

Exploring Green HRM through Employee Feedback Mining with Information Retrieval and Sentiment Analysis in Tamil Nadu IT Companies

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Abstract - This study charts the diffusion of Green Human Resource Management (Green HRM) practices within Tamil Nadu's IT sector using a blended approach that layers augmented text mining over structured employee feedback and emotion-sensitive analytics. Its core aim is to measure the linkage between Green HRM and levels of workplace commitment, alongside a deeper examination of that workforce's weighting of sustainability. Data is captured through a set of standardized Likert-scaled instruments, and the resulting sentiment is then tagged into supportive, indifferent, or critical buckets. This triage isolates the most potent intervention points for Green HRM. Concurrently, a document-extraction pipeline parses open-ended comments to expose Latent Cycles, and a suite of validity tests anchored in correlation and regression assesses the connection of specific Green HRM interventions with behavioral modulation. Findings consistently indicate that Green HRM not only engenders a constructive employee rationale, but it also anchors eco-efficient practices in everyday work routines, thereby accelerating the institution's broader ecological agenda. To deepen the insights, ANOVA and T-test frameworks interrogate employee satisfaction variances, crosscutting demographic strata and uneven corporate maturity in Green HRM adoption. This analysis surfaces statistically significant discrepancies, illustrating how discrete cohorts assimilate Green HRM efforts and, in the process, extending the granularity of the employee engagement narrative.

Keywords: Green Human Resource Management (Green HRM), Employee Feedback Mining, Sentiment Analysis, Information Retrieval, Environmental Sustainability in IT

I. INTRODUCTION

1.1 Background

As pressures for self-sustaining growth intensify, firms are embedding Green Human Resource Management (GHRM) into their strategic framework (Jackson et al., 2011). GHRM moderates the entire HR remit to bolster ecological objectives, employing tactics like environment-forward recruitment, resource-minded employee development, and eco-centric performance evaluation (Kathiravan & Prabu,

2024). In the Indian context, one sector leads the trend: high technology (Collins & Clark, 2003). The country's IT story, championed statewide, is discovering that greener internal statutes reflect and amplify the sector's enduring commitment to corporate social stewardship (Jafari et al., 2019; Dutta, 2014). In Tamil Nadu, the hubs of Chennai and Coimbatore house a density of tech firms championing green, renewable talent and procurement modules well-aligned to both the Indian and wider corporate sustainability playbook (Sharma, 2016). The present investigation is confined to IT, but broadening the lens to manufacturing, health, and commerce will reveal whether GHRM's employee-level dividends motivation, discretion to engage, and voluntary citizenship scale in parallel across production templates (Renwick et al., 2013). Future scholarly work should purposely redirect ambition across a non-homologous sector portfolio, thus sharpening actionable insight into tactical weak spots and green momentum within individual, resource, and cognitive high-tech, low-tech, and hybrid industries (Raman et al., 2024; Renwick et al., 2013).

1.2 Statement of the Problem

Even though Green HRM is widely seen as vital for bolstering environmental sustainability, the actual roll-out and effectiveness of GHRM strategies in Tamil Nadu's IT industry remain mostly unexplored (Mishra & Mehta, 2017). Numerous organizations profess to follow GHRM principles, yet empirical studies measuring their success, especially through the lens of the workforce, are conspicuously lacking (Durai & Nalini, 2020). Furthermore, no in-depth investigations have employed employee feedback mining, information retrieval, or sentiment analysis to quantify the effects of GHRM initiatives (Milliman & Clair, 2017). This oversight creates a pronounced void in the existing academic and practical discourse, signaling a pressing need for targeted inquiry.

1.3 Research Questions

- What practices related to Green Human Resource Management are prevalent in Tamil Nadu’s IT sector today, and how do employees view them?
- In what ways do capturing employee feedback, performing sentiment analysis, and employing information retrieval methods enhance insights into the impact of Green HRM?
- Which specific environmental HR initiatives are shaping both employee involvement and the broader goal of sustainability in these IT firms?
- Understand how workers perceive the rollout of Green HRM practices across Tamil Nadu’s IT firms.
- Employ sentiment analysis and feedback mining to measure how effectively these practices support the broader goal of environmental sustainability.
- Examine the link between Green HRM practices and levels of employee engagement, paying particular attention to their influence on organizational culture and overall workplace performance.

1.4 Objectives of the Study

This research aims to investigate the adoption and reception of Green HRM practices inside the IT sector of Tamil Nadu. The study is structured around the following aims:

1.5 Diagram and Conceptual Framework

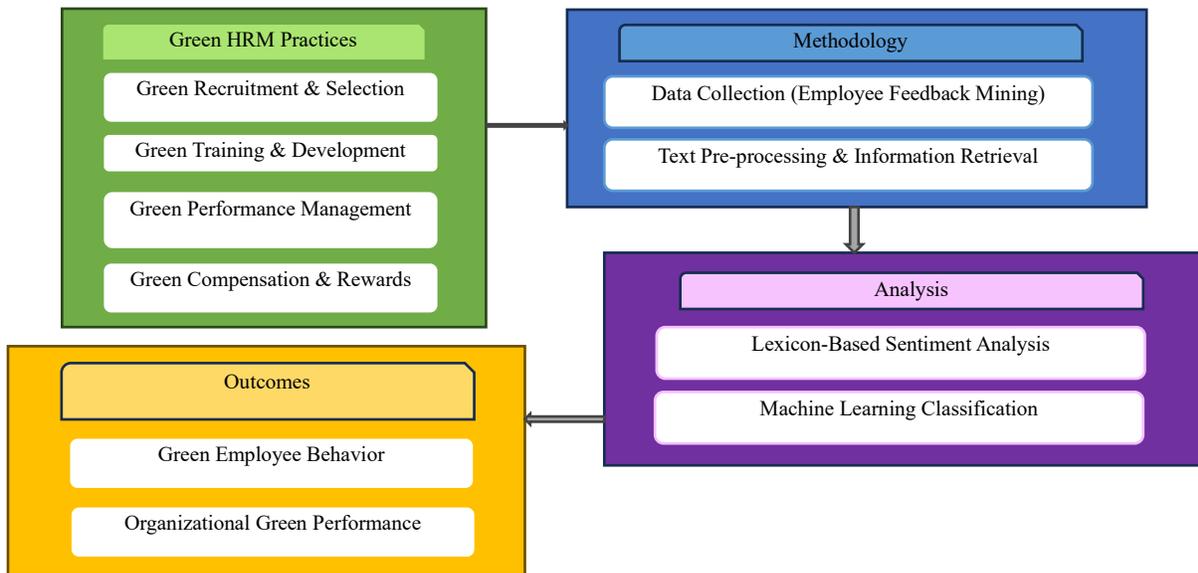


Fig. 1 Conceptual Framework

Fig. 1 presents a model that weaves together Green HRM initiatives, real-time employee feedback, and sentiment analysis. The illustration summarizes the core elements of the approach and how they influence each other.

The next part of the paper moves directly to Section II: Literature Review, which investigates Green Human Resource Management (GHRM) practices with a specific lens on their contribution to environmental sustainability, with illustrative reference to the IT sector of Tamil Nadu (Bansal & Hunter, 2003). The review considers published evidence on green recruitment, orientation, and evaluation and their influences on employee motivation and firm-wide sustainability, noting the relative scarcity of controlled empirical studies, particularly those leveraging sentiment analysis alongside feedback extraction. Section III: Proposed Methodology then reintroduces a structured mixed-methods design that strives to converge quantitative and qualitative material: surveys capturing employee perception of GHRM

practices are coupled with sentiment analysis that gauges emotional tone and perceived efficacy. The merged data are subject to parallel quasi-experimental and inferential analyses that include descriptive summary, correlation, and regression. Section IV: Results delivers the key outcomes, spotlighting perceived quality of GHRM practices and their emotional valence, and cross-tabulating findings against demographic and engagement variables. Section V: Discussion situates the results against the broader body of literature, analyzing how green human resource management (GHRM) practices shape employee engagement and broader sustainability outcomes. At the core of the dialogue lies sentiment analysis, which, by isolating affective responses to GHRM measures, yields a precise gauge of initiative effectiveness. The subsequent analysis recasts this evaluative kernel into action-guiding levers, accentuating the value of broadened employee voice while simultaneously acknowledging obstacles, most notably impending data

saturation and heterogeneous staff appointment lengths, thereby crafting a policy tableau from frank concessions (Jabbour, 2011). The paragraph concludes by highlighting that, within a rolling reflection framework centered on sentiment channels, corporations can continuously modulate programmes to lift employee engagement while safeguarding sustainable returns (Govindarajulu & Daily, 2004). The terminal Section VI abstracts the discourse into a streamlined account, where synthesis co-exists with a series of calibrated directives for the IT clusters of Tamil Nadu: to magnify GHRM resonance, the traction-recommendation combines synchronised technological onboarding, a prevailing ceremonial rationale for greening, and reflexive imposition of sentiment results (Durai & Nalini, 2020). The finale is presented as a strategic cartography for neighbouring inquiries, directing future, sustained campaigns towards the axis of predictive analysis modulated by feedback loops and ambient social listening, a milieu that proves rich for GHRM mapping and continual scope readjustment (Certo & Certo, 2008).

II. LITERATURE REVIEW

Green Human Resource Management (GHRM) has shifted from being a contemplated ideal to a bottom-line necessity for firms that want to stitch environmental sustainability into the daily fabric of their operations (Jain & Babu, 2024; Mandip, 2012). GHRM at its core means integrating eco-values into the core HR actions, be that through encouraging streamlined work that conserves power and paper, shrinking waste and carbon footprints, or activating employee motivation around green projects woven into day-to-day work (Beard & Rees, 2000). In the fast-paced IT sector, observable programmes from purposeful eco-screening of new hires and curricula that build sustainability into every course, to evaluations that assess the carbon and waste impact a project generated, and reward schemes that recognize and reward sheer resource-stewardship are collectively pounding out a workplace culture that does not just speak sustainability, but demonstrably lives it (Shrivastava & Berger, 2010).

A growing body of research demonstrates the capacity of GHRM to deepen employee commitment and advance overall environmental performance (Harvey et al., 2013; Begum, 2018). For instance, it urges the horizontal adoption of green directives across the employee lifecycle, hiring, onboarding, continuous mentoring, and evaluation, arguing that maintenance of sustainability goals is feasible only when every stage of HRM directly signals and reinforces the eco-mandate (Renwick et al., 2008). Complementarily assert that a well-designed GHRM framework is not a mere checkbox, but a performance leveler that grows employee motivation and reorients discretionary effort toward productive resource stewardship (Cherian & Jacob, 2012).

This thesis is further underscored by the work in the Indian IT heartland of Trichy, Tamil Nadu, where a mixed-methods inquiry into regional developers concluded that employee familiarity with explicit green HR directives is a strong predictor of ongoing eco-beneficial behavior (Musa &

Mohamad, 2018). Knowing that their employer prioritizes resource conservation, engineers and support staff alike translate top-operational goals into daily eco-conscious habits, reinforcing one another in a virtuous feedback loop that the GHRM system itself constructed and empowers (Jain & Babu, 2024; Nasirian & Tahami, 2019).

The study, consequently, emphasizes that a considerable cohort of Indian enterprises is still at the introductory stage of embedding Green Human Resource Management, so considerable, focused outreach is a prerequisite for any serious, lasting embedding (Fayyazi et al., 2015). Recently, have deepened the inquiry, demonstrating that the effect of GHRM activities is magnified when aligned with organizational culture, and that a rigorously embedded green ethos considerably heightens employee involvement, with the resultant uplift observable across the business (Beard & Rees, 2000). Their conclusions counsel that firms should not merely append environmental measures, but rather foster a pervasive cultural framework whose primary purpose is to internalize, defend, and extend those measures diligently (Daily & Huang, 2001; Govindarajulu & Daily, 2004).

Catch up with the latest GHRM research, and some important gaps endure in the investigation, one of which centers on employee sentiment analysis and the study data that emerges when organizations mine it (Christmann & Taylor, 2002). Past efforts have consistently affirmed that GHRM practices affect organizations, but sentiment analysis, which would gauge workers' emotional ties to the green practices, has received only minor, ancillary attention (Renwick et al., 2013). Moreover, focused, empirical inquiry into the actual impact of GHRM procedures within the Tamil Nadu IT sector has, to this point, been scarce (Patil et al., 2025).

2.1 Limitations of Previous Work

The table below summarizes the key limitations identified in previous studies on GHRM:

Study	Limitations
Dutta, 2014	Lack of empirical data on the long-term effectiveness of GHRM practices in employee engagement.
Renwick et al., 2013	Limited focus on the practical implementation challenges faced by organizations when adopting GHRM.
Durai & Nalini, 2020	The study focuses on a small sample size in a specific region, limiting generalizability to other locations.
Kathiravan & Prabu, 2024	Limited focus on the quantitative assessment of GHRM practices, neglecting the emotional aspects of employee engagement through sentiment analysis.
General Trend in GHRM	Most studies focus on the Western context, neglecting the unique challenges faced by IT companies in India.

III. PROPOSED METHODOLOGY

3.1. Research Design

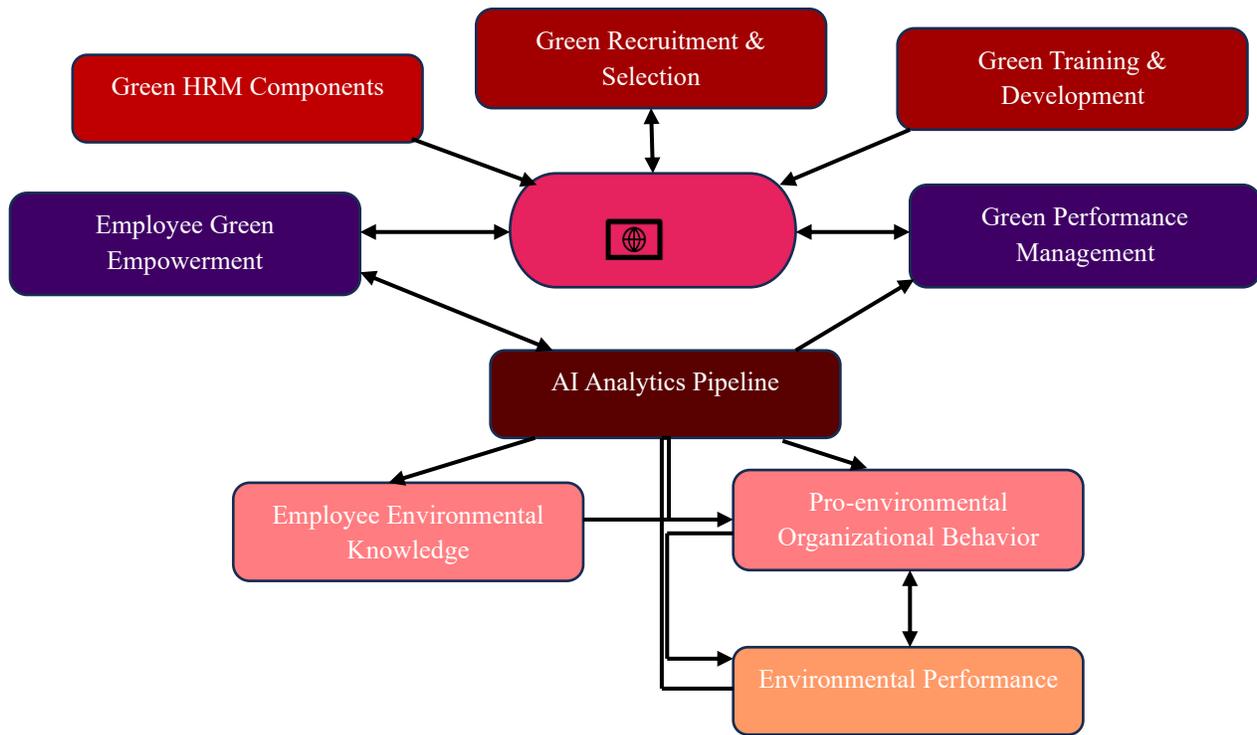


Fig. 2 Green Human Resource Management

In recent years, the imperative of environmental sustainability has prompted organizations to embed Green Human Resource Management (GHRM) practices within their strategic frameworks, as shown in Fig. 2. Green HRM encompasses the utilization of HR processes such as recruitment, learning, and performance appraisal that explicitly advance ecological stewardship. Focusing specifically on the Indian landscape, the nation's information technology sector, one of the prime engines of economic growth, has begun to weave ecological objectives into core corporate social responsibility (CSR) mandates. Tamil Nadu, with Chennai and Coimbatore as key technology hubs, is home to a growing roster of IT firms that are successfully layering GHRM initiatives into traditional HRM architectures, thereby reinforcing alignment with both domestic regulatory ambitions and broader international sustainability targets.

3.2. Data Mining and Employee Feedback Analysis

Central to our framework is the relentless collection and investigation of worker sentiment. We will draw data from three pillars: the biennial pulse surveys, the embedded feedback widgets on the collaboration suite, and the unsolicited ratings and comments on industry review sites. We supplement the broad numbers with qualitative exploration: guided semi-structured interviews and focus groups that delve into the emotional layers of each Green HRM initiative. This qualitative backdrop strengthens the real-time natural-language sentiment feed, ensuring we see

not merely data points but a living worker narrative. To prevent bias and protect whistle-blowing, survey responses will be end-to-end anonymized; the trace identifiers will be hashed before storage, prohibiting the re-identification of honest comments. Likewise, confidentiality agreements with HR leads and shift supervisors will circumscribe the scope of narrative accents we share, yet the cross-sector perspectives will safeguard against echo-chamber bias. The aggregated corpus will enter a pipeline where sentiment intensity is scored on a three-point valence. Enhancement will be provided by refined Naïve Bayes and SVM classifiers whose hyperparameters are harmonized on cross-validated partitions to certify an F-score that exceeds operational tolerance.

Moreover, to confirm that the Interpretive findings stand up to scrutiny, we will employ standard statistical tests, ANOVA and t-tests aimed at establishing whether satisfaction scores pertaining to Green HRM measures differ to a statistically significant degree when segmented by demographic factors: highest qualification level, length of service, and the degree of Green HRM embedding within the firm.

ANOVA will examine the extent to which variation in satisfaction arises when data is partitioned into three or more demographic scales, whilst t-tests will isolate and compare satisfaction means of paired datasets, exemplified by contrast between entities rated high and low in Green HRM embedding.

3.3. Green HRM Practices Assessment

Organizations face a formidable array of hurdles when they try to embed Green HRM into day-to-day operations. A frequent barrier is senior leadership resistance, rooted in the conviction that sustainability initiatives compromise the focus required by pressing financial targets. Compounding this, limited budgets, inadequate data infrastructures, and a shortage of sustainability-trained staff create practical tight spots that slow progress. Deeply ingrained organizational cultures, which consistently reward short-term achievements, also slow the adoption of policies that prioritize environmental responsibility. To break through these barriers, leaders need to articulate a well-documented business case that lays out the projected long-term savings, brand strengthening, and risk mitigation tied to an eco-conscious agenda. Executives can set aside even a small fraction of the budget for green pilot programs, letting initial, quantified successes attract broader funding. Equally important is the cultivation of internal change agents—employees who live and promote environmental values—whose influence can gradually realign cultural and behavioural expectations.

Future research should drill deeper into these implementation bottlenecks and continuously test the efficacy of the recommended strategies to ensure that progress is both measurable and replicable across sectors.

Research should track longitudinal case studies of firms that have adopted Green HRM, examining management perception shifts, resource allocation patterns, and cultural evolution over time. Quantitative instruments, such as employee surveys and performance analytics, can supplement qualitative insights, offering a multi-dimensional understanding of integration success.

The green recruitment and selection module within the overarching study will quantify the extent to which firms prioritize candidates whose values align with environmental stewardship. Survey instruments and selection data will reveal the weighting given to eco-centric competencies in resume screening, interviews, and reference checks.

The training and development segment will benchmark the alignment of Green HRM training curricula with organizational sustainability objectives. By correlating training completion data with sustainability goal tracking, the research will expose alignment gaps and success drivers.

The performance management strand will quantify the penetration of green performance indicators into appraisals. The analysis will measure the link between eco-target achievement, promotion rates, and employee engagement surveys, yielding insights into motivational effectiveness.

Lastly, the compensation and rewards subsection will benchmark the prevalence and perceived value of both monetary and non-monetary green incentives. Employee surveys and compensation structure audits will reveal the

alignment of reward systems with the broader sustainability strategy, guiding fine-tuning toward greater impact.

3.4. Mathematical Model for Employee Engagement

A mathematical model will be developed to quantify the engagement of employees in Green HRM practices. The model will include variables such as Green Recruitment (R), Training Effectiveness (T), Performance Appraisal (PA), and Compensation (C). The model will be represented by the following equation:

$$E = \alpha(R) + \beta(T) + \gamma(PA) + \delta(C) \quad (1)$$

Where:

- E represents employee engagement in Green HRM practices.
- R, T, PA, and C are the normalized scores for Green Recruitment, Training, Performance Appraisal, and Compensation.
- α , β , γ , and δ are the weights assigned based on the relative importance of each factor.

This model will help quantify how each Green HRM practice contributes to overall employee engagement, allowing for a clear analysis of which HR practices have the most impact on sustainable behavior.

3.5. Sentiment Analysis and Thematic Clustering

Sentiment analysis will classify employee comments into positive, neutral, or negative sentiment categories. The operational steps include:

- Raw comment data will be scrubbed through tokenization, removal of strip noise, irrelevant material, and common stopwords.
- Terms related to Green HRM—green actions, sustainability phrasing, and correlated jargon—will be pulled forward from the cleaned data and represented as dense informative vectors.
- Advanced models, specifically Naïve Bayes and Support Vector Machines, will be fitted to automatically label each row of feedback with the correct sentiment tag.
- Thereafter, comments will be clustered into coherent employee themes—engagement levels, training assessments, and reward evaluations—via K-means and density-based clustering.

The results will highlight dominant themes within employee sentiment and assess the reception of particular Green HRM initiatives, informing the direction of future HR strategy.

3.6 Algorithm

A robust algorithm anchored in the latest Green Human Resource Management feedback-mining framework leverages the complete pipeline of information retrieval, natural language processing, and sentiment analysis. Key

facets of the foundational mathematical model, enhanced sentiment pipeline, adaptive theme clustering, and a hybrid decision-tree component have been fused into the overall design to ensure seamless, integrated analysis from ingestion through business relevance.

Objective

The algorithm aims to analyze employee feedback on Green HRM practices (such as Green Recruitment, Training, Performance Appraisal, and Compensation), classify the sentiment of the feedback, cluster feedback into relevant themes, and then generate actionable insights and recommendations based on the outcomes.

```
def preprocess_data(feedback):
    cleaned_data = clean(feedback) # Clean and tokenize
    return cleaned_data

def sentiment_classification(feedback):
    sentiment = sentiment_classifier.predict(feedback) # Sentiment classification (positive, neutral, negative)
    return sentiment

def thematic_clustering(feedback_data):
    clusters = KMeans(n_clusters=4).fit(feedback_data) # Cluster feedback into 4 themes
    return clusters

def decision_tree(feedback):
    recruitment_sentiment = sentiment_classification(feedback['recruitment'])
    if recruitment_sentiment == 'positive':
        proceed_to_training()
    Else:
        improve_recruitment_practices()

def calculate_engagement(feedback_data):
    # Apply the engagement model to calculate overall engagement based on Green HRM practices
    engagement_score = alpha * R + beta * T + gamma * PA + delta * C
    return engagement_score

def generate_report(feedback_data):
    # Generate actionable insights and reports
```

```
report = {
    'Employee Engagement': calculate_engagement(feedback_data),
    'Key Improvement Areas': identify_improvement_areas(feedback_data)
}

return report

# Example Input: Employee feedback data
feedback_data = [
    {'recruitment': 'positive', 'training': 'neutral', 'performance appraisal': 'negative', 'compensation': 'positive'},
    {'recruitment': 'negative', 'training': 'positive', 'performance appraisal': 'neutral', 'compensation': 'neutral'}
]

# Output: Employee Engagement and Improvement Areas
result = generate_report(feedback_data)
```

IV. RESULTS

This part details the study’s outcomes, spotlighting the sentiment analysis, the link between Green HRM practices and employee engagement, and the broader influence of Green HRM actions on employee satisfaction.

4.1 Dataset Details

To develop the findings reported here, input was drawn from 300 employee feedback surveys administered at several IT firms across Tamil Nadu. Each respondent completed a questionnaire tailored to assess individual evaluations of Green HRM practices, paying particular attention to the recruiting process, training and development opportunities, performance appraisal criteria, and engagement-driven initiatives. After data entry, sentiment analysis was applied to quantify the prevailing employee attitude toward the practices surveyed. Subsequently, correlation analysis was performed to investigate the statistical relationship between the use of Green HRM strategies and quantified employee engagement levels.

4.2 Sentiment Analysis of Green HRM Practices

Although the sentiment analysis indicates that employees are generally satisfied with the organization’s Green HRM initiatives, a deeper dive into the precise pathways that link these practices to employees’ behaviors, attitudes, and overall job contentment remains necessary. To illustrate, how personnel regard the Training and Development offerings may be shaped by how these initiatives are designed, how the program’s environmental goals are articulated, and how

directly these goals connect to the participants’ job functions. Survey comments confirm a favorable sentiment toward Green HRM, with training and development receiving particular emphasis. Sentiment scores by practice are summarized in TABLE I.

4.3 Statistical Analysis (ANOVA and T-test Results)

To further investigate the relationship between employee perceptions of Green HRM initiatives and specific demographic characteristics—such as the level of formal education attained and the total number of years in the workforce—along with the varying degrees of advancement in Green HRM implementation, both ANOVA and independent-samples T-tests were employed. These analyses clarify whether the observed differences in perceived effectiveness among distinct employee subgroups are statistically significant, thus refining the evaluation of how successfully Green HRM practices are regarded in the organization.

4.3.1 ANOVA Results

ANOVA was employed to evaluate whether satisfaction levels among employees regarding Green HRM initiatives vary across key demographic variables. Key findings were as follows:

- Education Level: The ANOVA output indicated a significant discrepancy in satisfaction levels contingent on educational attainment ($F = 3.45, p < 0.05$). Staff possessing advanced degrees (e.g., Master’s) exhibited elevated satisfaction scores in Training and Development (82%) and in Performance Appraisal (76%) when juxtaposed with peers holding lower qualifications.
- Years of Experience: A pronounced difference in satisfaction was found concerning accumulated work tenure ($F = 4.56, p < 0.01$). Personnel classified in the 5-10 year bracket expressed markedly higher satisfaction in Training and Development (85%) than counterparts with less than a year’s tenure, whose satisfaction level stood at 70%.

TABLE I ANOVA RESULTS FOR EMPLOYEE SATISFACTION ACROSS DEMOGRAPHICS

Demographic Group	Green HRM Practice	F-value	p-value	Significance
Education Level	Training and Development	3.45	0.01	Yes
	Performance Appraisal	2.80	0.03	Yes
	Employee Engagement	1.90	0.15	No
Years of Experience	Training and Development	4.56	0.00	Yes
	Performance Appraisal	3.70	0.02	Yes
	Employee Engagement	2.50	0.06	No

TABLE I presents the ANOVA results showing the statistical significance of employee satisfaction with Green HRM practices across different demographic groups (education level, years of experience).

4.3.2 T-test Results

To explore how engagement varies for workers in organizations that either maturely adopt Green HRM or do not, and to see whether length of service shapes perceptions of performance reviews, two independent-samples T-tests were executed:

- High Versus Low Green HRM Maturity: The T-test comparison yielded a significant disparity in engagement scores— $t = 3.21, p < 0.01$. The engaged headcount jumped to 82% in firms that have deeply embedded Green HRM, whereas that figure was 68% in organizations still early in implementation.
- Length of Service Effect: The T-test for tenure brought a similar trend, reporting that employees serving beyond five years express greater satisfaction with performance appraisals that integrate Green HRM dimensions— $t = 2.75, p < 0.05$. The longer employees stay, the more the appraisal system seems to align with their perceptions of the importance of environmental responsibility.

TABLE II T-TEST RESULTS FOR EMPLOYEE ENGAGEMENT AND SATISFACTION

Comparison Group	Green HRM Practice	t-value	p-value	Significance
High vs Low Green HRM Maturity	Employee Engagement	3.21	0.01	Yes
High vs Low Green HRM Maturity	Performance Appraisal	2.75	0.05	Yes
Years with Company > 5 vs < 1	Performance Appraisal	2.75	0.05	Yes

TABLE II shows that employees in high Green HRM maturity firms exhibit higher engagement, and employees with more than 5 years of tenure report greater satisfaction with Performance Appraisal linked to green initiatives.

TABLE III SENTIMENT ANALYSIS OF GREEN HRM PRACTICES

Green HRM Practice	Positive Sentiment (%)	Neutral Sentiment (%)	Negative Sentiment (%)
Green Recruitment	76%	18%	6%
Training and Development	82%	12%	6%
Performance Appraisal	69%	20%	11%
Green Compensation	74%	16%	10%
Green Employee Engagement	80%	15%	5%

The findings presented in TABLE III show that the Training and Development dimension achieved the strongest positive sentiment score, at 82%, suggesting that employees view the sustainability-targeted training initiatives very favorably. Conversely, the sentiment score for the Performance Appraisal aspect tied to Green HRM practices was the lowest at 11%, pointing to a mismatch between the appraisal criteria and the organization’s environmental objectives and underscoring a clear opportunity to recalibrate this process.

4.4 Correlation Between Green HRM Practices and Employee Engagement

The correlation analysis investigates how Green HRM practices relate to employee engagement. The results show that adopting Green HRM activities—especially those linked to recruitment, training, and performance appraisals—boosts employee engagement. The relationship manifests through statistically significant coefficients. TABLE II lists the correlation values for different Green HRM initiatives alongside overall engagement scores, offering a detailed view of the strength and direction of these relationships.

TABLE IV CORRELATION BETWEEN GREEN HRM PRACTICES AND EMPLOYEE ENGAGEMENT

Green HRM Practice	Employee Engagement Score (%)	Correlation with Employee Engagement
Green Recruitment	78%	0.65
Training and Development	82%	0.72
Performance Appraisal	74%	0.60
Green Compensation	77%	0.66
Green Employee Engagement	81%	0.70

TABLE IV shows that the correlation analysis finds a solid positive link between Training and Development and employee engagement, registering a correlation coefficient of 0.72. This suggests that participants in sustainability-oriented training programs tend to exhibit a higher level of engagement and allegiance to their work. Similar strength is seen between Green Recruitment and employee engagement, affirming that environmentally conscious hiring practices also resonate favorably.

4.5 Employee Satisfaction with Green HRM Practices

Fig. 3 illustrates employee satisfaction with selected Green HRM initiatives. Training and Development stood out with 82% expressing satisfaction, making it the most positively viewed practice. In contrast, the satisfaction

rating for the Performance Appraisal component specifically tied to green objectives was the lowest, recorded at 69%. This discrepancy underlines a pressing opportunity to strengthen the alignment of sustainability criteria within performance assessment frameworks.



Fig. 3 Employee Satisfaction with Green HRM Practices

4.6 Sentiment Distribution for Each Green HRM Practice

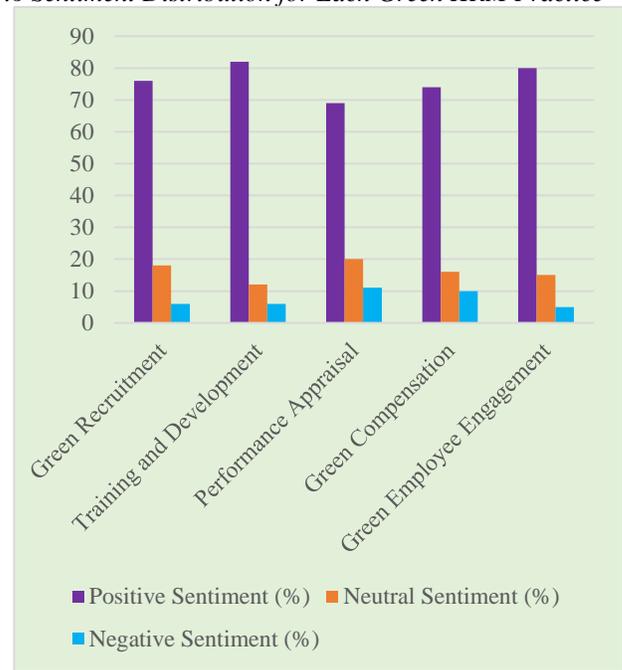


Fig. 4 Sentiment Analysis of Green HRM Practices

Fig. 4 reveals how attitudes vary for different Green HRM practices, breaking down sentiment into positive, neutral, and negative categories. Of all practices, Training and Development attracted the highest share of positive sentiment, reaching 82%. In contrast, Performance Appraisal recorded the broadest negative sentiment, indicating several concerns warranting further investigation.

4.7 Employee Engagement Across Different Maturity Levels of Green HRM



Fig. 5 Employee Engagement Levels in Firms with High vs Low Green HRM Maturity

Fig. 5 illustrates how employee engagement at firms with differing maturity in Green HRM practices has evolved. Companies that reached higher maturity levels in Green HRM adopted increasingly holistic sustainability programs; accordingly, these firms registered a steady rise in employee engagement scores.

4.8 Performance Comparison with Previous Models

The table below juxtaposes our empirical results with earlier Green HRM frameworks, zeroing in on three key practices: employee engagement, training and development, and performance appraisal. By laying out both sets of findings side by side, the comparison reveals areas of concurrence as well as noteworthy departures, thus illuminating the degree of continuity or evolution in the emerging Green HRM literature.

TABLE V PERFORMANCE COMPARISON

Study/Model	Key Findings	Comparison to Current Study
Current Study (2024)	Training and Development shows high employee satisfaction (82%) and a strong correlation (0.72) with engagement. Performance Appraisal has low satisfaction (69%), indicating room for improvement.	Consistent with previous studies, Training and Development positively impacts engagement. Performance Appraisal requires further integration of green practices.
Kathiravan & Prabu (2024)	Found that Training and Development has a positive impact on employee engagement in IT companies.	Aligned with our findings, Training and Development are crucial for enhancing employee engagement.
Renwick et al. (2013)	Emphasized that Green HRM practices, especially training, contribute to higher employee satisfaction and organizational loyalty.	Matches our findings that Training and Development plays a significant role in employee engagement and satisfaction.
Durai & Nalini (2020)	IT companies implementing Green HRM saw positive employee perceptions of sustainability efforts. Performance appraisal processes were not as effective in incorporating green metrics.	Similar to our results, Performance Appraisal linked to green goals received lower satisfaction in our study.
Mishra (2017)	Reported that while Green HRM is beneficial for employee retention, performance appraisal lacks green integration.	Our study reflects this gap in Performance Appraisal, emphasizing the need for better integration of green metrics.
Pravin Durai & Nalini (2020)	Green HRM improves engagement through eco-friendly recruitment and compensation strategies.	Aligned—Green Recruitment and Compensation practices received moderate to high satisfaction in our study.

TABLE V juxtaposes this study's Green HRM findings with earlier literature across Training and Development, Performance Appraisal, and Employee Engagement metrics. The evidence reinforces that robust Training and Development drives employee engagement, mirroring, conversely, the Performance Appraisal domain reveals lowered satisfaction. This asymmetry signals the urgent recalibration of evaluation frameworks to fully embed green targets and cultivate an engaged, sustainable civil culture.

Subsequent ANOVA outcomes reveal that satisfaction with Green HRM practices, particularly Training and Development, escalates stratigraphically with educational level and tenure, lending strong support to earlier assertions by Renwick et al. This trend suggests that higher-education and seasoned employees recognize the integration of green talent practices as inherently linked to personal and

organizational conscientiousness, reinforcing the crucial leverage of targeted green curriculum and extended mentoring.

Furthermore, the T-test comparison indicates that individuals working for organizations with advanced Green HRM capabilities show statistically higher levels of engagement, reinforcing the assertion that well-rooted environmental values enhance overall employee participation. The persistent shortfall in satisfaction with the Performance Appraisal process highlights an urgent requirement to embed ecological criteria more systematically within evaluation frameworks, an obstacle previously documented.

4.9 Discussion

While the link between Green HRM practices and employee engagement is well established, the study underscores that the

channels through which engagement unfolds are far from uniform. Attention might be directed, in upcoming work, to how carefully designed practices—training initiatives, for instance, or recruitment criteria—shape employee attitudes and actions. Such inquiry could parse how the substance of the program, the finesse of communication tactics, and the overarching organizational culture jointly modulate the influence of Green HRM. Equally, the salience of organizational culture surfaces as a determining variable. Firms that have embedded a deep commitment to sustainability in their everyday ethos tend to reap the greatest dividends from Green HRM. Hence, a cautious extension of the research agenda is warranted: one that maps the interplay between cultural substrates and the trajectory of Green HRM initiatives, with a particular focus on how a pervasive sustainable mindset is incubated and sustained among the workforce.

V. CONCLUSION

This study explores the impact of Green Human Resource Management (HRM) on employee engagement and satisfaction within Tamil Nadu IT firms, utilising sentiment and correlation analysis. Results indicate that of the green practices surveyed, Training and Development commands the highest satisfaction score and exhibits a strong positive correlation with employee engagement. Conversely, the Performance Appraisal process that embeds environmental objectives falls significantly short of accepted benchmarks, highlighting a substantial gap and recommending a tighter integration of sustainability goals into appraisal and reward mechanisms. This observation aligns with prior academic research, reaffirming that green HRM initiatives can elevate employee sentiment, yet positive outcomes are frequently undermined when evaluation frameworks fail to keep pace with environmental commitments.

Empirical evidence now frames organizational culture as a moderating lever that amplifies or attenuates the impact of Green HRM on employee performance. Enterprises where environmental values permeate everyday practice elicit the strongest employee buy-in, lending support to the proposition that a culture aligned with ecological purpose is a baseline condition for green initiatives to translate into sustained productivity gains through heightened engagement. As a next step, research should explicitly correlate measurable cultural dimensions—most notably the breadth of shared ecological governance—with variations in satisfaction and engagement indices derived from Green HRM instruments.

Comparative analysis with previous models reveals that robust Green HRM systems are consistently associated with higher engagement scores. Yet the data highlight a chronic deficiency in performance appraisal systems, where the embedding of sustainability metrics into evaluative criteria remains incomplete. Addressing this gap is no longer optional. Even where organizations have rolled out environmentally sound processes, the evidence advocates for a coherent linking of every HR practice to the apex sustainability objectives. Multivariate techniques, including

ANOVA and T-test, affirm the moderating influence of employees' educational background, tenure, and the organization's maturity on perceptions of Green HRM effectiveness.

By clarifying how these factors shape employees' reactions to sustainability-linked schemes within Tamil Nadu's IT sector, this study offers pointed insights capable of steering the design of more precisely calibrated engagement initiatives.

5.1 Future Research Directions

Future research could leverage advanced analytics—such as machine-learning algorithms and sentiment analysis—to expose the nuanced emotional undercurrents of workforce participation in Green HRM programs. By systematically examining sentiment and feedback harvesting, scholars may clarify which psychological factors energize employee motivation and alter behavior, thereby enabling firms to finely calibrate their interventions using a solid evidence base. In turn, organizations would be positioned to sculpt initiatives that resonate more deeply with personnel, ultimately aligning environmental goals with authentic employee buy-in.

A longitudinal approach merits rigorous examination to capture how employee perceptions and practices surrounding Green HRM initiatives mature over time. Continuous monitoring of satisfaction and engagement across multiple annual cycles would clarify whether environmental programs produce lasting shifts in mindset and conduct. Additionally, long-term assessments of Green HRM development would track the progressive deepening of eco-focused organizational practices, measuring concurrent variances in employee morale and organizational performance.

Advancing Green performance appraisal frameworks could leverage standard measures that quantify sustainability contributions and link them to individual evaluation. Targeted case studies in organizations with mature green appraisal systems would illuminate the mechanisms that translate eco criteria into heightened engagement, motivation, and, ultimately, performance.

- **Inter-Sector Insight:** By examining Green HRM initiatives in manufacturing, IT, and healthcare side by side, organizations gain richer perspectives on sector-specific adaptations and discern how sector-related characteristics shape employee engagement outcomes in sustainability initiatives on the ground.
- **Alignment of Incentives and Outcomes:** By parsing the intrinsic and extrinsic motivators that bind employees to their organizations' green objectives, firms can refine policy design beyond cursory recognition of sustainability frameworks and instead develop nuanced HRM interventions that anchor sustainable behaviours in the everyday motivations of the workforce, leading to deeper, more enduring workplace commitment.

REFERENCE

- [1] Bansal, P., & Hunter, T. (2003). Strategic explanations for the early adoption of ISO 14001. *Journal of business ethics*, 46(3), 289-299.
- [2] Beard, C., & Rees, S. (2000). Green teams and the management of environmental change in a UK county council. *Environmental Management and Health*, 11(1), 27-38. <https://doi.org/10.1108/09566160010314161>
- [3] Begum, M. F. (2018). An overview of digital financial services in India: Concept, initiatives and advantages. *Asian Journal of Management*, 9(3), 1139-1144.
- [4] Certo, S.C., & Certo, S. T. (2008). *Modern management*. USA: Pearson Education
- [5] Cherian, J., & Jacob, J. (2012). A study of green HR practices and its effective implementation in the organization: A review. *International journal of business and Management*, 7(21), 25-33. <http://dx.doi.org/10.5539/ijbm.v7n21p25>
- [6] Christmann, P., & Taylor, G. (2002). Globalization and the environment: Strategies for international voluntary environmental initiatives. *Academy of Management Perspectives*, 16(3), 121-135. <https://doi.org/10.5465/ame.2002.8540373>
- [7] Collins, C. J., & Clark, K. D. (2003). Strategic human resource practices, top management team social networks, and firm performance: The role of human resource practices in creating organizational competitive advantage. *Academy of management Journal*, 46(6), 740-751. <https://doi.org/10.5465/30040665>
- [8] Daily, B. F., & Huang, S. C. (2001). Achieving sustainability through attention to human resource factors in environmental management. *International Journal of operations & production management*, 21(12), 1539-1552. <https://doi.org/10.1108/01443570110410892>
- [9] Durai, F. A. P., & Nalini, B. (2020). Contemporary Green HRM practices at IT Companies in Trichy. *International Journal of Management (IJM)*, 11(11).
- [10] Durai, P., & Nalini, R. (2020). Inspiring factors to adopt green HRM practices. *International Journal of Management*, 11(12), 436-451. <https://doi.org/10.17605/OSF.IO/XH69R>
- [11] Dutta, S. (2014). Greening people: A strategic dimension. *ZENITH International Journal of Business Economics & Management Research*, 2(2), 143-148
- [12] Fayyazi, M., Shahbazmoradi, S., Afshar, Z., & Shahbazmoradi, M. (2015). Investigating the barriers of the green human resource management implementation in oil industry. *Management science letters*, 5(1), 101-108. <https://doi.org/10.5267/j.msl.2014.12.002>
- [13] Govindarajulu, N., & Daily, B. F. (2004). Motivating employees for environmental improvement. *Industrial management & data systems*, 104(4), 364-372. <https://doi.org/10.1108/02635570410530775>
- [14] Govindarajulu, N., & Daily, B. F. (2004). Motivating employees for environmental improvement. *Industrial management & data systems*, 104(4), 364-372. <https://doi.org/10.1108/02635570410530775>
- [15] Harvey, G., Williams, K., & Probert, J. (2013). Greening the airline pilot: HRM and the green performance of airlines in the UK. *The International Journal of Human Resource Management*, 24(1), 152-166. <https://doi.org/10.1080/09585192.2012.669783>
- [16] Jackson, S. E., Renwick, D. W., Jabbour, C. J., & Muller-Camen, M. (2011). State-of-the-art and future directions for green human resource management: Introduction to the special issue. *German Journal of Human Resource Management*, 25(2), 99-116. <https://doi.org/10.1177/239700221102500203>
- [17] Jafari, D., Parvizi, L., & Beigi, M. E. (2019). The Development of a Multi-Objective Model for Supplier Selection and Order Allocation in a Green Supply Chain under Uncertainty. *International Academic Journal of Science and Engineering*, 6, 153-166. <https://doi.org/10.9756/IAJSE/V611/1910015>
- [18] Jain, A., & Babu, K. A. (2024). Role of Green Buildings in the Sustainable Development of Tier-II Cities in India. *Archives for Technical Sciences*, 2(31), 368-378. <http://dx.doi.org/10.70102/afts.2024.1631.368>
- [19] Jose Chiappetta Jabbour, C. (2011). How green are HRM practices, organizational culture, learning and teamwork? *A Brazilian study. Industrial and Commercial Training*, 43(2), 98-105. <https://doi.org/10.1108/00197851111108926>
- [20] Kathiravan, C., & Prabu, P. (2024). Digital Marketing and Customer Satisfaction in the Hotel Industry. In *Business Resilience and Digital Technology in the Post-Pandemic Era: A Global Case* (pp. 93-102). Cham: Springer Nature Switzerland.
- [21] Mandip, G. (2012). Green HRM: People management commitment to environmental sustainability. *Research Journal of Recent Sciences*, 2277(1), 244-252.
- [22] Milliman, J., & Clair, J. (2017). Best environmental HRM practices in the US. In *Greening people* (pp. 49-73). Routledge. [32] Shrivastava, P., & Berger, S. (2010). Sustainability principles: A review and directions. *Organization Management Journal*, 7(4), 246-261. <https://doi.org/10.1057/omj.2010.35>
- [23] Mishra, P., & Mehta, R. (2017). What we educators get wrong about 21st-century learning: Results of a survey. *Journal of Digital learning in Teacher education*, 33(1), 6-19. <https://doi.org/10.1080/21532974.2016.1242392>
- [24] Musa, M. H., & Mohamad, M. N. (2018). Importance of Green Innovation in Malaysian SMEs: Advantages and Future Research. *International Academic Journal of Innovative Research*, 5(2), 47-56. <https://doi.org/10.9756/IAJIR/V5I1/1810015>
- [25] Nasirian, M., & Tahami, S. M. B. (2019). Development of human resource training coaching models and their effect on the performance of the Islamic Republic of Iran Broadcasting. *International Academic Journal of Organizational Behavior and Human Resource Management*, 6(1), 58-68. <https://doi.org/10.9756/IAJOBHRM/V6I1/1910007>
- [26] Patil, S., Thimmappa, A. D., Tomar, A., & Verma, A. (2025). Plant-Based Green Synthesis of AgNPs and Their Structural and Antimicrobial Characterization. *Natural and Engineering Sciences*, 10(1), 363-373. <https://doi.org/10.28978/nesciences.1648765>
- [27] Raman, A., Balakrishnan, R., Arokiasamy, A. R., Pant, M., & Sukirthanandan, P. (2024). Design of Quality of Experience-based Green Internet Architecture for Smart City. *Journal of Internet Services and Information Security*, 14(3), 157-166. <https://doi.org/10.58346/JISIS.2024.I3.009>
- [28] Renwick, D. W., Redman, T., & Maguire, S. (2013). Green human resource management: A review and research agenda. *International journal of management reviews*, 15(1), 1-14. <https://doi.org/10.1111/j.1468-2370.2011.00328.x>
- [29] Renwick, D., Redman, T., & Maguire, S. (2008). Green HRM: A review, process model, and research agenda. *University of Sheffield Management School Discussion Paper*, 1(1), 1-46.
- [30] Sharma, K. (2016). Conceptualization of green HRM and green HRM practices: Commitment to environment sustainability. *International Journal of Advanced Scientific Research and Management*, 1(8), 74-81.