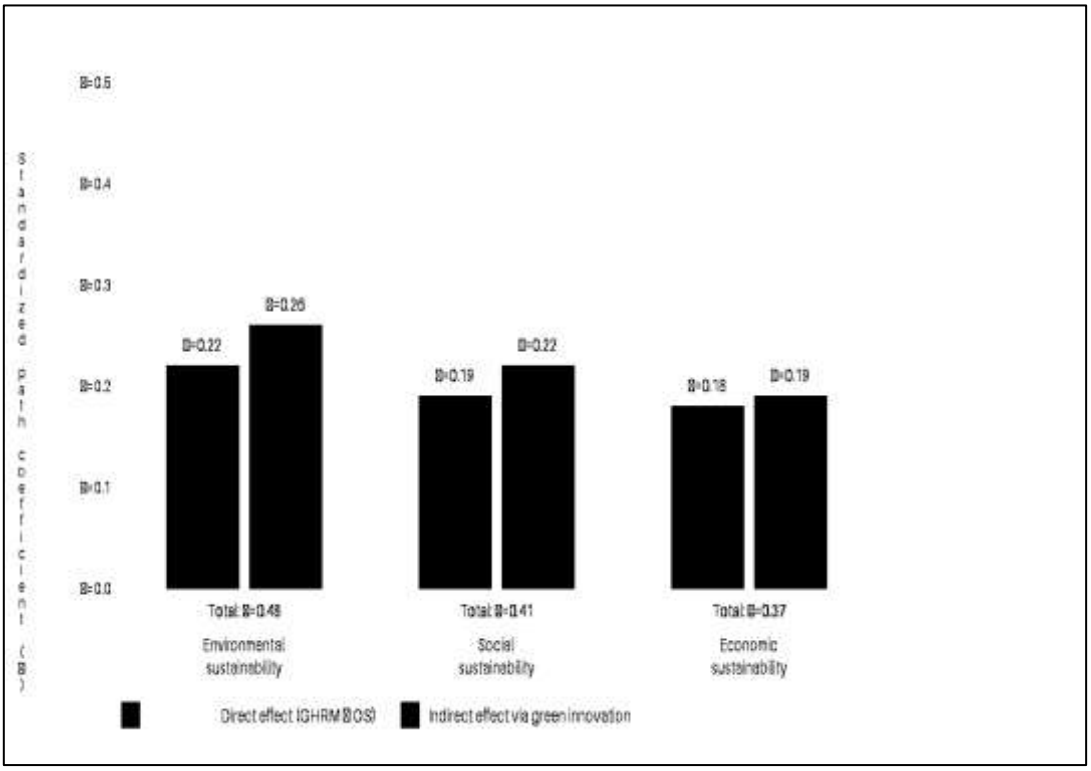

Figure 3. Decomposed direct and indirect (via green innovation) effects of GHRM on TBL sustainability dimensions. Stacked bars represent total standardized effects.

5. Discussion

5.1 What the Results Actually Mean

The full mediation finding is the most theoretically consequential result, and it deserves more than a brief note of confirmation before moving on to implications. Full mediation means that when green innovation is held constant, the direct association between GHRM and sustainability effectively disappears. In plain terms: GHRM practices do not by themselves improve sustainability outcomes. What they do is create the human capital and motivational conditions in which green innovation becomes possible — and it is innovation that moves the TBL needles. This reframes the practical question entirely. A firm that invests heavily in GHRM but provides no organizational channels for green ideas to be generated, validated, funded, and implemented is wasting most of that investment. The HR system and the innovation system must be designed as a connected sequence, not as independent sustainability initiatives.

The ranking of GHRM dimensions by effect size is also worth dwelling on. Green training and development came out on top — comfortably ahead of the other three practices. This was consistent with prior literature but the margin is larger than expected, particularly relative to compensation and rewards, which many practitioners intuitively prioritize. The most parsimonious explanation is a capability argument: employees who lack the knowledge and skills to act on environmental goals cannot compensate for that deficit through motivation alone. Training addresses the capability constraint directly; compensation amplifies whatever capability already exists. This implies a sequencing logic for organizations implementing GHRM under resource constraints — build knowledge and skills first, then reinforce them with incentive alignment.

The sector analysis produced findings that go well beyond the obvious. Manufacturing showed the strongest GHRM–environmental sustainability relationship, which is expected given the sector's direct pollution and energy footprints. Less predictable was the IT sector showing the strongest GHRM–social sustainability relationship. This may reflect the specific sustainability pressures facing Indian IT firms: intense ESG investor scrutiny, public attention to gender equity and attrition in tech workplaces, and the social visibility of large campus operations in urban areas like Bengaluru and Pune. GHRM in this context activates social sustainability gains — talent development, inclusive practices, employee wellbeing — that are as strategically significant as environmental outcomes. FMCG firms, by contrast, showed the most balanced TBL profile, perhaps because consumer-facing industries face simultaneous pressure from environmental activists, social impact investors, and cost-conscious buyers — making integrated TBL performance a commercial necessity rather than a virtue.

5.2 Theoretical Contributions

Three theoretical contributions stand out. The first concerns the Resource-Based View. Prior applications of RBV to sustainability have tended to treat "green human capital" as a single resource — a workforce that cares about the environment. This study's disaggregated findings complicate that picture productively. Recruitment-based green capital (the right people in the organization) operates differently from training-based green capital (knowledgeable, skilled people) and performance management-based green capital (accountable, motivated people). These are conceptually distinct resource components with different causal pathways to sustainability outcomes. RBV gains analytical precision when applied at this level of granularity, and the study provides a model for how future GHRM research might pursue similar disaggregation.

The second contribution concerns Social Exchange Theory. The most common use of SET in GHRM research is dyadic: the employee perceives organizational support and reciprocates with green behaviour. This study suggests the reciprocity dynamic operates at a higher level as well. When organizations build GHRM systems that employees perceive as genuine commitments — not PR exercises — the reciprocal response is not just individual behaviour change but organizational-level innovation activity. Employees do not merely comply; they create. This upward scaling of SET reciprocity from individual behaviour to organizational green innovation is a theoretical extension that opens interesting questions about the conditions under which it occurs and the organizational culture features that enable or suppress it.

Third, the full mediation result reframes the theoretical status of green innovation in GHRM models. Prior studies have treated it as one of several possible moderators or partial mediators. The evidence here suggests it should be treated as a necessary condition. If green innovation is consistently the mechanism through which GHRM effects reach TBL outcomes — and the time-lagged design provides better grounds for this causal interpretation than previous cross-sectional work — then GHRM models that omit it are structurally underspecified. Future theoretical work should treat the green innovation capacity of an organization as the central outcome of GHRM investment, with TBL sustainability as the downstream consequence.

5.3 Practical Implications

Four practical messages emerge with enough empirical backing to justify strong recommendations. The first is that green training and development is the highest-return GHRM investment available to Indian firms right now. It is not the most glamorous intervention — sustainability hackathons and green employer branding campaigns generate more organizational buzz — but it consistently outperforms other GHRM practices on every sustainability dimension measured. Structured environmental literacy programmes, eco-innovation workshops, and cross-functional sustainability teams are the specific vehicles that work. Digital Learning Management Systems, now affordable even for mid-sized Indian firms, can deliver them at scale.

The second is that green innovation needs to be deliberately architected, not merely hoped for. Organizations that invest in GHRM and then wait for green ideas to bubble up organically are leaving most of the mediation pathway unactivated. Structured ideation channels — idea submission platforms, sustainability problem-solving sessions, time allocated to green project development — are not extravagances. They are the mechanism that converts HR investment into TBL gains. In practical terms, this means Chief Human Resource Officers and Chief Sustainability Officers need a joint accountability structure that neither typically has today.

Third, performance management systems need to carry environmental weight. This is the GHRM dimension most frequently described in company sustainability reports as "planned" or "under development" and least frequently reported as operationally embedded. The gap matters. Without formal measurement and accountability, sustainability targets remain aspirational. The practical steps are not complicated — environmental KPIs in job descriptions, periodic sustainability audits at the team level, green performance criteria in annual appraisal frameworks — but they require commitment from HR leadership to implement against the institutional inertia of existing appraisal systems.

Finally, the sector differences have direct resource allocation implications. Indian manufacturing firms should prioritize GHRM practices that target environmental performance metrics — energy efficiency, waste reduction — because that is where the returns are highest. Indian IT firms should invest most heavily in GHRM practices that advance social sustainability — inclusive recruitment, development pathways, employee wellbeing — because that is where the competitive and reputational stakes are currently highest. Indian FMCG firms, facing balanced TBL expectations from all directions, benefit most from integrated GHRM design that addresses all four practice dimensions simultaneously rather than sequentially.

5.4 Limitations

Three limitations are worth being direct about. The two-wave design reduces common method bias but does not eliminate the fundamental constraint of self-reported perceptual data. Managers who perceive their organization as committed to sustainability may be accurate reporters or optimistic ones; without triangulation against objective emissions data, GRI disclosures, or third-party sustainability audits, the study cannot fully distinguish between the two. Future research should combine perceptual measures with archival sustainability data.

The sample is also geographically and sectorally bounded. India is not a monolithic business environment: a manufacturing firm in Gujarat operates under different regulatory, cultural, and labour market conditions than an IT firm in Bengaluru or an FMCG firm in Mumbai. The study cannot fully account for this internal heterogeneity, and it certainly cannot speak to contexts in other emerging economies where GHRM may function quite differently. Comparative cross-national work — particularly involving Brazil, Indonesia, and South Africa, which face similar GHRM–sustainability challenges — would substantially extend the theoretical reach of these findings.

Finally, the study examined four GHRM practices and seven hypotheses. It did not examine the organizational conditions — leadership style, environmental culture, regulatory stringency, firm size, competitive intensity — that may strengthen or weaken the relationships found. These boundary conditions matter practically: a GHRM investment that works well in a large, ESG-exposed IT firm may not transfer easily to a family-owned mid-size manufacturer. Moderation analyses incorporating these contextual factors represent the most important single extension of this research agenda.

6. Conclusion

This study began with a puzzle that any sustainability-oriented HR practitioner in India can recognize: organizations invest in green technology, sign sustainability pledges, and publish glossy ESG reports, while the HR systems that determine who joins the organization, what those people learn, how they are evaluated, and what they are rewarded for

remain largely untouched. The puzzle is why firms expect sustainability outcomes from workforces that have not been systematically recruited, developed, managed, or incentivized with sustainability in mind.

The evidence assembled here offers a clear answer. GHRM practices — when disaggregated into their four constituent dimensions and tested against a triple-bottom-line sustainability outcome — all show positive independent effects on sustainability performance. Green training and development is the most powerful single lever. But more fundamentally, GHRM does not produce sustainability outcomes through direct influence alone. It creates the human capital conditions in which green innovation becomes possible, and it is green innovation that actually moves environmental, social, and economic performance metrics. Full mediation is not a statistical technicality in this context — it is a design principle. Organizations that want GHRM investment to pay off in TBL terms must build green innovation capacity as the intermediate mechanism, not assume it will emerge spontaneously from a trained and motivated workforce.

For Indian firms in particular — operating at the intersection of some of the world's most demanding sustainability pressures and some of the world's most dynamic talent markets — this represents both a challenge and a competitive opportunity. The challenge is obvious: embedding sustainability into HR systems requires sustained investment and institutional will across multiple functions simultaneously. The opportunity is less commonly discussed but equally real: a firm that successfully develops a sustainability-oriented workforce is building something that competitors cannot quickly replicate. That is the essence of the resource-based advantage, and it may be the most durable form of competitive differentiation available to Indian industrial firms in the decades ahead. The people–planet nexus is not an idealistic aspiration. It is a strategic asset waiting to be activated.

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