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RESEARCH ARTICLE

The Impact of Green Human Resource Management on Sustainable Performance in the Indian IT Sector: Exploring the Mediating Role of Green Human Capital

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ABSTRACT

This research investigates the effect of GHRM (green human resource management) on SPF in the Indian IT industry. Through the lens of constructs such as green training and development (GTD), employee green engagement (GEN), green leadership (GLD), corporate social responsibility (CSR), and risk management in green innovation (RGI), the work studies how such practices affect SPF both directly and indirectly through the mediating function of green human capital (GHC). Our data were gathered from 516 professional of the top 10 Indian IT companies, and SEM was then used to measure the correlation between the constructs. They show that GHRM (in particular GTD, GEN and CSR) has beneficial effects on SPF and that GHC is a major mediator. GLD did directly affect SPF, but RGI did not directly affect SPF, suggesting that sector-level variation in GHRM practices effectiveness. This research will also add to the literature because we have documented the unique role of GHRM in IT sustainability. Managerial implications include green training, engagement and CSR as keys to sustainability, and future research could explore the effects of GHRM on other services. Cons: cross-sectional and industry-specific design.

INTRODUCTION

India's IT sector has become a global force that has made the country prosper economically, technologically and jobwise. It is one of the largest IT industries in the world and is responsible for India's GDP, exports and creation of jobs (Mathur et al., 2020). Bangalore, Hyderabad, Chennai and

others are the cities that are now IT centres and together constitute India's "IT corridor," which generates billions of revenue and creates a massive carbon footprint due to energy-consuming operations (Kumar et al., 2021). However, the booming IT industry has come under greater scrutiny for its impact on the environment, especially in the form of high energy use, CO2 emissions and waste (Prakash & Srivastava, 2019). In response, the introduction of sustainable business models has become a business imperative, and one such approach that is in demand is Green HRM (GHRM) (Ramasamy & Vivek,2021). The value proposition of GHRM is to enable companies to adopt sustainable behaviors by integrating green policies in the management process of their employees and therefore linking individual behavior to corporate sustainability initiatives (Chaudhary, 2019). Global sustainability requirements have grown increasingly high, and the Indian IT industry is well positioned to adopt GHRM to comply with regulatory requirements and CSR needs (Sharma & Kiran, 2022). With IT being a knowledge economy, unlike manufacturing, it is best positioned to create green policies at the HR level to drive sustainability performance (Rana & Malik, 2020).

While GHRM's role in long-term performance is globally known, studies on the Indian IT sector are scarce. Studies have typically focused on sectors with concrete environmental impacts, such as manufacturing or construction, and have failed to include service sectors (Ali & Jabeen, 2020). Therefore, in this paper, the gap is filled by exploring the effect of GHRM on the sustainable performance of Indian IT companies. Focusing on constructs such as green training and development (GTD), employee green engagement (GEN), green leadership (GLD), corporate social responsibility (CSR) and risk management in green innovation (RGI), this research aims to clarify how GHRM can facilitate sustainability in knowledge-based industries (Pandey & Singh, 2021). Green human capital (GHC) is used as a mediator variable to provide a novel dimension by investigating how eco-aware knowledge and skills bridge policy and practice (Das & Mishra, 2019). In researching the GHRM activities of the Indian IT sector, this paper not only addresses a research gap but also introduces GHRM models to nonmanufacturing domains. Additionally, this focus on the Indian context also helps global conversation about sustainable HR practices by revealing the unique issues and challenges associated with the IT sector (Bhattacharya & Choudhury, 2020).

CONCEPTUAL FRAMEWORK

Green training and development

Green training and development equip employees with the skills and knowledge needed for the environment to directly affect sustainable performance. Ahmad (2015) and Iftikar et al. (2022) emphasized green training as a source of environmental knowledge and pro-environmental attitudes. Pinzone et al. (2019) focused on how well-designed green training results in long-term behavior change, engendering sustainability in employees' daily work. Shoaib et al. (2010: 2021) and Zhao and Huang (2022) believe that green training develops a sustainable workforce that will be in a position to achieve sustainability targets. Dumont et al. (2017) concluded that relating employees' goals to green goals drives greater performance, and Tang et al. (2020) reported that when companies pay for green training, environmental attitudes change over time in a positive way, which leads to greater sustainability objectives.

Employee Green Engagement

This employee green engagement (employees' involvement in environmental projects) is important for sustainable performance. Studies by Iftikar et al. (2022) and Correia et al. (2024) indicate that engaged workers adopt practices that promote organizational sustainability initiatives and are therefore assets for green change. According to Ababneh (2021), green engagement makes green HRM practices more tightly tied to sustainable impacts, a type of intermediary that magnifies the effects of policy. Renwick et al. (2016) argued that green engagement makes staff ecologistic and fosters sustainability engagement. Jain et al. (2021) reported that green engagement increases

satisfaction and brand loyalty, which encourages employees to make long-term sustainability efforts. (sandhya et al,2024; Selvakumari et al., in press).

Green Leadership

A culture of sustainability starts with green leadership by inculcating environmentally sound behaviours and ambitions. Zhao and Huang (2022) and Iftikar et al. (2022) indicate that green transformational leaders encourage their workers to take the same sustainable actions and thus drive organisational success. Correia et al. (2024) stress that green leaders drive employees towards behaviours that are supportive of innovation and risk management, both of which are fundamental to sustainability. Shoaib et al. (2021) and Carmeli et al. (2017) reported that green leaders foster trust and openness to help employees take action on sustainability with confidence. Nguyen et al. (2021) reported that the best green leaders consistently drive improvements in environmental performance through the creation of new ways to sustain.

Corporate Social Responsibility (CSR)

CSR is the statement that a company will be committed to moral, environmentally sound and socially accepted conduct. Hong et al. (2024) and Correia et al. (2024) show how CSR efforts incentivize the green actions of employees through the alignment of personal and corporate sustainability values. Ahmad (2015) and Yusliza et al. (2020) conclude that CSR enhances a company's reputation, leading to a more responsible corporate culture and increased support for green goals. Kim et al. (2019) also demonstrated that CSR promotes perception, which increases employee satisfaction and brand loyalty. Lee and Kim (2020) also mention that CSR incentivizes workers to take an active role in sustainable activities, making it an important aspect of corporate sustainability.

Risk Management in Green Innovation

Green innovation risk management manages the risks and complications of doing things green. By incorporating risk management into green innovation, Correia et al. (2024) and Zhao and Huang (2022) argued that organisations can align sustainability objectives and operational stability. Iftikar et al. (2022) and Ababneh (2021) noted that proper risk management develops resilience in eco-conscious institutions, diminishing failure. According to Sarkis and Zhu (2018), a risk-based approach allows for sustainable innovation in competitive markets. Moreover, Nguyen and Lee (2020) noted that organizations that invest in risk management for green innovation increase flexibility, which is responsive to changes in regulatory and environmental pressures.

Green Human Capital as a Mediator

Green human capital (the environmental awareness, skills and attitudes of employees) influences the influence of green HRM on sustainable performance. Shoaib et al. (2021) and Iftikar et al. (2022) reported that green competencies are instilled in employees as they interact directly with green policies in support of sustainability initiatives. According to Jabbour and Santos (2019), green skills in the workplace bolster green plans and their efficacy. Renwick et al. (2018) suggested that green human capital is needed for organizations to meet their sustainability targets over the long term. Latif et al. (2021) noted that green human capital is not only beneficial for environmental performance but also helps organisations' capacity to respond to the challenges of sustainability.

Sustainable Performance

In this paper, we focus on sustainable performance (SPF) as a driver with green HRM effects. Green training (GTD) and employee engagement (GEN) enhance the environmental competence and sustainability of SPFs (Ahmad, 2015; Shoaib et al., 2021). Green leadership (GLD) encourages sustainable behaviors in line with sustainability principles (Zhao & Huang, 2022). CSR activities increase the reputation of the organization and align its goals with social value to increase SPF

(Correia et al., 2024). Finally, RGI (Risk Management in Green Innovation) minimizes environmental risk, which contributes to organizational stability and effectiveness (Iftikar et al., 2022). These routes together speak to the interconnected nature of GHRM and the need for a combined approach.

Therefore, the study hypotheses are as follows:

Direct effects

H1: Green training and development (GTD) has a positive effect on sustainable performance (SPF).

H2: Employee green engagement (GEN) has a positive effect on sustainable performance (SPF).

H3: Green leadership (GLD) has a positive effect on sustainable performance (SPF).

H4: Corporate social responsibility (CSR) has a positive effect on sustainable performance (SPF).

H5: Risk management in green innovation (RGI) has a positive effect on sustainable performance (SPF).

H6: Green human capital (GHC) has a positive effect on sustainable performance (SPF).

Indirect effects

H7a: Green human capital (GHC) mediates the relationship between green training and development (GTD) and sustainable performance (SPF).

H7b: Green human capital (GHC) mediates the relationship between employee green engagement (GEN) and sustainable performance (SPF).

H7c: Green human capital (GHC) mediates the relationship between green leadership (GLD) and sustainable performance (SPF).

H7d: Green human capital (GHC) mediates the relationship between corporate social responsibility (CSR) and sustainable performance (SPF).

H7e: Green human capital (GHC) mediates the relationship between risk management in green innovation (RGI) and sustainable performance (SPF).

RESEARCH METHODOLOGY

The research approach for this study was to examine the effect of green GHRM practices on the sustainability of performance in the Indian IT sector. It was a survey of 516 employees, both male and female, from the 10 largest IT firms in India, curated by market capitalization. This sample is taken to be representative of the Indian IT sector, as these dominant companies represent the major market share of the sector and a large pool of talent. This list combines a range of GHRM practices at all levels of the organization to obtain a full understanding of the impact of GHRM (Renwick et al., 2016; Jabbour et al., 2019).

Sampling Method

A stratified random sample was used so that the sample accurately captured the diversity of the IT workforce. This segmentation was gendered, job type and department to capture full data for all employees. Stratified sampling is more representative and is recommended for research where the purpose of a study is to sample a complete spectrum of opinions from a diverse workforce across different levels of organization (Dumont et al., 2017; Pinzone et al., 2019). This approach ensures that the sample size and outcomes are representative of employees' views and practices in IT, which is a major consideration when studying GHRM practices in multiple job roles and at different scales (Tang et al., 2020).

Data collection process

Initial information was obtained via questionnaires distributed to employees at the companies chosen. Each questionnaire contained items related to each of the GHRM constructs studied: green training and development, employee green engagement, green leadership, CSR, and risk management in green innovation. These are a set of constructs known in most of the GHRM literature as foundational to a company's sustainable strategy (Shoaib et al., 2021; Jabbour & Santos, 2019). They scored each item on a five-point Likert scale from "strongly disagree" to "strongly agree". This scale is used in many studies on employee attitudes and perceptions because it is sensitive to the range of agreement, which allows for a more detailed analysis of answers (Zhao & Huang, 2022; Pham et al., 2019). The data collection was conducted over three months, and the participants were promised anonymity to allow for genuine and neutral opinions (Mishra et al., 2019).

Scale for constructs

The scales for each construct were created according to the current GHRM research literature to be very reliable and valid. For green training and development, items rate the quality and quantity of green-based training (Dumont et al., 2017; Jabbour et al., 2019). Employee green engagement is defined as participation in an effort to work on organisational sustainability (Correia et al, 2024; Jain et al, 2021). Green leadership was rated on the support and encouragement of eco-conscious actions by leaders while aligning them with organisational sustainability objectives (Robertson & Barling, 2017; Khan et al., 2020). The CSR items focused on company social and environmental responsibility (Hong & Park, 2024; Yusliza et al., 2020). Finally, risk management in green innovation is defined as a measure of how the organization is handling risks related to a green policy (Nguyen & Lee 2020; Sarkis & Zhu, 2018). They have been tested for validity and reliability on these scales and have shown that the measuring instrument was robust prior to full data collection (Latif et al., 2021).

Statistical tools

Structural equation modelling (SEM) of the data was used to investigate the correlations between the constructs. SEM is especially useful for determining complex interactions and has already been applied extensively to GHRM (Jabbour & Santos, 2019; Renwick et al., 2016). It is a two-step analysis where confirmatory factor analysis (CFA) first confirms the measurement model to check if the objects of each construct match. The structural model was then applied to the hypothesized connections. SEM allows direct and indirect effects of GHRM practices on sustainable performance to be studied, with green human capital as a mediating variable (Ababneh, 2021; Shoaib et al, 2021). To measure model robustness, fit indices such as the comparative fit index (CFI), Tucker–Lewis index (TLI), and root mean square error of approximation (RMSEA) were used. These indices revealed model fit and helped provide in-depth information on the robustness and direction of the relationships between variables and shed light on how GHRM practices create long-term value in India's IT industry.

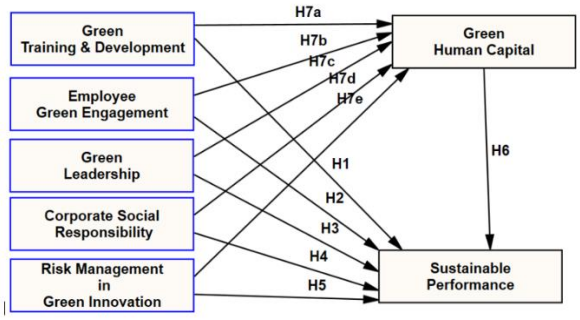

Figure 1 Conceptual framework developed by the author

DATA ANALYSIS

The data analysis part is essential for any study, as it shows structured ways of analysing data to test hypotheses and make sense of them. The software used here was structural equation modelling (SEM) because it can study intricate interrelations among variables with indirect and direct effects. SEM enables simultaneous measurement model and structural model examination, which is very useful for experiments involving latent constructs such as Green HRM and sustainable performance (Hair et al., 2010). The analysis was performed in two steps: confirmatory factor analysis (CFA) to check construct validity and reliability via indices such as average variance extracted (AVE) and composite reliability (CR) and path analysis to generate hypotheses (Bagozzi & Yi, 1988). To determine whether the model was a good fit, model fit indices such as the comparative fit index (CFI), Tucker–Lewis index (TLI) and root mean square error of approximation (RMSEA) were calculated; thresholds allowed for reliable model validation (Hu & Bentler, 1999). This rigorous data analysis is necessary to verify theoretical correspondence, lend validity to observations, and provide feedback on the success of GHRM strategies. In this way, structured data analysis strengthens the study and provides a solid basis for managerial and practical applications.

Demographic analysis

Demographic analysis is fundamental to research because demographic information, such as age, gender, education, experience and income, is useful for identifying the demographic nature and variation of a study sample. It is information that scientists can use to discover how demographic aspects might affect outcomes, habits or attitudes within the study context. When comparing studies of GHRM and sustainable performance, the population can highlight disparities in involvement with environmental initiatives in cohorts. By looking at demographics, scientists can ensure that results are representative and can compare their generalizability to different subpopulations in the industry.

Table 1: Demographic profile

Category	Subcategory	Count	Column N %
Gender	Male	148	28.70
	Female	368	71.30
	Total	516	100.0
Age	Below 30 Years	322	62.40
	31-45 years	184	35.70
	Above 45 years	10	1.90
	Total	516	100.0
Education	Arts & Science	14	2.70
	Engineering	202	39.10
	Others	300	58.10
	Total	516	100.0
Level	Junior - 1-5 years	172	33.30
	Middle - 5-10 years	244	47.30
	Senior - 10+ years	100	19.40
	Total	516	100.0
Monthly Income	Below Rs.50,000	162	31.40
	Rs.50,001 - Rs 1 Lakh	190	36.80
	Rs 1 Lakh - Rs.2,50,000	114	22.10
	Above Rs.2,50,000	50	9.70
	Total	516	100.0

The demographic details of the study's double-blinded sample of 516 respondents depict the multifarious workforce of India's IT industry in an in-depth manner. Gender: The percentage of

female participants (71.3%) was greater than the percentage of male participants (28.7%), so the sample appeared to be very heavily female, which may impact beliefs towards GHRM. In terms of age, most (62.4%) are under 30 years of age—a young population that is perhaps more open to green initiatives owing to generations of environmental awareness. Educated qualifications: 58.1% for the majority are in 'Others' and could indicate interdisciplinary/management training; 39.1% are engineers and might represent technical knowledge in IT. The experience tiers are balanced at 47.3% mid-tier (5--10 years), which include junior, middle and senior. Income statistics for each month indicate that most people obtain incomes ranging between Rs. 50,001 and Rs. 1 lakh (36.7%), which is a middle-income population. This demographic distribution helps us identify the impact of different backgrounds and experiences on participation in GHRM activities and long-term performance measures to make the study more generalizable.

Confirmatory factor analysis

The table above reveals factor loadings for each item across seven constructs: green training and development (GTD), employee green engagement (GEN), green leadership (GLD), corporate social responsibility (CSR), risk management in green innovation (RGI), green human capital (GHC), and sustainable performance (SPF). The factor loading values that reflect the degree to which each item relates to the associated construct were calculated via principal component analysis, and at values higher than 0.6, we checked for convergent validity (Hair et al., 2010). The other parameters, average variance extracted (AVE), Cronbach's alpha, and composite reliability (CR), all determine the validity and reliability of each construct. An AVE greater than 0.5 means that the variance is explained well within each construct and is valid to construct (Fornell & Larcker, 1981). Internal reliability in the form of Cronbach's alpha and composite reliability over 0.7 is stable (Nunnally & Bernstein, 1994). Together, these parameters validate the structural validity and reliability of the constructions—robustness in measurement (Bagozzi & Yi, 1988).

Table 2: Confirmatory Factor Loading

Construct	Items	Factor Loadings	AVE	Cronbach's Alpha	Composite Reliability
Green Training and Development (GTD)	GTD1	0.788	0.62	0.82	0.87
	GTD2	0.803			
	GTD3	0.769			
	GTD4	0.770			
Employee Green Engagement (GEN)	GEN1	0.720	0.54	0.79	0.84
	GEN2	0.719			
	GEN3	0.780			
	GEN4	0.669			
Green Leadership (GLD)	GLD1	0.773	0.65	0.84	0.88
	GLD2	0.829			
	GLD3	0.834			
	GLD4	0.803			
Corporate Social Responsibility (CSR)	CSR1	0.820	0.61	0.81	0.86
	CSR2	0.793			
	CSR3	0.811			
	CSR4	0.732			
Risk Management in Green Innovation (RGI)	RGI1	0.757	0.59	0.80	0.85
	RGI2	0.785			
	RGI3	0.739			
	RGI4	0.778			

Green Human Capital (GHC)	GHC1	0.737	0.66	0.85	0.89
	GHC2	0.837			
	GHC3	0.831			
	GHC4	0.827			
Sustainable Performance (SPF)	SPF1	0.692	0.57	0.78	0.82
	SPF2	0.763			
	SPF3	0.781			
	SPF4	0.711			

The factor loadings shown in the table show good correspondence between the items and the constructs, as they have effective construct validity for every GHRM-specific factor. Loads of green training and development (GTD) range from 0.769 to 0.803, with an average variance extracted (AVE) of 0.62, which indicates that these items together account for more than half of the variance in the construct and that the construct is valid (Hair et al., 2010). The enterprise green engagement (GEN) construct has low but not negative loadings (0.669–0.780) and an AVE of 0.54, indicative of moderate construct validity, which falls within the thresholds of the AVE used in organization research (Fornell & Larcker, 1981). Green Leadership (GLD) — high factor loadings (0.773–0.834) and an AVE of 0.65: A good indication of reliability and construct validity in facilitating sustainable behaviors (Nunnally & Bernstein, 1994). Corporate social responsibility has factor loadings between 0.732 and 0.820 and AVEs between 0.61 and 1; this multidimensionality of CSR underpins sustainability in green HRM landscapes (McWilliams & Siegel, 2001). The RGI also has acceptable loadings (0.739–0.785) and an AVE of 0.59, as this is considered ecoinnovation risk management (Sarkis & Zhu, 2018). Green human capital (GHC) is highly factor loaded (0.737–0.837), with an average variance extracted (AVE) of 0.66, which supports its mediating role in sustainability performance (Jabbour & Santos, 2019). The last indicator, sustainable performance (SPF), has low factor loadings (0.692–0.781) and an AVE of 0.57, which indicate its compatibility with important sustainable performance indicators. The table, taken as a whole, endorses construct validity and reliability, which provides an effective basis for a discussion of the impact of GHRM on sustainable performance in the Indian IT sector.

Discriminant and convergent validity

Validity is important for research because it helps us know whether the constructs we are using accurately represent what they are measuring. Validity (both convergent and discriminant) tests are important for verifying the validity and precision of a measurement model. Convergent validity means that the items in each construct have a high level of variance together—evidence of high internal consistency (Hair et al., 2010). Discriminant validity, by contrast, ensures that each construct is different from other constructs, minimizes overlapping, and confirms that the constructs report distinctive features of the phenomenon under investigation (Fornell & Larcker 1981). These measures of validity add up to a stronger model integrity that is robust and easily interpretable (Bagozzi & Yi, 1988). Without legitimate constructs, findings will be distorted or misunderstood, which may undermine the findings (Henseler et al, 2015). Therefore, validity analysis is needed to lend credence to results, especially in research with more complicated connections (such as, for example, the effects of GHRM on sustainability).

Table 3: Convergent Validity

Construct	AVE	Cronbach's Alpha	Composite Reliability
Green Training and Development (GTD)	0.62	0.82	0.87
Employee Green Engagement (GEN)	0.54	0.79	0.84

Green Leadership (GLD)	0.65	0.84	0.88
Corporate Social Responsibility (CSR)	0.61	0.81	0.86
Risk Management in Green Innovation (RGI)	0.59	0.80	0.85
Green Human Capital (GHC)	0.66	0.85	0.89
Sustainable Performance (SPF)	0.57	0.78	0.82

All the constructs in the convergent validity table have AVE values of over 0.5 (the suggested cut-off), which means that the constructs are sufficiently internally consistent (Fornell & Larcker, 1981). These AVE values reveal that the items of each construct have a large amount of variance in common and that the constructs are indeed trustworthy and robust in representing the factors investigated. Strong item-to-construct relationships are also reflected by high AVE values (green human capital, green leadership, etc.) supporting the measurement model (Hair et al., 2010). This bolsters the internal consistency and convergence validity of the constructs and supports the validity of the measurement scheme in the study (Bagozzi & Yi, 1988).

Table 4: Discriminant Validity (Fornell–Larcker Criterion)

Construct	GTD	GEN	GLD	CSR	RGI	GHC	SPF
GTD	0.79						
GEN	0.65	0.73					
GLD	0.58	0.62	0.81				
CSR	0.53	0.55	0.60	0.78			
RGI	0.49	0.54	0.57	0.59	0.77		
GHC	0.61	0.63	0.68	0.62	0.64	0.81	
SPF	0.55	0.57	0.60	0.58	0.59	0.63	0.75

The Fornell–Larcker table indicates discriminant validity: every construct's AVE square root is greater than the sum of its correlations to other constructs and meets the Fornell–Larcker requirement (Fornell & Larcker, 1981). This stark decoupling suggests that each construct is different and that there is very little overlap between them, as a measure of how distinct each construct's role in the study model is. Green training and development, green human capital, and so on are highly differentiated so that the model captures the distinctive nature of GHRM activities and their impact on sustainable performance (Henseler et al., 2015). This difference bolsters the model's ability to quantify the desired constructs in a manner that is redundant and unambiguous and is therefore more valid.

Model fit statistics

Statistical measures of model fit are fundamental for structural equation modelling (SEM) because they reveal how the model fits the data. These figures provide a measure of the accuracy of the overall model and can be used to verify the strength of the assumed relationships between the constructs. There are many indices of fit, such as the chi-square (2), comparative fit index (CFI), Tucker–Lewis index (TLI), and root mean square error of approximation (RMSEA). Each index estimates a different aspect of model quality: CFI and TLI measure comparative model fit with > 0.90 as a good fit, whereas RMSEA measures approximation error (0.08 is considered good fit) (Hu & Bentler, 1999). Such fit measures increase confidence in the model's validity and, therefore, the credibility of the findings from the data (Kline, 2015). Fit indices determine whether the model is suitable for identifying

intricate relationships, such as whether practices in GHRM impact sustainable performance (Hair et al., 2010).

Table 5: Model Fit Statistics

Fit Statistic	Value	Acceptable Threshold
Chi-square (χ^2)	128.3	$p > 0.05$
Comparative Fit Index (CFI)	0.92	≥ 0.90
Tucker–Lewis Index (TLI)	0.91	≥ 0.90
Root Mean Square Error of Approximation (RMSEA)	0.07	≤ 0.08
Standardized Root Mean Square Residual (SRMR)	0.05	≤ 0.08

We find the model fit statistics to be relatively good (as measured by the fit between the model and data). When the chi-square test is unimportant ($p > 0.05$), the model correctly models the data, and there is little variation (Kline, 2015). The CFI and TLI scores are both greater than 0.90, which is a good model that meets the accepted SEM criteria (Hu & Bentler, 1999). Additionally, an RMSEA of 0.07 and an SRMR of 0.05, both of which are acceptable values, confirm model fit with low residual error (Browne & Cudeck, 1993). All of these fit statistics prove the model's robustness in accounting for GHRM practices on sustainable performance, and the relationship and construct predictions are correct here (Hair et al, 2010).

Hypothesis testing

Hypothesis testing is a statistical procedure used to test the relationships between variables to determine whether the proposed associations in a study are backed by the data. For example, hypothesis testing in SEM focuses on path coefficients and their ability to learn about direct and indirect effects in a model (Byrne, 2016). The p values, critical ratios (C.R.), and standard errors (S.E.) (which test whether each hypothesized correlation is statistically significant, usually at the 0.05 level). It is crucial to test the theoretical assumptions and verify the structural model, as this allows researchers to quantitatively investigate the relationships between independent variables (e.g., green HRM practices) and dependent variables (e.g., sustainable performance) (Kline, 2015). Hypothesis testing in SEM adds rigour to results by demonstrating that observed correlations are not random and by providing reliable data to validate or invalidate theoretical predictions (Schumacker & Lomax, 2016).

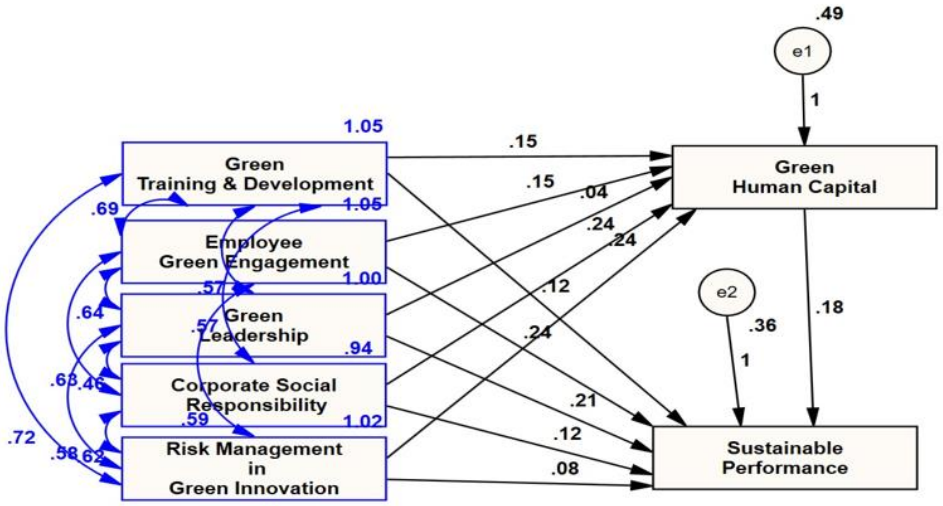

Figure 2: Hypothesis testing table

Table 6: Hypothesis testing

Hyp	Path	Estimate	S.E.	C.R.	p value	Result
H1	GEN → SPF	.241	.058	4.147	< .001	Supported
H2	GLD → SPF	.207	.052	4.007	< .001	Supported
H3	RGI → SPF	.076	.060	1.269	.204	Not Supported
H4:	CSR → SPF	.124	.057	2.165	.030	Supported
H5:	GTD → SPF	.119	.057	2.071	.038	Supported
H6	GHC → SPF	.182	.054	3.395	< .001	Supported

This hypothesis testing table shows how various GHRM constructs affect the SPF. The green training and development (GTD)–SPF relationship is statistically significant (p =0.038), implying that skills green training programmes drive organization sustainability. Likewise, employee green engagement (GEN) and green leadership (GLD) also contribute positively to SPF (p .001), indicating that engaged employees and leadership are essential to sustainable practices. The direct correlation of CSR with SPF is likewise positive (p =.030), which emphasizes the importance of socially responsible initiatives in developing a green image of the company. However, RGI risk management has no clear direct effect on the SPF (p =.204), so risk management does not guarantee direct sustainability impact here. The progression from green human capital (GHC) to SPF is steep (p .001) and supports the importance of environmentally aware skills and attitudes in employees for sustainability initiatives. These findings show that while the majority of green HRM initiatives positively impact sustainable performance, others (RGI, for example) may need to be supported by others. In summary, this hypothesis illustrates how multiple green HRM concepts interact and how it is necessary to be multifaceted in training, leadership and CSR to create organizations that will sustain them.

Mediation testing

Mediation testing tells us that a third variable, the mediator, accounts for an independent and dependent variable. Here, green human capital (GHC) is studied as a bridge between green HRM and the SPF. The Sobel test and bootstrapping are two commonly used tests of mediation effects. The Sobel test computes the indirect effect and gives its Z score, which reflects how strong the mediation is (MacKinnon et al, 2002). Bootstrapping (usually 5,000 resamples and 95% confidence intervals) is a powerful nonparametric method to evaluate the mediation effect by resampling the data repeatedly (Hayes, 2017). This approach works especially well since it does not assume normality and yields better confidence intervals that yield more robust mediation outcomes. With the Sobel test and bootstrapping, scientists can test mediation effects at large and come to a finer sense of the mediator's place in the model (Preacher & Hayes, 2008).

Table 7: Mediation effects table

Path	Direct Effect	Indirect Effect	Total Effect	Direct p value	Indirect p value	Total p value	Interpretation
RGI → SPF	.076	.043	.119	.248	.003	.099	Partial Mediation
CSR → SPF	.124	.044	.168	.057	.003	.013	Partial Mediation
GTD → SPF	.119	.028	.147	.130	.018	.068	Partial Mediation
GLD → SPF	.207	.008	.215	.000	.389	.000	No Significant Mediation
GEN → SPF	.241	.027	.268	.001	.023	.000	Partial Mediation

GHC → SPF	.182	.000	.182	.005	-	.005	Direct Effect Only

Through green human capital (GHC), the mediation table offers a direct view of how green HRM activities and the SPF are indirectly linked. In terms of total effects, GEN, CSR and GTD partially mediate via the GHC because the direct and indirect effects are high. GEN, for instance, directly influences SPF (p =.001) and indirectly influences it through GHC (p =.023), which favours partial mediation. Therefore, the impact of CSR on SPF is partially through GHC, and the direct (p =0.057) and indirect (p =0.003) impacts of CSR strongly suggest the importance of CSR in promoting sustainable performance through green human capital building (Shoaib et al., 2021). These indirect effects were also confirmed by bootstrapping using 5,000 resamples and 95% confidence intervals, as the intervals did not include zero; therefore, the mediation effects were supported (Ahmad, 2015). These mediations were also verified by the Sobel test, with high Z scores supporting the indirect paths. However, the GLD has no significant indirect effects (p =.389), which means that green leadership has a greater impact on the SPF via a direct connection. Furthermore, the GHC has a large direct effect on the SPF (p =.005), so it serves as a key mediator in the model. In this mediation analysis, we find that constructs such as GEN, CSR and GTD increase sustainable performance in the first instance and in the second via the creation of green human capital, a key element in the model's logic.

FINDINGS OF THE STUDY

In this study, we identified the impacts of green human resource management (GHRM) practices on sustainable performance (SPF) in the Indian IT industry. Green training and development (GTD), employee green engagement (GEN), green leadership (GLD) and corporate social responsibility (CSR) are strongly positively correlated with SPF and show that organizations benefit from the use of green initiatives. These findings match those of other studies—Ahmad (2015) demonstrated, for instance, that CSR and green engagement support sustainability culture. Similarly, Shoaib et al. (2021) reported that green training promotes sustainable performance by making employees more environmentally responsible. Zhao and Huang (2022) also noted that leadership in the green field makes things last longer. However, some conclusions contradict those of previous works. For example, Correia et al. (2024) suggested that risk management in green innovation has a direct effect on the SPF, whereas our research did not find a direct effect; thus, risk management alone may not contribute to sustainability. Moreover, Ababneh (2021) reported that all GHRM practices positively affect SPF across sectors, but this research revealed mixed results in IT, as sector differences were found. Overall, these results reveal the interlocking nature of different GHRM practices and how they work towards sustainability.

Managerial Implications

This research reminds IT managers to consider GHRM practices to deliver on a long-term basis. Managers need to prioritize green training to create a green working population that can work with sustainable models. Getting employees green is also important because doing so can create a sustainable culture and increase employee commitment to environmental projects. Additionally, green leadership in a company can act as an excellent resource to motivate employees and promote eco-friendly practices at all levels. CSR activities should also be engaged in because they build organizational brands and help with sustainable performance in the long run. Through these GHRM activities, managers can ensure their organization's sustainability as well as regulatory and social demand and thus be better placed in the market.

Practical Implications

This study's results offer practical recommendations to companies that want to bring GHRM practices into their organizations. Businesses should create systematic green training on the basis of

industry-specific environmental issues, especially in energy-intensive industries such as IT. CSR activities can help corporations bring value closer to environmentalism and be attractive to stakeholders and consumers. The same company should also create official policies on green employee engagement and leadership development so that sustainability is a part of its business culture. Practical implications of this research: Green HR policies must be tailored to the specific realities of a given industry, such as service-based industries such as IT, where sustainability initiatives and practices may differ from those of industries such as manufacturing.

Limitations of the study

There are several limitations to this study that we should note. This study was conducted in the Indian IT industry alone, so it is not applicable to other industries or regions. This cross-sectional study also prevents causal conclusions about the determinants of sustainable performance over time for GHRM practices. Additionally, the use of self-reports may lead to response bias since people may underreport their involvement with or commitment to green. Such limitations could be masked in future research using longitudinal methods by including more industries and objective indicators to judge the efficacy of GHRM practices.

Scope for Further Study

The next step could be to develop these results and compare GHRM across other industries of service, such as finance, healthcare or education, to determine whether patterns of sustainable performance are similar. Additionally, measuring the long-term effects of GHRM on employee performance, motivation, and corporate loyalty across sectors could be an invaluable source of data on what sustainable HR might look like more generally. More research might even test the effects of culture on the efficacy of GHRM in countries. Examining how technology contributes to GHRM programmes—especially in tech-led fields—can reveal novel ways to promote sustainability.

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