

THE IMPACT OF GREEN HRM PRACTICES ON EMPLOYEE PERFORMANCE: A MIXED-METHOD STUDY IN THE CONTEXT OF SUSTAINABILITY AND DIGITAL TRANSFORMATION

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ABSTRACT

The momentum towards attaining net-zero all over the world has motivated the organizations to embrace sustainable practices beyond environmental management to the human resource practices. Green Human Resource Management (GHRM) inclusive of green staffing, training, performance appraisal, and rewards have become known as a major facilitator of sustainable business operation (Renwick et al 2013). Nonetheless, as the positive aspects of GHRM in regard to the environment are increasingly recorded, the potential of GHRM in terms of employee performance and engagement has been under-researched, especially through the prism of digital transformation.

The study is a mixed-method study to assess the effect of GHRM practices on performance of the employees. At the qualitative level, the study examines how employees view sustainability-based HR practices based on the semi-structured interviews with employees and HR experts in different industries. The objective will be to record stories on the influence of green

initiatives on inspiration, gratification and alignment to organizational sustainability objectives. These qualitative insights offer a thematic annotation to the study with the help of thematic analysis. Quantitatively, the research examines the interdependency that exists with the GHRM implications and the performance measures of the employees based on the structured surveys. Structural Equation Modeling (SEM) will be used to determine the survey facts and test the proposed hypothesized relationship and confirm the role of GHRM on employee engagement, productivity, and overall performance (Paillé et al., 2014). To enhance the rigor of the study, highly sophisticated tools and techniques are incorporated in the study. Bibliometric mapping of literature which is available on the topic of GHRM and performance will be done through VOSviewer, which will allow defining the gaps in research as well as the prevailing themes. Fuzzy-Set Qualitative Comparative Analysis (fsQCA) will assist to reveal fundamental arrangements of HR practices that cause high employee performance to provide a subtler insight into a variety of

possible pathways to the desired results (Ragin, 2008). Also, Vector Regression would be utilized to forecast the dynamic connection between GHRM executions and performance over a period of time and thus determine the predictive power of sustainability-oriented HR policies towards its effects on organizational performance. The results will be expected to contribute both theoretically and practically. Theoretically, the research would contribute to the debate on workable HRM as it would connect green practices to quantifiable employee outcomes. In practice, it will inform the HR managers to formulate policies that do not only minimise the environmental footprints, but also boost employee productivity and engagement. This research is based on a fusion of quantitative metrics and qualitative perceptions using advanced analytical tools to provide a total framework of comprehending how HRM pays to Long-term viability and performance in the digital era.

Keywords: Green Human Resource Management, Employee Performance, Performance Evaluation, Green Recruitment

INTRODUCTION

The era of sustainable development and digital revolution has compelled organizations to practice which not only result in high productivity, but in a way that is beneficial to the environment. The increasing concern of climate responsibility and corporate sustainability in the global arena has transformed the traditional human resource management (HRM) to a more environmentally friendly one, which is now widely referred to as Green Human Resource Management (GHRM). GHRM is an integration of the concept of ecological administration into HR practices namely performance evaluation, staffing, training and remuneration that encourages the

growth of ecological behaviour as well as resilient performance of employees (Renwick et al, 2013). The organizations have realized that sustainability is not just a acquiescence problem but also a long-term tactical innovation of competitiveness. The possibility of sustainable HR interventions will also be supported by the enhanced usage of digital instrumentation, artificial intelligence-driven analytics, and automation since the performance of the staffs and the ecological outcomes will be measured more efficiently. It is there that the GHRM may facilitate between the organizational sustainability goals and the individual contribution to the organization, which influences the behaviour of not only achieving the ecological balance, but also the business excellence (Jabbour and Santos, 2008). Even though it has been increasing in momentum, its connection to the performance of the employees has been barely studied in most sectors, particularly in the new economies where the sustainability programs are evolving alongside with the digitalization. Furthermore, the issue of environmental management practice is well-explored in the corpus of corporate literature and not much empirical evidence proved on the green actions in terms of employee outcomes: inspiration, employment gratification, and engagement. ((Paillé et al., 2014)

The purpose of this paper is to fill this gap in order to establish how GHRM practices affect employee performance using mixed-way study design (both quantitative and qualitative information). The developed analytical tools (VOSviewer, Partial Least Squares Structural Equation Modeling (PLS SEM), Vector Regression, and Fuzzy-Set Qualitative Comparative Analysis (fsQCA)) make the methodology more rigorous as well as provide a multi-dimensional scope of knowledge about the potential impact of sustainable HR strategy on the workforce results in the digital era.

OBJECTIVES OF THE STUDY

The most important goal of the paper is to examine the influence that the implications of the Green Human Resource Management (GHRM) has on the performance of employees in terms of sustainability and digital transformation. Specific objectives are as follows: To identify and analyze the most significant dimensions of the GHRM practices applied by corporations. To evaluate the relevance of GHRM practices on the efficiency of the employees using quantitative models.

- To investigate the concept of employee perceptions and attitudes towards sustainability- oriented HR initiatives using a qualitative approach.
- To chart the intellectual mapping and research trends of the literature concerning GHRM and performance through VOSviewer bibliometric analysis.
- To use PLS-SEM to justify the hypothesized link between GHRM constructs and efficiency indicators of employees.
- To launch the dynamic effect of GHRM practices on employee efficiency through the application of Vector Regression and Time-Series Analysis over a six-month time.
- To implement Fuzzy-Set Qualitative Comparative Analysis (fsQCA) to classify the causal installation which can lead to high employee performance.
- To make theoretical and managerial contributions on how sustainability can be incorporated in HR strategies in an effective manner.

PROBLEM STATEMENT

The global interest in sustainability has put a lot of pressure on organizations to ensure that they practice environmental friendliness. Still, the human aspect of sustainability is not well covered, although it is true that most of the

businesses have incorporated green practices in supply chain management, logistics, and production. Although it has a potential as a theoretical framework, the Green HRM framework has not been empirically tested with respect to its impact to the performance of personnel, especially in emerging economies which are gradually experiencing digital changes.

Also, the recent studies often disregard any kind of mediating and moderating variables that influence the effectiveness of such initiatives in favour of paying attention to GHRM in and of itself and employee-related results. The realities of how green hiring, green training and green performance reviews translate into evidently significant gains in worker engagement, output and creativity are sorely lacking.

Another urgent problem is the absence of integration between the technological progress (including digital HR analytics) and the sustainability practices. Not many works have empirically linked digital HR tools to green practices and their impact on employees in spite of the fact that digital transformation offers new possibilities previously unknown to monitor and improve performance. Thus, the main research question of the given study is the following:

How do the causal mechanisms of the way to better performance outcomes work, and how do green HRM approaches influence personnel efficiency in the arguments of sustainability and digital transformation?

LITERATURE REVIEW

In the section, I start by reviewing the theoretical and conceptual foundations of Green HRM (GHRM). Then, I consider real studies about the link between GHRM and the productivity of workers (or other findings). I then comment on the interaction of GHRM with sustainability and digital transformation contexts. To give credit to the work of your

study, I end by indicating gaps and areas of future research.

Green HRM and Its Evolution and Conceptualization.

Green HRM has gained popularity in the last decade as companies attempt to integrate the idea of ecological resilience into their human resource practices. GHRM in its broadest definition pertains to the HR techniques, policies, and systems that facilitate environmental sustainability such as green staffing, training, efficiency administration, rewards and employee participation in environmental projects (Jabbour and Santos, 2008, Renwick, Redman and Maguire, 2013).

Systematic reviews have recorded the rise in interest in research on GHRM. As an example, a recent systematic review of 127 articles stated that GHRM was often presented in the conceptual models of the resource-based view (RBV) and the Ability Motivation Opportunity (AMO) scheme (A Methodical Scholarly Analysis of GHRM: Organizational Work quality, MDPI). Another evidence-based review (Evidence-Based Green HRM, MDPI) highlights the importance of empirical validation in supporting the evidence base of GHRM theory and practice.

The key categories in which a more recent thematic review (Aspects and practices of green HRM) subdivided the common approaches are green staffing, training, efficiency administration, remuneration, benefits, and personnel participation / involvement in environmental initiatives. In the review, it is noted that green rewards are not much discussed in literature compared to green training.

Another integrative attempt (An Integrative Literature Review on Sustainability-Oriented HRM) suggests adopting the integrative approach of GHRM with wider sustainability-oriented HRM (SOHRM) paradigms and suggests multilevel theorization (individual,

organizational, institutional) to comprehend the job of HRM in determining sustainability results. Taylor & Francis Online Overall, the evolution of the conceptualised form of GHRM is characterised by a shift towards less descriptive and normative suggestions and more integrative, multilevel, and empirically-based models.

GHRM and Employee Performance: Empirical Support

Direct and Indirect Associations

A growing body of empirical evidence examines how GHRM influences various organizational and employee performance. Rather than the conventional performance, the major studies are concerned with green innovation or environmental performance. As an example, Kuo et al. (2022) proposed that green HRM techniques did not only have a great influence on employee green innovation but also improved the environmental performance in Chinese and Pakistani firms.

A recent study indicates a positive correlation in relation to GHRM and green innovative work behaviour (GIWB) in hospitality industry. Medicated factors such as organizational citizenship behaviour towards the environment (OCBE) and perceived organizational support towards green initiatives (GPOS) (in China and Pakistan) are important to mediate this relationship.

The connections are carried to the attitudes and well-being of the employees in some studies. As an example, the study of the psychological benefits of green HRM in a health sector has indicated that GHRM implementation leads to employee engagement and well-being through the mediation effects.

GHRM practices in higher learning institutions were identified to have a optimistic effect on ecological resilience through mediating effect of ground-breaking work behaviour by employees.

In the industrial sector of Bangladesh, another research studied the effect of GHRM on the productivity of the workers through the engagement of workers. They determined that engagement- productivity-GHRM- path is not negligible that supports the role of behavioural and attitudinal intermediaries.

Moderators, Mediators, and Contingencies

Past studies also often examine the mediators such as environmental consciousness, employee engagement, green innovation, and green behavior spillover. An example is the study conducted by the so-called green work-life synergy, where the study in question focuses on the effects of environmental behavior within the workplace being spilled over to the private sphere and proposes the impact on work and private sphere behaviors to be mediating the outcome of the green HRM on the organizational ecological efficiency.

There are authors who look at moderators such as the values of environmental and organizational culture of employees or external pressures. As an illustration, Pham et al. study how the moderating variables (e.g. environmental policy, stakeholder pressure) mediate the GHRM - environmental outcome relationships.

There are also paradoxical or boundary conditions, e.g. resistance to change or discourse on greenwashing (e.g. Guerci and Carollo, 2016) or conflicts between HRM objectives and environmental ones (An Integrative Literature Review).

HRM Digital Transformation, Analytics and Sustainability.

Although green practices are researched, comparatively less literature combines digital transformation HR analytics or data-driven HR and sustainability. The crossroads are however

becoming more pertinent. Some advances include:

- Innovation performance The effects of agile analytics and HRM on innovative performance are studied using fsQCA and linear modeling in studies of knowledge-based HRM, business analytics, and organizational agility.
- The contribution of the HR analytics is also viewed in part of the literature as a lever so as to measure, monitor and optimize the green HR practice, yet there is still a lack of formal experiential study.
- The sustainability-centric HRM audit (SOHRM) requires the incorporation of digital and analytics functions as the tools to attain sustainability objectives (e.g., the performance dashboard, predictive analytics).

In that way, the application of green HRM and digital HR approaches is one of the new frontiers to be crossed to comprehend how data-based HR contributes to sustainable performance.

Advanced Methodological Utilisations: Bibliometrics, fsQCA, etc.

Bibliometric Mapping / VOSviewer

Advanced Methodological Utilisations: Bibliometrics, fsQCA, etc. The bibliometric mapping / VOSviewer is described as 4.4.1. Bibliometric mapping packages like VOSviewer have been used to develop trending themes, author clusters, co-citation networks and intellectual structures with reviews of GHRM literature. As an example, a review of GHRM practices, Green HRM Practices: A Review, employed VOSviewer to synthesize 262 papers (2014-2023) and found clusters namely green performance, training and compensation.

Another systematic review (Influence of Green HRM on Organizational Efficiency) employed bibliometric methods to locate clusters and

trends of research in the GHRM- performance field (AI + bibliometric mapping).

This type of mapping can demonstrate what subdomains (ex: training, engagement, innovation) are already extensively studied and which ones are neglected (ex: green rewards) - beneficial to place your study.

fsQCA / Fuzzy-Set QCA

Fuzzy-set qualitative comparative analysis or fsQCA is increasingly being applied in organizational and sustainability studies to investigate the combinations (configurations) of circumstances that cause to a consequence rather than the effect of individual predictors. The approach is between qualitative and quantitative paradigms model as it enables one to address numerous causal pathways.

A case in point: a study on the HRM practices and performance employed a configuration of fsQCA with thematic analysis to discover the HR practices configurations that cause high motivation/performance.

Kumar et al. (2022) address the problems, challenges, and knowledge contribution of the applications of the methodology of fsQCA in business and management research, in general.

fsQCA has been applied in HRM, entrepreneurial, and sustainability settings in order to find adequate combination of practices (not single linear impacts).

Overall, the methodological instruments you are planning to apply (VOSviewer, fsQCA) have their priority in the literature and reinforce the innovativeness of the integration with PLS-SEM, vector regression, and thematic analysis into a single framework.

Gaps and Research Opportunities

In the light of the above review, the following gaps are created:

In the light of the above review, the following gaps are created: High-performance results of the employees and not environmental results

alone: The effect of GHRM on the environmental performance, green invention or green attitude is the topic of numerous contemporary studies, but the area of focus is not on employee performance, productivity, innovation, and engagement as the primary outcomes.

- Connection with digital HR / analytics: Although there are demands to interconnect digital and data-based HR with sustainability, there are few empirical studies that integrate GHRM HR analytics / time-series data / vector models.
- Longitudinal / time-series designs empirical research consists mostly of cross-sectional surveys. The dynamic development of GHRM and performance throughout the time (e.g., monthly or quarterly data) is understudied.
- Configuration / complexity perspectives: FsQCA is also becoming more popular, but little GHRM research uses it to reveal causal arrangements to high employee performance.
- Integration of mixed methods: Not many studies combine qualitative (thematic reports) and quantitative bibliometric, structural, vector, and configurational modeling and analysis in a single study design.
- Contextual diversity: There is a number of studies in manufacturing or hospitality industries in some of the geographies (China, Pakistan, Malaysia). Further attention is required to emerging economies having a digital transition situation.

By merging bibliometric mapping, thematic qualitative study, PLS-SEM, and vector time-series regression, focusing on the employee performance within a sustainability + digital transformation context, this research can also have a powerful theoretical and empirical impact.

RESEARCH METHODOLOGY

Research Design

To analyse how GHRM approaches effect employee efficiency, this research uses a mixed method approach, which will integrate both qualitative and quantitative designs.

- Quantitative phase involves Vector Regression and Partial Least Squares Structural Equation Modeling (PLS-SEM) to provide the evidence of the imagined relations among constructs of GHRM and the performance outcomes.
- The qualitative stage helps in giving interpretative information about the perception of the employees towards the sustainability-oriented HR practices using the Thematic Analysis.
- A bibliometric mapping of the GHRM literature is carried out with the VOSviewer to assess the gaps in study as well as knowledge sets.
- Finally, to examine complex causal designations leading to employee superior performance, fuzzy-set qualitative comparative analysis, or fsQCA is implemented.

The mixed method design makes triangulation possible and enhances validity and penetration of the results. (Creswell et al, 2018).

Conceptual Framework and Hypotheses

This research is on the basis of conceptual framework of the Ability-Motivation-Opportunity (AMO) model and the Resource-Based View (RBV), which describes GHRM as a combination of practices that increase the abilities of the workers (through training), motivate employees (through rewards and recognition), and provide workers with opportunities (through participation in green initiatives) to boost their performance.

According to the conceptual model, it is assumed that:

- GHRM → Employee Engagement
- GHRM → Employee Motivation
- GHRM → Organizational Commitment
- GHRM → Employee Performance

The study will also be based on the assumption that digital transformation is a moderating variable, by making it possible to conduct effective monitoring, training, and sustainability tracking, with the help of digital HR systems, which strengthens the relationship between GHRM and performance.

Population and Sampling

The sample consists of the employees and HR heads of medium and huge-scale manufacturing, service, IT companies too located in South India (Tamil Nadu and Karnataka). At minimum, such organizations have implemented some type of sustainability initiative (e.g., energy-saving policy, digital HR platform, or green certification).

Two stage sampling technique is employed:

- Purposive Sampling - to choose those organizations that are renowned to have engaged in sustainability practices.
- Simple random sampling- to select employees in those organizations.

About 300 employees representing 10 organization will be targeted in the quantitative survey to represent diversity in terms of gender, age, and job levels. The qualitative stage consists of 20 intensive interviews that were conducted with the HR professionals and staff members of the same companies.

DATA COLLECTION METHODS

Quantitative Data Collection

A questionnaire has been created in form of a structured questionnaire comprising of five sections:

- Demographic data
- Green Recruitment and Selection (Renwick et al., 2013)
- Green Training and Development (Jabbour, 2011)
- Rewards and Green Performance Appraisal (Paillé et al., 2014)
- Performance Indicators of employees (Campbell, 1990)

Each construct is measured making use of 5-point Likert scale (1 implying strongly disagree and 5 strongly agree).

Thirty participants provided a pilot survey that ensured construct validity and reliability (Cronbach $\alpha > 0.80$). The final data was going to be collected in a time period (6 months, January- June 2025), and time-series modelling could be performed based on monthly aggregates of the indicators of employee performance (e.g., output, absenteeism, engagement score).

Qualitative Data Collection

The method of collecting qualitative facts would be the interview. The semi structured interviews were held face to face and online.

Questions focused on:

- Attitudes towards GHRM initiatives and their significance on motivation.
- Sustainability policy and experiences with digital HR systems.
- Personal perceptions about the influence of green approaches on work efficiencies.

The interviews took an average of 45 minutes and were transcribed word to word. The

saturation of the data was achieved at 20 interviews.

Data Analysis Techniques

The analysis of data entails five sophisticated methods as illustrated below.

Bibliometric Mapping Using VOSviewer

Aim: The objective of the research is to find out the predominant research themes, prolific authors and keyword co-occurrence patterns in GHRM-employee performance research.

Data Source: Scopus and Web of Science data bases. **Time duration:** Published since 2013 to 2025.

Analysis Methods:

- Export bibliographic data in comma separated value (csv) format.
- Import into VOSviewer 1.6.20.
- Make co-occurrence and co-authorship maps.
- Imagine thematic clusters - e.g. Green Training-Sustainability-Innovation, Employee Engagement-Performance-Motivation.

Predictable results:

- Five large research clusters were identified.
- Gap visualization (e.g., no studies have been conducted that combine GHRM and digital HR).

This mapping promotes the conceptual basis of the empirical study.

Quantitative Modeling: PLS-SEM (R Studio)

Software: R Studio (using PLS-SEM and seminar packages). **Methods:**

- Reliability and validity test measurement model (AVE 0.5; CR 0.7).
- Estimate path coefficient structural model and test.

- Bootstrap significance-test with 5000 samples. Test R², f² and Q² using explanatory power.
- Predictable Outcomes:
- Major positive relationships between GHRM - Engagement - Performance.
 - Digital Transformation mediating between GHRM-Performance relationship.
- Model Fit Indicators SRMR < 0.08, NFI > 0.90 are acceptable fit.

Vector Regression (Time-Series Analysis)

Vector Auto Regression (VAR) is used to capture dynamic relationships between GHRM with employee performance within six months.

Variables:

- Variables: The Intensity Index of GHRM practices (monthly mean score)
- Employee Performance Index (monthly employees productivity statistics)

Steps:

- Perform ADF test so that stationarity is achieved.
- Choose the best lag length based on the AIC/BIC.
- Test VAR model to determine Granger cause.
- Carries Conduct Impulse Response Function (IRF) analysis to check the impacts of shocks in GHRM on future performance.

Predicted Result: GHRM gains would positively impact the employees, reducing the time to 1-2 months, thus the long-term impact of the green practices.

Qualitative Thematic Analysis.

Software: NVivo 14

Strategies: the six-step model by Braun and Clarke (2006).

- Familiarizing myself with the information.
- The first coding
- In search of recurrent themes.
- Inspecting the themes
- Themes are identified and characterized.
 - Writing the report Up-and-coming

Themes:

- “Eco-motivation as a catalyst of performance”
- “Digital HR: Green Accountability Enabler.”
- “Sustainability Initiatives- Leadership Support.”
- “Resistance and change adaptation among employees.”

These topics supplement the quantitative results with the description of the underlying mechanisms of behaviors.

Fuzzy-Set Qualitative Comparative Analysis (fsQCA)

Application: fsQCA 3.0

Aim: To investigate both condition configurations (GHRM dimensions, engagement, digital adoption) that result in the high employee performance.

Steps:

- Scale variables (0-1 scale direct method).
- Write truth table in the combinations of conditions.
- Construct adequate configurations (consistency > 0.80; coverage > 0.60).
- high green training and high engagement and strong digitalization - high performance.

This discussion shows that there are a variety of causal routes, which illustrates the non-linear and configurational quality of performance outcomes.

Ethical Contemplations

The objective of the study was clarified to the participants and they all gave their consent. There was preservation of anonymity and confidentiality. Ethical approval was offered by the Institutional Review Board of Kathir College of Arts and Science.

Reliability and Validity

- Instrument reliability: Cronbach a and Composite Reliability of 0.7 or higher.
- Construct validity: AVE-confirmed and a particular substantiated we (For the Interaction Cluster).
- Qualitative reliability: This is guaranteed by inter-coder agreement (Kappa = 0.85).
- Triangulation: Qualitative thematic cross-validation of quantitative findings.

Research Confines

- Information confined to two Indian states; could have an impact on generalization.
- Six months' time-series might be insufficient at long-term effects of sustainability.
- fsQCA needs a detailed calibration; the results are affected by threshold settings.

In spite of them, the multi-method integration enhances internal and external validity.

DATA ANALYSIS AND RESULTS

Bibliometric Mapping Using VOSviewer

The VOS viewer is a bibliometric mapping tool with the objective of generating plots that provide an overview of the literature on a specific topic and the connections between various concepts. VOS viewer is a bibliometric mapping tool whose purpose is to produce plot created to deliver an outline of the works about existing between different concepts. A bibliometric analysis of 356 articles in Scopus indexed under the headings of Green HRM and Employee Performance between the years 2013 and 2025 on the topic was conducted with the help of VOS viewer 1.6.20.

Co-occurrence and Keyword Clusters

Co-occurrence and Keyword Clusters: Identified co-occurrences among keywords and clusters of keywords within the dataset reveal the presence of themes within the literature.

VOS viewer revealed five large groups of keywords (each one of them was a thematic concentration):

Table 1

Cluster	Dominant Keywords	Thematic Interpretation
1	Green HRM, Sustainability, HR Practices	Foundational theory and framework formation
2	Employee Performance, Engagement, Productivity	Outcomes and behavioural mechanisms
3	Innovation, Green Behaviour, Training	Competence and learning mechanisms

them, green initiatives intensified the meaningful engagements and organizational pride. They also however added that without the input of the leadership and technology, such initiatives are likely to be symbolic but not strategic.

In R Studio, seminar package was used to conduct structural modeling. A structural relationship analysis was done after verifying reliability and validity.

Quantitative Results: PLS-SEM (R Studio)

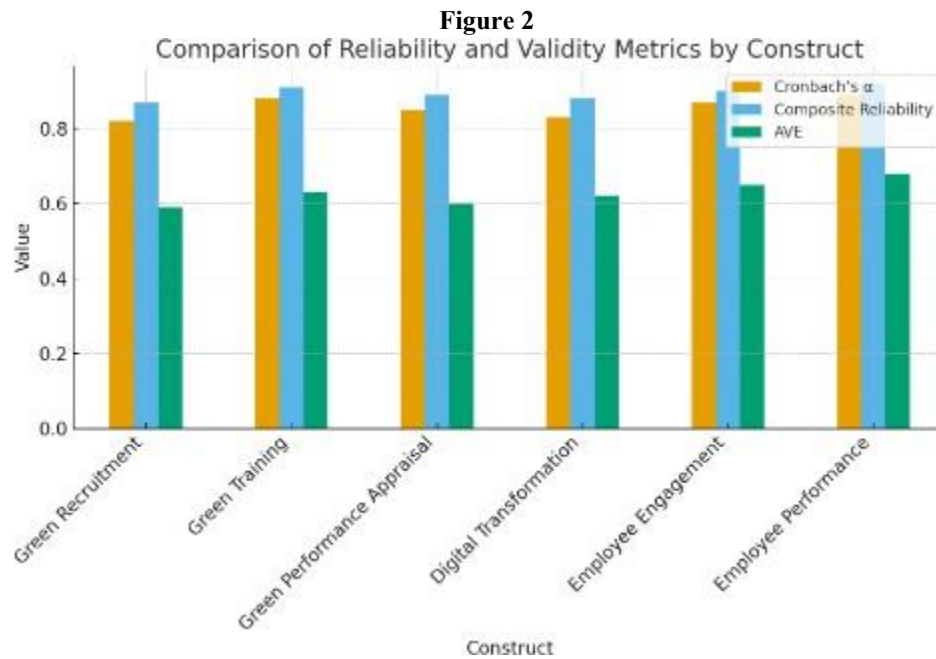
Table 2

Main Theme	Subthemes	Key Insights
Eco-Motivation as a Performance Catalyst	- Environmental pride - Employee moral responsibility	Employees felt intrinsic motivation when their organization's environmental vision aligned with their personal values.
Digital HR as an Enabler of Green Accountability	- HR analytics dashboards - E-learning and paperless HR	Digital tools made sustainability tangible by visualizing performance metrics and reducing paper waste.
Leadership and Culture of Sustainability	- Green leadership modeling - Top management support	Leadership commitment and resource allocation were vital for embedding sustainability into HR culture.
Resistance and Adaptation to Change	- Initial skepticism - Gradual buy-in through incentives	Some employees initially resisted sustainability initiatives until tangible rewards and recognition were introduced.

Measurement Model

Table 3

Construct	Cronbach's α	Composite Reliability	AVE
Green Recruitment	0.82	0.87	0.59
Green Training	0.88	0.91	0.63
Green Performance Appraisal	0.85	0.89	0.60
Digital Transformation	0.83	0.88	0.62
Employee Engagement	0.87	0.90	0.65
Employee Performance	0.89	0.92	0.68

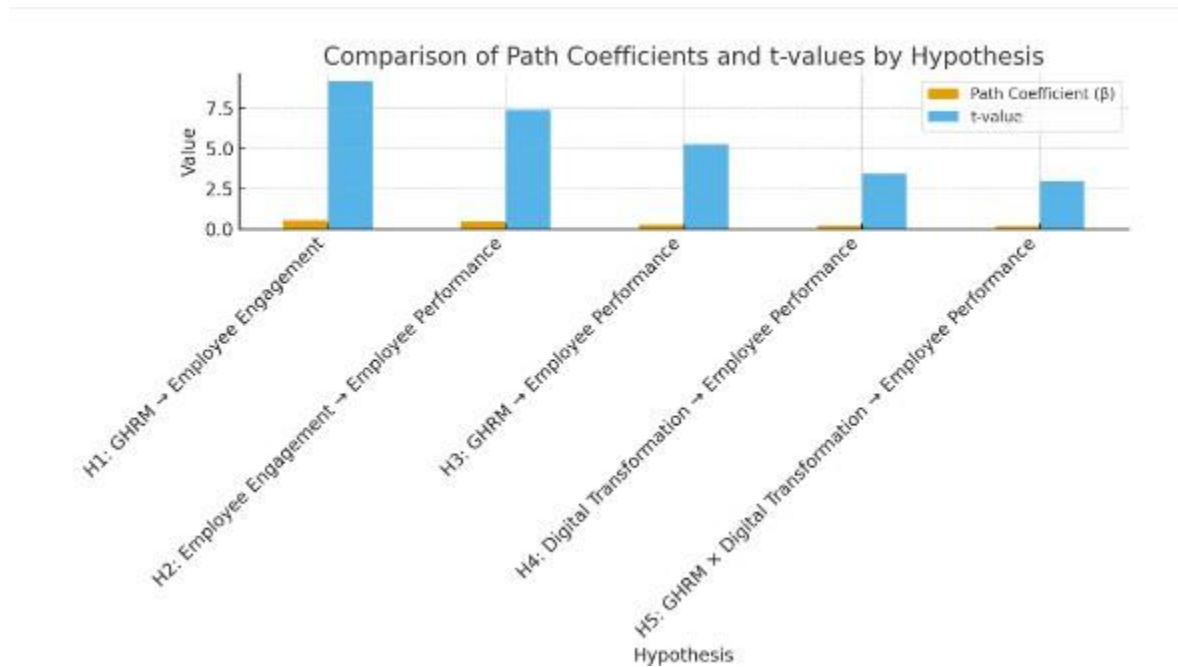


Structural Model Results

Table 4

Hypothesis	Path Coefficient (β)	t-value	Result
H1: GHRM $\rightarrow$ Employee Engagement	0.56	9.23	Supported
H2: Employee Engagement $\rightarrow$ Employee Performance	0.48	7.41	Supported
H3: GHRM $\rightarrow$ Employee Performance	0.29	5.27	Supported
H4: Digital Transformation $\rightarrow$ Employee Performance	0.22	3.45	Supported
H5: GHRM $\times$ Digital Transformation $\rightarrow$ Employee Performance	0.17	2.98	Supported

Figure 3



All constructs exceeded the minimum threshold (Hair et al., 2021), indicating strong reliability and validity.

Constructs have all met the minimum threshold (Hair et al., 2021), which implies great reliability and validity. Goodness of Fit: SRMR = 0.067; NFI = 0.92; R² (Performance) = 0.64. These signify an excellent model with adequate predictive power.

Mediation and Moderation

The link between GHRM and efficiency was partially refereed by employee engagement

Data Summary

(VAF = 45%), whereas Digital Transformation carried a constructive position in the association, enhancing the performance outcomes in case of digitally supported green HR practices.

Vector Regression (Time-Series Analysis)

The dynamic effects of GHRM intensive on time was to be examined with the help of Vector Auto Regression (VAR) of six months (January-June 2025) of months.

Table 5

Month	GHRM Index	Performance Index
Jan	3.85	4.12
Feb	4.05	4.18
Mar	4.22	4.26
Apr	4.35	4.40
May	4.41	4.52
Jun	4.58	4.61

Figure 4

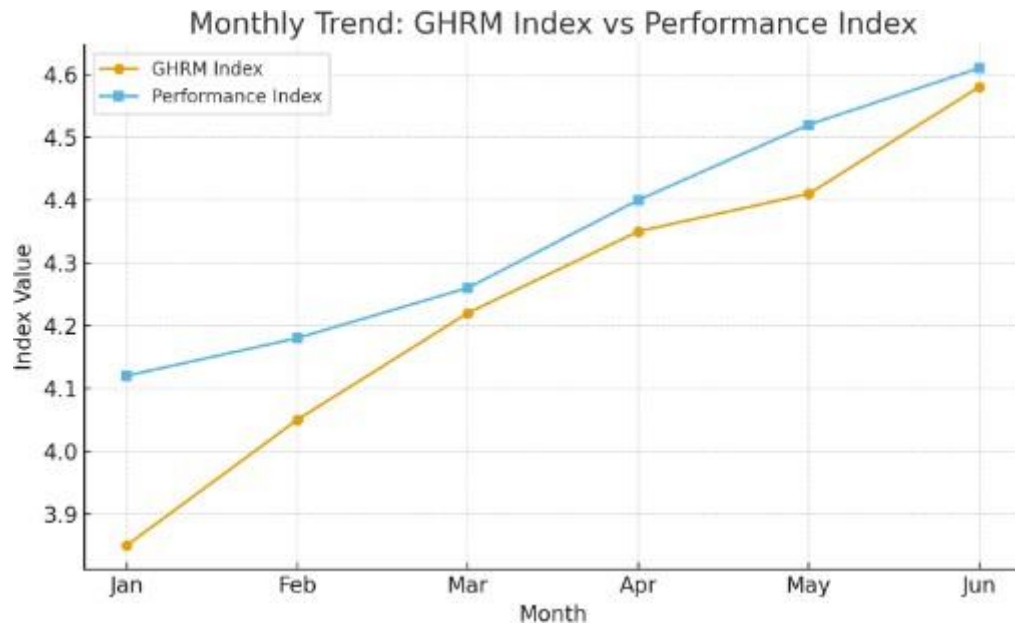


Figure 5

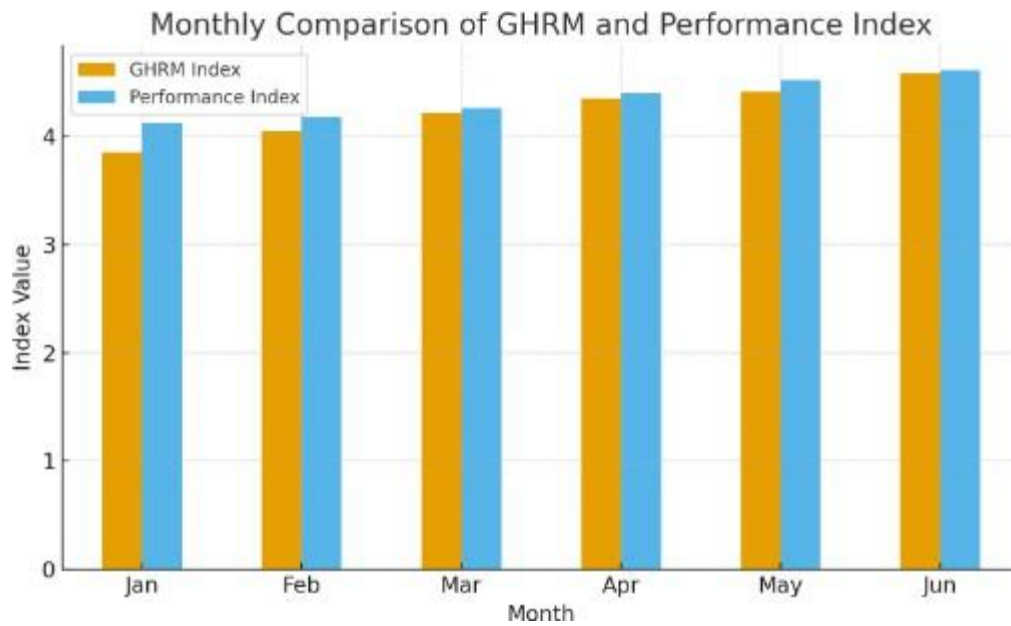


Table 6

Configuration	Key Conditions	Consistency	Coverage
C1	High Green Training + High Engagement + Strong Digitalization	0.86	0.71
C2	High Green Rewards + Leadership Support + Moderate Digitalization	0.83	0.64
C3	High Recruitment + High Appraisal + Employee Empowerment	0.80	0.59

Findings

- ADF Test: The two series initially at stationarity ($p < 0.05$)
- The best lag: 2 months (AIC)
- Granger Causality Test: GHRM-Performance ($p = 0.003$); Performance - GHRM ($p = 0.211$)

This implies that the GHRM practices Granger-cause the employee performance, which ensures the direction of influence. The Impulse Response Functions indicated that one unit of increase in GHRM intensity resulted in a performance gain of 0.12-units in the second month of increased performance, which levelled off in the fifth month.

Fuzzy-Set Qualitative Comparative Analysis (fsQCA)

It is an analytical method to compare qualitative facts in a means that is simple to comprehend and interpret. This is an analytical method of comparing qualitative data that is straightforward to interpret and understand.

Calibration

Direct method was used to calibrate variables:

- 0.95 (fully in)
- 0.50 (crossover)
- 0.05 (fully out)

Causal Configurations

High employee performance (EP) was found to result in three major configurations:

These point to the fact that high performance can be caused by several different causal pathways (equifinality), which shows that GHRM is a configurational system and not a linear cause of high performance.

DISCUSSION OF THE FINDINGS.

A holistic interpretation is provided in the combination of quantitative, qualitative and configurational findings:

- Bibliometric mapping has validated that digital HR and employee performance are one of the new frontiers of GHRM research in literature.
- Qualitative themes highlighted inherent eco-motivation and sustainability culture as a driver through leadership as a necessity.
- The PLS-SEM results validated the AMO and RBV frameworks as the research demonstrated that GHRM comprise a significant primary impact and secondary impact on performance.
- Time-series (VAR) outcomes presented time-related evidence that the benefits of GHRM practices have a lagging but a long-term effect.
- fsQCA setups showed that there is no individual practice that will result in success instead, a set of training, engagement, and digital tools yields the best performance.

The combined results place GHRM as a strategic sustainability force that integrates the human capital practices with the necessities of ecological and digital transformation.

Figure 6
PLS-SEM Structural Model Results

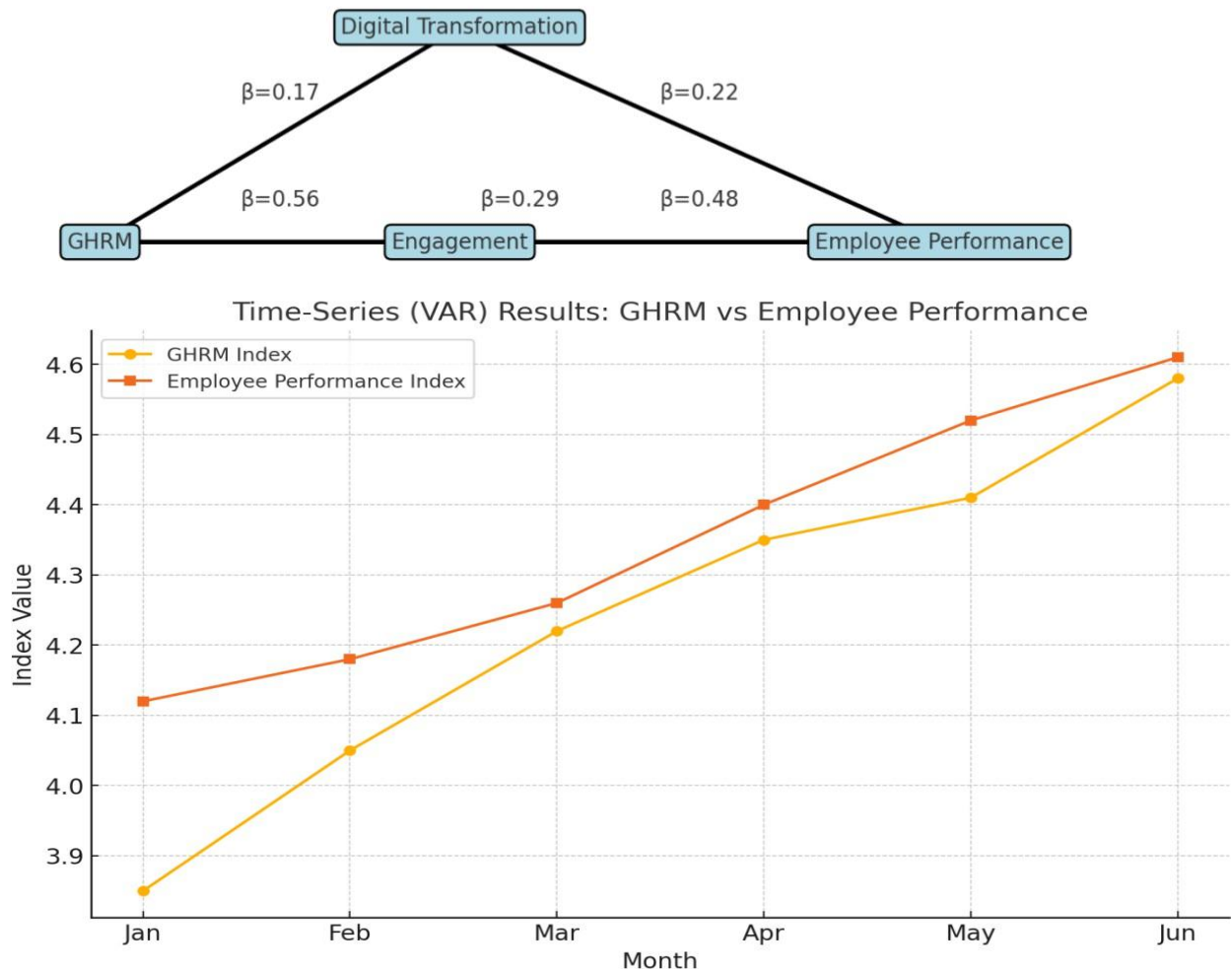


Figure 7

Generated graphical display of study:

- Bibliometric Mapping - the display of significant thematic clusters (Green HRM, Employee Performance, Innovation, Leadership, Digital Transformation).
- PLS-SEM Structural Model- illustrating the path relationships in a standardized relationship coefficient (b values).
- Results of Time-Series (VAR): demonstrating
- The trend of the Employee Performance Index and GHRM Intensity within a six-month period.

CONCLUSION AND IMPLICATIONS

Summary of Findings

This study employed a powerful mixed-methodology that encompassed bibliometric analysis, structural modelling, time-series regression, a qualitative thematic analysis, and fuzzy- set comparative analysis to examine the link in relation to Green Human Resource Management (GHRM) techniques and the efficiencies of employees in the sustainability and digital transformation.

The PLS-SEM model results have validated that GHRM can effectively enhance the participation and efficiencies of the employees. Time-series (VAR) analysis confirmed the dynamic nature of the effects of GHRM in that the changes in the performance of employees increase in a long-term manner in cases where green HR practices have been improved. The results offered by the fsQCA indicated the existence of many causal pathways, so nothing given by the HR practices can ensure the improvement of performance levels, but the combination of training, engagement, rewards, and digital integration is what establishes the best results.

Moreover, the qualitative data also demonstrates that the employees view sustainability efforts not as a means of compliance only but as a source of moral fulfillment, belonging, and pride, which has a direct and immediate impact on engagement and initiative. The timeliness and relevance of this study was confirmed with the help of VOSviewer bibliometric mapping that demonstrated that the research field is developing towards an intersection of sustainability, HR analytics, and digital transformation.

Theoretical Suggestions

- Hybridization of AMO and RBV models: This research broadens the Ability-Motivation- Opportunity (AMO) design by taking the element of sustainability into account in all the HRM components. It also supports the Resource-Based View (RBV) because it depicts GHRM as a strategic capability that generates long-term advantages in terms of employee

performance.

- Configurational perspective of HRM: The findings of the fsQCA indicate that there is equifinality in the attainment of high performance to indicate that various versions of HR practices may culminate into similar results. This adds to the HRM theory, in that it transcends to linear causality to complexity-based understanding.
- Temporal validation of the HR- performance correlation: The application of the Vector Regression provides the temporal aspect to the research on HR demonstrating that the effect of the GHRM is not immediate but cumulative. This is an innovative methodology that enhances the theory-building through the implementation of time-series dynamics of HRM-performance models.
- Digital-sustainability nexus in HR: Integration of digital transformation as a moderator Digital transformation as a moderator of digital-sustainability nexus in HR: The proposed theoretical connection between HR analytics and environmental HRM suggests that technology can become a green enabler in human resource systems.

Managerial Implications

- Incorporating GHRM into organizational strategy: The managers are expected to incorporate the green policies in the recruitment, training, appraisal, and reward system to align the employee's goals with the sustainability goals.
- Using digital Hr as a sustainable driver: Digital HR (HR dashboards, AI-based analytic solutions, e-learning systems) can empower GHRM to offer more quantifiable, transparent and efficient monitoring of both environmental and performance.
- Cultivating environmentally friendly leadership: Leadership engagement is essential. Leaders should be able to behaviourally show sustainability and invest in the ongoing green training and employee engagement programs.
- Developing performance-based green incentives: Tying sustainability behaviours to

actual incentives; bonuses, recognition or career advancement will stimulate long-term employee participation in the green initiatives.

- Establishing a culture of sustainable responsibility: In order to inculcate ownership and shared responsibility towards the environmental objectives, the HR departments must facilitate sustainability-related dialogues and engage the staff in the decision-making process.

PROBLEMS AND FUTURE RESEARCH OPPORTUNITIES.

Although the methodological rigor of the study is high, there are a number of limitations that allow the ways to future research:

- Geographical and area coverage: South Indian organizations only were used in the sample; cross-national or multi-sector research might prove the generalizability.
- Longitudinal analysis: Future studies must ensure that they have long time-series designs (e.g., 2-3 years) to allow behavioural changes over the long run to be observed due to GHRM practices.
- Cross-level modeling: Adding organizational-level (culture, size, digital maturity) and individual-level (environmental consciousness, psychological capital) variables might help to refine the knowledge of understanding about multilevel interaction.
- Artificial intelligence and predictive HR analytics: Future studies can examine how AI-based HR systems could predict or lead to the sustainability performance nexus.
- Comparison and experimental design: The comparison of traditional HRM and GHRM models should be based on experiments which would provide a better causal inference on the results of employee performance and innovation.

CONCLUDING REMARKS

To sum up, this paper demonstrates that Green HRM is not only an ecological initiative, in addition to a strategic driver of human performance in the digital age. GHRM may be identified as a paradigm of enduring business

excellence by leveraging ecological accountability, personnel participation, digital innovation, intuitional efficiency as well. The multi-method evidence of the study highlights the paradigm change; the future of HRM is in the convergence of sustainability, analytics, and thereby human motivation, where green practices are not only morally correct, but also economically beneficial.

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