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Green HRM Practices and Workforce Sustainability in Indian Software Firms: The Mediating Role of Employee Retention Using SEM

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Abstract - **Workforce sustainability is mainstream in HRM practices. This article examines how Green HRM practices could help with Employee Retention and Workforce Sustainability in selected software companies in Bangalore. Three types of study designs were utilized: quantitative, descriptive, and explanatory. Three hundred and fourteen workers from eight major software businesses filled out a structured questionnaire to provide primary data, while the companies' sustainability reports and published literature provided secondary data. We performed structural equation modeling, confirmatory factor analysis, and reliability and validity assessments using SPSS and AMOS. Employee Retention is favorably and substantially impacted by all Green HRM aspects, according to the collected data. These dimensions include Green Recruitment, Green Training and Development, Green Performance Management, Green Compensation and Rewards, and Green Employee Involvement. In fact, the results of structural equation modeling show that Green Performance Management ($\beta = 0.30$, $p < 0.001$) and Green Employee Involvement ($\beta = 0.26$, $p < 0.001$) predict Employee Retention the most. Moreover, Employee Retention predicts Workforce Sustainability ($\beta = 0.57$, $p < 0.001$), explaining 32% of its variance. The Workforce Sustainability was also significantly positively impacted by Employee Retention, and it explained 32% of its variance. By adding to what is already known about green HRM, this study strengthens the case for employee retention as a mediator between green HRM practices and the sustainability of the IT workforce in India.**

Keywords: **Green HRM, Employee Retention, Workforce Sustainability, Software Industry, SEM**

I. INTRODUCTION

Sustainability has become one of the strategic focuses in organizations around the world to cover the long-term welfare, stability, and productivity of the workers, and is not limited to the environment (Ehnert, 2009). In fields of knowledge such as the software business, human capital constitutes a major source of competitive advantage. This has made retention of employees a burning managerial problem, because not only does turnover increase recruitment and training expenses, but also upsets organizational knowledge and continuity of projects (Jabbour et al., 2022). In a bid to overcome these, companies are turning to more innovative human resource practices that consider the welfare of the employees in line with organizational sustainable growth objectives.

A better way is the Green Human Resource Management (Green HRM) that incorporates environmentally friendly values into HR policies, procedures, and systems (Renwick et al., 2013). Green HRM involves environmentally oriented recruitment, training that is based on sustainability, eco-friendly performance appraisal, green rewards, and involvement of the employees in environmental programs. The previous studies have indicated that the practices increase the environmental awareness, organizational commitment, and job satisfaction of the employees (Dumont et al., 2017). Nevertheless, empirical studies about the correlation between Green HRM and long-term retention of employees are less in number, especially in emerging

economies such as India (Gomes et al., 2023; Venkatarathnam et al., 2025).

Extrinsic factors, including compensation and career development, affect employee retention, and intrinsic ones, including meaningful work and alignment with organizational values (dos Santos Fortunato et al., 2024). The practices of green HRM encourage intrinsic motivation through the development of a feeling of purpose, moral responsibility, and pride in organizational membership (Ma et al., 2024). The employees, especially younger and highly qualified workers in the IT sector, are showing a tendency to work in companies that prioritize environmental sustainability (Vadithe et al., 2025)

Workforce sustainability transcends the idea of retention into ongoing skill development, employee engagement, and long-term employability (Soyombo et al., 2024). The features of sustainable workforces include a low level of burnout, high adaptability, and high commitment to organisations. The crucial mediating variable in the realization of workforce sustainability is staff retention, since staff retention guarantees continuity, knowledge retention, and minimized operational disruption (Kramar, 2014). However, even with its significance, there is a lack of empirical study of the retention and workforce sustainability link in the Green HRM literature.

This paper fills these gaps in research by looking at how the Green HRM practices, the Employee Retention, and the Workforce Sustainability are linked to the Indian software industry (Ahmad et al., 2023). Its donations are three times better:

- It brings Green HRM, Employee Retention, and Workforce Sustainability together in one conceptual framework, which is missing in the literature of sustainability-focused HRM.
- It also empirically models the mediating position of Employee Retention through Structural Equation Modeling (SEM), thus enhancing rigor in methodology.
- It chooses to study the Indian software industry, which gives the contextual specifics of how Green HRM practices impact retention and sustainable workforce results.

Research Questions

1: Is there a mediation effect of Employee Retention between Workforce Sustainability and the Green HRM practices?

2: Which particular dimensions of Green HRM, including Green Recruitment, Green Training and Development, Green Performance Management, Green Compensation and Rewards, and Green Employee Involvement, predict the greatest influence on Employee Retention?

3: To what extent does Employee Retention significantly influence Workforce Sustainability in the Indian software industry?

4: How well does the proposed Structural Equation Model account for the relationship between the Green HRM practices and Employee Retention and Workforce Sustainability?

The remainder of the paper is structured in the following way. Section 2 provides a literature review, elaborates on the theoretical framework, and presents the hypotheses. Section 3 provides the methodology of the research. The empirical findings are provided in Section 4, and the findings, managerial implications, and policy recommendations are discussed in Section 5. The conclusion section contains the study limitations and future research directions.

II. Review of Literature

Principles Underpinning Sustainable Human Resource Management and Green HRM

The concept of sustainable Human Resource Management (HRM) was a response to the issues related to the longevity of the organization and the welfare of the employees (Khamdamov et al., 2023). It is contended that the equilibrium between economic performance, social responsibility, and long-term welfare of the employees should be reached (Ehnert, 2009). Sustainable HRM highlights strategic HR activities, including continuity of workforce, workforce burnout, and employability as fundamental elements of organizational success in the long run. The article (Kramar, 2014) also implemented the concept of sustainability as more than an organizational goal but as a part of a system entrenched in the HR systems, and HRM represents a way of balancing this (Veerasamy et al., 2024).

Following on this, (Jabbour et al., 2022) emphasized that the central position in the organizational strategy of environmental sustainability is played by the HR functions, since employee attitudes and behavioral patterns toward green practices are mostly shaped by HR policies. According to Renwick et al., (2013), the idea of green HRM can be seen as a systematic introduction of environmental management within HR practices, which are: recruitment, training, compensation, performance appraisal, and employee involvement (Lin et al., 2024). This theory has given ground to further empirical research on how Green HRM affects employee attitudes and organizational performance.

Positive Attitudes and Eco-Friendly HRM Practices

The effect of Green HRM practices has also been receiving increased attention in the empirical research studies based on the effect it has on employee attitudes, such as engagement, commitment, and trust. The empirical evidence provided by (Dumont et al., 2017) was quite solid to argue that Green HRM practices can be used to enhance the rate of employee engagement and organizational commitment significantly by making them feel that they have a sense of purpose and can do something positive in the environment (Xie et al., 2023). Their findings show that the employees perceive green activities as supported by the organization, and this leads to

psychological attachment. Ahmed et al., (2023) have determined that ethical and environmentally friendly HR practices are important in promoting job satisfaction, particularly when it comes to knowledge workers, because they place significance on the adherence to organizational values (Ahmad et al., 2023).

Further, (Ma et al., 2024) established that there is a good correlation between Green HRM and organizational citizenship behaviour, implying that when employees feel that their employer takes environmental issues into account, they are prone to go the extra mile to work. Collectively, these studies indicate that Green HRM fosters engagement, trust, satisfaction, and discretionary behaviors, which are essential for sustaining a committed and environmentally conscious workforce.

The Mediating Function of Employee Retention in the Long-Term Sustainability of the Workforce

Workforce sustainability is the capacity to retain an effective, dedicated, and competent labor force within a period of time (Soyombo et al., 2024). Employee retention is critical in this regard, as it reduces knowledge loss, ensures operational continuity, and preserves organizational learning. The causality element between Green HRM practices and the performance of the organization in a long-term perspective exists, and the high level of the stability of the human capital is justified by the achievement of the sustainability objectives (Aggarwal & Agarwala, 2023).

Thus, employee retention is an intermediary mechanism that changes the Green HRM practices into the outcomes of workforce sustainability. Retained employees are part of the long-term productivity, innovation, and environmental stewardship, which enhance organizational sustainability. This gives the theoretical backing to H2: Employee Retention is a meaningful predictor of Workforce Sustainability.

Theoretical Framework

The paper is based on the Ability-Motivation-Opportunity (AMO) model and Social Exchange Theory (SET) to conceptualize the correlation between and among Green HRM practices, employee retention, and workforce sustainability. SET assumes that the nature of the employment relationship is mutual exchange: as organizations invest in environmentally-friendly and people-oriented HR practices, the employees will feel that the organization is supportive and just, which increases loyalty, trust, and retention.

The AMO model supports this as it explains the effect that certain HRM green practices have on the performance of employees. Green Training and Development improves the skills and environmental awareness of the employees. Green Performance Management and Compensation reward business actions that are eco-friendly and raise morale, whereas Green Employee Involvement makes the employees feel included in the environmental programs. All these practices enhance the abilities, inspiration, and chances of employees, which result in increased job satisfaction and devotion.

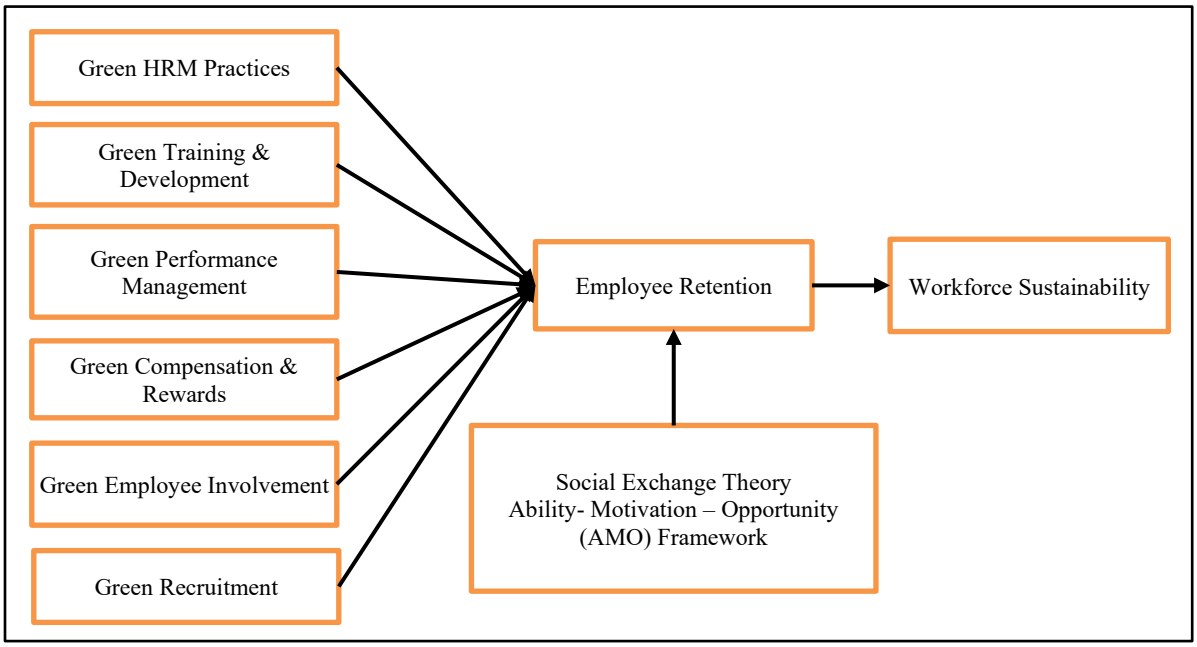

Fig. 1 Theoretical Framework

Fig. 1 shows how employee outcomes through Green HRM practices guided by the AMO framework and steered by SET have an impact on employee outcomes, which consequently leads to Employee Retention. Retention is a mediating construct that transforms Green HRM practices into Workforce Sustainability through retaining a skilled, active, and environmentally aware workforce. Retaining this type of employee guarantees a continuity of knowledge, long-term

performance, and adherence to economic, social, and environmental objectives.

In this way, the suggested framework assumes that Green HRM practices positively impact the sustainability of the workforce due to the improvement of employee retention. The Structural Equation Modeling (SEM) analysis of this study has good theoretical backing provided by this conceptual model and fits in modern research on sustainable HRM.

Research Objectives

- Research on the staff demographics of chosen software companies.
- Determine the validity and reliability of Green HRM, Employee Retention, and Workforce Sustainability constructs.
- Examine the impact of Green HRM practices on employee retention.
- Determine how the environmentally aware HR practices impact employee retention.
- Mediate between Retention of Employees and the Structural Equation Model between Green HRM and Workforce Sustainability.

Hypothesis

H1: Green HRM practices play an important role in establishing Employee Retention.

H2: Workforce Sustainability is highly influenced by Employee Retention.

III. Research Methodology

The proposed research uses a quantitative, descriptive, and explanatory research design to investigate the impact of Green Human Resource Management practices on Employee Retention and Workforce Sustainability in select software companies in Bangalore, India.

The targeted population was employees in eight leading software companies, namely TCS, Infosys, Wipro, IBM, Accenture, Cognizant, SAP Labs, and Caterpillar, because of their prominent presence and engagement with sustainability efforts in Bangalore. A total of 420 questionnaires were administered employing a non-probability sampling design called convenience sampling, and 314 usable responses were selected based on data inspections for missing data, consistency, and data point anomalies. It has a large sample size of 314, which is good enough to meet the minimum requirement of Structural Equation Modeling (SEM) and has adequate statistical power.

The survey involved a 5-point Likert scale (1 = Strongly Disagree to 5 = Strongly Agree). Validated scales were used to derive items in order to attain content validity. Green HRM was also developed as a multidimensional variable, which incorporates the following: Green Recruitment, Green Training and Development, Green Performance Management, Green Compensation and Rewards, Green Employee Involvement. Analysis of data was performed on SPSS 29 version and AMOS. The reliability tests, descriptive statistics, correlation analysis, and regression analysis were used as preliminary analysis, and the measurement model was validated using Confirmatory Factor Analysis (CFA). The Maximum Likelihood Estimation (MLE) approach was used to perform Structural Equation Modeling (SEM), which is suggested when the model being tested concerns normally distributed variables that are theory-driven.

Procedural steps, such as anonymity of the questionnaire, a researcher-neutral wording of the items, and cognitive disembodiment of variables, were used to overcome common method variance (CMV). Statistically, Harman's single-factor test indicated that no single factor accounted for the majority of variance, confirming minimal CMV in the study.

Findings of the Study

TABLE I DEMOGRAPHIC PROFILE OF RESPONDENTS

Variable	Category	Frequency	Percentage
Gender	Male	178	56.7
	Female	136	43.3
Age	Below 30 years	92	29.3
	31–40 years	148	47.1
	Above 40 years	74	23.6
Work Experience	Below 5 years	96	30.6
	5–10 years	142	45.2
	Above 10 years	76	24.2
Designation / Position	Software Engineer	164	52.2
	Analyst	96	30.6
	Managerial	54	17.2
Monthly Income	Below 40,000	74	23.6
	40,001–70,000	138	43.9
	Above 70,000	102	32.5
Residential Area	Urban	221	70.4
	Semi- Urban	63	20.1
	Rural	30	9.5

Table I provides an excellent summary of the respondent profile of the top software firms in Bangalore. By having a respectable 43.3% of women in the workforce and 56.7% of men, IT is certainly heading towards gender parity. The majority of respondents (47.1%) are aged 31–40 years, with 45.2% having 5–10 years of experience, indicating a mature, knowledgeable, and mid-career workforce likely to engage meaningfully with Green HRM practices.

In terms of designation, more than half of the respondents are software engineers, and the second part is analysts and managerial employees, with both lower and higher levels of

the hierarchy covered. There is income data that approximately 76% of the individuals who were interviewed earn over INR 40, 000 per month, which is economically viable and also offers professional development. Since 70.4% of the respondents lived in urban regions, they are presumably more familiar with the sustainability ideas and environmentally friendly working practices. Combined, the demographic information reveals that the sample is appropriate and can be used in responding to the research question regarding the effect of environmentally friendly HRM practices on both the longevity of the workforce and the probability of employees remaining in the workforce.

TABLE II DESCRIPTIVE STATISTICS

Variables	Mean	S. D	Min	Max
Green Recruitment (GR)	2.78	0.61	2.98	5.00
Green Training & Development (GTD)	2.92	0.69	2.35	5.00
Green Performance Management (GPM)	2.91	0.68	2.44	5.00
Green Compensation & Rewards (GCR)	2.73	0.56	2.23	5.00
Green Employee Involvement (GEI)	3.01	0.67	2.19	5.00
Employee Retention (ER)	2.88	0.59	2.38	5.00
Workforce Sustainability (WS)	2.91	0.63	2.37	5.00

Table II shows moderate scores in perception of Green HRM practices, employee retention, and workforce sustainability, with Green Employee Involvement having the highest value (3.01) and Green Compensation and Rewards having the lowest value (2.73), which indicates more participation but needs improvement in the incentive systems. The small to moderate standard deviations signify response homogeneity, thus rendering the data fit for CFA and SEM analysis.

TABLE III RELIABILITY AND CONVERGENT VALIDITY RESULTS

Variables	Cronbach's Alpha	CR	AVE
Green Recruitment (GR)	0.82	0.85	0.59
Green Training & Development (GTD)	0.84	0.87	0.61
Green Performance Management (GPM)	0.86	0.89	0.63
Green Compensation & Rewards (GCR)	0.83	0.86	0.60
Green Employee Involvement (GEI)	0.88	0.91	0.66
Employee Retention (ER)	0.87	0.90	0.64
Workforce Sustainability (WS)	0.85	0.88	0.62

Table III shows that all latent constructs are reliable and valid, with Cronbach's Alpha > 0.70, Composite Reliability > 0.80, and AVE > 0.50, supporting internal consistency, measurement stability, and convergent validity. All these findings support the measurement model and guarantee that every construct will capture adequate variance of its indicators. The good reliability and validity results offer good methodological support for testing Hypothesis H1, Hypothesis H2 assesses the effect of employee retention on workforce sustainability, while the first one seeks to ascertain how green HRM practices influence retention rates. In accordance with the first hypothesis, which supposes that the green HRM practices are strongly affecting employee retention, the results suggest that the five Green HRM characteristics have a strong and meaningful effect on Employee Retention. Green performance management (= 0.30) is the most significant predictor of employee retention.

TABLE IV CORRELATION MATRIX

Variables	GR	GTD	GPM	GCR	GEI	ER
GR	1					
GTD	0.64	1				
GPM	0.62	0.65	1			
GCR	0.65	0.63	0.67	1		
GEI	0.65	0.68	0.71	0.69	1	
ER	0.59	0.61	0.67	0.65	0.72	1

Table IV shows positive and statistically significant correlations between all Green HRM practices and Employee Retention, with Green Performance Management and Employee Involvement showing the strongest links. All the correlations are less than 0.85, which shows that they are not multicollinear and proves the discriminant validity. The findings provide credence to Hypothesis H1, which posits that Green HRM practices have a significant impact on employee retention. Although correlation does not carry causation, the findings warrant the additional causal examination using regression and SEM analysis.

TABLE V STANDARDIZED FACTOR LOADINGS (CONFIRMATORY FACTOR ANALYSIS)

Variables	Item Code	Factor Loading
Green Recruitment (GR)	GR1	0.72
	GR2	0.78
	GR3	0.75
	GR4	0.74
	GR5	0.70
Green Training & Development (GTD)	GTD1	0.83
	GTD2	0.80
	GTD3	0.85
	GTD4	0.78
	GTD5	0.82
	GTD6	0.77
Green Performance Management (GPM)	GPM1	0.76
	GPM2	0.81
	GPM3	0.78
	GPM4	0.73
	GPM5	0.71
Green Compensation & Rewards (GCR)	GCR1	0.75
	GCR2	0.80
	GCR3	0.77
	GCR4	0.72
	GCR5	0.70
Green Employee Involvement (GEI)	GEI1	0.79
	GEI2	0.84
	GEI3	0.81
	GEI4	0.76
	GEI5	0.73

Table V of the Confirmatory Factor Analysis results indicates a high level of measurement of all constructs of Green HRM that were incorporated in the study. The standardized factor loadings all have a range of 0.70-0.85 and are all above the recommended 0.60, hence verifying satisfactory item reliability. The Structural Equation Model finds ample theoretical as well as empirical justification in supporting the proposed hypothesis. Hypothesis H1 is fully supported, as all five green HRM practices, including Green Recruitment, Green Training & Development, Green Performance Management, Green Compensation & Rewards, and Green Employee Involvement, all have a positive effect on the outcome measure of Employee Retention in a statistically significant manner ($p < 0.001$), with Beta values of between 0.18 and 0.30. Of these, Green Performance Management & Green Employee Involvement had the largest positive effects ($\beta = 0.30$ & 0.26, respectively).

TABLE VI STRUCTURAL PATH ESTIMATES (GREEN HRM → EMPLOYEE RETENTION)

Path	B	CR	P
GR → ER	0.18	0.25	0.000
GTD → ER	0.22	0.30	0.000
GPM → ER	0.30	0.38	0.000
GCR → ER	0.20	0.28	0.000
GEI → ER	0.26	0.33	0.000

Green HRM practices have an effect on employee retention at some software organizations, according to the structural route estimations shown in table VI. In keeping with the first hypothesis, which states that green HRM practices significantly affect employee retention, the results demonstrate that the five Green HRM characteristics positively and substantially influence Employee Retention. The most important predictor of employee retention is green performance management ($\beta = 0.30$). This connotes the significance of feedback systems, evaluation frameworks that are built on sustainability, and performance appraisal frameworks that are environmentally aligned and performance-oriented in ensuring that the employees are committed to the company. Further, positive impacts can be observed in Green Employee Involvement ($\beta = 0.26$) and Green Training and Development ($\beta = 0.22$), such that participative green cooperation and sustainability of the environmental skills development cause employees to experience as part of the organization and commitment. Green Recruitment ($\beta = 0.18$) and Green Compensation and Rewards ($\beta = 0.20$) are also significantly found to have a positive effect, thus indicating that incentives that focus on sustainability and the implementation of environmentally friendly practices during the recruitment process enhance the retention levels.

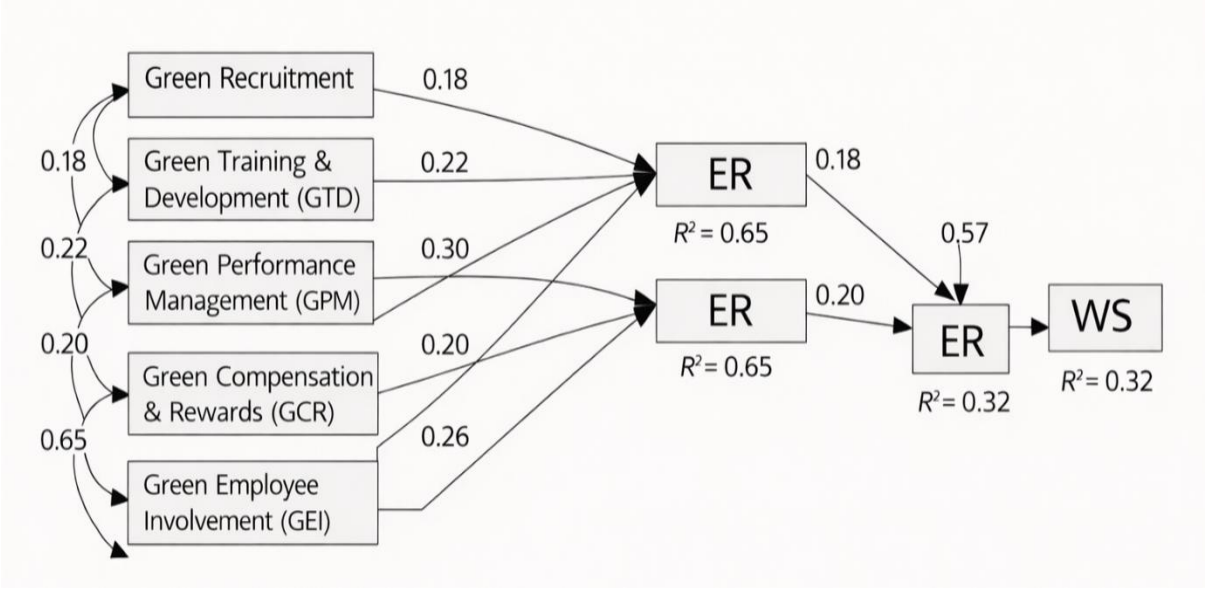

Fig. 2 Structural Equation Modelling (SEM) Path Analysis

The results presented in fig. 2 indicate that there are high causal relationships between Green HRM practices and Employee Retention, which reflects that psychologically attached, job satisfaction, and long-term commitment are the results of environmentally friendly HR systems. This fully supports Hypothesis H1.

TABLE VII STRUCTURAL PATH ESTIMATE (EMPLOYEE RETENTION - WORKFORCE SUSTAINABILITY)

Path	β	CR	p	R^2
ER → WS	0.57	8.94	0.000	0.32

H2 is accepted due to the fact that Employee Retention affects Workforce Sustainability significantly and positively ($\boldsymbol{\beta} = 0.57$, $p < 0.001$), which translates to 32% of its variance. Table VII shows the structural relationship between Employee Retention and Workforce Sustainability, indicating a strong and statistically significant impact. The path coefficient ($\beta = 0.57$) demonstrates that retention-oriented HR practices, particularly Green Performance Management and Employee Involvement, substantially contribute to workforce continuity, knowledge preservation, and sustainable employability. This confirms that Employee

Retention is a crucial mechanism through which Green HRM practices promote sustainable workforce outcomes.

TABLE VIII MODEL FIT INDICES

Fit Index	Recommended Value	Obtained Value
χ^2 / df	< 3.00	**2.36**
GFI	> 0.90	**0.91**
AGFI	> 0.90	**0.92**
CFI	> 0.90	**0.96**
TLI	> 0.90	**0.95**
RMSEA	< 0.08	**0.049**

Table VIII shows that the goodness-of-fit indicators are adequate to suggest that the measurement model provided can fit the data satisfactorily. The degree of model parsimony is also reasonably good, as indicated by the chi-square/ degrees of freedom ratio (χ2/df = 2.36), as it is significantly lower than the advised 3.00. The absolute fit measures, such as the Goodness-of-Fit Index (GPI = 0.91) and the Adjusted Goodness-of-Fit Index (AGFI = 0.92), indicate that the covariance matrix of the sample is well represented, and its values are above the minimum values. Incremental fit indices, e.g., Comparative Fit Index (CFI) and Tucker-Lewis Index (TLI), show that a model fits well as opposed to a null model. Also, the Root Mean Square Error of Approximation (RMSEA = 0.049) shows that the approximative fit is near with minimal residual error. The measurement model is statistically sound, as shown in table VII of the fitted model. It may be used for additional structural equation modeling and hypothesis testing.

Policy Recommendations

- *Integration of Green HRM within Organizational and ESG Policies*

The implementation of green HRM practices should be introduced in the organizational framework of HR by policymakers and sector regulators. The implementation of green hiring, training, and reward practices in the organizational framework will not only create sustainable workforces but will also create sustainable organizations in the knowledge-driven industry of software services.

- *Green Performance Management System Standardization*

Notably, the predictive role of Green Performance Management in determining Employee Retention requires the use of standardized sustainability-based performance evaluation practices. Responsible environmental practices and sustainability behaviors can be standardized in employment evaluation and promotion practices through the development of guidelines by policy institutions and HR professional bodies.

- *Promotion of Green Skill Development and Employee Involvement*

Organizations should be encouraged by Govt bodies, industry associations, et cetera, to invest in green training, participative sustainability, et cetera. Involvement in environmental management by employees leads to a future-ready, agile, and committed workforce.

IV. Conclusion

The current research gives strong empirical support for the strategic use of Green HRM practices towards Employee Retention and Workforce Sustainability among the software companies in Bangalore. Findings from the current study clearly establish empirical proof that Green HRM practices exert a significant impact on Employee Retention with a set of standardized path coefficients varying from $\beta = 0.18$ to $\beta = 0.30$ ($p < 0.001$). In addition, it was observed that Employee Retention has exerted a significant and positively influential impact on Workforce Sustainability with $\beta = 0.57$ and $p < 0.001$, and it explains 32% variance in the latter. These results do establish the validity of the proposed model using Structural Equation Modeling. The results validate the strength of the proposed model, which has identified the paramount importance of Employee Retention as a transmission technique. From the managerial point of view, the findings also highlight that the inclusion of environmental sustainability in the basic HR processes of performance management and employee involvement benefits the environment as well as the commitment of the employees towards the organization. To the policymakers, the study indicates the significance of promoting Green HRM practices as part of ESG sustainability initiatives, especially in the knowledge-intensive sectors like the software industry of India that are growing at a remarkable rate.

V. Future of the Study

The study has some flaws despite the helpful contribution it makes. To start with, it makes use of the cross-sectional design that prevents drawing causal conclusions across time. Secondly, no effort was made to extrapolate the findings to other industries or other places, but the sample was restricted to software firms in Bangalore. Third, self-reported responses could be affected by common method bias. A longitudinal study could be used in future studies to determine relationships between Green HRM and the sustainability outcomes, which are continuously changing. External validity would also be improved through comparative studies between industries or countries. Also, future research can address mediating and moderating factors, i.e., organizational culture, leadership approach, or green values of employees, in order to learn more about Green HRM mechanisms.

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