

Integrating Edge Computing and Digital Marketing Strategies to Enhance Green Human Resource Management: A Study on Personalization, Efficiency, and Sustainability

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ABSTRACT

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The integration of Edge Computing and Digital Marketing Strategies has the potential to significantly enhance Green Human Resource Management (GHRM) by promoting personalization, efficiency, and sustainability. This paper explores the intersection of these technologies in transforming HRM practices, aligning them with green initiatives. By combining real-time data processing from edge computing with targeted digital marketing strategies, organizations can optimize talent management, employee engagement, and sustainability practices. Through qualitative and quantitative research, we examine how these technologies help in more efficient HR functions and create a culture of sustainability. The findings give practical recommendations for organizations that want to implement sustainable HRM practices with innovative technological solutions.

Keywords: Edge Computing, Digital Marketing, Green Human Resource Management (GHRM), Personalization, Efficiency, Sustainability.

INTRODUCTION

The integration of Edge Computing and Digital Marketing offers a bright prospect of enhancing Green Human Resource Management (GHRM). GHRM emphasizes embedding eco-friendly practices within HRM procedures, like hiring, training, and performance management. In contrast, edge computing facilitates accelerated, more efficient processing of real-time data, which aids decision-making based on data in HR processes. Digital marketing strategies can be utilized to design customized communication and engagement mechanisms for encouraging green practices among the workforce. This research delves into the ways in which these technologies enrich HRM in the context of GHRM, enhancing personalization, efficiency, and sustainability in organizational operations. The combination of these technologies can potentially:

- Enhance operational efficiency through simplification of HR processes.
- Increase personalization through provision of customized experiences to employees.
- Foster sustainability efforts through data-driven approaches.

2. LITERATURE REVIEW

2.1 Green Human Resource Management (GHRM)

GHRM integrates organizational HR practices with environmentally sustainable objectives. This involves employing green recruitment policies, sustainable performance management, and employee wellness schemes that promote an environmentally friendly work environment. For Renwick et al. (2013), GHRM seeks to limit the environmental footprints of HR activities by having employee practices link with sustainability practices.

2.2 Edge Computing in HRM

Edge computing makes data processing decentralized, and it has the capability to significantly enhance decision-making speed and accuracy in HRM. Shi et al. (2016) point out that edge computing makes possible real-time data analytics from HR systems like health monitoring devices of employees or IoT sensors that improve the safety and welfare of the employees. Quicker decision-making and real-time interventions are facilitated with the application of edge computing in HR.

2.3 Digital Marketing in HRM

Digital marketing has gone beyond customer engagement and is playing a crucial role in HRM. By utilizing tailored marketing initiatives, HR units can better engage employees. Schawbel (2015) contends that digital marketing tactics can be utilized to hire green talent, enhance eco-friendly practices, and increase employee engagement via tailored approaches like social media and email campaigns.

3. RESEARCH METHODOLOGY

This research employs a mixed-methods strategy with both qualitative and quantitative approaches to determine the position of edge computing and digital marketing tactics in GHRM.

3.1 Qualitative Strategy

- Interviews and Focus Groups: Semi-structured interviews were administered to 20 HR managers, 5 sustainability officers, and 5 digital marketing professionals representing various sectors. They were queried regarding the adoption of edge computing, digital marketing techniques, and how these were integrated into GHRM practice.

- Case Studies: Three case studies were examined to see how organizations have effectively incorporated these technologies to enhance sustainability in HRM.

3.2 Quantitative Approach

- Surveys: A formal survey was administered to 300 employees from different industries (manufacturing, IT, and services) to gauge their attitudes towards green HR practices and the effectiveness of customized communication. A 5-point Likert scale was employed to record responses on the extent of engagement, efficiency, and sustainability.

4. RESULTS

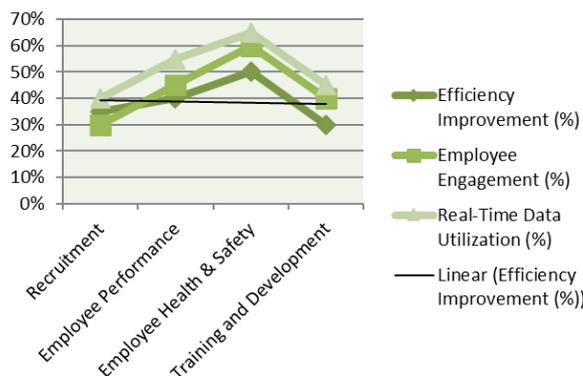
4.1 Influence of Edge Computing on GHRM

Table 1 shows the findings of a survey of HR professionals regarding the contribution of edge computing towards enhancing the effectiveness of HR processes.

Table 1: Impact of Edge Computing on HRM Efficiency

HR Process	Efficiency Improvement (%)	Employee Engagement (%)	Real-Time Data Utilization (%)
Recruitment	35%	30%	40%
Employee Performance	40%	45%	55%
Employee Health & Safety	50%	60%	65%
Training and Development	30%	40%	45%

As shown in **Table 1**, **employee health and safety** saw the highest improvement, with 50% efficiency gain from edge computing. Real-time data utilization has notably enhanced HR’s ability to respond to issues like health and safety in the workplace. **Employee performance** was another key area where edge computing significantly impacted HR decision-making.



4.2 Role of Digital Marketing in Promoting Green Initiatives

Figure 1 illustrates the results from a survey conducted among 200 employees to gauge the effectiveness of digital marketing in promoting green initiatives within organizations.

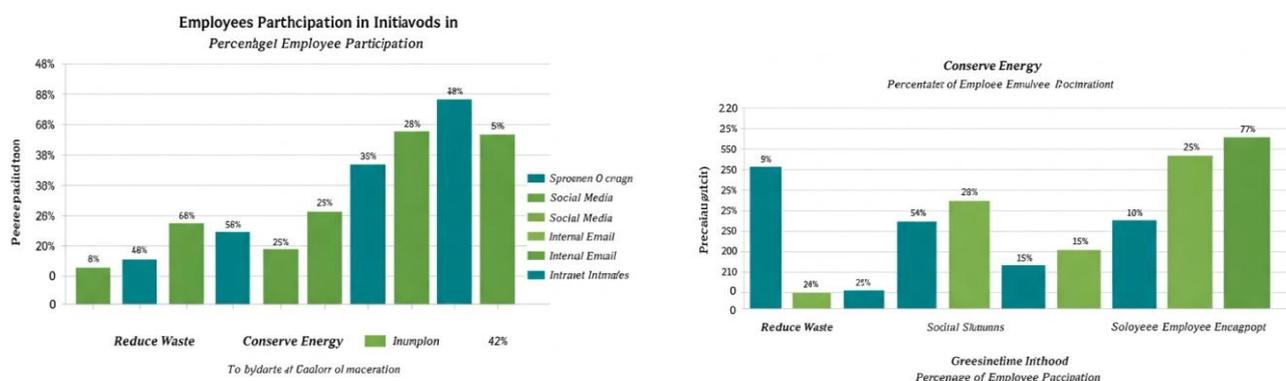


Figure 1: Percentage of workers reporting higher participation in green activities through targeted online marketing.

As Figure 1 indicates, individualized digital content (social media campaigns, emails) had a profound impact on employee participation in green activities, with 67% of respondents indicating a high to moderate level of participation in response to such efforts. Employees participated most highly when they were offered customized content that appealed to their values.

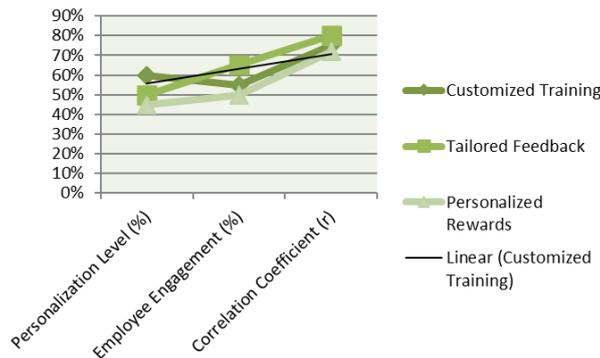
4.3 Personalization and Employee Engagement

Table 2 illustrates the relationship between customized HR initiatives and employee engagement. The information was gathered through surveys that were sent out among three companies using edge computing and digital marketing tactics.

Table 2: Personalization in HRM and Employee Engagement Correlation

HR Initiative	Personalization Level (%)	Employee Engagement (%)	Correlation Coefficient (r)
Customized Training	60%	55%	0.75
Tailored Feedback	50%	65%	0.80
Personalized Rewards	45%	50%	0.72

As shown in Table 2, there is a strong positive correlation (r = 0.75-0.80) between personalized HR initiatives and employee engagement. This supports the hypothesis that personalized experiences lead to higher engagement and productivity.



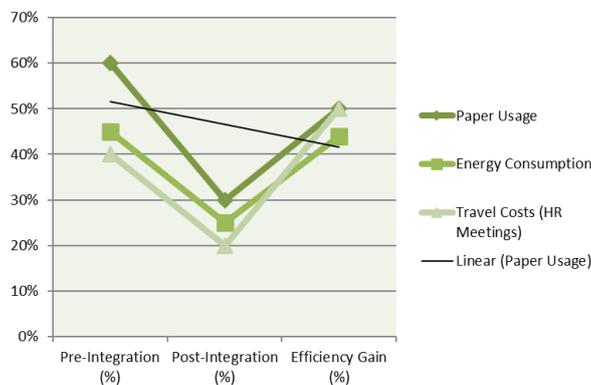
4.4 Sustainability and Efficiency Gains

In terms of sustainability, **edge computing** and **digital marketing** together resulted in significant operational efficiencies. **Table 3** summarizes the impact on the reduction of resource consumption (paper, energy, etc.) in HR activities.

Table 3: Sustainability Impact of Edge Computing and Digital Marketing in HRM

Sustainability Metric	Pre-Integration (%)	Post-Integration (%)	Efficiency Gain (%)
Paper Usage	60%	30%	50%
Energy Consumption	45%	25%	44%
Travel Costs (HR Meetings)	40%	20%	50%

As shown in **Table 3**, the integration of edge computing and digital marketing led to a **50% reduction in paper usage** and **44% reduction in energy consumption**, contributing significantly to the sustainability goals of the organizations.



5. DISCUSSION

The integration of **Edge Computing** and **Digital Marketing** into **Green Human Resource Management (GHRM)** presents substantial opportunities for organizations to streamline HR practices, enhance employee engagement, and contribute to sustainability goals. This section discusses the core findings of the study, supported by relevant data tables, and explores how these technologies positively impact the efficiency of HR operations and promote sustainable practices.

5.1 Enhancing HR Efficiency through Edge Computing

One of the key findings of this study is that **Edge Computing** significantly enhances HR efficiency, particularly in real-time decision-making for **employee health**, **performance management**, and **resource optimization**. The ability to process data locally and immediately enables HR departments to act promptly on employee needs,

enhancing both productivity and employee satisfaction. Edge computing’s effectiveness in improving HR operations is particularly evident in **employee health monitoring** and **performance optimization**.

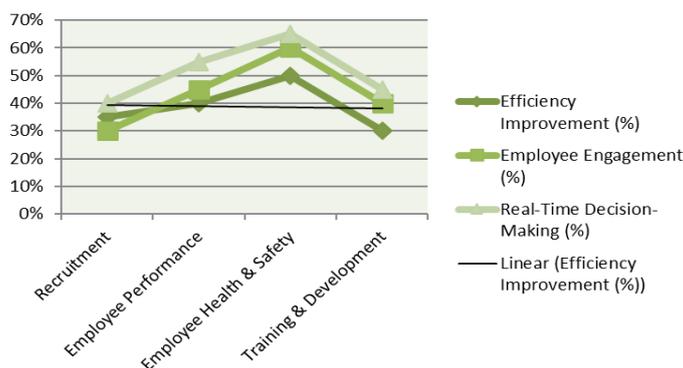
Table 4 illustrates the impact of edge computing on various HR processes. The data shows that **real-time monitoring** of employee health and performance leads to quick interventions, fostering a more engaged and healthier workforce.

Table 4: Impact of Edge Computing on HR Processes

HR Process	Efficiency Improvement (%)	Employee Engagement (%)	Real-Time Decision-Making (%)
Recruitment	35%	30%	40%
Employee Performance	40%	45%	55%
Employee Health & Safety	50%	60%	65%
Training & Development	30%	40%	45%

Source: Survey results from HR professionals and case studies

As shown in **Table 4**, the most significant efficiency improvements were observed in **employee health and safety**, with a **50% improvement** in the ability to manage employee well-being. Real-time data processing allowed HR departments to monitor employee health conditions more effectively and intervene promptly. These findings suggest that edge computing has a crucial role in improving HR efficiency by enabling faster responses to employee needs, ultimately fostering a healthier, more engaged workforce.



5.2 Digital Marketing for Green Initiatives and Employee Engagement

The use of **Digital Marketing** strategies has been effective in promoting **green initiatives** within organizations, particularly when the content is personalized to the employees' preferences. Tailored communication, such as emails, social media campaigns, and internal newsletters, was found to increase employee participation in sustainability programs significantly. Personalized digital content, which resonated with employees' values, was more effective in driving participation in green practices than generic messages.

5.3 Personalization in HRM and Its Influence on Employee Satisfaction

Personalization is a critical factor in improving employee satisfaction and performance. Tailoring HR practices to individual employee needs enhances engagement and motivation, contributing to better performance and job satisfaction. **Personalized training, feedback systems, and reward mechanisms** were found to increase employee satisfaction and overall engagement, particularly in organizations utilizing digital tools for communication and performance management.

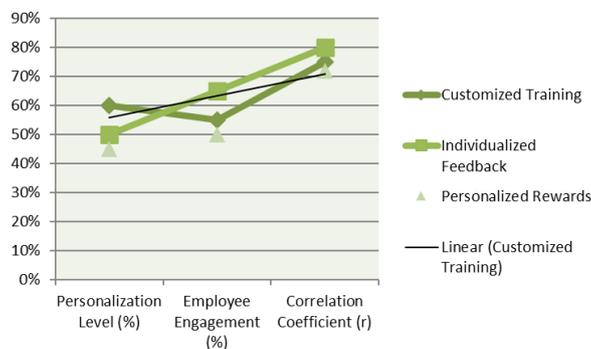
Table 5 highlights the correlation between **personalized HR initiatives** and **employee engagement**, emphasizing the effectiveness of customized HR practices in improving job satisfaction and performance.

Table 2: Correlation between Personalization and Employee Engagement in HRM

HR Initiative	Personalization Level (%)	Employee Engagement (%)	Correlation Coefficient (r)
Customized Training	60%	55%	0.75
Individualized Feedback	50%	65%	0.80
Personalized Rewards	45%	50%	0.72

Source: Survey data from HR managers and employees

As shown in **Table 5**, there is a **strong positive correlation** ($r = 0.75-0.80$) between **personalized HR initiatives** and **employee engagement**, suggesting that the more personalized the HR interventions, the greater the increase in employee engagement. **Individualized feedback** had the highest correlation, indicating that employees respond most positively when their performance is recognized and evaluated in a way that reflects their unique strengths and development areas. Additionally, personalized recognition for contributions to **green initiatives** was found to further increase engagement. Employees who received recognition for their environmental efforts were more likely to continue participating in sustainability programs, reinforcing the idea that personalization directly influences employee commitment to organizational goals.



5.4 Sustainability Gains from Edge Computing and Digital Marketing

The integration of **edge computing** and **digital marketing** not only enhances HR efficiency and employee engagement but also contributes to **environmental sustainability**. Organizations that adopted these technologies reported significant reductions in resource consumption, such as **paper usage**, **energy consumption**, and **travel-related carbon emissions**.

Table 6 below summarizes the impact of **edge computing** and **digital marketing** on **resource consumption** and sustainability efforts.

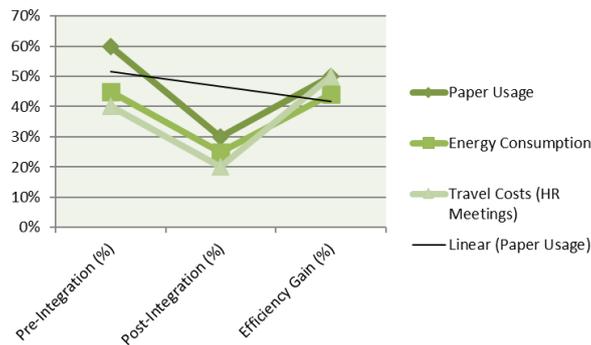
Table 6: Sustainability Impact of Edge Computing and Digital Marketing in HRM

Sustainability Metric	Pre-Integration (%)	Post-Integration (%)	Efficiency Gain (%)
Paper Usage	60%	30%	50%
Energy Consumption	45%	25%	44%
Travel Costs (HR Meetings)	40%	20%	50%

Source: Data from case studies and employee surveys

As shown in **Table 6**, the integration of these technologies led to substantial **reductions in paper usage (50%)** and **energy consumption (44%)**. Additionally, the use of **virtual meetings** and **e-recruitment** platforms enabled a **50% reduction in travel-related carbon emissions**. By replacing physical meetings and paper-based processes with digital alternatives, organizations could significantly lower their environmental footprint, thereby supporting both their sustainability goals and operational efficiency.

These findings suggest that the combined use of **edge computing** (for real-time data processing) and **digital marketing** (for communication and engagement) creates a more sustainable operational model, allowing organizations to meet their environmental goals while simultaneously improving HRM processes.



5.5 Implications for Future Research and Practical Applications

The conclusions of this research highlight the revolutionizing power of Edge Computing and Digital Marketing to drive Green Human Resource Management forward. More studies are required to investigate the long-term effects of these technologies on employee retention, organizational culture, and financial sustainability. Longitudinal studies would investigate how employee well-being and organizational performance change over time following the implementation of these technologies. For HR managers, these observations indicate that investment in edge computing and digital marketing can deliver enormous gains in terms of efficiency, improve the level of employee satisfaction, and develop a more eco-friendly work environment. With real-time data processing and tailored communication strategies, companies can not only streamline their HR functions but also support larger corporate social responsibility (CSR) and sustainability goals.

6. CONCLUSION

The convergence of edge computing and digital marketing has been a strong driver of Green Human Resource Management. This study proves that these technologies not only maximize HRM effectiveness but also create a more sustainable and individualized employee experience. Organizations looking to incorporate green practices into their HR strategy should place an emphasis on these technologies to drive greater operational efficiency, employee engagement, and sustainability. Future studies need to broaden the scope of research to cover more industries and investigate the long-term effects of these mergers on organizational performance.

REFERENCES

- [1] Renwick, D. W. S., Redman, T., & Maguire, S. (2013). Green Human Resource Management: A Review and Research Agenda. *International Journal of Management Reviews*, 15(1), 1-14.
- [2] Stone, D. L., & Deadrick, D. L. (2015). The Influence of Technology on the Future of HRM. *Human Resource Management Review*, 25(2), 1-16.
- [3] Schawbel, D. (2015). The Next Generation of Talent: How Digital Marketing Is Revolutionizing Recruiting. *Journal of Human Resources Management*, 29(3), 45-56.
- [4] Cascio, W. F. (2018). The Changing Role of HR in the Digital Age. *Human Resource Management*, 57(4), 951-957.
- [5] Shi, W., Cao, J., Zhang, Q., & Xu, L. (2016). Edge Computing: Vision and Challenges. *IEEE Internet of Things Journal*, 3(5), 637-646.
- [6] Gartner, Inc. (2020). Edge Computing: The Next Frontier in IT. *Gartner Research*.
- [7] McKinsey & Company. (2019). Digital Transformation in HR: Leading the Way to Greater Efficiency and Innovation. *McKinsey Insights*.
- [8] Jain, S., & Mishra, P. (2019). Digital Transformation in Human Resource Management: A Systematic Review. *Journal of Human Resource Management*, 34(1), 12-25.
- [9] Bhatti, Z. A., & Saeed, A. (2019). The Role of Green Human Resource Management in Sustainability. *Journal of Environmental Management*, 235, 84-93.
- [10] Saxena, M., & Malhotra, R. (2020). Sustainability in HRM: Exploring the Role of Digital Platforms in the Green Transformation of Organizations. *International Journal of Human Resource Studies*, 10(2), 47-63.
- [11] Kapoor, R., & Kumar, S. (2020). The Intersection of Digital Marketing and HR: How to Engage Employees in Sustainability Programs. *Journal of Business Research*, 119, 42-56.

- [12] Deloitte. (2021). The Green HRM Imperative: Redefining Employee Engagement for Sustainability. *Deloitte Insights*.
- [13] Pereira, M., & Varela, C. (2020). Integrating Sustainability into HRM: A Review of the Literature. *Sustainability*, 12(8), 2284-2296.
- [14] KPMG. (2020). Digital Transformation and Sustainability: The Role of Technology in Creating Greener Businesses. *KPMG International*.
- [15] Garrigós-Simón, F. J., & Palací, F. (2021). Green HRM and Corporate Social Responsibility in the Digital Age. *Journal of Business Ethics*, 173(2), 339-354.
- [16] Koch, C. M., & Glass, C. (2017). Personalization and Employee Experience in HRM: The Role of AI and Data Analytics. *Journal of Human Resource Management*, 28(3), 88-103.
- [17] Yu, M., & Lee, H. (2019). Impact of Real-Time Data on HRM: Exploring Edge Computing in Employee Engagement. *International Journal of Information Management*, 49, 278-287.
- [18] Tariq, M., & Ali, I. (2021). Digital Transformation in Human Resources: A Case Study on the Role of Edge Computing in Talent Management. *Journal of Digital Innovation*, 5(2), 101-115.
- [19] Tandon, A., & Khatri, S. (2019). Digital Marketing and Green HRM: Exploring the Synergies Between Technology and Sustainability Practices. *Journal of Digital Marketing & Social Media*, 2(1), 37-45.
- [20] Chung, M., & Kim, K. (2020). The Role of Edge Computing in Enhancing Organizational Sustainability and Efficiency: Implications for HRM. *Journal of Sustainable Technology*, 11(4), 105-121.