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When Leadership Meets Talent and Technology: Understanding Drivers of Employees' Green Innovative Work Behavior

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Abstract

Introduction/Main Objectives: The objective of this study is to strengthen the theoretical and empirical understanding of the impact of Green Entrepreneurial Leadership (GEL) on employees' Green Innovative Work Behavior (EGIWB), mediated by Digital Technology Capability (DTC) and moderated by Green Talent Management (GTM). The research specifically focuses on batik MSMEs in East Java.

Background Problems: Employees' green innovative work behavior in batik MSMEs remains very limited. This is evident from the dominant use of chemical dyes, low initiative in proposing eco-friendly innovations, and minimal promotion and implementation of green practices. These shortcomings hinder the ability of batik MSMEs in East Java to adopt sustainable practices and meet market demand for environmentally friendly products.

Novelty: The novelty of this study lies in integrating three main constructs—green entrepreneurial leadership, green talent management, and digital technology capability—to explain employees' green innovative work behavior. Few previous studies have examined the interrelationship of these variables simultaneously, particularly in traditional creative industries such as batik, which are currently adapting to sustainability and digitalization demands.

Research Methods: A quantitative methodology was utilized to gather data from 220 batik MSME owners in East Java through accidental–purposive sampling, ensuring respondents were active, had at least three years of business experience, and were willing to utilize digital platforms. The data were analyzed via PLS-SEM with SmartPLS to evaluate the hypotheses.

Findings/Results: The results indicate that Green Entrepreneurial Leadership (GEL) significantly enhances Employees' Green Innovative Work Behavior (EGIWB). Moreover, Green Talent Management (GTM) mediates this relationship, while Digital Technology Capability (DTC) acts as a moderator that strengthens the influence of GEL on EGIWB.

Conclusion: Green Entrepreneurial Leadership (GEL) enhances Employees' Green Innovative Work Behavior (EGIWB) through effective Green Talent Management (GTM) and strong Digital Technology Capability (DTC).

Keywords: Green Entrepreneurial Leadership; Green Talent Management; Digital Technology Capability; Green Innovative Work Behavior; Batik MSMES

Introduction

The development of digital technology has become a major driver of transformation across economic sectors (Khairi, 2025), including Micro, Small, and Medium Enterprises (MSMEs), which form the backbone of Indonesia's economy (Eli Fujawati et al., 2023). Among creative economy subsectors, batik MSMEs in East Java hold strategic importance as they represent cultural heritage while contributing significantly to economic growth (Perkembangan, n.d.; et al., 2022). However, amid globalization and digitalization, these enterprises face significant challenges in maintaining relevance and competitiveness (Baihaqy et al., 2024).

One critical issue is the limited adoption of digital platforms for marketing, social media, content creation, and payment systems, largely due to low digital literacy and inadequate resources (Muazza et al., 2025). At the same time, growing consumer demand for eco-friendly products and increasing global competition require batik MSMEs to innovate not only in design but also in production processes and business models that align with sustainability principles (Dahlena et al., 2025; SOEWARNO et al., 2020). Digitalization offers opportunities to enhance operational efficiency, expand market reach, and accelerate green innovation (Setyaningrum & Muafi, 2023). Yet, its implementation remains constrained by traditional organizational culture and limited technological readiness (Wulandari et al., 2024).

To address these challenges, developing employees' digital capabilities and fostering green-oriented leadership are essential (Rahmayanti et al., 2024). Visionary, pro-environmental leadership is considered capable of guiding cultural transformation toward greener practices (Omarova & Jo, 2022). Furthermore, individual proactivity and organizational learning play a vital role in building digital technology capability, which is critical for integrating technology into sustainable innovation (Chen & Zheng, 2022). Prior research has emphasized the significance of proactive personality and organizational learning in driving innovation (Kim et al., 2009), but few have explored their combined impact on digital capability and green innovation within traditional craft industries such as batik (Rahmat et al., 2024).

This study seeks to address this gap by employing Social Exchange Theory (SET) as a theoretical foundation (Cropanzano & Mitchell, 2005). The primary objective is to examine the role of proactive personality and organizational learning in shaping digital capabilities that drive sustainable innovation among East Javanese batik MSMEs (Tran et al., 2024).

Green Entrepreneurial Leadership (GEL) plays a critical role in fostering environmentally oriented innovative behavior among employees, particularly within MSMEs in East Java. Leaders who embrace green entrepreneurial principles not only inspire but also empower employees to develop eco-friendly innovations and cultivate a sustainability-driven organizational culture (Sari & Widodo, 2024; Brown et al., 2024). Drawing on Social Exchange Theory (Blau, 1964) and Social Learning Theory (Bandura, 1977), prior research demonstrates that leaders' trust, support, and role modeling significantly enhance employee engagement, creativity, and ecological commitment (Zhang et al., 2025).

H1: Green Entrepreneurial Leadership has a positive influence on Employees' Green Innovative Work Behavior.

In the sustainability era, Green Talent Management (GTM) is essential for achieving environmentally responsible business objectives (Umair, Waqas, & Mrugalska, 2024). GEL drives GTM success by embedding sustainability values and promoting green innovation (Ecohumanism, 2024). According to Social Exchange Theory (Blau, 1964), leaders who provide training, support, and role modeling foster employee loyalty and motivation toward green practices (Yu et al., 2024). GEL thus strengthens GTM effectiveness by creating a

collaborative and innovative culture that enables MSMEs to develop eco-conscious talent (MSEJ, 2024).

H2: Green Entrepreneurial Leadership positively affects Green Talent Management.

GTM serves as a strategic approach to developing competent employees committed to sustainability (Umair et al., 2024; Fitriyani, 2023). Based on Social Exchange Theory (Cropanzano & Mitchell, 2005), organizational support through training and empowerment enhances employee motivation and participation in green innovation (Zhang & Liu, 2024; Wang et al., 2023). Effective GTM practices, reinforced by green leadership, encourage adaptive capacity and readiness to address environmental and digital challenges (Odugbesan et al., 2023).

H3: Green Talent Management positively influences Employees' Green Innovative Work Behavior.

GEL plays a pivotal role in advancing sustainable innovation in batik MSMEs (Yan et al., 2024). Social Exchange Theory (Blau, 1964; Chernyak-Hai & Rabenu, 2018) suggests that leaders' support and role modeling foster employee engagement and innovation. GTM acts as a mediator by providing training, psychological empowerment, and rewards, thereby enhancing employee capability and motivation (Putri, 2025; Peng & Chen, 2023; Fitriyani, 2023). GTM builds dynamic capabilities for sustainable innovation, such as natural dye usage and energy-efficient production (Al-Romeedy & Alharethi, 2024).

H4: Green Talent Management mediates the relationship between Green Entrepreneurial Leadership and Employees' Green Innovative Work Behavior.

In the digital transformation era, Digital Technology Capability (DTC) is a key enabler that strengthens the impact of GEL on employees' green innovative behavior (Abdurrahman et al., 2024; Setyaningrum et al., 2023). DTC facilitates digital design platforms, online marketing, integrated production systems, and green technologies, supporting eco-innovation (Blau, 1964; Chernyak-Hai & Rabenu, 2018). Acting as a moderator, DTC enhances collaboration, data-driven decision-making, and responsiveness to leadership vision, thereby increasing efficiency and sustainable innovation (Wang, Niu et al., 2024; Amie Kusumawaxdhani et al., 2023).

H5: Digital Technology Capability positively moderates the relationship between Green Entrepreneurial Leadership and Employees' Green Innovative Work Behavior in batik MSMEs.

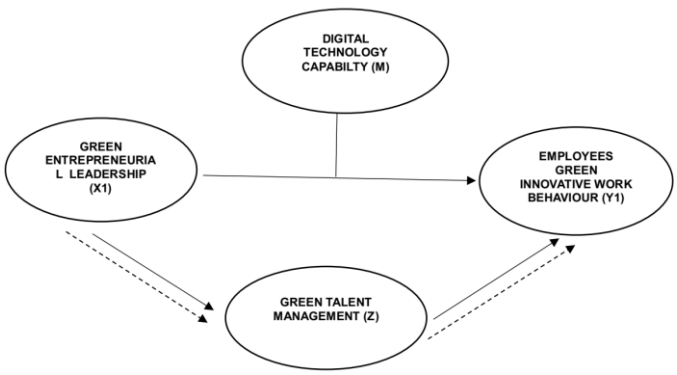

Figure 1. Conceptual Framework
Source: Author's Work, 2025.

Research Methods

This study employed a quantitative research design to examine the relationships among Green Entrepreneurial Leadership (GEL), Green Talent Management (GTM), Digital Technology Capability (DTC), and Employees' Green Innovative Work Behavior (EGIWB) within the context of batik MSMEs in East Java. The primary objective was to test a conceptual framework that integrates leadership, talent management, and technological capability to predict green innovative behavior. The use of a quantitative approach was deemed appropriate because it allows for hypothesis testing and the identification of causal relationships through statistical modeling (Rahmawati et al., 2024).

The population of this research consisted of owners and artisans actively engaged in batik MSMEs across East Java. These enterprises were selected because they represent a traditional creative industry currently facing sustainability and digitalization challenges (Azhar & Evanthi, 2024). The sampling technique applied was accidental–purposive sampling, ensuring that respondents met specific criteria: (1) actively involved in batik production, (2) possessing at least three years of business experience, and (3) demonstrating willingness to adopt digital platforms for marketing and innovation. A total of 220 respondents were successfully recruited, which satisfies the minimum sample size requirements for Partial Least Squares Structural Equation Modeling (PLS-SEM) analysis (Hair et al., 2021).

Table 1. Measurement Variable

Variable & Source	Indicator Code	Measurement Items
Green Entrepreneurial Leadership (GEL) (Adapted from Kautonen et al., 2023; Singh et al., 2023; Li et al., 2022)	GEL1	Leaders demonstrate commitment to environmentally friendly principles in every business decision.
	GEL2	Leaders encourage innovation that supports environmental sustainability.
	GEL3	Leaders inspire employees to contribute to green business practices.
	GEL4	Leaders exemplify environmentally friendly behavior in daily activities.
	GEL5	Leaders are willing to take risks in implementing environmentally oriented solutions.
	GEL6	Leaders collaborate with external parties to create green innovations.
Green Talent Management (GTM) (Adapted from Otoo & Mishra, 2022; Renwick et al., 2013; Saeed et al., 2019)	GTM1	The company recruits employees with an environmental focus.
	GTM2	The company provides training on environmental innovation and sustainability.
	GTM3	The company has a reward system for employees who demonstrate environmentally friendly behavior.
	GTM4	The company conducts performance evaluations based on contributions to green practices.
	GTM5	The company provides career development opportunities for employees with green competencies.
Employees' Green Innovative Work Behavior (EGIWB) (Adapted from Chen	GIWB1	I have successfully created creative green products that consumers love.
	GIWB2	I am fully involved in the process of creating innovative green products.

& Chang, 2013; Fawehinmi et al., 2020; Shao et al., 2022)	GIWB3	I am flexible in finding solutions to green product development challenges.
	GIWB4	I am able to collaborate effectively in teams to create environmentally friendly products.
	GIWB5	I actively share ideas and knowledge for green product innovation.
	GIWB6	I quickly identify new ideas that benefit green innovation.
Digital Technology Capability (DTC) (Adapted from Abdurrahman et al., 2024; Wang et al., 2024; Setyaningrum et al., 2023)	DTC1	The company uses digital technology in its environmentally friendly production processes.
	DTC2	I have the ability to use digital applications to support green product innovation.
	DTC3	The company utilizes digital platforms for marketing sustainable products.
	DTC4	Digital technology helps me work more efficiently.
	DTC5	The company provides digital technology training for the development of green innovation projects.

Source: Author's Work, 2025.

Data were collected through a structured questionnaire distributed to batik MSME owners and artisans. The instrument was designed to measure four latent constructs: GEL, GTM, DTC, and EGIWB. Each construct was operationalized using validated indicators adapted from prior studies, such as Kautonen et al. (2023) for GEL, Renwick et al. (2013) for GTM, Chen & Chang (2013) for EGIWB, and Abdurrahman et al. (2024) for DTC. Respondents were asked to rate their agreement on a five-point Likert scale ranging from "strongly disagree" to "strongly agree." This approach ensured consistency and comparability across responses while minimizing measurement bias.

The collected data were analyzed using Partial Least Squares Structural Equation Modeling (PLS-SEM) with SmartPLS software (version 4.1.1.4). PLS-SEM was chosen because it is suitable for predictive modeling and theory development, particularly when dealing with complex models and relatively small sample sizes (Hair et al., 2021). The analysis involved two stages: (1) assessment of the measurement model to evaluate reliability and validity through indicators such as Cronbach's Alpha, Composite Reliability, and Average Variance Extracted (AVE), and (2) evaluation of the structural model to test hypotheses using path coefficients, t-statistics, and p-values obtained through bootstrapping procedures.

Ethical compliance was maintained throughout the research process. Participation was voluntary, and respondents were assured of confidentiality and anonymity. Data were used solely for academic purposes, and informed consent was obtained prior to questionnaire administration. Despite these precautions, the study acknowledges certain limitations, including reliance on self-reported data, which may introduce common method bias, and the cross-sectional design, which restricts causal inference. Future research could address these limitations by employing longitudinal designs and incorporating qualitative methods for deeper insights (Rahmat et al., 2024).

Result

Sample Characteristics

The study analyzed responses from 220 participants comprising owners and artisans of batik MSMEs in East Java. Most respondents were aged 35–44 years (38.6%), followed by 20–25 years (27.3%), 45–54 years (20.5%), and less than 25 or more than 54 years (each 6.8%). Business tenure was predominantly 6–10 years (36.4%), with smaller proportions in 3–5 years (31.8%), more than 10 years (22.7%), and less than 3 years (9.1%). Firm size was largely micro-scale, with 1–5 employees (40.9%), followed by 6–10 employees (31.8%), 11–20 employees (18.2%), and more than 20 employees (9.1%). The majority operated handwritten batik businesses (54.5%), while others specialized in stamped batik (31.8%) or a combination of both (13.6%). Digital technology usage was uneven, with most reporting occasional use (36.4%), followed by frequent (27.3%), rare (22.7%), and very frequent (13.6%) adoption. These characteristics reflect the traditional and resource-constrained nature of batik MSMEs and their transitional stage in digitalization (see Table 2).

Table 2. Respondent Demographics

Variable	Category / Scale	Frequency (f)	Percentage (%)
Gender	Male	130	59.1
	Female	90	40.9
Age	< 25	15	6.8
	20–25	60	27.3
	35–44	85	38.6
	45–54	45	20.5
	> 54	15	6.8
Business Duration	< 3 years	20	9.1
	3–5 years	70	31.8
	6–10 years	80	36.4
	> 10 years	50	22.7
Number of Employees	1–5 employees	90	40.9
	6–10 employees	70	31.8
	11–20 employees	40	18.2
	> 20 employees	20	9.1
Type of Batik Business	Handwritten (Tulis)	120	54.5
	Stamped (Cap)	70	31.8
	Combination (Tulis & Cap)	30	13.6
Frequency of Digital Technology Use	Rarely	50	22.7
	Occasionally	80	36.4
	Often	60	27.3
	Very often	30	13.6

Source: Author’s Work, 2025.

Measurement Model

Convergent validity was confirmed as all indicators exhibited loading factors ≥ .70. Average Variance Extracted (AVE) values exceeded .50 for all constructs: Digital Technology Capability (DTC) = .739, Employees' Green Innovative Work Behavior (EGIWB) = .927, Green Entrepreneurial Leadership (GEL) = .720, and Green Talent Management (GTM) = .831. Reliability was strong, with Cronbach's alpha ranging from .912 to .984 and composite reliability (rho_c) between .934 and .987, surpassing recommended thresholds. These results indicate that the measurement model demonstrates robust validity and reliability.

Discriminant Validity

Discriminant validity was assessed using the Fornell–Larcker criterion. The square roots of AVE for each construct (DTC = .859; EGIWB = .963; GEL = .849; GTM = .912) exceeded inter-construct correlations, confirming adequate discriminant validity. The strongest correlation was observed between GTM and EGIWB (.789), followed by GEL–GTM (.751) and GEL–DTC (.700), all remaining below the respective √AVE values.

Table 3. Validity and Reliability Test Results

Construct	Cronbach's Alpha	Composite Reliability (rho_a)	Composite Reliability (rho_c)	Average Variance Extracted (AVE)
Digital Technology Capability (DTC)	0.912	0.917	0.934	0.739
Employee Green Innovative Work Behavior (EGIWB)	0.984	0.985	0.987	0.927
Green Entrepreneurial Leadership (GEL)	0.921	0.929	0.939	0.72
Green Talent Management (GTM)	0.949	0.952	0.961	0.831

Source: Author's Work, 2025.

Model Fit

The structural model's goodness of fit (GoF) was evaluated using Tenenhaus' formula. GTM demonstrated a GoF of .696 (high), EGIWB .837 (very strong), and DTC .161 (low). These results indicate that the model effectively explains GTM and EGIWB, while DTC's direct explanatory power is limited, reflecting its contextual role in the model.

Table 4. Fornell–Larcker Criterion

Construct	DTC	EGIWB	GEL	GTM
Digital Technology Capability (DTC)	0.859			
Employee Green Innovative Work Behavior (EGIWB)	0.679	0.963		
Green Entrepreneurial Leadership (GEL)	0.7	0.747	0.849	
Green Talent Management (GTM)	0.629	0.789	0.751	0.912

Source: Author's Work, 2025.

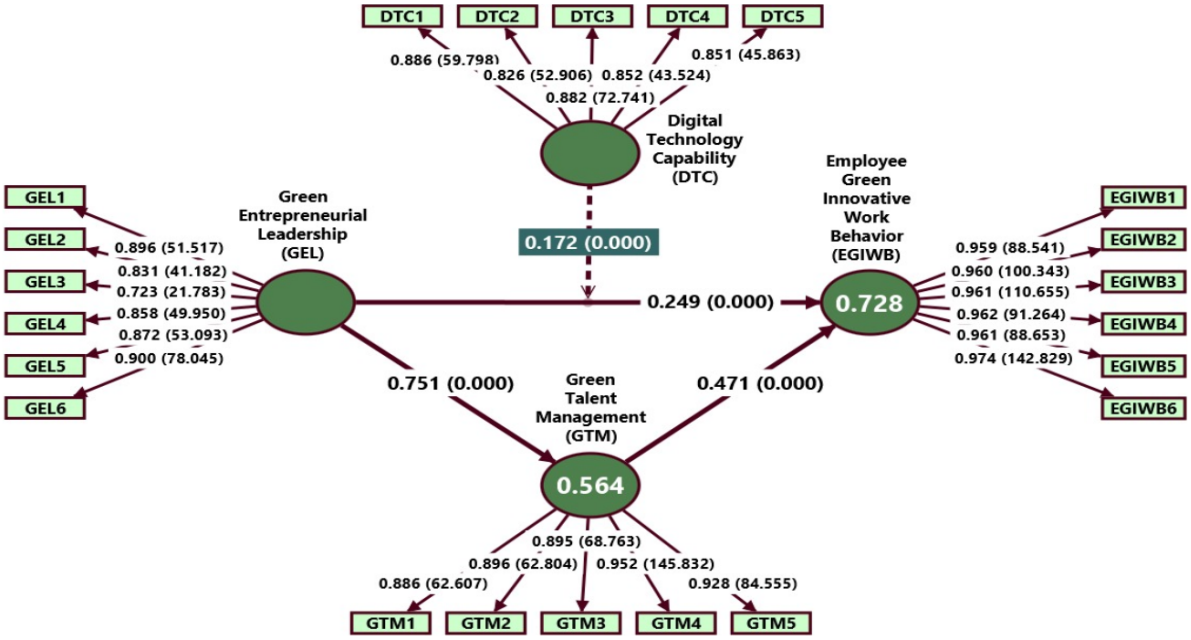

Figure 1. Inner Model Measurement
Source: Author's Work, 2025.

Table 5. Hypotheses Test Results

Path	Original Sample (O)	T Statistics (O/STDEV)	P Values	Inference
Direct Effect				
GEL → EGIWB	0.249	4.223	0	Positive Significant Effect; H1 Supported
GEL → GTM	0.751	24.535	0	Positive Significant Effect; H2 Supported
GTM → EGIWB	0.471	9.271	0	Positive Significant Effect; H3 Supported
Specific Indirect Effect				
GEL → GTM → EGIWB	0.354	8.33	0	Positive Significant Effect; H4 Supported; Sequential Mediation
Moderating Effect				
DTC × GEL → EGIWB	0.172	4.777	0	Positive Significant Effect; H5 Supported; Sequential Moderation

Source: Author's Work, 2025.

Direct Effects

Hypothesis testing revealed significant direct effects. GEL positively influenced EGIWB (O = .249, t = 4.223, p < .001), supporting H1. GEL strongly affected GTM (O = .751, t = 24.535, p < .001), confirming H2. GTM positively impacted EGIWB (O = .471, t = 9.271, p < .001),

validating H3. These findings underscore the central role of leadership and talent management in driving green innovative behavior.

Indirect Effect

The mediation analysis demonstrated that GTM significantly mediates the relationship between GEL and EGIWB ($O = .354$, $t = 8.330$, $p < .001$), supporting H4. This sequential mediation suggests that leadership's green orientation translates into structured talent management practices, which subsequently foster employees' green innovation.

Moderating Effect

The interaction term (DTC × GEL → EGIWB) was significant ($O = .172$, $t = 4.777$, $p < .001$), supporting H5. This indicates that digital technology capability strengthens the positive influence of green leadership on employees' innovative behavior.

Total Effect

The total effect of GEL on EGIWB was substantial ($O = .603$, $t = 11.472$, $p < .001$), reflecting the combined direct and indirect contributions of leadership to green innovation outcomes.

Integrated Interpretation

Overall, the model reveals a leadership–talent–behavior chain: GEL strongly shapes GTM, which in turn drives EGIWB, alongside a direct leadership effect. DTC's role is primarily as a moderator, amplifying leadership's impact when technological readiness exists. These findings align with the demographic reality of uneven digital adoption among small, artisan-led firms.

Practical Implications

For batik MSMEs, the results suggest prioritizing green leadership and talent management as strategic levers for sustainability. Investments in digital capability, while not immediately transformative, can enhance leadership effectiveness and innovation responsiveness. A phased approach combining green leadership, structured HR practices, and targeted digital upskilling is recommended to bridge the gap between sustainability vision and technological readiness.

Discussion

The findings of this study confirm that all proposed hypotheses were supported, demonstrating the significant roles of Green Entrepreneurial Leadership (GEL) and Green Talent Management (GTM) in shaping Employees' Green Innovative Work Behavior (EGIWB). Higher implementation of green-oriented leadership and effective talent management practices strongly correlate with employees' tendency to engage in environmentally innovative behaviors, generate sustainable ideas, and develop eco-friendly products. These results align with prior research emphasizing that innovation in MSMEs is not solely driven by individual motives but is substantially influenced by social dynamics, leadership practices, and collaborative human resource management (Guha et al., 2025; Gürbüz et al., 2024).

GEL and Employees' Green Innovative Work Behavior

The analysis revealed that GEL exerts a positive and significant impact on EGIWB, consistent with previous studies (Yan et al., 2024). In the context of batik MSMEs, GEL manifests through leaders' initiatives to adopt cleaner production practices, willingness to explore environmentally

friendly market opportunities, and ability to inspire employees to prioritize ecological issues. Employees who perceive strong green leadership tend to demonstrate greater initiative in creating innovations such as natural dye usage and wastewater recycling systems. These findings reinforce Social Exchange Theory (SET), suggesting that perceived organizational support from ecologically oriented leaders fosters reciprocal behaviors, including green innovation.

GTM and Employees' Green Innovative Work Behavior

The study also confirmed that GTM significantly influences EGIWB, supporting earlier research that highlights the role of green HRM practices in shaping employee competencies and motivation for ecological innovation (Ahmad & Ahmad, 2020; Masri et al., 2023). In batik MSMEs, GTM is reflected in sustainability-focused recruitment, training programs on eco-friendly production techniques, and reward systems for employees who successfully implement green innovations. Such practices create an environment that enhances employees' readiness and motivation to engage in sustainable innovation initiatives.

Mediating Role of GTM

The mediation analysis demonstrated that GTM serves as a critical mechanism through which GEL affects EGIWB. This finding aligns with the Ability–Motivation–Opportunity (AMO) framework, which posits that talent management practices enhance employees' capabilities through training, strengthen motivation via recognition and rewards, and provide opportunities through supportive work structures (Renwick et al., 2013; Appelbaum et al., 2000). Empirical evidence suggests that leaders who adopt green entrepreneurial principles are more likely to institutionalize GTM policies, thereby reinforcing employees' innovative behaviors.

Moderating Role of Digital Technology Capability

The moderating effect of Digital Technology Capability (DTC) introduces an important nuance. While DTC significantly strengthens the relationship between GEL and EGIWB, its overall contribution remains modest due to structural limitations in the batik sector. Low digital literacy, reliance on manual production techniques, and limited integration of digital tools into green workflows hinder the full realization of DTC's potential (Pingali et al., 2023; Hu et al., 2025). This highlights an implementation gap between sustainability vision and technological readiness, suggesting that digital capability development must accompany leadership and HR interventions to achieve comprehensive green innovation.

Practical and Theoretical Implications

Theoretically, this study expands the literature on green leadership and HRM within MSMEs by integrating Social Exchange Theory and the AMO framework. It demonstrates that leadership effectiveness in promoting green innovation depends on structured talent management and contextual technological readiness. Practically, the findings suggest that batik MSMEs should prioritize green leadership and GTM as foundational strategies while gradually investing in digital capability to amplify innovation outcomes.

Conclusion

This study concludes that green transformation and sustainable innovation in batik MSMEs in East Java depend heavily on the synergy between leadership and human resource management practices. The findings confirm that Green Entrepreneurial Leadership (GEL) and Green Talent Management (GTM) significantly and positively influence Employees' Green Innovative Work Behavior (EGIWB), consistent with Social Exchange Theory, which

emphasizes the importance of reciprocal relationships. The mediating role of GTM further reinforces these results, demonstrating that a leader's ecological vision must be translated into structured talent management strategies to generate tangible green innovative behaviors among employees.

However, the most notable and cautionary finding relates to the moderating role of Digital Technology Capability (DTC). The analysis indicates that DTC has not yet fully strengthened the positive relationship between green leadership and innovative behavior. This gap suggests that although batik MSMEs exhibit strong green-oriented commitments, limited digital literacy and resistance to technological change hinder the efficient execution of sustainability-driven innovations. This insight contributes to the literature by illustrating that the integration of sustainability and digitalization is highly contextual and not automatic, particularly in traditional sectors reliant on local wisdom.

Research Limitations

The study was limited to batik MSMEs in East Java, which possess unique cultural and operational characteristics, restricting generalizability to other creative sectors. The reliance on self-reported survey data introduces potential bias, and the cross-sectional design limits causal inference. Additionally, the research focused on four primary constructs—GEL, GTM, DTC, and EGIWB—while other influential factors such as organizational culture, environmental motivation, and regulatory support were not examined.

Suggestions for Future Research

Future studies should broaden the scope to include diverse creative MSME sectors such as eco-tourism, handicrafts, and green culinary businesses. Employing longitudinal designs would allow observation of how GTM and DTC evolve over time and influence green innovation. Incorporating qualitative approaches, such as interviews or ethnographic studies, could provide deeper insights into cultural and social dynamics. Further research should also consider additional variables, including green transformational leadership, digital literacy, and government incentives, to develop a more comprehensive model of green innovative work behavior. Exploring the role of advanced technologies, such as AI-driven design tools and green marketplaces, may also offer valuable contributions to theory and practice.

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