Human Resources Management and Services 2026, 8(1), 5629.
https://doi.org/10.18282/hrms5629

Article

Green leadership and digital innovation in enhancing environmental performance: Evidence from Ghanaian SMEs through the lens of institutional theory

Junhui Han[1], Joshua Kojo Bonzo[1,*], Philip Adu Sarfo[2], Vivian Osafo Amoako[1], Nathan Awelama Atigah[1], Sackey Naa Adjeley[1], Maclean Kwasi Fiati[3]

[1] Department of Economics and Management, Taiyuan University of Technology, Taiyuan 030024, China
[2] School of Management, Zhengzhou University, Zhengzhou 450001, China
[3] Lally School of Management, Rensselaer Polytechnic Institute, Troy, NY 12180, USA
*** Corresponding author:** Joshua Kojo Bonzo, bonzokojo@gmail.com

CITATION

Han J, Bonzo JK, Sarfo PA, et al. (2026). Green leadership and digital innovation in enhancing environmental performance: Evidence from Ghanaian SMEs through the lens of institutional theory. Human Resources Management and Services. 8(1): 5629. https://doi.org/10.18282/hrms5629

ARTICLE INFO

Received: 26 December 2025
Accepted: 9 January 2026
Available online: 19 January 2026

Abstract: Small and medium-sized enterprises (SMEs) play a critical role in achieving environmental sustainability, particularly in developing economies where regulatory enforcement and resource constraints remain significant challenges. Drawing on Institutional Theory, this study examines how green leadership influences environmental performance in Ghanaian SMEs, with digital innovation as a mediating variable and environmental culture as a moderating variable. Institutional Theory provides the conceptual foundation for explaining how normative pressures embedded in leadership values and organizational culture, alongside mimetic pressures associated with digital innovation adoption, shape firms' environmental outcomes. Using survey data collected from SMEs in Ghana and analyzed using Partial Least Squares Structural Equation Modeling (PLS-SEM), the results revealed that green leadership has a significant positive effect on both digital innovation and environmental performance. Digital innovation also significantly enhances environmental performance and partially mediates the relationship between green leadership and environmental performance. Notably, the findings demonstrated that environmental culture significantly moderates the relationship between digital innovation and environmental performance, with the effect stronger in organizations with a well-developed environmental culture. This indicates that internalized environmental values amplify the effectiveness of digital innovation initiatives. The study contributes to the sustainability and organizational literature by extending Institutional Theory to the SME context in a developing economy and by clarifying the conditional role of environmental culture in translating digital innovation into superior environmental performance. Practically, the findings suggest that SME leaders and policymakers should promote environmentally oriented leadership, invest in digital innovation, and cultivate strong environmental cultures to enhance sustainability outcomes.

Keywords: green leadership; digital innovation; green human resource practices; environmental culture; environmental performance; institutional theory

1. Introduction

Sustainability has shifted from a marginal issue to a core strategic priority for modern organizations, especially in emerging economies like Ghana. Increasing global environmental degradation, stakeholder pressure, and stricter regulatory frameworks have forced firms to incorporate environmental, social, and governance (ESG) considerations into their strategic planning (Lisniak, 2024; Van Tulder et al., 2021). The worldwide dedication to achieving the United Nations Sustainable

Development Goals, particularly SDG 13 (Climate Action), has increased the urgency for companies to adopt sustainable practices. This commitment requires organizations worldwide to take responsibility for their ecological footprint and implement measures to mitigate environmental impact (Van Tulder et al., 2021). Consequently, sustainability has become one of the most important key themes in corporate strategy, with firms striving to reduce carbon emissions, minimize waste, and increase resource efficiency while remaining competitive in a rapidly changing marketplace.

Theoretically, Institutional Theory offers a valuable lens for understanding how external and internal influences shape organizational actions. Under Institutional Theory, organizations face pressures from coercive government regulations and policies, normative influences reflecting societal values and professionalism, and mimetic processes that promote the emulation of successful or legitimate practices within a given sector or industry (DiMaggio & Powell, 1983; Scott, 2014). With regard to environmental sustainability, the growing influence of these 'institutions' pushes business organizations, especially small-scale enterprises, towards adopting environmentally conscientious leadership practices and related organizational practices.

Organizational sustainability is now attainable solely through innovative solutions and leadership approaches that increase efficiency and reduce waste, while building long-term organizational resilience to improve societal well-being. Green leadership drives this change, linked to sustainability at every level of an organization's guiding principles, where shared concern and care most fundamentally relate to environmental stewardship (DiBella et al., 2023). Within an institutional framework, green leadership reflects normative pressures, as leaders internalize and transmit socially accepted environmental values and expectations throughout the organization (Dubey et al., 2015). Green leadership sets the pace for sustainability goals within an organization and ensures that the organizational culture is aligned with these goals. Complementing this is the rising digital innovation, which is crucial for optimizing resource use and increasing efficiency to enhance organizational performance (Miao & Nduneseokwu, 2025). From an institutional perspective, digital innovation is often driven by mimetic pressures, as firms emulate technologically advanced or environmentally successful peers to enhance legitimacy and performance (Liang et al., 2023). With technological advancement, organizations are better positioned to reduce waste, improve energy efficiency, and monitor environmental performance, all of which are crucial to the overall sustainability agenda (Tasleem et al., 2019).

While some studies have examined the relationship between green leadership, digital innovation, and sustainability, the manner in which internal organizational conditions, particularly environmental culture, shape the effectiveness of these relationships remains insufficiently explored (Cui, 2025). Organizational culture, including shared values, beliefs, and practices, has increasingly been recognized as a key factor in advancing sustainability and as a major driver of digital technology adoption. An environmental culture reflects the extent to which environmental values are internalized within the organization, thereby transforming external institutional pressures into shared norms and routines (Caprar & Neville, 2012). This environmental culture would align the collective mindset with sustainability goals,

ensuring that environmental considerations are infused into every aspect of the organization's operations (Daud et al., 2019; Loeser et al., 2017). It has been found that organizations with strong environmental cultures are more likely to adopt digital technologies that support sustainability and thus realize significant environmental benefits (Javaid et al., 2022). The impact of digital transformation in reshaping organizational structures and cultures is well documented. Typically, digitalization will require new leadership roles and strategic frameworks that combine technological innovations with sustainability goals.

The focus of the present study is not digital leadership per se, but rather digital innovation as an organizational capability that translates institutional pressures and leadership orientations into environmental performance outcomes. Accordingly, digital innovation is examined as a central mediating mechanism linking green leadership to environmental performance. Based on the above findings, a single research framework is developed, encompassing green leadership and digital innovation, to investigate the interactive relationship between the two concepts and their relationship with environmental performance. Based on Institutional Theory, the research work illustrates how the pressure for normalization, associated with the adoptability for mimetic innovations, and the incorporation of environmental values, together, have a positive effect on sustainability. Moreover, the research identified influencing factors related to the function of green human resource practices (GHRPs) and the moderating effect of environmental culture.

The novelty of this study lies in three key contributions. Firstly, this article combines leadership behavior, technological capabilities, and organizational culture within the Institutional Theory framework. Secondly, this article proposes a scenario that has been empirically tested under the environment of Ghanaian SMEs. Thirdly, this article has helped validate an existing PLS-SEM model that explains the moderators of sustainability outcomes.

2. Theoretical framework and literature review

2.1. Theoretical framework

Institutional theory offers a solid basis for understanding how organizations respond to environmental pressures and adopt sustainable practices. According to Meyer and Rowan (1977), the organizations seek legitimacy by aligning their activities with socially accepted norms, values, and expectations. In sustainability contexts, institutional theory explains how external pressures, coercive (regulatory), mimetic (competitive), and normative (social and professional) influence firms to adopt environmental practices for legitimacy and survival (Colwell & Joshi, 2011; Wijethilake et al., 2017).

According to Ren et al. (2023), the mechanisms that drive organizational behavior within institutional theory are categorized into three main types: coercive, mimetic, and normative pressures. Coercive pressures originate from external forces, such as regulatory and stakeholder demands, that compel organizations to adopt specific practices to meet legal and societal expectations. For instance, Colwell et al. (2011) confirm that institutional pressures significantly influence organizational responsiveness to environmental responsibilities, highlighting the interplay of

coercive, mimetic, and normative pressures in shaping organizational practices. Mimetic pressures arise in uncertain environments, where organizations imitate the successful practices of peers to maintain competitiveness and legitimacy. For example, a company might adopt a new technology because a competitor has successfully implemented it. On the other hand, normative pressures are driven by professional norms and societal values, influencing organizations to adopt practices that resonate with cultural expectations. For instance, a company might implement a diversity and inclusion program to align with societal values (Ren et al., 2023; Wijethilake et al., 2017).

Institutional theory can be applied to this research to provide a clear understanding of the interactive relationships among green leadership, digital innovation, and green HR practices, and their impact on green performance. Green leadership reflects normative isomorphic pressures, in which leaders' personal values align with green ideals, leading them to enforce green values within the organization (Alwali & Alwali, 2025; Liang et al., 2023). Green HR practices reflect both coercive and normative isomorphic pressures, forcing organizations to incorporate green practices into their HR policies, including employee selection, training, and HR appraisal systems (Zhang et al., 2024). Coercive pressures, such as climate action mandates, encourage organizations to adopt green technologies and sustainable practices. For example, Wijethilake et al. (2017) demonstrate how coercive sustainability pressures from government and regulatory bodies force organizations to adopt sustainable practices. Mimetic pressures motivate firms to imitate industry leaders in digital innovation, incorporating advanced technologies like artificial intelligence (AI) and the Internet of Things (IoT) into their environmental management systems (EMS). Normative pressures foster a cultural shift within organizations, embedding sustainability into key HR practices such as recruitment, training, and performance management (Kooij et al., 2012; Ren et al., 2023). This focus on the role of institutional theory in understanding green leadership integration offers a comprehensive view of the strategic approach to sustainability, ensuring the audience remains well-informed.

Furthermore, institutional theory posits that the institutionalization of sustainability-oriented practices results from organizations' responses to external pressures. Alvarado (2022) argues that these practices are shaped not only by external forces but also by internal mechanisms of leadership, innovation, and organizational culture. In this respect, green leadership is a strategic response to normative and coercive pressures, integrating sustainability into decision-making and employee practices. Digital innovation enables organizations to counter pressures to conform by adopting environmentally efficient technologies. Environmental culture plays its part in this process by reinforcing the integration of institutional pressures into sustainability initiatives (Jia et al., 2023; Lee, 2024).

Institutional theory, therefore, provides a comprehensive framework for analyzing organizational sustainability by emphasizing the dynamic interaction between external institutional pressures and internal organizational adaptations. By explaining how coercive, mimetic, and normative pressures jointly shape the adoption and institutionalization of green leadership, digital innovation, and GHRPs, the theory offers a robust foundation for examining environmental performance in SMEs (Adams

et al., 2022; Napathorn, 2022).

2.2. Literature review

Organizations are facing sustainability challenges of unprecedented scale, requiring transformational responses from leadership in today's business environment. As global environmental concerns grow, leadership can play a vital role in promoting social, ethical, environmental, and economic sustainability (Woo & Kang, 2020). Today, leaders are expected to reshape organizational objectives to align with environmental imperatives that support the global sustainability framework and foster long-term stakeholder trust. Thus, from the institutional theory viewpoint, this leadership behavior might be viewed as organizational responses to coercive forces, such as environmental regulations, and to normative pressures, such as social and professional beliefs, and mimesis, such as imitating or following successful organizations in their efforts to protect the environment (Kauppi, 2022; Ren et al., 2023). Furthermore, leadership, according to this viewpoint, acts as a conduit through which external pressures from the environment are channeled within organizations (Bleiklie et al., 2015). This shift is encapsulated in the emerging paradigm of green leadership, which integrates ecological values into decision-making, policy development, and human capital development to ensure sustainability remains a core organizational priority (Ahsan, 2025). Green leaders function not only as strategic visionaries but also as legitimacy agents who institutionalize sustainability-oriented norms and practices within organizations.

Although previous research has examined various leadership styles in relation to corporate performance, the direct and indirect mechanisms linking green leadership to environmental performance remain inadequately researched in developing economies and in small and medium-sized enterprise (SME) organizations (Singh et al., 2020; Zhuravleva et al., 2022). Notably, there has been a lack of concern for addressing GHRPs and environmental culture, which are fundamental mechanisms in organizations that link green leadership to environmental performance. This study addresses a significant gap in the literature by investigating how green leadership influences environmental performance and further examines the mediating role of GHRPs and the moderating impact of environmental culture.

2.2.1. Green leadership and environmental performance

Green leadership has emerged as a pivotal force in fostering environmental sustainability and profoundly shaping organizational culture in response to increasing institutional pressures for responsible business conduct. Drawing on institutional theory, green leadership acts as a normative mechanism through which organizations internalize societal and regulatory expectations for sustainable behavior (Napathorn, 2022; Ren et al., 2023). It includes strategic behaviors and values that shape organizational norms and motivate employees to participate in pro-environmental initiatives (Zhuravleva et al., 2022). Leaders with green orientations, especially those displaying transformational qualities, cultivate organizational cultures that emphasize sustainability, resource efficiency, and environmental stewardship (K. Kura, 2016). By aligning organizational practices with institutional expectations, green leadership enhances organizational legitimacy and facilitates compliance with environmental

norms and standards.

Furthermore, research focuses on the role of green human resource management systems in maintaining environmental performance and the relationship with green leadership. Yan and Hu (2021) assert that environmentally oriented transformational leadership positively impacts employees' green creativity and enhances green product development performance. This aligns with Boakye et al. (2020), who state that investment in environmental practices, guided by effective leadership, leads to better organizational outcomes, such as reduced negative environmental impacts and improved financial performance.

According to Chen et al. (2014), leaders who demonstrate green transformational behaviors have the potential to inspire their followers to achieve environmental aims, thereby improving the organization's green performance. Through consistent communication and role modeling, green leaders legitimize sustainability-oriented behaviors and foster collective commitment to environmental objectives (Poperwi, 2024).

Based on the foregoing discussion, the following hypothesis is proposed:

H1: *Green leadership positively influences environmental performance.*

2.2.2. Digital innovation and environmental performance

Digital innovation has become a key element of organizational transformation towards sustainability, enabling firms to align technological progress with environmental goals. Drawing on institutional theory, digital innovation exemplifies a mimetic response to external environmental pressures, where organizations imitate the best sustainability practices of successful peers to stay competitive and legitimate (Kauppi, 2022; Ren et al., 2023). These technologies have been used to increase resource productivity while improving service delivery and minimizing environmental impacts.

Digital innovation involves applying advanced technologies like AI, IoT, big data analytics, and blockchain to optimize resource use, reduce emissions, and minimize waste (Hussain et al., 2020; Sahoo et al., 2024). AI also saves resources as it analyzes big data to increase the efficiency of routes and limit fuel use in a supply chain's flow of operations (Jamil & Said, 2018; Park & Li, 2021). Similarly, IoT applies sensors whereby emissions and resource use are constantly monitored to enable organizations to eliminate problems promptly (Rauniyar et al., 2022). For example, smart meters know when electricity is mainly used and improve energy use (Santos & Ferreira, 2019). Especially with the integration of AI, IoT enhances the efficiency of data analytics overall, enabling firms to make appropriate choices on resource utilization and waste minimization (Jamil & Said, 2018). Apart from that, the sustainability process gets another fillip through the use of blockchain technology, which provides a clear view of supply chain processes.

The synergy between AI and IoT will enhance precision in energy management and reduce waste. Blockchain technology further enhances transparency and traceability in supply chains, making it easier to comply with green standards and support renewable energy trading. Several studies demonstrate these aspects (Sahoo et al., 2024). Together, these allow firms to re-engineer processes for operational excellence in accordance with sustainability mandates. Institutional theory helps to

explain why organizations pursue technologies beyond mere economic motives; mimetic isomorphism compels firms to adopt industry leaders' technological sustainability to maintain legitimacy (Ren et al., 2023). In this way, digital innovation enhances performance. It serves as a strategic legitimacy mechanism, aligning organizations with global sustainability goals through coercive regulatory pressures and normative stakeholder expectations for sustainability (Lee et al., 2024). Some recent empirical studies have further supported the crucial role of digital and information technology resources in improving firms' environmentally oriented performance. Moreover, a study conducted by Hashmi (2023) confirms that the use of information technology resources significantly improves firms' environmentally oriented performance, with green supply chain integration mediating this effect.

Moreover, digital innovation enhances the influence of GHRPs by offering digital channels for recruitment, training, and performance management. Digital recruitment portals attract environmentally conscious employees to organizations, as noted by (Gilch & Sieweke, 2021). Online sustainability training modules support ongoing learning on energy conservation and waste management, as discussed by (Akbar et al., 2024). Performance management systems, along with digital dashboards, enable the real-time monitoring of environmental KPIs, which promotes sustainable behavior across all areas of an organization, as noted by (Morioka & Carvalho, 2016). These applications not only enhance operational performance through digital innovation but also foster cultural alignment towards sustainability (Schein, 2010). This ecological culture encourages collaboration and responsiveness, enabling firms to adapt to changing regulations and stakeholder expectations while maintaining a competitive advantage (Akbar et al., 2024). Accordingly, the following hypothesis is proposed:

H2: *Digital innovation positively impacts environmental performance.*

2.2.3. Green leadership, digital innovation, and environmental performance: The mediating role of green HR practices

Green leadership has been broadly recognized as a key way to improve environmental performance by integrating sustainability values into organizational systems and employee conduct. Guided by sustainability principles, green leadership shapes how managers and employees incorporate ecological considerations into daily operations and decision-making processes Benn et al. (2014); (Zhuravleva et al., 2022). From an institutional theory perspective, green leadership reflects normative pressures, as leaders internalize and transmit socially accepted environmental values that legitimize sustainability-oriented organizational practices. Based on this premise, the findings from this study clearly confirm that improving organizational culture is an essential aspect of GL, particularly in key areas of sustainable business intra-organizational culture. Singh et al. (2020) found that GHRPs mediate the relationship between green leadership (GL) and environmental performance (EP), especially in small and medium-sized enterprises (SMEs), where aligning human capital is crucial for sustainable outcomes. Green leadership enhances employees' environmental attitudes and motivation, which, when reinforced through GHRPs, lead to improved environmental behavior and performance (Boakye et al., 2020).

According to Nisar et al. (2017), green recruitment and selection foster a workforce that resonates with environmental values, thereby strengthening employees'

psychological connection to sustainability objectives. Similarly, Sule et al. (2022) demonstrate that integrating GHRPs into organizational culture leads to higher environmental performance by institutionalizing sustainability at all levels. In doing so, coercive pressures, such as demands related to environmental regulations, are offset by internal alignment. In contrast, normative pressures, like societal expectations, are further reinforced through HR-led engagement and training initiatives.

Digital innovation further enhances the mediating role of GHRPs by offering platforms and tools that support the sustainability of HR processes. Digital systems such as e-recruitment, e-learning, and digital performance dashboards enable organizations to deliver sustainability education, assess eco-efficiency, and monitor employee progress toward green objectives (Akbar et al., 2024). These digital tools support data-driven environmental management and enhance employee engagement, thereby reinforcing the linkage between leadership performance and GHRPs. Accordingly, the following hypothesis is proposed:

H3: *Green Human Resource Practices mediate the relationship between green leadership and environmental performance*.

2.2.4. Digital innovation and environmental performance: The moderating role of environmental culture

Environmental culture has become a vital factor in determining how effectively organizations convert digital innovation into improved environmental performance. An environmental culture is a shared system of values, beliefs, and practices that promotes environmental stewardship and sustainable decision-making across all levels of an organization (Daud et al., 2019; Loeser et al., 2017). From an institutional theory perspective, environmental culture represents the internalization of normative pressures, whereby external environmental expectations become embedded within organizational routines and mindsets (Ren et al., 2023). When employees and managers share strong, aligned environmental values, the organization is much more likely to adopt and optimize digital technologies for sustainable operations. This cultural alignment transforms external sustainability pressures, such as regulatory and market demands, into internal commitments that amplify the impact of digital innovation on environmental performance (Kauppi, 2022). Rather than focusing on digital leadership, this study emphasizes environmental culture as a contextual condition that strengthens or weakens the effectiveness of digital innovation in improving environmental performance.

Furthermore, integrating digital technologies into EMS can greatly enhance organizations' environmental performance. Companies can optimize resource use, monitor environmental outcomes, and reduce their ecological footprint by adopting these technologies. This transformative potential of digital tools offers optimism for a more sustainable future (Loeser et al., 2017; Morgan et al., 2020). For instance, combining data and analytics with IoT tools enables real-time monitoring of resource usage. Simultaneously, machine learning AI can be employed to advise on improving energy consumption or waste management. Such collaboration not only supports green initiatives but also enhances the organization's effectiveness and efficiency within the evolving market landscape (Surmanidze, 2024; Zhang et al., 2025). Moreover,

sustainability-driven digital transformation helps an organization improve its brand image, build stakeholder confidence, and meet all regulatory requirements.

Empirical evidence suggests that organizations with strong environmental cultures are better positioned to leverage digital innovation for long-term environmental sustainability, particularly under conditions of regulatory and stakeholder pressure (Hsiao, 2024). Accordingly, the following hypothesis is proposed:

H4: *Environmental culture positively moderates the relationship between digital innovation and environmental performance, such that the relationship is stronger when the level of environmental culture is high*.

3. Research framework

The proposed conceptual model in **Figure 1** below integrates green leadership and digital innovation as independent variables, GHRPs as a mediator, and environmental culture as a moderator affecting the dependent variable, environmental performance.

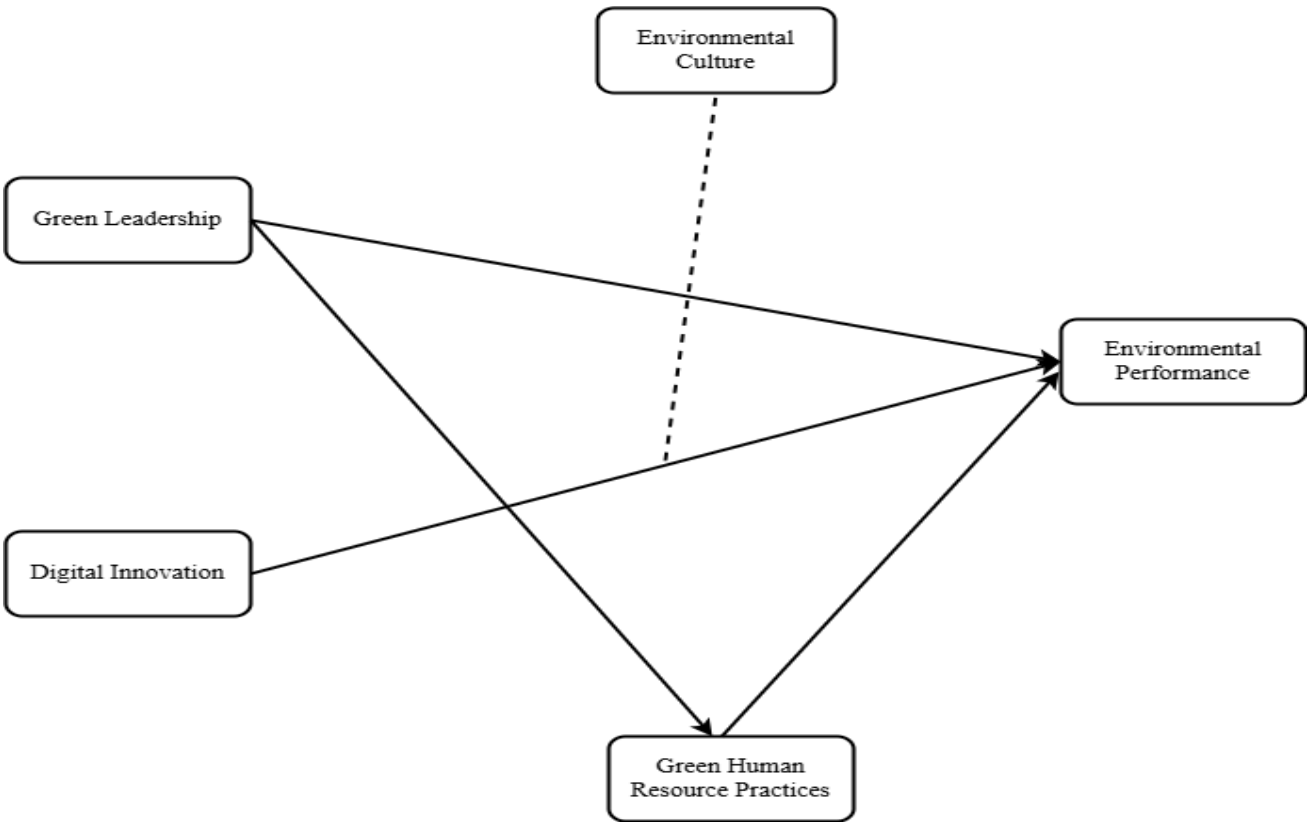

Figure 1. Research framework.

4. Methodology

This study employs a quantitative method to explore the role of green leadership and digital innovation in enhancing environmental performance. The research evaluates green human resource practices as a mediating effect and environmental culture as a moderating effect. Consistent with Institutional Theory, the methodological design aligns organizational-level constructs with coercive, mimetic, and normative institutional pressures to ensure theoretical–empirical coherence.

5. Research design and approach

5.1. Research design

A quantitative survey research design was adopted in this study to empirically test the influence of green leadership and digital innovation on environmental performance, with GHRPs as a mediating variable and environmental culture as a moderating variable. The quantitative approach is appropriate, as it facilitates testing hypotheses and establishing statistical generalizations and causality among latent constructs (Hair & Alamer, 2022). The research is grounded in Institutional Theory. This theory explains how institutions shape organizational adaptation to sustainability pressures arising from coercive (governmental), mimetic (competitive), and normative (social and professional) sources (Daddi et al., 2020) The managerial-level constructs are derived from Institutional Theory. Normative pressure, in the form of green leadership and a green environment, is integrated into organizational values through internalization; digital innovation is driven by competitive pressure, influenced by industry comparisons and technological best practice, and coercive and normative pressures shape green human resource practices.

The study was conducted among SMEs in Ghana, a country where firms are increasingly integrating sustainability into their business operations (Osafo et al., 2025; Owusu et al., 2024). The focus on SMEs in agriculture, manufacturing, and food processing was motivated by their vital role in Ghana's economy and environmental influence. This framework provides a foundation for examining how leadership and digital innovation collaborate to improve environmental outcomes in resource-constrained settings. This context is particularly relevant for institutional analysis, as SMEs in developing economies face increasing regulatory demands, stakeholder scrutiny, and competitive pressure to legitimize sustainability practices despite limited resources.

5.2. Population and sampling

The target population included employees and managers of Ghanaian SMEs operating in the key sectors of agriculture, manufacturing, and services, which hold significant potential to lead sustainability transitions. To ensure representativeness, the study used stratified random sampling. First, the population was divided into strata based on firm size and industry type, then firms were randomly selected within each stratum. This approach helps achieve proportional representation, reduces sampling bias, and enhances external validity. The respondents included owners, managers, supervisors, and administrative staff with substantial knowledge of organizational

sustainability practices, leadership behavior, HR systems, and digital initiatives. These respondents are appropriate informants for capturing institutionalized organizational practices and internal responses to environmental pressures. Regarding the distribution of questionnaires, 430 were issued, of which 395 were retrieved. After verification, 350 responses were deemed valid, resulting in an effective response rate of 81.4%. This is considered adequate as it exceeds the minimum threshold at least 10 times the maximum number of structural paths in SEM models, ensuring statistical power in the analysis (Hair & Alamer, 2022).

5.3. Data collection procedure

To gather primary data, a structured, self-administered questionnaire was developed based on validated scales from the literature that measure each construct. The instrument employed a 5-point Likert scale from 1 (strongly disagree) to 5 (strongly agree) to gauge the respondents' level of agreement with each statement. To reduce common method bias (CMB), several procedural remedies were implemented: (a) predictor and criterion items were separated within the questionnaire layout; (b) assurances of anonymity and confidentiality were provided to respondents; and (c) the wording of questions was kept simple and straightforward to minimize ambiguity (Podsakoff et al., 2003). Harman's single-factor test indicated that no single factor accounted for more than 50% of the total variance. Therefore, CMB was not a significant concern. Before the main survey, a pilot test was conducted with 30 respondents from similar SMEs to ensure that the instrument was clear, reliable, and understandable. The respondents' feedback led to minor adjustments in wording and layout, ensuring the instrument was suitable for the Ghanaian context.

5.4. Measurement of variables

To address the theory-method alignment required by Institutional Theory, each construct was selected and operationalized to reflect specific institutional mechanisms rather than to capture abstract institutional pressures directly. Green Leadership (GL) was measured using items by (Rawashdeh, 2018). This construct operationalizes normative institutional pressures by capturing leaders' roles in embedding environmental values, legitimizing sustainability norms, and guiding pro-environmental behavior within organizations. Digital Innovation (DI) was assessed using items adopted from (Parida & Brown, 2021; Sahoo et al., 2024). Digital innovation represents mimetic institutional pressure, as firms adopt advanced technologies such as AI, IoT, and blockchain to emulate industry leaders and maintain competitive and environmental legitimacy. Green human resource practices (GHRPs) were measured using a multidimensional scale of green training, green recruitment, and sustainability-oriented performance management by (Al-Hawary & Abdallah, 2023). GHRPs serve as an internal response to both coercive pressures (e.g., environmental regulations and compliance demands) and normative pressures by institutionalizing sustainability expectations into HR systems and employee behavior. Environmental culture was assessed using a scale that measures shared values and beliefs that prioritize environmental considerations within organizations. The scale was adapted from Sancha et al. (2020). This construct captures internalized normative

pressures by assessing shared environmental values and beliefs that shape how digital innovation is translated into environmental outcomes. Lastly, environmental performance was measured using the scale developed by Singh et al. (2020), which combines major energy-efficiency indicators, waste reduction, and carbon-emission mitigation. These measures can provide a holistic framework for analyzing the relationship among green leadership, digital innovation, green HR practices, environmental culture, and environmental performance, offering sound theoretical and practical insights.

5.5. Reliability and validity assessment

The multi-step validation process was conducted as follows to ensure measurement reliability and construct validity.

Although the measurement scales used in this research were adapted from validated scales, an Exploratory Factor Analysis (EFA) was conducted before conducting the PLS-SEM test. This was because the adapted measurement scales had been used in a different empirical and institutional setting, the Ghanaian SME sector. The literature on semantic methodologies suggests that EFA should ideally be conducted when existing measurement scales are used across different cultural environments and settings to establish construct validity before confirmatory tests are used to establish construct validity in this research (Hair & Alamer, 2022). Hence, this step was necessary before conducting the confirmatory structural tests.

An Exploratory Factor Analysis (EFA) was initially performed to identify underlying factor structures and to remove items with low loadings. Confirmatory Factor Analysis (CFA) was then employed to validate the measurement model. Fit indices such as χ^2/df, CFI, TLI, and RMSEA were examined to assess the model's adequacy. Convergent validity was established through Average Variance Extracted (AVE > 0.50) and Composite Reliability (CR > 0.70). Discriminant validity was evaluated using the HTMT criterion (values < 0.85) and cross-loadings (Hair & Alamer, 2022). Collectively, these steps ensured that the measurement model was both statistically robust and conceptually sound for subsequent structural analysis using PLS-SEM.

5.6. Ethical considerations

Ethical protocols were strictly followed throughout the research process. Participation was voluntary, and informed electronic consent was obtained prior to data collection. Respondents were fully briefed about the study's purpose, procedures, and their right to withdraw at any time. To maintain confidentiality, responses were anonymized and stored on encrypted, password-protected servers, in accordance with data protection guidelines. Care was taken to prevent any psychological or social discomfort by ensuring all items were neutrally worded and pertinent to professional experience.

6. Data analysis and results

6.1. Descriptive statistics

This section presents the descriptive statistics of the key study variables, including demographics, means, standard deviations, and correlations among constructs. The data were checked for normality and missing values prior to analysis to ensure suitability for PLS-SEM estimation.

6.2. Demographic characteristics

Analyzing the characteristics of the demographic respondents is important for shaping the research methodology and addressing specific issues. This study carefully collected demographic data from individuals across various organizations. **Table 1** shows that 56.3% of respondents are male and 43.7% are female. The majority of respondents, 55.1%, are aged 31–40, followed by 21.4% in the 41–50 age group. Educationally, 56.9% hold a bachelor's degree, with only 2% having a PhD. Regarding organizational roles, 61.7% are general workers, while supervisors, middle-level managers, and top-level managers make up 15.7%, 12.6%, and 10% of the respondents, respectively. Regarding tenure, 46.9% have been with their organization for 1–5 years, 26.6% for 5–10 years, 14.6% for less than a year, and 12% for over 10 years. These demographic profiles suggest that respondents possessed adequate organizational exposure and role-specific knowledge to reliably assess leadership behavior, HR practices, digital innovation, and environmental performance within their firms.

Table 1. Demographic characteristics.

Variable	Category	Frequency	Percentage
Sex	Male	197	56.3
	Female	153	43.7
	Total	350	100.0
Age range	21–30	52	14.9
	31–40	193	55.1
	41–50	75	21.4
	51–60	30	8.6
	Total	350	100.0
Level of Education	High School Certificate	34	9.7
	Diploma	46	13.1
	Bachelor's Degree	199	56.9
	Master's	64	18.3
	PhD	7	2
	Total	350	100.0
Level of Position in Organization	General worker	216	61.7
	Supervisor	55	15.7
	Middle–level Manager	44	12.6
	Top–level Manager	35	10
	Total	350	100.0
Years of Service in Organization	Less than a year	51	14.6
	1–5 years	164	46.9
	5–10 years	93	26.6
	Above 10 years	42	12
	Total	350	100.0

6.3. Measurement model assessment

The measurement model was assessed to confirm the reliability, validity, and unidimensionality of all latent constructs. As shown in **Table 2**, all item loadings surpassed the minimum acceptable threshold of 0.70 (Hair & Alamer, 2022), indicating strong indicator reliability and implying that each item significantly contributes to its underlying construct. For example, DINV loadings ranged from 0.716 to 0.842, with the highest loading for DINV1 (0.842), signifying that this item has the strongest correlation with the construct. Likewise, items under Environmental Culture (ENC) ranged between 0.797 and 0.812, demonstrating excellent reliability. The constructs Environmental Performance (ENP), Green Human Resource Practices (GHRP), and Green Leadership (GL) also showed loadings above 0.70, supporting their unidimensionality. Variance Inflation Factor (VIF) values for all items were below the critical threshold of 5.0, indicating no multicollinearity concerns among the measurement indicators.

Table 2. Measurement model assessment.

Constructs	Items	Loadings	VIF	Cronbach's Alpha	Composite reliability (rho a)	Composite reliability (rho c)	AVE
DINV				0.875	0.879	0.906	0.616
	DINV1	0.842	2.328				
	DINV2	0.804	2.016				
	DINV3	0.790	1.893				
	DINV4	0.756	1.758				
	DINV5	0.794	1.939				
	DINV6	0.716	1.644				
ENC				0.731	0.731	0.848	0.651
	ENC1	0.810	1.456				
	ENC2	0.812	1.484				
	ENC3	0.797	1.399				
ENP				0.873	0.873	0.904	0.612
	ENP1	0.739	1.685				
	ENP2	0.804	2.011				
	ENP3	0.795	1.901				
	ENP4	0.777	1.808				
	ENP5	0.797	1.942				
	ENP6	0.787	1.883				
GHRP				0.870	0.871	0.902	0.607
	GHRP1	0.766	1.822				
	GHRP2	0.789	1.933				
	GHRP3	0.758	1.874				
	GHRP4	0.777	1.927				
	GHRP5	0.793	2.101				
	GHRP6	0.796	1.991				
GL				0.832	0.833	0.882	0.599

GL1	0.762	1.641
GL2	0.788	1.775
GL3	0.779	1.692
GL4	0.805	1.814
GL5	0.732	1.519

DINV = Digital Innovation; ENC = Environmental Culture; ENP = Environmental Performance; GHRP = Green Human Resource Practices; GL = Green Leadership. Note(s): Cα ≥ 0.7; CR ≥ 0.7; AVE ≥ 0.5; loadings ≥ 0.6

This suggests that each construct is distinct and not inflated by redundancy among its indicators. The internal consistency reliability of each construct was evaluated using Cronbach's Alpha (α) and Composite Reliability (CR). All constructs met or surpassed the 0.70 threshold, indicating adequate reliability. Specifically, Cronbach's Alpha values were DINV = 0.875, ENC = 0.731, ENP = 0.873, GHRP = 0.870, and GL = 0.832. These results confirm that all measurement items are internally consistent and reliably capture the underlying latent variables. Similarly, both rho_a and rho_c (composite reliability) values exceed 0.70, further validating the measurement model's reliability. For instance, DINV has a composite reliability of 0.879 (rho a) and 0.906 (rho c), while ENC shows 0.731 (rho a) and 0.848 (rho c). These high coefficients demonstrate stable, consistent measurement of constructs across indicators. Convergent validity was established as all Average Variance Extracted (AVE) values surpassed the recommended threshold of 0.50 (Fornell & Larcker, 1981), indicating that each construct explains more than 50% of the variance in its indicators. The AVE values were: DINV = 0.616, ENC = 0.651, ENP = 0.612, GHRP = 0.607, and GL = 0.599. These results confirm that the constructs account for sufficient variance among their observed items, confirming convergent validity.

6.4. Heterotrait-Monotrait (HTMT) ratio of correlations

Table 3 presents the HTMT ratio of correlations, calculated to verify discriminant validity further, following (Henseler et al., 2015). The HTMT criterion confirms discriminant validity when values are below 0.85 for the strict criterion or below 0.90 for the liberal criterion. When the values are close to or slightly above these thresholds, it indicates conceptual proximity but not necessarily problematic overlap (Hair & Alamer, 2022). The results indicated that some pairs of constructs, such as ENC and ENP (HTMT = 0.940) and also GL and ENC (HTMT = 0.970), were highly correlated. This may be due to the theoretical and empirical proximity of constructs related to sustainability, as both environmental culture and green leadership inherently support sustainable organizational practices (Ren et al., 2023). However, this does not automatically invalidate discriminant validity. For conceptually related constructs, HTMT values can exceed 0.85 without serious validity concerns if cross-loadings and the Fornell-Larcker criterion indicate a clear distinction between the constructs. In this study, all indicator loadings were highest on their respective constructs, and cross-loadings were within acceptable ranges, confirming that the constructs, while related, remain empirically distinct. The HTMT values for the interaction term were relatively low, with the highest correlation of 0.510 with ENC, indicating satisfactory discriminant validity for the moderating construct. That is, although the latent

variables of leadership, innovation, and culture may be theoretically aligned within institutional and sustainability frameworks, they are empirically distinguishable in measurement terms.

In line with this evidence, **Figure 2** also illustrates the distinct yet interconnected roles of the constructs by displaying the simple-slope graph of the moderation effect. The positive, upward-sloping lines at low, mean, and high levels of the moderator show that the influence of environmental culture on green leadership becomes progressively stronger as digital innovation increases. The steeper slope at higher levels of digital innovation indicates a reinforcing interaction effect rather than redundancy of the construct, thus visually confirming the HTMT findings of a meaningful and valid moderation relationship.

Table 3. HTMT ratio of correlations.

DINV	ENC	ENP	GHRP	GL	ENC × DINV
ENC	0.950				
ENP	0.920	0.940			
GHRP	0.890	0.910	0.880		
GL	0.940	0.970	0.920	0.920	
ENC × DINV	0.400	0.510	0.390	0.426	0.430

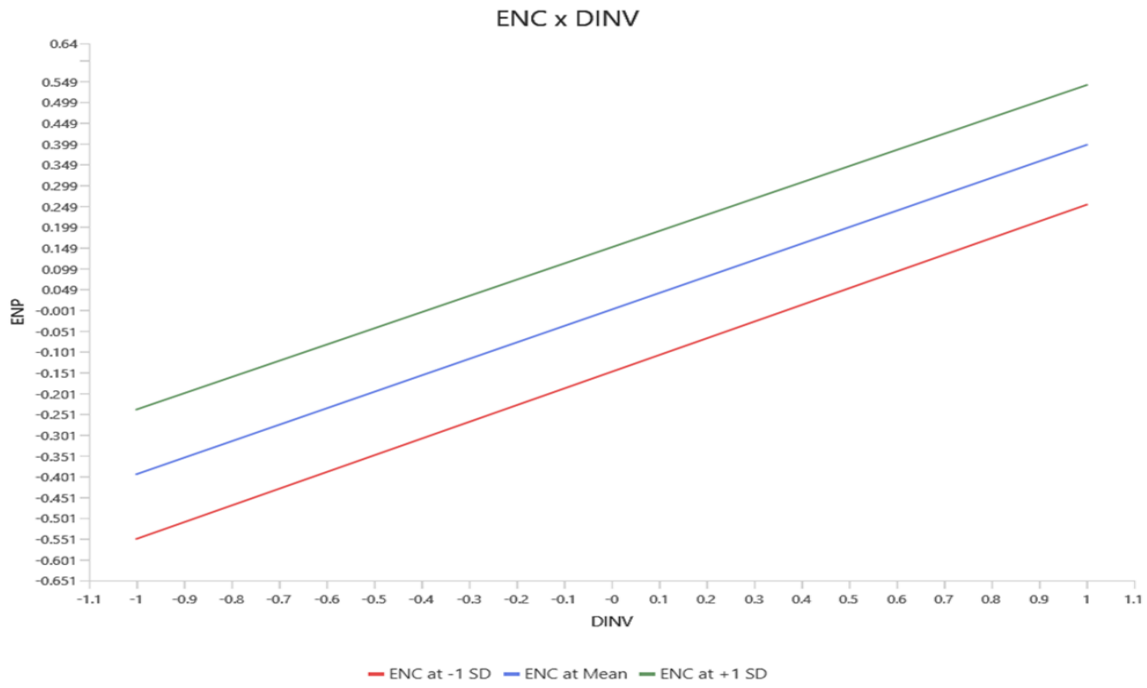

Figure 2. Simple slope analysis.

6.5. Discriminant Validity (Fornell-Larcker criterion)

The Fornell-Larcker criterion (Fornell & Larcker, 1981) is one of the widely accepted methods for assessing the distinctiveness of constructs in a measurement model. For any given pair of constructs, this criterion states that the square root of each construct's AVE should be greater than the inter-construct correlations (Hair & Alamer, 2022). Therefore, a latent variable would share more variance with its

respective indicators than with any other construct in the model, meeting the requirements for discriminant validity. **Table 4** shows that the diagonal elements, which represent the square roots of the AVEs for each construct, are greater than the off-diagonal correlation estimates, indicating that the constructs are empirically distinct. For instance, the square root of AVE for Digital Innovation (0.785) exceeds its correlations with Environmental Culture (0.620), Environmental Performance (0.610), Green Human Resource Practices (0.580), and Green Leadership (0.610). Similarly, other constructs display the same pattern: the diagonal values for Environmental Culture (0.807), Environmental Performance (0.782), Green HR Practices (0.779), and Green Leadership (0.774) are higher than their respective off-diagonal values. These findings collectively establish that, across all constructs, discriminant validity is achieved, with each variable uniquely representing its underlying theoretical concept. Such a finding reinforces the notion that constructs like green leadership, digital innovation, environmental culture, and green HR practices, although conceptually related within the institutional sustainability framework, are empirically distinct in measurement terms.

Table 4. Fornell-Larcker criterion.

Constructs	DINV	ENC	ENP	GHRP	GL
DINV	0.785				
ENC	0.620	0.807			
ENP	0.610	0.640	0.782		
GHRP	0.580	0.590	0.590	0.779	
GL	0.610	0.620	0.630	0.620	0.774

6.6. Coefficient of Determination (R^2) and Predictive Relevance (Q^2)

Table 5 presents the coefficient of determination (R^2) and the Stone–Geisser predictive relevance measure (Q^2), which are used to assess the explanatory and predictive capabilities of the structural model, respectively, as recommended by (Hair & Alamer, 2022). The results indicate that the model has strong explanatory power for both endogenous constructs. The R^2 value for Environmental Performance (ENP) is 0.736, suggesting that its predictors: Green Leadership (GL), Digital Innovation (DINV), Green Human Resource Practices (GHRP), and Environmental Culture (ENC), explain approximately 73.6% of the variance in ENP. According to (Hair & Alamer, 2022). R^2 values of 0.75, 0.50, and 0.25 signify substantial, moderate, and weak explanatory power; thus, the R^2 for ENP is high and meaningful from a theoretical perspective.

Table 5. Coefficient of Determination (R2) and Predictive Relevance (Q2).

Constructs	R-square (R^2)	(Q^2)
ENP	0.736	0.714
GHRP	0.609	0.606

Furthermore, the R^2 value for GHRP is 0.609, indicating that Green Leadership and Digital Innovation together explain 60.9% of the variation in GHRP. This

emphasized that both leadership and technological innovation are crucial factors in fostering sustainable HR practices within organizations. The Q^2 of the cross-validated redundancy measure was assessed to determine predictive relevance. Both ENP (Q^2 = 0.714) and GHRP (Q^2 = 0.606) reported positive Q^2 values, indicating that the models have significant predictive relevance (Henseler et al., 2015). This suggests that the constructs can not only explain the variance within the sample but also demonstrate strong out-of-sample predictive accuracy, supporting the practical utility of the proposed framework.

6.7. Structural model and hypothesis analysis

The structural model was then estimated to examine the hypothesized relationships among the study variables using PLS-SEM. Bootstrapping with 5000 subsamples was conducted to achieve reliable estimates of the standard errors, *t*-values, and *p*-values, in accordance with the guidelines of (Hair & Alamer, 2022). The results in **Table 6** confirm that all hypothesized direct paths are statistically significant, indicating strong empirical support for the conceptual model. In detail, the impact of DINV on ENP was found to be positive and significant ($\beta = 0.396$, $p < 0.001$), thus supporting H1. This means that the adoption of digital technologies, such as AI, IoT, and blockchain, significantly enhances firms' capacity to optimize resources and minimize environmental impacts in response to institutional pressures for technological adaptation.

Table 6. Structural model and hypothesis analysis.

Direct effects						
Constructs	**Path**	**Mean**	**Standard deviation**	***t*-Statistics**	***p*-Values**	**Decision**
DINV-> ENP	0.396	0.398	0.051	7.794	0.000	Accepted
ENC-> ENP	0.150	0.150	0.050	3.013	0.003	Accepted
GHRP-> ENP	0.190	0.189	0.059	3.189	0.001	Accepted
GL-> ENP	0.196	0.195	0.063	3.114	0.002	Accepted
GL-> GHRP	0.781	0.782	0.027	29.171	0.000	Accepted
Indirect Relationships						
Mediating						
GL-> GHRP-> ENP	0.148	0.148	0.048	3.091	0.002	Partially Mediated
Moderating Variable						
ENC × DINV -> ENP	0.320	0.120	0.027	4.074	0.001	Accepted

DINV = Digital Innovation; ENC = Environmental Culture; ENP = Environmental Performance; GHRP = Green Human Resource Practices; GL = Green Leadership; SRMR = Standardized Root Mean Squared Residual. SRMR = 0.069

Similarly, ENC was found to relate positively and significantly to EP, $\beta = 0.150$, $p = 0.003$, thus supporting H2. This result underscores that organizations with sustainability-oriented cultures are more likely to achieve superior environmental performance, reflecting normative and coercive institutional influences that reinforce ecological accountability. The analysis validated the GHRP-mediated mechanism. GL showed a significantly positive impact on GHRP ($\beta = 0.781$, $p < 0.001$), and GHRP further exerted a positive effect on Environmental Performance ($\beta = 0.190$, $p < 0.001$),

thus supporting both H3 and H5. This therefore shows that effective green leadership enhances sustainability-oriented HR practices, which, in turn, improve environmental performance.

To analyze the mediating role of GHRP between GL and ENP, bias-corrected bootstrapping was used (Hayes & Preacher, 2010) with 5000 resamples and 95% confidence intervals. The results showed that the indirect effect was significant ($\beta = 0.148$, $p = 0.002$), indicating partial mediation. This means that green leadership influences environmental performance both directly and indirectly by fostering HR practices that embed ecological values into employee behavior and organizational routines. In addition, the role of ENC as a moderator in the relationship between DINV and ENP was examined by including an interaction term, ENC × DINV → ENP. The interaction effect was statistically significant ($\beta = 0.320$, $p = 0.001$), thus supporting H4. This means that the positive impact of digital innovation on environmental performance is amplified in organizations with strong environmental cultures, where employees and managers share ecological values and norms that are propitious to sustainability-driven innovation.

7. Discussions

The findings provide strong empirical support for the argument that green leadership and digital innovation are key drivers of environmental performance in Ghanaian SMEs. This aligns with institutional theory Kauppi (2022); Meyer and Rowan (1977). The results demonstrate how organizational sustainability outcomes are shaped by the interplay of normative, mimetic, and coercive institutional pressures operating through leadership behavior, technological adoption, and internal organizational systems.

First, the findings of this study demonstrate that green leadership significantly and positively predicts environmental performance, thereby supporting Hypothesis 1 (H1). This result suggests that leaders who embody environmental stewardship and pro-environmental values play a vital role in embedding sustainability into an organization's culture. From an institutional perspective, green leadership reflects normative pressures by internalizing socially accepted environmental norms and coercive pressures arising from regulatory and stakeholder expectations. These leaders encourage employees to engage in eco-friendly behaviors, align organizational strategies with sustainability objectives, and promote ecological accountability. The findings are also corroborated by previous studies that highlight leadership commitment as a key factor in driving environmental responsibility and sustainable performance (K. M. Kura, 2016; Zhuravleva et al., 2022). From an institutional perspective, this demonstrates how normative and coercive pressures necessitate the integration of environmental concerns into organizational processes to secure legitimacy and competitive advantage (Wijethilake et al., 2017).

Second, the positive link between digital innovation and environmental performance thus supports Hypothesis 2 (H2), indicating that organizations can optimize resource use, enhance energy efficiency, and minimize environmental waste by adopting technologies such as AI, IoT, and blockchain. These findings align with the research of (Hussain et al., 2020; Sahoo et al., 2024), who discovered that digital

transformation enables better environmental monitoring and sustainability outcomes. From an institutional theory perspective, mimetic pressures may drive firms to adopt such technologies to emulate successful peers and achieve legitimacy for their environmentally responsible practices. This result aligns with Hashmi (2023), who empirically demonstrates that digital and IT-enabled integration mechanisms play a critical role in translating technological resources into superior environmental performance outcomes.

Third, the study finds strong evidence that GHRPs mediate the relationship between Green Leadership and Environmental Performance, thus confirming Hypothesis 3 (H3). This mediation suggests that leadership indirectly influences environmental outcomes by implementing HR systems that support green recruitment, training, and performance management. Such practices institutionalize sustainability in employees' behaviors, thereby strengthening the impact of leadership on environmental success. GHRPs serve as an internal institutional mechanism that translates leadership-driven sustainability intentions into routinized employee behaviors, thereby reinforcing both normative and coercive pressures. Our results are therefore consistent with the works of Singh et al. (2020) and Sule (2025), who viewed HRM as an important facilitator of environmental change. Through institutional mechanisms, GHRPs translate leaders' sustainability vision into tangible, employee-driven environmental initiatives that embed sustainability at all levels of the organization.

Fourth, the study's findings confirm that environmental culture moderates the relationship between digital innovation and environmental performance, thus supporting Hypothesis 4 (H4). This further suggests that digital innovation is most effective in settings where ecological values, sustainability consciousness, and openness to change are collectively shared. These results align with those of (Loeser et al., 2017; Yu & Moon, 2021), who found that a culture oriented towards sustainability leads to better digital transformation outcomes. Within an institutional framework, such cultural alignment is promoted through normative pressures that reinforce sustainability norms and behaviors, ensuring that technological advancements translate into improved environmental performance. These findings carry several practical implications. Managers should prioritize leadership development programs that emphasize environmental values, invest in digital technologies that enhance sustainability performance, and embed green HR practices into core management systems. An environmental culture can strengthen innovation efforts and foster long-term resilience. Lastly, policymakers must develop regulatory and incentive frameworks that foster the emergence of digital innovation and the development of green leadership capabilities in SMEs, thereby contributing to broader national and global sustainability goals.

8. Limitations and directions for future research

Though this study has contributed to the literature on green leadership, digital innovation, and environmental performance, several limitations should be considered. These limitations, however, provide fertile ground for future research.

This study was carried out in the context of Ghanaian SMEs; thus, the

generalizability of these findings may be limited to similar socio-economic and institutional settings. The regulatory, technological, and cultural context of Ghana, influenced by emerging sustainability frameworks and developing digital infrastructures, may not be comparable to those in more industrialized countries. Replication studies across different geographical and industrial contexts can validate and compare the model's applicability under varying institutional pressures, as Institutional Theory suggests.

Second, the use of a cross-sectional design limits the ability to draw causal inferences about the relationships among green leadership, digital innovation, and environmental performance. As the nature of sustainability transformation and leadership behaviors unfolds over time, a longitudinal or mixed-methods design would better capture the dynamics of these relationships. This would also outline how changes in institutional pressures-coercive, mimetic, and normative-drive sustainability practices in response to dynamic global standards.

Third, this research relied primarily on self-reported data, which may introduce social desirability and common-method biases. Even though procedural remedies were applied to reduce the effect, future studies should complement perceptual data with objective measures of environmental performance, such as energy consumption metrics, carbon footprint data, waste reduction rates, or third-party sustainability audit reports. The inclusion of such objective measures would further strengthen the robustness and validity of future studies.

While this study included environmental culture as a moderator, other contextual variables may be more informative in developing an understanding of the sustainability-performance nexus. For instance, future studies may examine the moderating effects of regulatory policy frameworks, industry competitiveness, and financial incentives on firms' decisions regarding green technologies and practices. Also, adding psychological or behavioral factors, such as employee commitment to the natural environment and green self-efficacy, could extend the conceptual framework and deepen understanding of organizational sustainability dynamics. By addressing these limitations, future research can help develop a more nuanced, global understanding of how leadership, technology, and human resource practices interact across varying institutional and cultural contexts to achieve sustainable performance.

9. Conclusion

This paper significantly contributes to the growing literature on organizational sustainability by empirically examining how green leadership and digital innovation influence environmental performance, with GHRPs as a mediator and environmental culture as a moderator. Grounded in Institutional Theory, the findings show that sustainability performance arises from the interplay among leadership-driven norms, technology-driven imitation, and institutionalized organizational systems. The results indicate that green leadership and digital innovation play important roles in improving SMEs' environmental performance in Ghana. Specifically, green leadership develops the culture of sustainability through vision, inspiration, and values that align organizational behavior toward environmental objectives. In the same way, digital innovation enables firms to achieve resource efficiency, minimize waste, and enhance

operational processes, thereby contributing to environmental performance.

The mediating role of GHRPs underlines the strategic relevance of human resource management in entrenching sustainability at all levels of organizations. Green recruitment, training, and performance management are the fundamental mechanisms through which leadership and innovation get translated into tangible environmental outcomes. Contrary to this statement, the empirical results confirm that environmental culture significantly strengthens the relationship between digital innovation and environmental performance, underscoring the importance of cultural alignment in sustainability-driven digital transformation.

Theoretically, this research enriches the understanding of the intersection among leadership theory, digital transformation, and sustainability by integrating human resource and cultural dimensions into a single conceptual framework. It provides empirical evidence supporting a holistic approach to sustainability, where leadership and technology interact in synergy with human systems to enhance environmental outcomes.

On a practical note, the findings present the following recommendations. Organizational leadership development programs should be channeled toward environmental stewardship, ethical decision-making, and sustainability-driven innovation. Investments in enabling digital technologies also promise to improve monitoring, reporting, and resource management, specifically through artificial intelligence, the Internet of Things, and blockchain. In addition, integrating green HR practices into organizational strategies will further strengthen employee commitment to and accountability for sustainability objectives. At the policy level, governments and regulatory bodies should create incentives to encourage firms to adopt sustainable technologies and green management practices. Examples of such incentive frameworks could include tax benefits, capacity-building programs, and public-private partnerships to promote environmental innovation and responsible leadership.

Conflict of interest: The author declares no conflict of interest.

References

Adams, D. J., Donovan, J., & Topple, C. (2022). Implementing sustainability in food manufacturers' operations and supply chains. Management of Environmental Quality: An International Journal, 33(5), 1132–1146. https://doi.org/10.1108/meq-09-2021-0225

Ahsan, M. J. (2024). Green leadership and innovation: catalysts for environmental performance in Italian manufacturing. International Journal of Organizational Analysis, 33(7), 1646–1669. https://doi.org/10.1108/ijoa-04-2024-4450

Akbar, A., Ahmad, S., Khalid, M., et al. (2024). Analyzing the Effect of Green HRM on Organizational Performance. Bulletin of Business and Economics (BBE), 13(2), 864–869. https://doi.org/10.61506/01.00402

Hawary, S. I. S. A., & Abdallah, F. A. (2023). The moderating effect of organisational power on the relationship between green human resources practices and achieving strategic objectives. International Journal of Business Information Systems, 43(2), 258–280. https://doi.org/10.1504/ijbis.2023.131349

Almaraz, A. (2022). Small and Medium Enterprises in Mexico and the Craft Beer Sector in Baja California: Dynamic Capabilities, Culture, and Innovation. Journal of Evolutionary Studies in Business, 7(1), 166–203. https://doi.org/10.1344/jesb2022.1.j102

Alwali, J., & Alwali, W. (2025). Transformational leadership and moral norms: Green human resource management and behaviour. Management Decision, 63(5), 1417–1442. https://doi.org/10.1108/MD-09-2023-1682

Benn, S., Edwards, M., & Williams, T. (2014). Organizational change for corporate sustainability. Routledge. https://doi.org/10.4324/9781315819181

Bleiklie, I., Enders, J., & Lepori, B. (2015). Organizations as Penetrated Hierarchies: Environmental Pressures and Control in Professional Organizations. Organization Studies, 36(7), 873–896. https://doi.org/10.1177/0170840615571960

Boakye, D. J., TIngbani, I., Ahinful, G., et al. (2020). Sustainable environmental practices and financial performance: Evidence from listed small and medium‐sized enterprise in the United Kingdom. Business Strategy and the Environment, 29(6), 2583–2602. Portico. https://doi.org/10.1002/bse.2522

Caprar, D. V., & Neville, B. A. (2012). "Norming" and "conforming": Integrating cultural and institutional explanations for sustainability adoption in business. Journal of Business Ethics, 110(2), 231–245. https://doi.org/10.1007/s10551-012-1424-1

Chen, Y., Chang, C., & Lin, Y. (2014). Green transformational leadership and green performance: the mediation effects of green mindfulness and green self-efficacy. Sustainability, 6(10), 6604–6621. https://doi.org/10.3390/su6106604

Colwell, S. R., & Joshi, A. W. (2011). Corporate Ecological Responsiveness: Antecedent Effects of Institutional Pressure and Top Management Commitment and Their Impact on Organizational Performance. Business Strategy and the Environment, 22(2), 73–91. Portico. https://doi.org/10.1002/bse.732

Cui, J. (2025). Exploring the Impact of Digital Leadership and Green Digital Innovation on Corporate Digital Transformation. Journal of Current Social Issues Studies, 2(4), 215–220. https://doi.org/10.71113/jcsis.v2i4.229

Daddi, T., Bleischwitz, R., Todaro, N. M., et al. (2020). The influence of institutional pressures on climate mitigation and adaptation strategies. Journal of cleaner production, 244, 118879. https://doi.org/10.1016/j.jclepro.2019.118879

Daud, S., Yusof, N., & Mokhtar, M. (2019). The Effectiveness of the Environmental Management System (EMS) Implementation in Green Supply Chain: A Case Study. KnE Social Sciences. https://doi.org/10.18502/kss.v3i22.5105

DiBella, J., Forrest, N., Burch, S., et al. (2022). Exploring the potential of SMEs to build individual, organizational, and community resilience through sustainability‐oriented business practices. Business Strategy and the Environment, 32(1), 721–735. Portico. https://doi.org/10.1002/bse.3171

DiMaggio, P. J., & Powell, W. W. (1983). The iron cage revisited: Institutional isomorphism and collective rationality in organizational fields. American Sociological Review, 48(2), 147–160. https://doi.org/10.2307/2095101

Dubey, R., Gunasekaran, A., & Samar Ali, S. (2015). Exploring the relationship between leadership, operational practices, institutional pressures and environmental performance: A framework for green supply chain. International Journal of Production Economics, 160, 120–132. https://doi.org/10.1016/j.ijpe.2014.10.001

Fornell, C., & Larcker, D. F. (1981). Evaluating Structural Equation Models with Unobservable Variables and Measurement Error. Journal of Marketing Research, 18(1), 39–50. https://doi.org/10.1177/002224378101800104

Gilch, P. M., & Sieweke, J. (2021). Recruiting digital talent: The strategic role of recruitment in organisations' digital transformation. German Journal of Human Resource Management, 35(1), 53–82. https://doi.org/10.1177/2397002220952734

Hair, J., & Alamer, A. (2022). Partial Least Squares Structural Equation Modeling (PLS-SEM) in second language and education research: Guidelines using an applied example. Research Methods in Applied Linguistics, 1(3), 100027. https://doi.org/10.1016/j.rmal.2022.100027

Hashmi, R. (2023). Business Performance Through Government Policies, Green Purchasing, and Reverse Logistics: Business performance and green supply chain practices. South Asian Journal of Operations and Logistics, 2(1), 1–10. https://doi.org/10.57044/sajol.2023.2.1.2301

Henseler, J., Ringle, C. M., & Sarstedt, M. (2014). A new criterion for assessing discriminant validity in variance-based structural equation modeling. Journal of the Academy of Marketing Science, 43(1), 115–135. https://doi.org/10.1007/s11747-014-0403-8

Hsiao, M. (2024). Resource integration and firm performance through organizational capabilities for digital transformation. Digital Transformation and Society. https://doi.org/10.1108/dts-07-2023-0050

Hussain, A., Draz, U., Ali, T., et al. (2020). Waste Management and Prediction of Air Pollutants Using IoT and Machine Learning Approach. Energies, 13(15), 3930. https://doi.org/10.3390/en13153930

Jamil, M., & Said, M. (2018). The Utilization of Internet of Things (IoT) for Multi Sensor Data Acquisition using Thingspeak. VOLT : Jurnal Ilmiah Pendidikan Teknik Elektro, 3(1), 13. https://doi.org/10.30870/volt.v3i1.1962

Javaid, M., Haleem, A., Singh, R. P., et al. (2022). Understanding the adoption of Industry 4.0 technologies in improving environmental sustainability. Sustainable Operations and Computers, 3, 203–217. https://doi.org/10.1016/j.susoc.2022.01.008

Jia, J., Yuan, S., Wei, L., et al. (2023). When firms adopt sustainable human resource management: A fuzzy‐set analysis. Human

Resource Management, 62(3), 283–305. Portico. https://doi.org/10.1002/hrm.22164

Kauppi, K. (2022). Institutional theory. In: Handbook of Theories for Purchasing, Supply Chain and Management Research. Edward Elgar Publishing. pp. 320–334. https://doi.org/10.4337/9781839104503.00025

Kooij, D. T. A. M., Guest, D. E., Clinton, M., et al. (2012). How the impact of HR practices on employee well-being and performance changes with age. Human Resource Management Journal, 23(1), 18–35. Portico. https://doi.org/10.1111/1748-8583.12000

Kura, K. M. (2016). Linking environmentally specific transformational leadership and environmental concern to green behaviour at work. Global Business Review, 17(Suppl. 3), 1S–14S. https://doi.org/10.1177/0972150916631069

Lee, J. (2024). The Role of Institutional Logics in Shaping Sustainable Talent Management: A Comparative Study of Two South Korean Conglomerates. Systems, 12(7), 227. https://doi.org/10.3390/systems12070227

Lee, M., Pak, A., & Roh, T. (2024). The interplay of institutional pressures, digitalization capability, environmental, social, and governance strategy, and triple bottom line performance: A moderated mediation model. Business Strategy and the Environment, 33(6), 5247–5268. Portico. https://doi.org/10.1002/bse.3755

Liang, Y., Zhao, C., & Lee, M.-J. (2023). Institutional pressures on sustainability and green performance: the mediating role of digital business model innovation. Sustainability, 15(19), 14258. https://doi.org/10.3390/su151914258

Lisniak, B. A. (2024). Global environmental problems and their impact on international business. https://doi.org/123456789/96788

Loeser, F., Recker, J., Brocke, J. v., et al. (2017). How IT executives create organizational benefits by translating environmental strategies into Green IS initiatives. Information Systems Journal, 27(4), 503–553. https://doi.org/10.1111/isj.12136

Meyer, J. W., & Rowan, B. (1977). Institutionalized organizations: Formal structure as myth and ceremony. American Journal of Sociology, 83(2), 340–363. https://doi.org/10.1086/226550

Miao, Q., & Nduneseokwu, C. (2025). Environmental Leadership in Private Organizations. In Environmental Leadership in a VUCA Era: An Interdisciplinary Handbook. Springer Nature Singapore. (pp. 317–398). https://doi.org/10.1007/978-981-96-0324-4_8

Morgan, Y., Fok, L., & Zee, S. (2020). Relationships among annual revenue and green initiatives, quality management, and organizational performance. International Journal of Applied Management and Technology, 19(1). https://doi.org/10.5590/ijamt.2020.19.1.02

Morioka, S. N., & Carvalho, M. M. (2016). Measuring sustainability in practice: exploring the inclusion of sustainability into corporate performance systems in Brazilian case studies. Journal of Cleaner Production, 136, 123–133. https://doi.org/10.1016/j.jclepro.2016.01.103

Napathorn, C. (2021). The development of green skills across firms in the institutional context of Thailand. Asia-Pacific Journal of Business Administration, 14(4), 539–572. https://doi.org/10.1108/apjba-10-2020-0370

Osafo, V. A., Sarfo, P. A., Bonzo, J. K., et al. (2025). Examining the Nexus between Knowledge Management Processes and Firm Sustainability: The Mediating Role of Innovation among SMEs in Ghana. Journal of Emerging Markets and Management, 1(3), 63–85. https://doi.org/10.63385/jemm.v1i3.225

Owusu, A., Tauringana, V., & Asare, N. (2024). Sustainability performance reporting in Ghana: The views of SMEs. Small Enterprise Research, 31(1), 56–75. https://doi.org/10.1080/13215906.2024.2304847

Parida, S., & Brown, K. (2021). Green human resource management and green innovation. In: Responsible Management in Emerging Markets: A Multisectoral Focus . Cham: Springer International Publishing. pp. 159–183. https://doi.org/10.1007/978-3-030-76563-7_7

Park, A., & Li, H. (2021). The effect of blockchain technology on supply chain sustainability performances. Sustainability, 13(4), 1726. https://doi.org/10.3390/su13041726

Podsakoff, P. M., MacKenzie, S. B., Lee, J.-Y., et al. (2003). Common method biases in behavioral research: A critical review of the literature and recommended remedies. Journal of Applied Psychology, 88(5), 879–903. https://doi.org/10.1037/0021-9010.88.5.879

Poperwi, L. (2024). The Effect of Green Transformational Leadership on Green Performance: A Systematic Review. Fostering Long-Term Sustainable Development in Africa: Overcoming Poverty, Inequality, and Unemployment, 309–341. https://doi.org/10.1007/978-3-031-61321-0_15

Rauniyar, A., Berge, T., & Hakegard, J. E. (2022). NEMO: Internet of Things based Real-time Noise and Emissions MOnitoring System for Smart Cities. In: Proceedings of the 2022 IEEE 12th Sensor Array and Multichannel Signal Processing Workshop

(SAM), 20–23 June 2022. pp. 206–210. https://doi.org/10.1109/sam53842.2022.9827835

Rawashdeh, A. M. (2018). The impact of green human resource management on organizational environmental performance in Jordanian health service organizations. Management Science Letters, 8(10), 1049–1058. https://doi.org/10.5267/j.msl.2018.7.006

Ren, S., Cooke, F. L., Stahl, G. K., et al. (2023). Advancing the sustainability agenda through strategic human resource management: Insights and suggestions for future research. Human Resource Management, 62(3), 251–265. https://doi.org/10.1002/hrm.22169

Sahoo, S., Kumar, S., Sivarajah, U., et al. (2022). Blockchain for sustainable supply chain management: trends and ways forward. Electronic Commerce Research, 24(3), 1563–1618. https://doi.org/10.1007/s10660-022-09569-1

Santos, D., & Ferreira, J. (2019). Iot power monitoring system for smart environments. Sustainability, 11(19), 5355. https://doi.org/10.3390/su11195355

Schein, E. H. (2010). Organizational culture and leadership. John Wiley & Sons. Volume 2.

Scott, J. (2014). A matter of record: Documentary sources in social research. John Wiley & Sons.

Singh, S. K., Giudice, M. D., Chierici, R., et al. (2020). Green innovation and environmental performance: The role of green transformational leadership and green human resource management. Technological Forecasting and Social Change, 150, 119762. https://doi.org/10.1016/j.techfore.2019.119762

Surmanidze, N. (2024). The impact of covid-19 on tourism marketing strategies and the role of digitalization. . Innovative Economics and Management, 11(1), 68–80. https://doi.org/10.46361/2449-2604.11.1.2024.68-80

Tasleem, M., Khan, N., & Nisar, A. (2019). Impact of technology management on corporate sustainability performance: The mediating role of TQM. International Journal of Quality & Reliability Management, 36(9), 1574–1599. https://doi.org/10.1108/ijqrm-01-2018-0017

Van Tulder, R., Rodrigues, S. B., Mirza, H., et al. (2021). The UN's sustainable development goals: can multinational enterprises lead the decade of action? Journal of International Business Policy, 4(1), 1. https://doi.org/10.1057/s42214-020-00095-1

Wijethilake, C., Munir, R., & Appuhami, R. (2017). Strategic responses to institutional pressures for sustainability: The role of management control systems. Accounting, Auditing & Accountability Journal, 30(8), 1677–1710. https://doi.org/10.1108/AAAJ-07-2015-2144

Woo, E.-J., & Kang, E. (2020). Environmental issues as an indispensable aspect of sustainable leadership. Sustainability, 12(17), 7014. https://doi.org/10.3390/su12177014

Yan, J., & Hu, W. (2021). Environmentally specific transformational leadership and green product development performance: the role of a green HRM system. International Journal of Manpower, 43(3), 639–659. https://doi.org/10.1108/ijm-05-2020-0223

Yu, J., & Moon, T. (2021). Impact of digital strategic orientation on organizational performance through digital competence. Sustainability, 13(17), 9766. https://doi.org/10.3390/su13179766

Zhang, J., Adu Sarfo, P., Amankwah, O., et al. (2025). Harnessing the synergy between green organizational strategy and technological capability for sustainable development in SMEs in Sub-Saharan Africa. Business Process Management Journal. https://doi.org/10.1108/bpmj-01-2025-0043

Zhang, Q., Yang, L., Cheng, J., & Feng, T. (2024). How green human resource management and institutional pressure drive performance via green image: the equifinal paths and their performance outcomes. Asia Pacific Journal of Human Resources, 62(1), e12389. https://doi.org/10.1111/1744-7941.12389

Zhuravleva, N. A., Chechenova, L. M., & Poliak, M. (2022). Activation of Sustainable Development Mechanisms on the Base of Green Projects of the Rail Transport. https://doi.org/ 10.5220/0010663300003223