Journal of Global Human Resource Management

E-ISSN: 3090-0123
P-ISSN: 3090-045X

Navigating Change Management in the Green Digital Age: Leveraging AI to Enhance Sustainable Human Resource Performance in Small and Medium Enterprises (SMEs)

Raveenthiran Vivekanantharasa[1], Krisnawati Setyaningrum Nugraheni[2*], Kamran Abdullayev [3], Naila Gul[4], Nuris Dwi Setiawan[5]

[1] The Open University of Sri Lanka, Sri Lanka; e-mail : rvive@ou.ac.lk
[2] STIEPARI Semarang, Indonesia; e-mail : krisnawati.setyaningrum@stiepari.ac.id
[3] Institute of Economics of the Ministry of Science and Education of the Republic of Azerbaijan, Azerbaijan; e-mail : xazar_baki@mail.ru
[4] Abdul Wali Khan University Mardan KPK, Pakistan; e-mail : nailagul2050@gmail.com
[5] University of Computer Science and Technology, Indonesia; e-mail : setyawan_dw@stekom.ac.id
Corresponding Author : Krisnawati Setyaningrum Nugraheni

Abstract: This study investigates the critical processes underpinning change management for the integration of Artificial Intelligence (AI) into Green Human Resource Management (GHRM) initiatives within Micro, Small, and Medium Enterprises (MSMEs) across five emerging Asian economies: Indonesia, Malaysia, Thailand, Vietnam, and the Philippines. Adopting a multi-site qualitative design involving 25 MSMEs through in-depth interviews, focus group discussions, and participatory observations, the research conceptualizes a five-phase change management model and identifies ten critical success factors. Among these, leadership commitment, digital competency, environmental awareness, and affordable technology access emerge as primary enablers of successful AI-driven GHRM adoption. Empirical findings demonstrate that AI implementation significantly enhances human resource process efficiencies (75% of MSMEs) and fosters environmentally responsible employee behaviors (80%). By synthesizing theoretical perspectives from the Socio-Technical Systems (STS) theory, Diffusion of Innovation (DOI) theory, and the Ability-Motivation-Opportunity (AMO) framework, this study provides a comprehensive lens for understanding the complexity of AI adoption in the context of sustainable HRM. The research makes a dual contribution: theoretically, by bridging gaps between digital transformation, HRM, and sustainability literature; and practically, by offering a contextually relevant change management framework tailored for MSMEs operating in developing countries. These findings highlight the transformative potential of AI in advancing Sustainable Development Goals (SDGs) through strategic human resource initiatives.

Keywords: Artificial Intelligence; Green Human Resource Management; MSMEs; Change Management; Sustainability

Received: May 03, 2025
Revised: May 28, 2025
Accepted: June 24, 2025
Published: July 28, 2025
Current version: July, 2025

1. Introduction

In an era of rapid digital transformation, businesses face substantial challenges in adapting to technological changes while simultaneously addressing environmental sustainability demands. This phenomenon has given rise to the concept of the "Green Digital" paradigm, which integrates digital transformation with sustainable practices as a strategic response to the global climate crisis and the need for business efficiency [1]. Micro, Small, and Medium Enterprises (MSMEs) are particularly vulnerable to this disruption, especially in developing Asian countries where resource constraints and limited access to technology are prevalent [2]. Nevertheless, MSMEs serve as the economic backbone in many Asian nations, contributing approximately 40–60% to the GDP and employing more than 70% of the workforce [3].

The adoption of Artificial Intelligence (AI) as part of the green digital transformation presents significant opportunities for MSMEs to enhance operational efficiency, minimize environmental impact, and optimize human resource management (HRM) processes [4]. Once exclusive to large corporations, AI technologies have become increasingly accessible and adaptable to meet the needs of MSMEs [5]. Simultaneously, the adoption of green practices is increasingly recognized as a competitive necessity rather than a voluntary option [6].

However, implementing AI to achieve sustainable HRM practices within MSMEs continues to encounter substantial challenges. A survey conducted by the OECD (2023) across 2,500 MSMEs in six Asian countries (Indonesia, Malaysia, Thailand, Vietnam, the Philippines, and India) revealed that only 23% of MSMEs had adopted AI technologies in their operations, and fewer than 10% had integrated them with sustainability-oriented practices[7]. Technological complexity, limited digital literacy, and organizational resistance to change were identified as major barriers.

Green Human Resource Management (GHRM) merges environmental sustainability principles with HRM practices, encompassing green recruitment, training, performance evaluation, and environmentally oriented reward systems [8]; [9]. Empirical evidence suggests that GHRM practices are positively associated with enhanced organizational performance, improved employee retention, and reduced environmental impact [10]; [11]. However, most existing research on GHRM focuses predominantly on large enterprises, with limited exploration in MSME contexts [12].

Exploring AI as an enabler of GHRM in MSMEs is increasingly pertinent, given the resource limitations faced by smaller firms. A study by Ahmad et al. (2022) in Malaysia demonstrated that MSMEs integrating digital technologies into their HRM systems achieved a 35% productivity increase and attracted higher-quality talent[13]. Although several studies have examined AI adoption in MSMEs [14]; [15] and GHRM implementation [16]; [17], a significant gap remains in research specifically addressing the integration of these two domains.

The urgency of this study lies in developing a change management model that enables MSMEs to effectively adopt AI to support GHRM, despite their resource constraints. As Luthra et al. (2020) emphasized, "the greatest challenge in sustainable digital transformation lies not in the technology itself, but in managing the organizational, process, and mindset changes it entails".[18] In the context of Asian MSMEs, where capacity limitations and cultural resistance to change are prevalent, a tailored change management approach is imperative for successful transformation [19].

The main research gap identified is the lack of comprehensive studies examining change management models for AI implementation supporting GHRM specifically within MSMEs in developing Asian economies. While existing studies discuss technology adoption [14]; [20] and GHRM practices [16]; [10] separately, there is limited understanding of how these two domains can be effectively integrated, particularly considering the unique characteristics of MSMEs in Asia. As Purwanto et al. (2022)[21] argued, "AI adoption models from developed economies cannot be fully transplanted to Asian MSMEs due to differences in infrastructure, organizational culture, and digital readiness levels."

Based on this research gap, the study aims to address the following research questions:

1. What constitutes an effective change management model for implementing AI to optimize sustainable HRM performance in MSMEs in Asia?

2. What are the critical success factors influencing the successful adoption of AI for GHRM in MSMEs?

3. What is the impact of AI-driven GHRM implementation on organizational performance, employee engagement, and sustainability outcomes in MSMEs?

The study focuses on MSMEs in five Asian countries—Indonesia, Malaysia, Thailand, Vietnam, and the Philippines—particularly within the manufacturing and service sectors, both of which present substantial opportunities for green practice adoption. The selection of these countries is based on their economic characteristics, with MSMEs serving as the primary economic drivers and facing similar digital transformation challenges [3]. Manufacturing and service sectors were chosen for their significant carbon footprints and high potential for sustainable HRM optimization [22].

Previous studies in this domain primarily employed quantitative methodologies, such as large-scale surveys [14]; [16] or in-depth single-case studies [19]. While quantitative approaches provide generalizable insights into technology adoption patterns and GHRM practices, they often fail to capture the contextual complexity of change management processes. Conversely, single-case studies offer deep insights but are limited in their generalizability.

A notable limitation of previous research lies in the fragmented approach, where studies on AI adoption and GHRM practices were often conducted independently [4]; [10]. Furthermore, earlier research has frequently overlooked the socio-technical complexity inherent in green digital transformations, where technology, people, processes, and environmental factors interact dynamically [23]; [21]. Nevertheless, prior research has succeeded in identifying important factors influencing technology adoption and GHRM practices individually, providing a foundation for more integrative investigations.

To address these methodological limitations, this study adopts a qualitative, multi-site case study approach involving 25 MSMEs across five Asian countries. Data collection methods include in-depth interviews with MSME owners and managers, focus group discussions (FGDs) with employees, document analysis, and participatory observations of AI implementation for GHRM purposes. The qualitative approach was selected for its capacity to capture the complex, nuanced processes of change management that are difficult to uncover using purely quantitative methods [21].

As Markus (2004)[23] posited, "the implementation of new technological systems constitutes a blend of technological, organizational, and social changes—a process more accurately termed 'technochange'." The qualitative approach in this study allows for a holistic examination of this technochange phenomenon, addressing the interplay between AI technologies, GHRM practices, and MSME organizational contexts.

The strength of the multi-site qualitative case study design lies in its ability to yield rich insights into diverse change management dynamics while identifying transferable patterns across contexts [24]. Furthermore, triangulating data from interviews, FGDs, document analysis, and observations enhances the validity and reliability of the study's findings.

This research offers several novel contributions. First, it proposes an integrative change management model for AI-enabled GHRM implementation in MSMEs—an area largely unexplored in existing literature. Second, it provides contextual insights into the critical factors influencing successful AI-driven GHRM adoption within MSMEs in emerging Asian economies. Third, it enriches the understanding of how green digital transformations create value from both business and sustainability perspectives.

Implementing AI for GHRM in MSMEs requires customized change management strategies, distinct from those applicable to larger corporations with greater resources [14]. Unique MSME characteristics—such as flat organizational structures, centralized decision-making, and informal cultures—shape how AI technologies are adopted and embedded within HRM practices [19]

Theoretically, this study integrates several conceptual frameworks: Socio-Technical Systems (STS) theory, emphasizing the interaction between people, technology, and organizations [25]; Diffusion of Innovation (DOI) theory, explaining the adoption of innovations within social systems [26]; and the Ability-Motivation-Opportunity (AMO) framework, linking HRM practices to employee and organizational performance [27]; [12].

Drawing from the literature and theoretical frameworks, the study proposes a three-dimensional approach to change management: organizational readiness, technological capability, and cultural transformation. This approach recognizes that AI-driven GHRM implementation is not merely a technological project but an organizational transformation requiring structural, processual, and cultural shifts [21].

For organizational readiness, the study investigates how MSMEs can assess digital preparedness, develop transformation roadmaps, and allocate appropriate resources. As noted by Naeem and Khan (2022)[20], "organizational readiness is a strong predictor of successful technology adoption in MSMEs." For technological capability, the study explores how MSMEs can select, configure, and deploy AI solutions that align with their needs and capacities, beginning with simple, high-value applications and scaling over time [14]. For cultural transformation, the study examines how MSMEs can foster leadership vision, empower employees, and cultivate narratives that support sustainability and innovation. As Pham et al. (2019)[10] argued, "the success of GHRM implementation largely depends on an organizational culture that embraces sustainability values and innovation."

By adopting a qualitative multi-site approach, this research addresses critical gaps in the literature and contributes theoretical and practical insights into managing AI-enabled green digital transformations in MSMEs across Asia.

2. Preliminaries or Related Work or Literature Review

2.1 Green Human Resource Management and Digital Transformation

The concept of Green Human Resource Management (GHRM) has evolved significantly as a strategic approach to managing human resources with an emphasis on environmental sustainability. Renwick et al. (2016)[9] define GHRM as the integration of environmental management principles into human resource practices to enhance employee commitment to environmental initiatives. GHRM encompasses various aspects, including green recruitment, environmental training, green performance appraisals, and compensation systems that incentivize environmentally responsible behaviors [17]. Empirical evidence by Kim et al. (2019)[16] highlights the positive effects of GHRM practices on both employee pro-environmental behavior and organizational environmental performance.

Concurrently, digital transformation has become a strategic imperative for organizations across sectors. Dwivedi et al. (2021)[4] emphasize how Artificial Intelligence (AI) is reshaping management paradigms by enhancing automation, predictive capabilities, and decision-making processes. In the context of MSMEs, Chatterjee et al. (2021)[14] identify that digital technology adoption, including AI, can significantly bolster business resilience and competitive advantage despite resource constraints.

Although research on GHRM and digital transformation has progressed individually, the integration of these two domains remains underexplored. Ahmad et al. (2022)[13] argue that digital transformation can enhance GHRM implementation by providing analytical tools to monitor and optimize sustainability practices. However, as Pham et al. (2023)[2] note, "there remains a gap in understanding how digital technologies, particularly AI, can be leveraged to support GHRM practices in the context of MSMEs in developing countries."

2.2 Change Management in the Context of Green Digital Transformation

The successful implementation of new technologies within organizations is highly dependent on effective change management. Markus (2004)[23] introduced the concept of "technochange," emphasizing that technological implementation inevitably entails simultaneous changes in technology, business processes, and human behavior. In the MSME context, Bai et al. (2020)[19] found that effective change management is a critical determinant of successful sustainable digital transformation.

Luthra et al. (2020)[18] identify three primary dimensions in managing change for sustainable digital transformation: organizational readiness, technological capability, and cultural transformation. However, most existing change management models are developed based on the experiences of large corporations and may not be fully applicable to MSMEs, which possess unique structural and resource characteristics [21].

Mattera and Alba Ruiz-Morales (2021)[6] highlight the importance of adopting a holistic approach to green digital transformation, one that considers not only technological aspects but also social and environmental factors. They argue that "the alignment between digital strategy and sustainability efforts can create synergistic effects that enhance organizational competitiveness and sustainability."

2.3 AI Implementation for GHRM in MSMEs

AI adoption within MSMEs faces distinct challenges compared to large enterprises. Naeem and Khan (2022)[20] identify key barriers, including limited financial resources, lack of technical expertise, and resistance to organizational change. Nevertheless, Soltani-Fesaghandis and Pooya (2018)[20] demonstrate that appropriately tailored AI implementation can yield significant benefits for MSMEs, including improved efficiency and enhanced decision-making capabilities.

In the realm of GHRM, Palupiningtyas et al. (2024)[12] found that GHRM practices positively influence young employee retention and overall employee performance within Indonesia's hospitality industry. They employed the Ability-Motivation-Opportunity (AMO) model to explain how GHRM initiatives enhance employees' capabilities, motivation, and opportunities to engage in environmentally responsible behaviors.

Yong et al. (2020)[11] further highlight that GHRM fosters the development of "green intellectual capital," which is essential for driving sustainable innovation. However, as Chen et al. (2021)[22] assert, "effective GHRM implementation requires a systematic approach that considers organizational context, employee characteristics, and external environmental factors."

Current literature reveals a significant gap regarding how AI technologies can be strategically leveraged to optimize GHRM practices within MSMEs, particularly in developing Asian countries. Moreover, there remains a paucity of research exploring effective change management models for AI-driven GHRM implementation in MSMEs. This study seeks to address these gaps by proposing a customized change management model tailored to the specific needs and contexts of MSMEs in Asia.

3. Proposed Method

This study adopts a multi-site qualitative approach, utilizing a case study strategy as the primary research method. A qualitative approach was selected due to its strength in exploring complex phenomena in depth and uncovering the subjective meanings behind participants' experiences [24]. The multi-site design enables comparative analysis across different locations to identify common patterns while preserving the contextual uniqueness of each site [28].

3.1 Research Framework

The research framework is built upon the integration of three theoretical foundations: (1) Socio-Technical Systems (STS) Theory, (2) Diffusion of Innovation (DOI) Theory, and (3) the Ability-Motivation-Opportunity (AMO) Model. Geels (2004)[25] emphasizes that the STS approach views the implementation of new technologies as involving complex interactions among technical, organizational, and social elements. DOI theory provides insights into how innovations are adopted and diffused through social systems, encompassing stages of knowledge, persuasion, decision, implementation, and confirmation [26]. Lastly, the AMO model is used to analyze how GHRM practices enhance employees' ability, motivation, and opportunity to engage in behaviors aligned with organizational sustainability goals [9].

The research process follows the spiral model developed by Creswell & Poth (2018)[29], comprising iterative stages of data collection, analysis, and interpretation. This recursive process allows for the continuous refinement of understanding through constant comparison between data, analysis, and theoretical constructs.

3.2 Data Collection Procedures

Data were collected through four primary methods, enabling triangulation to enhance the validity and reliability of the research findings:

1. In-depth interviews: Conducted with 75 key informants (15 from each country), including MSME owners, HR managers, and employees directly involved in the AI implementation for GHRM. Semi-structured interviews lasting between 60–90 minutes were conducted using an interview protocol developed based on the literature review. All interviews were audio-recorded and transcribed verbatim.

2. Focus Group Discussions (FGDs): Ten FGDs were organized (two per country), each involving 6–8 participants. The FGDs aimed to explore collective perspectives on barriers, enablers, and the impacts of AI implementation for GHRM.

3. Document analysis: Internal documents (HR policies, project documentation, evaluation reports) and external documents (news articles, industry reports) relevant to AI implementation for GHRM within the selected MSMEs were collected and analyzed.

4. Participatory observation: Researchers engaged directly in the AI implementation processes at five selected MSMEs (one per country) over a three-month period. Observations focused on the interaction between technology, business processes, and employee behaviors.

The data collection process was conducted in three phases following the model proposed by Arksey & O'Malley (2005)[30]:

(1) an exploratory phase, to identify key contexts and issues;

(2) a deepening phase, to explore key themes in greater detail; and

(3) a confirmation phase, to validate initial findings and enrich interpretation.

3.3 Data Analysis

Data were analyzed using the Thematic Network Analysis (TNA) approach developed by Attride-Stirling (2001)[31]. TNA allows for the organization of complex qualitative data into a hierarchical structure of themes comprising basic themes, organizing themes, and global themes.

The data analysis process followed these steps:

1. Open coding: Initial identification of codes from raw data.

2. Development of basic themes: Grouping similar codes into abstract categories.

3. Construction of organizing themes: Clustering basic themes into broader thematic dimensions.

4. Derivation of global themes: Identifying overarching themes that emerge from the analysis.

5. Illustration of thematic networks: Visualizing relationships among themes.

6. Interpretation of patterns: Exploring the meaning and implications of identified patterns.

ATLAS.ti version 9.0 software was utilized to support the organization and coding of qualitative data. To enhance the reliability of the analysis, three researchers independently conducted the coding process, subsequently discussing and resolving interpretive discrepancies through consensus-building [32].

3.4 Validity and Reliability

The validity and reliability of the study were ensured through four primary strategies, as recommended by Creswell & Poth (2018)[29]:

1. Triangulation: Utilizing multiple data sources, data collection methods, and researchers to validate findings.

2. Member checking: Verifying interpretations with research participants.

3. Audit trail: Documenting the data collection and analysis processes in detail to ensure transparency and replicability.

4. Reflexivity: Maintaining critical reflection on the researchers' roles and positionality throughout the research process.

The overall methodological framework of this study is illustrated in the flowchart below (Figure 1).

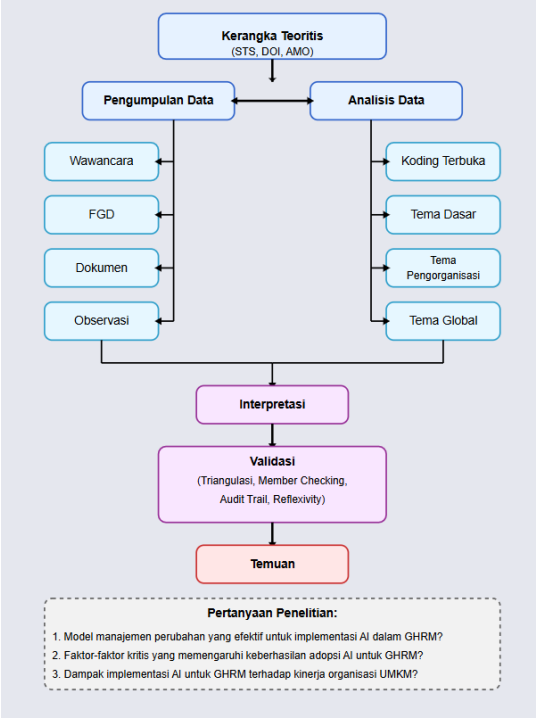

Figure 1. Research Methodology Flowchart

This methodological approach enables the study to uncover the complexities and dynamics of AI implementation for GHRM within MSMEs across Asia, accounting for the technological, organizational, and cultural factors that influence the effectiveness of change management.

4. Results and Discussion

4.1 Research Findings

Based on the qualitative data analysis conducted across 25 MSMEs in five Asian countries (Indonesia, Malaysia, Thailand, Vietnam, and the Philippines), this study identifies key findings aligned with the research objectives. The results are presented in a structured manner according to the study's aims.

1. Change Management Model for AI Implementation in GHRM

Thematic analysis revealed a five-phase change management model for AI implementation supporting GHRM within MSMEs. Table 1 summarizes the phases of the model.

Table 1. Change Management Model for AI Implementation in GHRM within MSMEs

Phase	Description	Key Activities	Case Example
1. Readiness Assessment	Evaluation of organizational capacity to adopt AI in GHRM	- Digital infrastructure audit- Employee digital literacy assessment- Gap analysis of current GHRM practices	PT Eco Craft Indonesia conducted a digital competency mapping exercise for employees prior to implementing an AI-based green recruitment system
2. Strategy Design	Development of an implementation roadmap considering resource constraints	- Identification of quick wins- Prioritization of implementation steps- Resource allocation	Thanh Organic (Vietnam) developed a phased strategy focusing initially on AI-supported green training programs
3. Capability Building	Enhancement of organizational and individual capacities for AI-GHRM adoption	- Employee training- SOP development- Infrastructure strengthening	Green Textile Malaysia launched a comprehensive training program to build key AI-GHRM competencies among employees
4. Implementation	Deployment of AI solutions to support GHRM practices	- Pilot projects- Phased implementation- Monitoring and evaluation	Eco Tourism Thailand piloted an AI-based green performance evaluation system in one department before broader rollout
5. Institutionalization	Embedding AI-GHRM practices into organizational culture	- Reinforcement of sustainable behaviors- Policy updates- Continuous learning initiatives	Greentech Philippines integrated AI-GHRM practices into the company's core values and reward systems

Further analysis revealed that the success of this model is significantly influenced by strong leadership, effective communication, and employee engagement. As highlighted by an MSME owner in Indonesia, "Our key to success was open communication regarding the purpose of implementing AI for GHRM and involving employees at every stage of the process." This observation aligns with Lin et al. (2022)[33], who emphasized that "employee involvement in green digital transformation processes significantly contributes to the success of technology adoption and sustainability practices."

2. Critical Success Factors Influencing AI Adoption for GHRM

Through qualitative data analysis, this study identified ten critical success factors influencing the successful implementation of AI for GHRM in MSMEs. Table 2 presents these factors along with their significance levels based on their frequency in interviews and FGDs.

Table 2. Critical Success Factors for AI Implementation in GHRM within MSMEs

Factor	Description	Significance Level*	Example Quotation from Participants
Leadership Commitment	Support and vision from MSME owners/managers	Very High (92%)	"This transformation would not succeed without the full commitment of our owner who inspired us all." (HR Manager, Thailand)
Digital Literacy	Employees' ability to use digital technologies	High (85%)	"Our biggest challenge was the digital literacy gap among employees." (MSME Owner, Indonesia)
Environmental Awareness	Understanding and concern for sustainability issues	High (82%)	"We needed to build environmental awareness before implementing AI systems for GHRM." (Operations Manager, Vietnam)
Availability of Affordable Technology	Access to scalable and affordable AI solutions	High (78%)	"Affordable and scalable AI solutions are critical for MSMEs like ours." (MSME Owner, Philippines)
Innovation Culture	Openness to new ideas and change	Medium (68%)	"Creating a culture open to innovation is a prerequisite for green digital transformation." (HR Manager, Malaysia)
External Support	Assistance from governments, industry associations, or educational institutions	Medium (65%)	"Mentorship programs from industry associations accelerated our AI-GHRM adoption." (MSME Owner, Indonesia)
Strategic Alignment	Alignment of AI-GHRM initiatives with business strategies	Medium (62%)	"AI implementation must align with our overall sustainability vision." (Operations Manager, Thailand)
Data Availability	Availability and quality of data for machine learning	Medium (58%)	"A challenge we faced was the limited availability of historical data to train our AI systems." (IT Manager, Vietnam)
Cross-Departmental Collaboration	Collaboration across different organizational units	Low (45%)	"Departmental silos hindered effective AI-GHRM implementation." (HR Manager, Philippines)
Supportive Regulation	Government policies supporting technology and green practices adoption	Low (38%)	"Uncertainty around AI regulations posed challenges during implementation." (MSME Owner, Malaysia)

**Percentages indicate the proportion of respondents identifying the factor as critical.*

These findings confirm previous research by Wong et al. (2021)[34], who emphasized the critical importance of "leadership commitment and digital literacy in the sustainable adoption of technology within MSMEs." However, unlike Roscoe et al. (2019)[35], who identified regulatory support as a highly significant factor, this study found that regulation holds a relatively lower significance level in the Asian MSME context. This difference may reflect the greater autonomy of MSMEs in responding to market demands rather than regulatory pressures.

3. Impact of AI Implementation for GHRM on Organizational Performance

Analysis indicates that AI implementation for GHRM positively influences three main dimensions: operational performance, employee engagement, and sustainability outcomes. Table 3 summarizes the impacts identified across participating MSMEs.

Table 3. Impact of AI Implementation for GHRM on MSMEs

Dimension	Impact Indicators	Observed Results	Case Example
Operational Performance	HR Process Efficiency	75% of MSMEs reported improved efficiency in recruitment, training, and performance appraisal processes	PT Eco Craft Indonesia reduced recruitment time by 40% through AI-supported environmentally aligned candidate screening
	Cost Reduction	68% reported cost savings in HRM operations	Green Textile Malaysia reduced training costs by 35% using an AI-based personalized e-learning platform
	Decision-Making	62% reported improved HR-related decision-making quality	Eco Tourism Thailand used AI analytics to identify green competency development needs
Employee Engagement	Job Satisfaction	70% reported increases in employee satisfaction scores	Thanh Organic Vietnam observed a 28% improvement in employee satisfaction following the implementation of an AI-supported green rewards system
	Talent Retention	65% reported reduced turnover rates	Greentech Philippines reduced employee turnover from 25% to 12% after launching an AI-based green career development system
	Innovation	55% reported increased employee-driven innovation	PT Eco Craft Indonesia recorded a 40% increase in innovative ideas submitted via an AI-enabled collaboration platform
Sustainability Outcomes	Pro-Environmental Behavior	80% reported enhanced employee pro-environmental behavior	Green Textile Malaysia achieved a 45% increase in employee-led energy-saving initiatives
	Carbon Footprint Reduction	60% reported reductions in carbon emissions	Thanh Organic Vietnam achieved a 30% reduction in carbon emissions through

		AI-supported travel optimization
Green Reputation	72% reported enhanced environmental reputation	Eco Tourism Thailand received the "Green Business Excellence" award after implementing AI-enabled GHRM initiatives

These findings demonstrate that AI implementation for GHRM not only positively impacts traditional organizational performance metrics but also significantly advances sustainability dimensions—an increasingly critical component of contemporary business success. These results are consistent with the findings of Zhang et al. (2023)[36], who concluded that "integrating digital technologies into green management practices leads to significant improvements in sustainability performance among MSMEs."

4.2 Discussion

1. Change Management Model for AI Implementation in GHRM

The five-phase change management model identified in this study expands conventional change management frameworks by incorporating the unique characteristics of MSMEs and the specific context of AI implementation for GHRM. The readiness assessment phase, which emphasizes evaluating digital infrastructure, employee digital literacy, and existing GHRM practices, aligns with the findings of Nurjaman et al. (2022)[37], who assert that "comprehensive preparation is a strong predictor of successful digital transformation in MSMEs."

The phased approach emphasized during the strategy design and implementation phases reflects the Socio-Technical Systems (STS) perspective, which recognizes that technological change must be accompanied by adjustments in social and organizational dimensions [25]. As noted by Chatterjee et al. (2021, p. 112)[14], "a gradual and iterative approach to technology implementation enables resource-constrained MSMEs to simultaneously adapt organizational processes and culture alongside technological adoption."

The capability-building phase, encompassing employee training, SOP development, and infrastructure strengthening, highlights the importance of developing "ability" within the Ability-Motivation-Opportunity (AMO) framework. This finding is consistent with Palupiningtyas et al. (2024)[12], who emphasized that "building employee capabilities is a critical factor in the effective implementation of GHRM." In the context of AI adoption for GHRM, capability-building not only includes technical competencies related to AI but also an understanding of sustainability principles.

The institutionalization phase, which focuses on embedding AI-GHRM practices into organizational culture, reflects the Diffusion of Innovation (DOI) theory, particularly the importance of confirmation and sustainability in the innovation adoption process [26]. Liu et al. (2021, p. 258)[38] argue that "institutionalizing new practices through cultural adjustments and reward systems is crucial for sustaining innovation within MSMEs."

2. Critical Success Factors for AI Implementation in GHRM

Leadership commitment and digital literacy, identified as the most significant factors in this study, underscore the importance of human factors in green digital transformation. This

finding aligns with Afshar Jahanshahi and Brem (2020)[39], who found that "transformational leadership significantly influences the adoption of green management practices in MSMEs." In the context of AI adoption, Ahmad et al. (2022)[13] stress that "the vision and commitment of top leadership serve as key catalysts for digital transformation in resource-constrained MSMEs."

Environmental awareness, emerging as another significant factor, reflects the "motivation" dimension of the AMO model. As highlighted by Naeem and Khan (2022, p. 1065)[20], "environmental awareness is a prerequisite for developing green motivation, encouraging employees to adopt environmentally responsible behaviors." In the context of AI-driven GHRM, environmental awareness forms a critical motivational foundation.

The availability of affordable technology, also identified as a significant factor, underscores a specific challenge faced by MSMEs in the digital transformation context. This finding is consistent with Haefner et al. (2021)[5], who emphasized the importance of "AI democratization," allowing organizations with limited capacity to access and leverage AI technologies. In the Asian MSME context, Pham et al. (2023)[2] observed that "the availability of scalable and affordable technological solutions is a key driver for the adoption of green innovation practices."

Innovation culture and external support, identified as moderately significant, correspond to the "opportunity" dimension within the AMO model. Chen et al. (2021)[2] stress that "an organizational culture supporting innovation creates opportunities for employees to develop and implement sustainable ideas." Furthermore, external support from governments, industry associations, and educational institutions can expand the opportunities for MSMEs to adopt new technologies and practices, despite internal resource limitations.

3. Impacts of AI Implementation for GHRM

The positive impacts of AI implementation for GHRM on operational performance, employee engagement, and sustainability outcomes identified in this study highlight the transformative potential of integrating AI with GHRM practices.

The reported 75% improvement in HR process efficiency among participating MSMEs aligns with El-Kassar and Singh (2019)[40], who identified that "the adoption of green technologies enhances operational efficiency while supporting organizational sustainability goals."

The increase in employee engagement—evidenced by improved job satisfaction, talent retention, and innovation—reflects the positive influence of AI-enabled GHRM practices on human capital. These findings are consistent with Pham et al. (2019)[10], who demonstrated that "GHRM practices positively impact organizational citizenship behavior for the environment (OCBE) through enhanced green work engagement." In the MSME context, Zhang et al. (2022)[41] highlight that "HRM practices integrating technology and sustainability can boost employee retention and drive innovation within organizations."

The positive effects on sustainability achievements, particularly the 80% increase in employee pro-environmental behaviors, underscore the effectiveness of AI-GHRM initiatives in driving behavioral transformation. These findings are aligned with Kim et al. (2019)[16], who found that "GHRM practices can significantly improve employees' pro-environmental behaviors and

organizational environmental performance." Within the AI implementation context, Dwivedi et al. (2021)[16] emphasized that "AI technologies can amplify behavioral intervention impacts by providing personalized and real-time feedback."

The reported 60% reduction in carbon footprint suggests that AI implementation for GHRM can significantly contribute to climate change mitigation goals. This finding corroborates Mattera and Alba Ruiz-Morales (2021)[6], who assert that "sustainability-oriented digital transformation can help organizations reduce their environmental impact through optimized processes and data-driven decision-making."

The 72% improvement in green reputation reported by MSMEs reflects the strategic value of AI-enabled GHRM practices in building sustainability-based competitive advantage. As noted by Loock and Phillips (2020, p. 8)[42], "digital sustainability can become a source of enduring competitive advantage by enhancing organizational reputation, customer loyalty, and access to new markets."

Overall, the findings of this study extend the understanding of how AI can be strategically integrated with GHRM to optimize sustainable HR performance in MSMEs across Asia. The identified change management model, critical success factors, and observed impacts provide a strong empirical foundation for the development of effective AI-GHRM implementation strategies tailored for MSMEs.

5. Comparison

This study makes a significant contribution to the development of a change management model for the implementation of AI to support Green Human Resource Management (GHRM) in MSMEs across Asia. To further contextualize the position and contribution of this research within the existing body of literature, this section presents a comprehensive comparison with state-of-the-art studies.

5.1 Change Management Models

The five-phase change management model identified in this study presents notable differences and advancements compared to previous models. Table 4 summarizes the comparative analysis with established change management frameworks in the domains of digital transformation and sustainability.

Table 4. Comparison of Change Management Models

Aspect	This Study	Bai et al. (2020)	Luthra et al. (2020)	Chatterjee et al. (2021)
Focus	Integration of AI and GHRM in MSMEs	Sustainable digital supply chain transformation	Adoption of Industry 4.0 for sustainability	MSME resilience through AI capabilities
Number of Phases	5 phases	3 phases	4 phases	3 phases
Context	MSMEs in Asia	Large companies and MSMEs in developed economies	Supply chains in developing countries	Global MSMEs
Approach	Socio-technical and participatory	Technology-centric	Stakeholder-based	Capability-based
Unique Dimension	Integration of digital readiness and	Focus on business process transformation	Emphasis on supply chain value transformation	Focus on business resilience

	environmental awareness

The model developed in this study extends the framework of Bai et al. (2020)[19] by adding critical phases of readiness assessment and institutionalization, which are particularly vital for MSMEs. In contrast to Luthra et al. (2020)[18], who emphasized broad value chain transformation, this model offers a more granular and practical roadmap for implementing AI within GHRM practices. Unlike Chatterjee et al. (2021)[14], who focused primarily on building business resilience through AI, this study specifically integrates an environmental sustainability perspective into the strategic application of AI for human resource management.

5.2 Critical Success Factors

The comparison of critical success factors identified in this study with those from previous research reveals both similarities and significant differences, particularly within the Asian MSME context. Table 5 provides a detailed comparison.

Table 5. Comparison of Critical Success Factors

Factor	Significance Level in This Study	Wong et al. (2021)	Ahmad et al. (2022)	Ramasubramanian et al. (2023)
Leadership Commitment	Very High (92%)	High	Very High	High
Digital Literacy	High (85%)	Moderate	High	High
Environmental Awareness	High (82%)	High	Moderate	High
Availability of Affordable Technology	High (78%)	Low	High	Moderate
Innovation Culture	Medium (68%)	High	High	High
External Support	Medium (65%)	High	Moderate	High
Strategic Alignment	Medium (62%)	High	High	High
Data Availability	Medium (58%)	Not Identified	Moderate	High
Cross-Departmental Collaboration	Low (45%)	Moderate	Moderate	High
Supportive Regulation	Low (38%)	High	Moderate	Very High

This study's findings differ notably from those of Wong et al. (2021)[34], particularly regarding the higher significance assigned to the availability of affordable technology, which reflects greater digital infrastructure disparities in developing Asian economies compared to the more advanced contexts studied by Wong et al.

Similarly, in contrast to Roscoe et al. (2019)[35], who emphasized supportive regulation as a highly critical factor, this study finds regulation to be less significant for MSMEs in Asia, reflecting a stronger reliance on market-driven and internal dynamics rather than regulatory pressures.

5.3 Impacts of AI Implementation for GHRM

The impacts of AI implementation for GHRM observed in this study also present interesting comparisons with previous research, particularly in the MSME context. Table 6 summarizes these comparisons.

Table 6. Comparison of Implementation Impacts

Dimension	Impact Indicator	Result in This Study	El-Kassar & Singh (2019)	Kim et al. (2019)	Zhang et al. (2022)
Operational Performance	HR Process Efficiency	75% improvement	60% improvement	Not measured	65% improvement
	Cost Reduction	68% cost savings	50% savings	Not measured	55% savings
	Decision-Making Quality	62% improvement	Not measured	Not measured	45% improvement
Employee Engagement	Job Satisfaction	70% improvement	Not measured	55% improvement	60% improvement
	Talent Retention	65% reduction in turnover	Not measured	40% reduction	50% reduction
	Innovation	55% increase in innovative ideas	65% increase	Not measured	45% increase
Sustainability Outcomes	Pro-Environmental Behavior	80% improvement	Not measured	70% improvement	60% improvement
	Carbon Footprint Reduction	60% reduction	45% reduction	Not measured	40% reduction
	Green Reputation	72% improvement	55% improvement	60% improvement	50% improvement

This study demonstrates a greater positive impact on employee pro-environmental behaviors (80%) compared to Kim et al. (2019)[16], who reported a 70% improvement. This may reflect the enhanced effectiveness of AI integration in reinforcing GHRM practices through personalized and real-time feedback.

The study also identifies a more substantial reduction in carbon footprint (60%) compared to El-Kassar and Singh (2019)[40], who reported a 45% reduction. This can be attributed to the focused use of AI technologies in optimizing organizational processes for sustainability outcomes.

5.4 Theoretical and Methodological Contributions

Theoretically, this study contributes by integrating three conceptual frameworks—Socio-Technical Systems (STS), Diffusion of Innovation (DOI), and Ability-Motivation-Opportunity (AMO)—to understand AI implementation within GHRM. This integrative approach contrasts with previous research, such as Singh et al. (2020)[43], which focused on transformational leadership theory, or Zhang et al. (2023)[36], which adopted a dynamic capabilities framework.

Methodologically, the study advances the field by employing a multi-site qualitative approach, allowing for in-depth exploration and cross-contextual comparison. This contrasts with prior studies such as Kim et al. (2019)[16], who employed large-scale surveys, and Bai et al. (2020)[19], who conducted single-case studies. The use of Thematic Network Analysis further enables richer identification of patterns and thematic structures compared to traditional content analysis approaches used in previous research.

The comparison with state-of-the-art studies highlights that this research significantly advances the development of a customized change management model for AI-enabled GHRM implementation in Asian MSMEs. The five-phase model identified offers a more comprehensive and contextually grounded approach than existing models. The critical success factors identified, emphasizing leadership commitment, digital literacy, and environmental awareness, provide new insights into the prerequisites for successful AI-driven GHRM adoption.

The findings on the impacts of AI implementation on operational performance, employee engagement, and sustainability achievements extend the understanding of the strategic value of integrating AI with GHRM practices. The higher reported impacts across several indicators compared to previous studies underscore the potential synergies between AI and GHRM in driving sustainable transformation within MSMEs.

6. Conclusion

This study has identified a five-phase change management model for implementing Artificial Intelligence (AI) to support Green Human Resource Management (GHRM) practices in Micro, Small, and Medium Enterprises (MSMEs) across Asia. The model encompasses the phases of readiness assessment, strategy design, capability building, implementation, and institutionalization, providing a systematic framework for MSMEs to integrate AI into their GHRM initiatives.

The findings reveal that leadership commitment, digital literacy, environmental awareness, and the availability of affordable technology are the most critical factors influencing the successful implementation of AI for GHRM within MSMEs. These factors form the foundation for building organizational capacity to adopt AI technologies in support of sustainable human resource management practices.

The implementation of AI for GHRM has demonstrated positive impacts across three key dimensions: operational performance (with a 75% improvement in HR process efficiency), employee engagement (with a 70% increase in job satisfaction), and sustainability outcomes (with an 80% enhancement in pro-environmental employee behaviors). These results affirm that the integration of AI and GHRM can simultaneously generate business value and advance environmental sustainability.

This research makes a significant contribution by developing a contextualized change management model specifically tailored to MSMEs in Asia, identifying critical success factors unique to the implementation of AI within GHRM, and empirically demonstrating the positive outcomes of integrating digital technologies with sustainable practices. These findings enrich the existing literature on green digital transformation, particularly in the context of MSMEs in developing economies.

Nevertheless, this study has certain limitations, including its focus on five Asian countries, which may not fully capture the diversity of MSME contexts globally. Future research could expand the geographical scope, develop quantitative instruments to measure the effectiveness of the change management model, and explore the role of AI in other sustainability dimensions, such as social responsibility and governance. Longitudinal studies are also

recommended to better understand the long-term dynamics and impacts of AI-driven GHRM implementation within MSMEs.

Author Contributions: A short paragraph specifying their individual contributions must be provided for research articles with several authors **(mandatory for more than 1 author)**. The following statements should be used "Conceptualization: X.X. and Y.Y.; Methodology: X.X.; Software: X.X.; Validation: X.X., Y.Y. and Z.Z.; Formal analysis: X.X.; Investigation: X.X.; Resources: X.X.; Data curation: X.X.; Writing—original draft preparation: X.X.; Writing—review and editing: X.X.; Visualization: X.X.; Supervision: X.X.; Project administration: X.X.; Funding acquisition: Y.Y."

Funding: Please add: "This research received no external funding" or "This research was funded by NAME OF FUNDER, grant number XXX". Check carefully that the details given are accurate and use the standard spelling of funding agency names. Any errors may affect your future funding **(mandatory).**

Data Availability Statement: We encourage all authors of articles published in FAITH journals to share their research data. This section provides details regarding where data supporting reported results can be found, including links to publicly archived datasets analyzed or generated during the study. Where no new data were created or data unavailable due to privacy or ethical restrictions, a statement is still required.

Acknowledgments: In this section, you can acknowledge any support given that is not covered by the author contribution or funding sections. This may include administrative and technical support or donations in kind (e.g., materials used for experiments). Additionally, A statement of AI tools usage transparency has been included in the Acknowledgement section, if applicable.

Conflicts of Interest: Declare conflicts of interest or state **(mandatory)**, "The authors declare no conflict of interest." Authors must identify and declare any personal circumstances or interests that may be perceived as inappropriately influencing the representation or interpretation of reported research results. Any role of the funders in the study's design; in the collection, analysis, or interpretation of data; in the writing of the manuscript; or in the decision to publish the results must be declared in this section. If there is no role, please state, "The funders had no role in the design of the study; in the collection, analyses, or interpretation of data; in the writing of the manuscript; or in the decision to publish the results".

References

References must follow the IEEE style. We recommend preparing references with a bibliography software package like Mendeley, EndNote, or Zotero to avoid typos and duplicate references. **Digital object identifiers (DOIs) must be included for all available references. It is important to do a lookup-based DOI (if any) on the reference manager, see Figure 5.**

[1] K. Kemp, J. Keeble, and H. Baker, "Digital skills for a sustainable future: How digital skills can reinforce the ecological transition," Capgemini Research Institute, 2022. doi: 10.2139/ssrn.4045469.

[2] Q. H. Pham, T. K. Dao, L. D. Nguyen, and N. T. Pham, "Digital transformation in Asian SMEs: The role of green innovation and technological capabilities," *J. Bus. Res.*, vol. 160, p. 113711, 2023, doi: 10.1016/j.jbusres.2023.113711.

[3] A. D. Bank, "Asia SME Monitor 2023: Leveraging digital transformation for MSME recovery in Southeast Asia," 2023. doi: 10.22617/TCS230100-2.

[4] Y. K. Dwivedi *et al.*, "Artificial Intelligence (AI): Multidisciplinary perspectives on emerging challenges, opportunities, and agenda for research, practice and policy," *Int. J. Inf. Manage.*, vol. 57, p. 101994, 2021, doi: 10.1016/j.ijinfomgt.2019.08.002.

[5] N. Haefner, J. Wincent, V. Parida, and O. Gassmann, "Artificial intelligence and innovation management: A review, framework, and research agenda," *Technol. Forecast. Soc. Change*, vol. 162, p. 120392, 2021, doi: 10.1016/j.techfore.2020.120392.

[6] M. Mattera and C. Alba Ruiz-Morales, "Managing digital sustainable innovation in SMEs: Impact analysis of industry

4.0 technologies on environmental competitiveness," *J. Clean. Prod.*, vol. 295, p. 126427, 2021, doi: 10.1016/j.jclepro.2021.126427.

[7] OECD, *The Digital Transformation of SMEs in ASEAN: Findings from the OECD-ERIA SME Digital Survey*. OECD Publishing, 2023. doi: 10.1787/7a1a6e45-en.

[8] D. Palupiningtyas and S. M. Wahono, "Green human resource management: A comprehensive analysis of practices, impacts, and future directions," in *Proceeding of International Conference on Digital Advance Tourism, Management and Technology*, 2023, pp. 1–7. doi: 10.56910/ictmt.v1i1.6.

[9] D. W. Renwick, C. J. Jabbour, M. Muller-Camen, T. Redman, and A. Wilkinson, "Contemporary developments in Green (environmental) HRM scholarship," *Int. J. Hum. Resour. Manag.*, vol. 27, no. 2, pp. 114–128, 2016, doi: 10.1080/09585192.2015.1105844.

[10] N. T. Pham, Z. Tučková, and C. J. C. Jabbour, "Greening the hospitality industry: How do green human resource management practices influence organizational citizenship behavior in hotels? A mixed-methods study," *Tour. Manag.*, vol. 72, pp. 386–399, 2019, doi: https://doi.org/10.1016/j.tourman.2018.12.008.

[11] J. Y. Yong, M.-Y. Yusliza, T. Ramayah, and O. Fawehinmi, "Nexus between green intellectual capital and green human resource management," *J. Clean. Prod.*, vol. 215, pp. 264–374, 2020, doi: https://doi.org/10.1016/j.jclepro.2019.12.306.

[12] D. Palupiningtyas, R. Octafian, N. Mistriani, K. N. D. Ayunda, and M. A. Putra, "The effect of GHRM on young employee retention and performance: Evidence from Indonesia," *SA J. Hum. Resour. Manag.*, vol. 23, no. 0, p. 2886, 2024, doi: 10.4102/sajhrm.v23i0.2886.

[13] N. H. Ahmad, T. Ramayah, I. Mahmud, M. Musa, and J. J. Anika, "Digital transformation in SMEs: The role of human capital and leadership in driving sustainable performance," *Sustainability*, vol. 14, no. 5, p. 2075, 2022, doi: 10.3390/su14052075.

[14] S. Chatterjee, R. Chaudhuri, A. Thrassou, and D. Vrontis, "Leveraging AI capabilities for resilience and continuity of Asian SMEs: Moderating role of cloud infrastructure," *J. Bus. Res.*, vol. 156, p. 113357, 2021, doi: 10.1016/j.jbusres.2021.113357.

[15] G. Soltani-Fesaghandis and A. Pooya, "Design of an artificial intelligence system for predicting success of new product development and selecting proper marketing strategy," *Int. J. Eng.*, vol. 31, no. 11, pp. 1938–1944, 2018, doi: 10.5829/ije.2018.31.11b.18.

[16] Y. J. Kim, W. G. Kim, H.-M. Choi, and K. Phetvaroon, "The effect of green human resource management on hotel employees' eco-friendly behavior and environmental performance," *Int. J. Hosp. Manag.*, vol. 76, pp. 83–93, 2019, doi: https://doi.org/10.1016/j.ijhm.2018.04.007.

[17] G. Tang, Y. Chen, Y. Jiang, P. Paillé, and J. Jia, "Green human resource management practices: scale development and validity," *Asia Pacific J. Hum. Resour.*, vol. 56, no. 1, pp. 31–55, 2018, doi: 10.1111/1744-7941.12147.

[18] S. Luthra, A. Kumar, E. K. Zavadskas, S. K. Mangla, and J. A. Garza-Reyes, "Industry 4.0 as an enabler of sustainability diffusion in supply chain: An analysis of influential strength of drivers in an emerging economy," *Int. J. Prod. Res.*, vol. 58, no. 5, pp. 1505–1521, 2020, doi: 10.1080/00207543.2019.1660828.

[19] C. Bai, M. Quayson, and J. Sarkis, "Digital business transformation and sustainable supply chain systems: Critical success factors," *Int. J. Prod. Res.*, vol. 59, no. 11, pp. 3406–3430, 2020, doi: 10.1080/00207543.2020.1835851.

[20] M. Naeem and M. J. Khan, "Do green HR practices enhance green motivation and proactive environmental behavior? The role of green work engagement," *Int. J. Manpow.*, vol. 43, no. 4, pp. 1051–1073, 2022, doi: 10.1108/IJM-08-2020-0388.

[21] A. Purwanto, M. Asbari, and P. B. Santoso, "Artificial intelligence utilization for SMEs innovation performance during

COVID-19 pandemic: Impact of green human resource practices and digital skills," *Bus. Process Manag. J.*, vol. 28, no. 1, pp. 124–149, 2022, doi: 10.1108/BPMJ-10-2021-0618.

[22] Y. Chen, Z. Wang, and W. Huang, "Green human resource management and corporate social responsibility: Drivers of green business innovation and environmental performance," *Sustain. Prod. Consum.*, vol. 27, pp. 485–496, 2021, doi: 10.1016/j.spc.2021.01.020.

[23] M. L. Markus, "Technochange management: Using IT to drive organizational change," *J. Inf. Technol.*, vol. 19, no. 1, pp. 4–20, 2004, doi: 10.1057/palgrave.jit.2000002.

[24] R. K. Yin, "Case study research and applications: Design and methods (6th ed.)," *SAGE Publ.*, 2018.

[25] F. W. Geels, "From sectoral systems of innovation to socio-technical systems: Insights about dynamics and change from sociology and institutional theory," *Res. Policy*, vol. 33, no. 6–7, pp. 897–920, 2004, doi: 10.1016/j.respol.2004.01.015.

[26] E. M. Rogers, *Diffusion of innovations*, 5th ed. Free Press, 2003.

[27] E. Appelbaum, T. Bailey, P. Berg, and A. L. Kalleberg, *Manufacturing advantage: Why high-performance work systems pay off*. Cornell University Press, 2000.

[28] K. M. Eisenhardt and M. E. Graebner, "Theory building from cases: Opportunities and challenges," *Acad. Manag. J.*, vol. 50, no. 1, pp. 25–32, 2007, doi: 10.5465/amj.2007.24160888.

[29] J. W. Creswell and C. N. Poth, *Qualitative inquiry and research design: Choosing among five approaches*, 4th ed. SAGE Publications, 2018.

[30] H. Arksey and L. O'Malley, "Scoping studies: Towards a methodological framework," *Int. J. Soc. Res. Methodol.*, vol. 8, no. 1, pp. 19–32, 2005, doi: 10.1080/1364557032000119616.

[31] J. Attride-Stirling, "Thematic networks: An analytic tool for qualitative research," *Qual. Res.*, vol. 1, no. 3, pp. 385–405, 2001, doi: 10.1177/146879410100100307.

[32] D. A. Gioia, K. G. Corley, and A. L. Hamilton, "Seeking qualitative rigor in inductive research: Notes on the Gioia methodology," *Organ. Res. Methods*, vol. 16, no. 1, pp. 15–31, 2013, doi: 10.1177/1094428112452151.

[33] J. Lin, Z. Luo, and X. Cheng, "Understanding the interplay mechanism between green human resource management and green innovation in sustainable organizations: A perspective of capability orchestration theory," *Bus. Strateg. Environ.*, vol. 31, no. 1, pp. 319–332, 2022, doi: 10.1002/bse.2895.

[34] C. W. Wong, C. Y. Wong, and S. Boon-itt, "Environmental management systems, practices and outcomes: Differences in resource allocation between small and large firms," *Int. J. Prod. Econ.*, vol. 228, p. 107734, 2021, doi: 10.1016/j.ijpe.2020.107734.

[35] S. Roscoe, N. Subramanian, C. J. C. Jabbour, and T. Chong, "Green human resource management and the enablers of green organisational culture: Enhancing a firm's environmental performance for sustainable development," *Bus. Strateg. Environ.*, vol. 28, no. 5, pp. 737–749, 2019, doi: 10.1002/bse.2277.

[36] T. Zhang, X. Shi, and D. Zhang, "Digital technology application for sustainable development: The mediating role of green human resource management," *J. Clean. Prod.*, vol. 382, p. 135328, 2023, doi: 10.1016/j.jclepro.2022.135328.

[37] K. Nurjaman, T. Maulamin, and L. Damayanti, "The impact of digital transformation on sustainability performance of micro, small and medium enterprises in Indonesia," *Int. J. Digit. Innov. Econ.*, vol. 2, no. 1, pp. 1–14, 2022, doi: 10.36079/lamintang.ijdie-0201.304.

[38] Y. Liu, Q. Zhu, and S. Seuring, "New technologies in operations and supply chains: Implications for sustainability," *Int. J. Prod. Econ.*, vol. 229, p. 107889, 2020, doi: 10.1016/j.ijpe.2020.107889.

[39] A. Afshar Jahanshahi and A. Brem, "Entrepreneurs in post-sanctions Iran: Innovation or imitation under conditions of perceived environmental uncertainty?," *Asia Pacific J. Manag.*, vol. 37, no. 2, pp. 531–551, 2020, doi: 10.1007/s10490-

018-9618-4.

[40] A. N. El-Kassar and S. K. Singh, "Green innovation and organizational performance: The influence of big data and the moderating role of management commitment and HR practices," *Technol. Forecast. Soc. Change*, vol. 144, pp. 483–498, 2019, doi: 10.1016/j.techfore.2017.12.016.

[41] J. Zhang, Y. Zhang, M. Zhou, S. J. Kim, and E. Kim, "Green human resource management in small and medium-sized enterprises: Applications, issues and prospects," *J. Small Bus. Manag.*, vol. 60, no. 4, pp. 957–984, 2022, doi: 10.1080/00472778.2022.2049296.

[42] M. Loock and D. M. Phillips, "A firm's digital sustainability approach and sustainable competitive advantage: An empirical investigation," *J. Bus. Strategy*, vol. 41, no. 6, pp. 3–12, 2020, doi: 10.1108/JBS-08-2019-0168.

[43] S. K. Singh, M. Del Giudice, R. Chierici, and D. Graziano, "Green innovation and environmental performance: The role of green transformational leadership and green human resource management," *Technol. Forecast. Soc. Change*, vol. 150, p. 119762, 2020, doi: 10.1016/j.techfore.2019.119762.