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GREEN HRM AND DIGITAL LEADERSHIP ON INNOVATION CULTURE: ITS IMPACT ON DIGITAL TRANSFORMATION AND WORKFORCE AGILITY

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ABSTRACT: This study examines how Green Human Resource Management (Green HRM) and Digital Leadership influence Innovation Culture, Digital Transformation, and Workforce Agility in the oil and gas sector in Balikpapan City, Indonesia. Using data from 300 respondents from various oil and gas companies, the analysis was conducted using SmartPLS to test direct and indirect (mediation) effects. The implication of this study is that oil and gas companies in Balikpapan should prioritise the development of digital leadership and environmentally friendly HR practices along with the formation of an innovation culture to accelerate digital transformation and increase workforce agility. Criticisms of this study include the limitations of cross-sectional samples and self-reported data, so further studies are recommended using longitudinal designs or triangulated data.

Keywords: Green HRM; Digital Leadership; Innovation Culture; Digital Transformation; Workforce Agility

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INTRODUCTION

The global oil and gas industry faces two simultaneous demands: digital transformation and environmental sustainability. The energy sector remains a major source of global greenhouse gas emissions, while rapid technological change is reshaping jobs and widening digital skill gaps (International Energy Agency [IEA], 2023; World Economic Forum [WEF], 2023). These pressures are acute in Balikpapan, a major center of Indonesia's oil and gas industry, where organizations must address environmental degradation, resource depletion, and stronger stakeholder expectations for responsible business conduct (Porter & Kramer, 2019; Schaltegger, 2012). Sustainability and digitalization can no longer be managed as separate priorities. Organizations that fail to address both risks losing their social legitimacy and competitive relevance.

Digital transformation supports sustainable economic development by improving data use, resource efficiency, productivity, and organizational value creation (Pricopoaia et al., 2025; Zhou & Kuang, 2025). It involves major changes in organizational processes through technologies such as artificial intelligence, the Internet of Things, big data, digital platforms, and advanced manufacturing systems (Chung et al., 2025; Vial, 2019; Zaki, 2019). Its success, however, depends on more than technology. Organizations also need workforce agility, defined as employees' capacity to respond effectively to volatile and uncertain conditions (Cyfert et al., 2022; Wageeh, 2016). Agile employees support organizational continuity, adaptation, and long-term performance (Martin, 2015; Muduli, 2017). Without employee readiness and adaptability, new technologies and work practices are unlikely to produce meaningful change (Storme et al., 2020).

Green Human Resource Management (Green HRM) and digital leadership offer complementary responses to these challenges (Guerci & Carollo, 2016; Yu et al., 2020). Green HRM integrates environmental objectives into recruitment, training, performance appraisal, rewards, and employee development (Mohammed & Osman, 2021; Sheikh et al., 2024). It develops ecological competence, environmental awareness, and sustainable work behavior, thereby transforming employees into active contributors to organizational sustainability (Ahmad et al., 2025; Hidayat et al., 2025). Digital leadership complements this process by combining technological vision, change leadership, and value creation through emerging technologies (Tate et al., 2025). Effective digital leaders must also understand sustainability and shape an organizational climate that supports innovation, adaptation, and responsible transformation (Soehaditama et al., 2023).

The resource-based view explains Green HRM and digital leadership as internal strategic resources that can create sustained competitive advantage when they are valuable, rare, difficult to imitate, and difficult to substitute (Barney, 1991). Green HRM develops sustainability-oriented human capital, while digital leadership converts technological knowledge and strategic vision into organizational action (Kane et al., 2019; Renwick et al., 2013). The natural resource-based view extends this argument by showing that competitive advantage also depends on capabilities related to pollution prevention, resource stewardship, and environmental responsibility (Hart, 1995). However, these resources may not directly produce digital transformation or workforce agility. Their value may depend on an innovation culture that encourages learning, experimentation, collaboration, and openness to change.

Existing studies have largely examined Green HRM, digital leadership, digital transformation, and workforce agility separately. Evidence remains limited on how these capabilities operate together in highly regulated and resource-intensive industries. This study addresses that gap by examining employees and managers in oil and gas companies in Balikpapan. It investigates how Green HRM and digital leadership shape innovation culture, how innovation culture supports digital transformation and workforce agility, and whether innovation culture mediates these relationships. The study therefore develops an integrated structural model that explains how environmental HR practices and digital leadership can support the dual transformation required by sustainability pressures and digital disruption.

THEORETICAL REVIEW

Green HRM and Innovation Culutre

The relationship between Green HRM and innovation culture has a strong theoretical foundation in several perspectives. First, from the Resource-Based View (RBV) perspective, Green HRM can create unique and difficult-to-imitate human resources, which in turn drives organizational innovation capabilities (Barney, 1991). Second, Social Identity Theory suggests that employees who identify with the environmental values of the organization tend to be more motivated to contribute to creative and innovative activities. A recent 2025 study in the hospitality sector in China and Pakistan confirmed the positive impact of Green HRM practices on green innovative work behavior, with the AMO framework as the theoretical basis (Khan et al., 2025). This study shows that Green HRM practices significantly increase sustainable innovative work behavior. Studies in the healthcare sector confirm that economic pressures and environmental degradation encourage organizations to adopt a green innovation culture through the implementation of Green HRM (Correia et al., 2024). A study in China involving 316 HR specialists in the manufacturing sector also shows that Green HRM influences innovation culture through multiple pathways (Shahzad et al., 2023).
H1: Green HRM has a significant positive effect on Innovation Culture.

Digital Leadership and Innovation Culture

The role of a leader is crucial in ensuring and encouraging transformation and driving change in the era of Industry 4.0 (Li et al., 2016). This leadership serves not only to create added value and strategic competitive advantage, but also to build a foundation for digital management based on digital culture and competencies (Mihardjo et al., 2019). Digital leadership has become a key pillar in driving a culture of innovation in various organizations, especially in this era of rapid digital transformation (Harto et al., 2022). Another study defines digital leadership as a combination of digital competencies and digital culture to drive change and capitalize on opportunities from digital technology (Priyantono et al., 2017) The relationship between digital leadership and innovation in the era of disruption shows that digital leadership influences innovation (Ralf T. Kreutzer et al., 2020). Previous research has found that digital leadership can influence innovation culture (Zervas & Stiakakis, 2024; Alshuaibi et al., 2024; Öngel et al., 2024).
H2: Digital leadership has a positive effect on innovation culture.

Green HRM and Digital Transformation

The theoretical basis for a positive Green HRM → Digital Transformation relationship is grounded in the Natural Resource-Based View (Hart, 1995) and AMO framework (Yu et al., 2020). Under NRBV, Green HRM develops pollution prevention and sustainability capabilities that cultivate the efficiency-oriented mindset conducive to digital technology adoption. From an AMO perspective, Green HRM builds employees' digital ability through cross-functional sustainability training, motivation through green performance rewards that incorporate digital KPIs, and opportunity through digitalized HR processes. Furthermore, Green HRM digitalization itself—electronic reporting, paperless recruitment, virtual environmental training—directly contributes to organizational digital transformation (Ali et al., 2025). This hypothesis therefore rests on the proposition that effective Green HRM accelerates digital transformation through (Yu et al., 2020). Will accelerate and facilitate the organization's Digital Transformation process, creating a transformation that is not only technology-driven but also sustainable and human-centric (Singh et al., 2020).
H3: Green HRM has a significant positive effect on Digital Transformation

Digital Leadership and Digital Transformation

It is a kind of leadership that emphasizes a digital vision, the ability to manage technology-based change, and the development of an innovative culture to accelerate organizational transformation. Digital leaders play an important role in directing strategy, encouraging the adoption of new technologies, and developing human resource capabilities to keep pace with the demands of the digital age. Recent research confirms that digital leadership has a significant positive impact on the success of digital transformation through the mechanisms of digital strategy, organizational readiness, and innovation culture (Kane et al., 2019). Furthermore,

empirical studies show that organizations with strong digital leaders are more adaptive, innovative, and capable of integrating technology into business processes saw (El Sawy et al., 2022; Jonathan & Kuika Watat, 2020). Thus, it can be hypothesized that Digital Leadership has a significant positive effect on Digital Transformation.
H4: Digital Leadersh*ip has a significant positive effect on Digital Transformation*

Green HRM and Workfore Agility

Green Human Resource Management (Green HRM) is a human resource management practice that integrates environmentally friendly principles into HR functions, such as recruitment, training, performance appraisal, and reward systems (Wang et al., 2024). This practice not only supports organisational sustainability but also increases employee engagement and creates an adaptive work environment (Liu, 2023). Recent studies show that Green HRM can drive organisational agility by strengthening employees' skills, commitment, and readiness to face change (Rizki et al., 2025). Workforce agility—the ability of the workforce to adapt, innovate, and respond to change quickly—can be developed through green HR programmes that emphasise efficiency, continuous learning, and employee empowerment (Sumayya et al., 2023). Thus, the hypothesis proposed is that Green HRM has a significant positive effect on Workforce Agility.
H5: Green HRM has a significant positive effect on workforce agility

Digital Leadership and Workforce Agility

The theoretical basis for a Digital Leadership → Workforce Agility relationship draws on Dynamic Capabilities Theory (Teece et al., 1997) and Organizational Climate Theory. Under Dynamic Capabilities, digital leaders develop the sensing capacity to identify skill gaps, the seizing capacity to design agility-building interventions, and the reconfiguring capacity to realign workforce competencies with emerging demands—producing workforce agility as an outcome. Organizational Climate Theory further predicts that digital leaders shape the psychological climate by modelling adaptive behavior, tolerating ambiguity, and rewarding flexibility, thereby normalizing agility across the workforce. Empirically, workforce agility encompasses the proactive, adaptive, and resilient dimensions of the workforce, and the capacity to develop these is strongly shaped by leadership capability and learning orientation. The impact of digital competence can improve individual and company performance, with increased profitability facilitated by leadership support (Zihan & Makhbul, 2024). Empirical research in 2024 shows that leadership, including its digital dimension, contributes to the development of employee agility (Awwad et al., 2022).
H6: Digital leadership has a significant positive effect on workforce agility

Innovation Culture and Digital Transformation

Innovation culture plays an important role in accelerating digital transformation because it creates an environment that supports the exploration of new ideas, technological experimentation, and continuous adoption of change. According to (Martins & Terblanche, 2003), innovation culture provides the basis for organizations to develop the creativity and learning necessary to deal with digital dynamics. (Zihan & Makhbul, 2024) show that the success of digital transformation is not only determined by technology, but also by an organizational culture that supports innovation and change. Companies with a strong culture of innovation are better prepared to leverage digital technology to improve performance and competitiveness (Kane et al., 2015). A recent study by (Nambisan et al., 2017) also emphasizes that digital innovation arises from the close interaction between an innovation culture and an organization's digital transformation strategy. Thus, the previous literature supports the view that an innovation culture acts as a catalyst that accelerates the success of digital transformation by strengthening creativity, adaptability, and readiness for change within an organization.
H7: Innovation Culture has a positive and significant effect on Digital Transformation.

Innovation Culture and Workforce Agility

A culture of innovation is seen as an important factor in improving workforce agility, as it encourages creativity, flexibility, and the ability to adapt to changes in the business environment. A culture of innovation provides space for continuous learning and tolerance for failure as part of the process of exploring new ideas (Martins & Terblanche, 2003). Research by (Sanz-Valle & Jiménez-Jiménez, 2018) Found that human resource management practices that support innovation can encourage innovative work behavior, which ultimately improves an organization's ability to adapt to market dynamics. Similar findings were reported by (Muduli, 2017) who showed that workforce agility is influenced by organizational practices that provide autonomy, training, and psychological empowerment, enabling employees to be more agile in facing change. Thus, previous literature supports the assumption that the stronger the culture of innovation in an organization, the higher the level of workforce agility it possesses.
H8: Innovation Culture has a positive and significant effect on Workforce Agility

Innovation Culture, Green HRM and Digital Transformation

According to Cao et al. (2025), organizational culture, particularly innovation culture, is an important factor that can accelerate digital transformation. Green HRM, which focuses on sustainability, makes organizations more open to the implications of digital technology, whereby innovation can create efficiency for organizations. Ali et al. (2025) also emphasizes that green HRM can increase the effectiveness of digital transformation.
H9: Innovation Culture mediates the influence of Green HRM on Digital Transformation.

Innovation Culture, Green HRM and Workforce Agility

Green Human Resource Management (Green HRM) is an HRM practice that emphasizes environmental sustainability through environmentally friendly recruitment, training, evaluation, and reward systems. This practice not only supports environmental goals but also increases employee motivation, skills, and engagement. Recent research indicates that Green HRM contributes to the formation of an innovation culture—a culture that encourages creativity, experimentation, and collaboration (Fang L et al., 2022). This innovation culture is a key factor in building workforce agility, which is the ability of the workforce to respond quickly to change, innovate, and remain adaptive in a dynamic business environment (Faheem et al., 2023). Thus, Green HRM can indirectly increase workforce agility through the mediating role of innovation culture.
H10: Innovation Culture mediates the influence of Green HRM on Workforce Agility

Innovation Culture, Digital Leadership and Digital Transformation

Digital leadership is a leadership style that emphasizes digital vision, technological mastery, and the ability to facilitate organizational change in the digital age. Digital leaders play a vital role in directing strategy, accelerating technology adoption, and ensuring digital integration into the organization's business model. However, the influence of digital leadership on the success of digital transformation is highly dependent on internal organizational conditions, one of which is innovation culture. Research shows that an innovation culture can strengthen the relationship between leadership and digital transformation performance, as it provides an environment that supports experimentation, risk-taking, and cross-functional collaboration. Thus, organizations with a strong innovation culture will be able to maximize the positive impact of digital leadership on digital transformation.
H11: Innovation Culture mediates the relationship between Digital Leadership and Digital Transformation.

Innovation Culture, Digital Leadership and Workforce Agility

Digital leadership is defined as the ability of leaders to integrate digital technology, strategic vision, and change management to enhance organizational competitiveness. In the context of a dynamic business environment, digital leadership is believed to play an important role in increasing workforce agility, which is the ability of the workforce to adapt, respond to rapid

changes, and remain innovative amid disruption. However, the strength of digital leadership's influence on workforce agility is influenced by internal organizational conditions, particularly innovation culture. An innovation culture creates a work environment that supports creativity, collaboration, and risk-taking, thereby strengthening the impact of digital leadership in shaping an agile and adaptive workforce. Thus, workforce agility will be higher in organizations with a strong innovation culture when led by effective digital leaders. Based on those Hypotheses, the conceptual framework is in Figure 1.

H12: Innovation Culture mediates the influence of Digital Leadership on Workforce Agility

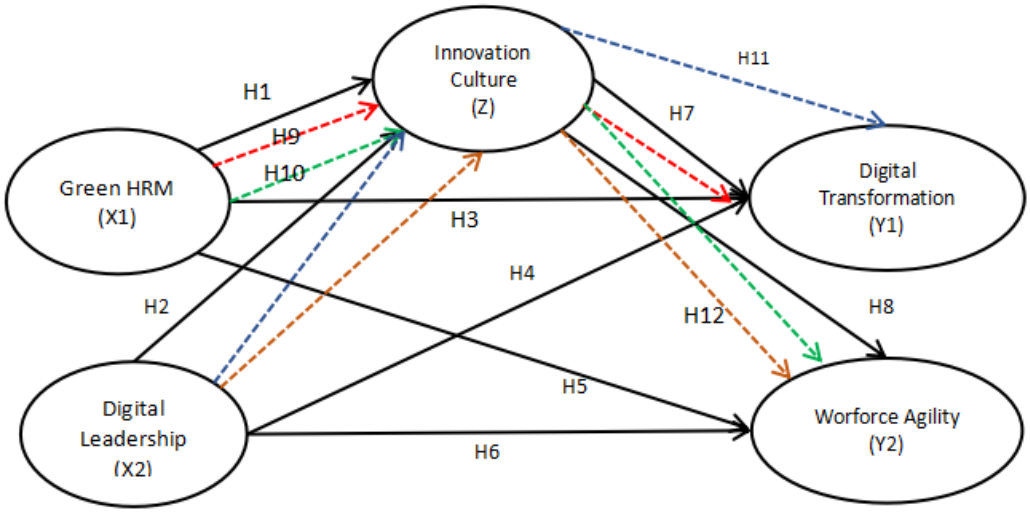


Figure 1. Conceptual Model

RESEARCH METHOD

This study uses a quantitative approach with an explanatory research design to examine the causal relationship between green HRM, digital leadership, innovation culture, digital transformation, and workforce agility. A cross-sectional survey design was chosen to collect data at a single point in time from respondents working in oil and gas companies in Balikpapan, East Kalimantan.

Independent variables: Green HRM (X1) with dimensions: Green Recruitment, Green Training, and Green Compensation. Digital Leadership (X2) with dimensions: Creativity, In-depth Knowledge, Networking, Strong Collaboration, and Loyalty through Vision. Mediating Variable: Innovation Culture (Z) with dimensions: Innovation Intention (Innovation Propensity, Organizational Constituency), Innovation Infrastructure (Organizational Learning, Creativity & Empowerment), Innovation Influence (Market Orientation & Value Orientation), Innovation Implementation (Implementation Context). Dependent Variables: Digital Transformation (Y1) with dimensions: Digital Technology Integration, Digital Business Model, and Digital Operational Excellence Workforce Agility (Y2) with dimensions: Proactive (Initiative Behavior & Anticipatory Behavior), Adaptive (Learning Behavior, Interpersonal Adaptability & Professional Flexibility), Resilient (individual ability to cope with a changing environment) and Research Instruments.

Data collection was conducted using a structured questionnaire with a 5-point Likert scale (1 = strongly disagree to 5 = strongly agree). The research instruments were adapted from validated scales established in prior literature. Green HRM items were adapted from Renwick et al. (2013) and Yu et al. (2020), covering green recruitment, training, and compensation dimensions. Digital Leadership items were adapted from Kane et al. (2019) and Mihardjo et al. (2019). Innovation Culture items were adapted from Martins and Terblanche (2003). Digital Transformation items followed Vial (2019) and Zaki (2019), while Workforce Agility items were adapted from Muduli (2017) and Storme et al. (2020). All items were reviewed by three academic experts in HRM and digital management and two oil and gas industry practitioners to assess content validity and contextual relevance before pilot testing. Minor wording adjustments were made to reflect the Indonesian oil and gas operational context. The research population consisted of employees and managers working in oil and gas companies operating in Balikpapan City. The

sampling technique used stratified random sampling with stratification by position (management and non-management) and department (HR, IT, Operations, HSE). Sample size was determined using the rule of 10 observations per path indicator recommended for PLS-SEM (Hair et al., 2019). With 25 structural paths in the model, the minimum required sample was 250 respondents; the researcher collected 300 responses to enhance statistical power and reduce the risk of Type II error. A post-hoc power analysis using G*Power confirmed that a sample of 300 provides power exceeding 0.95 at a significance level of 0.05 for the effect sizes observed. Describing respondent characteristics and distribution of answers using mean, median, mode, and standard deviation. Inferential statistical analysis: using the Structural Equation Modeling (SEM) approach with Smartpls 4 to test measurement models and structural models. SEM analysis stages: Evaluation of measurement models through Confirmatory Factor Analysis (CFA), Construct Validity Testing, Construct Reliability Testing, Evaluation of structural models and hypothesis testing and mediation effect analysis. Validity and Reliability Testing: Content Validity: conducted through review by academic experts in the fields of HRM and digital management as well as oil and gas industry practitioners. Construct Validity: tested through Convergent validity (Factor loading > 0.7, AVE >0.5). Reliability: measured using Cronbach's Alpha (> 0.6) (Hair et al., 2019).

RESULTS

Discriminatory Validity and R-square

The results show that each AVE root has a greater correlation with the other variables. One example is that variable Green HRM (GH) has a root value of AVE (0.796) that is more correlated with innovation culture (0.631), and workforce agility (0.415). Thus, this result shows that the discriminant variable of all variables is fulfilled. This study presents the R^2 describes the magnitude of the influence of endogenous variables that can be explained by other exogenous or endogenous variables in a model as in Table 1. The interpretation values on the R square include 0.19 (low), 0.33 (moderate), and 0.66 (high) (Chin, 1998).

Table 1. Correlation, and GOF Results

Measurement	Value Measurement		
	IC	DT	WA
R^2	0.801	0.668	0.360
R^2 adj.	0.800	0.665	0.354
Goodness of Fit Index (GoF)		0.646	

Source: Primary Data is processed, Smart PLS. 2025

Based on the Table 1, the result of the goodness of fit index (GoF) test have a ≥ 0.36. This means that the overall evaluation of the model with data is accepted with a high model suitability which is 0.646

Hypothesis Testing and Discussion

Hypothesis testing is one of the tests of structural model analysis used to examine the relationship between variables from the proposed hypothesis development as in Table 2. Hypothesis testing between variables is done by looking at the path coefficient value and p-value. If the p-value statistical calculation is less than 0.05, then there is a significant effect between variables. On the other hand, path coefficient is assessed to determine the magnitude of the influence between variables. Furthermore, the f-square value represents the direct influence of variables at the structural level, with the following conditions f square 0.02 is low, 0.15 is moderate, and 0.35 is high.

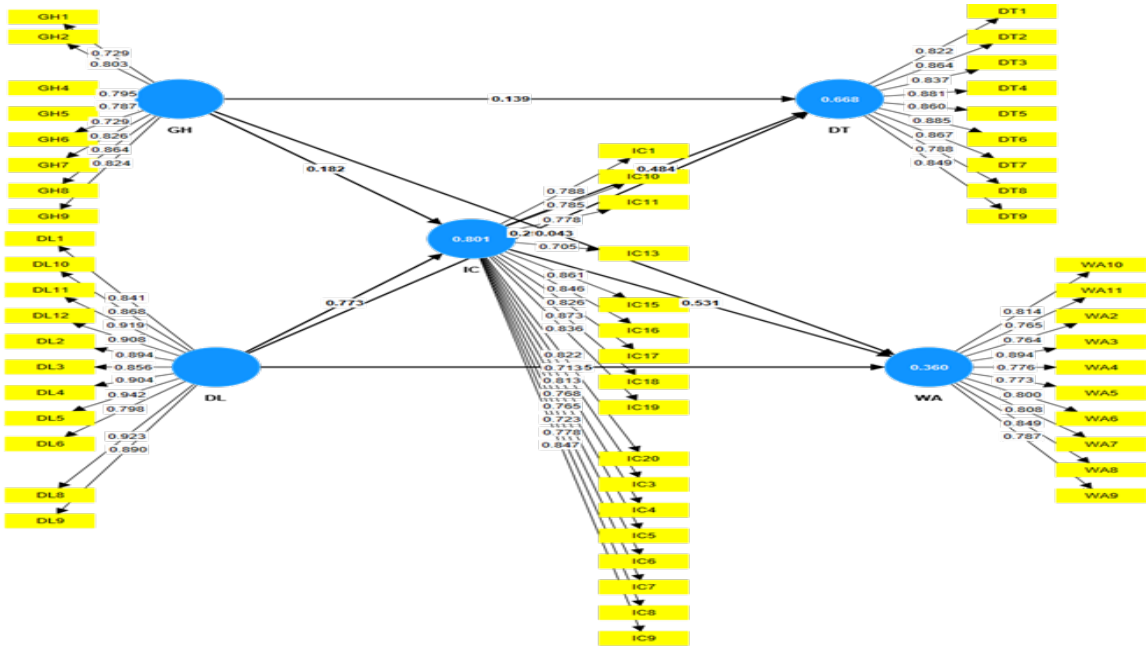


Figure 2. Path Coefficient Output
Source: Smartpls 4 output (2025)

Table 2. Hypothesis Test Results

Hypothesis	Effect	*t*-value	*p*-value	Description
Green HRM -> Innovation Culture	0.182	5.273	0.000	Accepted
Digital Leadership -> Innovation Culture	0.773	27.016	0.000	Accepted
Green HRM -> Digital Transformation	0.139	3.340	0.001	Accepted
Digital Leadership -> Digital Transformation	0.225	3.152	0.002	Accepted
Green HRM ->-> Workforce Agility	0.043	0.603	0.547	Rejected
Digital Leadership -> Workforce Agility	0.045	0.347	0.729	Rejected
Innovation Culture -> Digital Transformation	0.484	4.670	0.000	Accepted
Innovation Culture -> Workforce Agility	0.531	3.385	0.001	Accepted
Green HRM -> Innovation Culture -> Digital Transformation	0.088	3.377	0.001	Accepted
Green HRM -> Innovation Culture -> Workforce Agility	0.097	3.049	0.001	Accepted
Digital Leadership -> Innovation Culture -> Digital Transformation	0.374	4.568	0.000	Accepted
Digital Leadership -> Innovation Culture -> Workforce Agility	0.410	3.049	0.002	Accepted

Source: Primary data processed, Smart PLS. 2025

DISCUSSION

Green HRM and digital leadership both strengthen innovation culture, although they operate through different mechanisms. Green HRM embeds sustainability into recruitment, training, performance appraisal, and reward systems, thereby developing employees' abilities, motivation, and opportunities to generate environmentally responsible ideas (Yu et al., 2020). These capabilities constitute valuable and difficult-to-imitate resources under the resource-based view (Barney, 1991), supporting the findings of Fang et al. (2022) and Shahzad et al. (2023). However, its cultural influence may develop slowly in oil and gas organizations because regulations, safety procedures, and operational rigidity constrain experimentation, unlike the stronger effects observed in service settings (Khan et al., 2025). Digital leadership operates more

directly by legitimizing technological learning, collaboration, and calculated risk-taking. This interpretation supports Alshuaibi et al. (2024), Öngel et al. (2024), Wang et al. (2022), Zervas and Stiakakis (2024), and Wasono and Furinto (2018). Organizations should therefore integrate Green HRM with institutionalized digital leadership rather than rely on isolated environmental initiatives or individual leaders.

Green HRM also supports digital transformation by linking environmental responsibility with technological efficiency. The natural resource-based view explains that pollution prevention and resource stewardship encourage cleaner and more efficient organizational processes (Hart, 1995). Paperless recruitment, virtual training, digital performance assessment, and automated reporting illustrate this connection. This interpretation supports Ali et al. (2025), and Gazi et al. (2024), although Green HRM cannot independently overcome legacy systems, fragmented infrastructure, or capital-intensive technologies. Digital leadership plays a more direct role because leaders identify technological opportunities, align resources, reduce resistance, and establish transformation priorities. These functions reflect the strategic value of technological vision and change-management capability (Barney, 1991; Kane et al., 2019). The finding supports Qiao and Li (2024), but it also qualifies technology-centered models that emphasize direct leadership mandates (El Sawy et al., 2022). Managers should align digital investment with employee reskilling, participation, and organizational readiness.

Neither Green HRM nor digital leadership directly guarantees workforce agility. Green HRM primarily develops environmental awareness and responsible behavior, whereas agility requires rapid learning, digital fluency, cross-functional competence, and responsiveness to unfamiliar tasks. This interpretation supports Islam et al. (2025), although it differs from Handayani et al. (2025), who identified a more direct relationship in healthcare. Oil and gas operations may weaken this connection because specialized roles, formal procedures, and safety obligations restrict behavioral flexibility. Digital leadership faces a similar limitation. Leaders may communicate a compelling digital vision, but employees still require technological infrastructure, practical capabilities, autonomy, and psychological readiness to act on that vision. This interpretation is consistent with Awwad et al. (2022) and Kludacz-Alessandri et al. (2025). Organizations should therefore complement sustainability and digital leadership initiatives with job rotation, multidisciplinary projects, adaptive training, and greater employee discretion.

Innovation culture provides the organizational foundation for digital transformation and workforce agility. A culture that values learning, experimentation, collaboration, and responsible risk-taking enables organizations to sense technological opportunities, seize them, and reconfigure existing processes, as proposed by dynamic capabilities theory (Teece et al., 1997). This challenges the technology-push perspective, which views transformation mainly as the result of technological investment (Vial, 2019) and supports the culture-pull perspective that organizational values determine whether technology is accepted and used productively (Cao et al., 2025). Innovation culture also represents a socially complex resource that competitors cannot easily reproduce (Barney, 1991). At the workforce level, employees internalize cultural expectations concerning adaptability and continuous learning, as explained by social identity theory (Tajfel & Turner, 1979). This interpretation supports Alshuaibi et al. (2024), Wang et al. (2022), and Zihan and Makhbul (2024). Managers should therefore invest in collaborative learning, experimentation platforms, and tolerance for responsible failure.

Innovation culture also explains how Green HRM produces broader organizational outcomes. Green practices create environmental commitment, a learning orientation, and openness to resource-efficient solutions, but these values must become shared cultural norms before they generate digital transformation or workforce agility. This mechanism extends the natural resource-based view by showing that green resources create strategic value through adaptive organizational capabilities rather than through compliance alone (Hart, 1995). It also supports Ali et al. (2025), Cao et al. (2025), Gazi et al. (2024), Thomas and Suresh (2023), and Zihan and Makhbul (2024). Social exchange theory further suggests that employees reciprocate organizational commitment to sustainability through constructive and adaptive behavior, but such reciprocity becomes durable only when sustainability is culturally institutionalized. Green HRM should therefore function as a platform for innovation, digital experimentation, and continuous learning rather than remain a separate environmental program.

Innovation culture similarly converts digital leadership into digital transformation and workforce agility. Digital leaders can identify opportunities and articulate strategic direction, but cultural acceptance determines whether their vision becomes embedded in employee behavior and organizational processes. This pathway supports dynamic capabilities theory because leadership initiates opportunity recognition, while culture sustains organizational reconfiguration (Teece et al., 1997). It differs from the direct leadership model proposed for digitally mature organizations by El Sawy et al. (2022), suggesting that cultural readiness is more critical in emerging and highly regulated contexts. This interpretation supports Çetinkaya and Sürücü (2025), Kludacz-Alessandri et al. (2025), and Mollah et al. (2024). Oil and gas organizations should translate digital leadership into team routines, knowledge-sharing practices, performance systems, capability-building programs, and cross-functional collaboration. Innovation culture ultimately transforms leadership vision and green HR practices into sustained digital change and workforce adaptability.

CONCLUSION AND FURTHER STUDY

This study concludes that innovation culture is the central mechanism linking Green HRM and digital leadership with digital transformation and workforce agility. Green HRM and digital leadership do not produce these outcomes automatically. Their influence becomes stronger when organizations embed experimentation, continuous learning, collaboration, and adaptability into shared norms and daily practices. The findings extend management and sustainability theory by showing that strategic resources create value through cultural conversion. For managers, the implication is clear: environmental HR practices, digital leadership, and technology investment should be integrated with capability development, knowledge sharing, cross-functional teamwork, and formal innovation systems.

The study is limited by its focus on the oil and gas industry in Balikpapan, its cross-sectional design, and its reliance on self-reported questionnaire data. These conditions restrict broader generalization and prevent firm conclusions about long-term causality. Future research should test the model across sectors and regions, use longitudinal designs, and combine surveys with interviews, observations, or case studies. Further studies may also examine organizational structure, digital maturity, employee readiness, and environmental uncertainty as boundary conditions that shape the effectiveness of Green HRM, digital leadership, and innovation culture.

ETHICAL DISCLOSURE

All participants provided written informed consent prior to participation. They were informed about the study's purpose, their voluntary participation, the right to withdraw at any time, and the confidentiality of their responses.

CONFLICT OF INTERESTS

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