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DRIVING SUSTAINABLE PERFORMANCE THROUGH GREEN INNOVATION: THE STRATEGIC ROLE OF GREEN HUMAN RESOURCE MANAGEMENT IN SMES

RUDY IRWANSYAH[1], SUPIAH NINGSIH[2], DANIL SYAHPUTRA[3], ADETIA AZMI TANJUNG[4], TRI MARTIAL[5*]

[1,2,3,4]UNIVERSITAS MUHAMMADIYAH ASAHAN, INDONESIA
[5]TJUT NYAK DHIEN UNIVERSITY, MEDAN, INDONESIA
EMAIL: rudy.irwansyah@gmail.com[1], supiahningsih26@gmail.com[2], danilsyahputra686@gmail.com[3], tia.tanjung92@gmail.com[4], trimartial@utnd.ac.id[5*]

ABSTRACT
Sustainability issues have emerged as a central concern in the global business transformation. In Indonesia, including among Small and Medium-sized Enterprises (SMEs), which often face resource constraints and environmental pressures. This study investigates the strategic role of Green Human Resource Management (GHRM) in driving Green Sustainable Performance (GSP) through the mediating effect of Green Innovation (GI) within the context of SMEs in Tanjung Balai, Indonesia, while taking into account resource limitations and local characteristics in coastal areas. Adopting an explanatory quantitative approach, data were collected from 200 SMEs meeting specific criteria through a hybrid survey method and analyzed using Structural Equation Modeling-Partial Least Squares (SEM-PLS). The findings reveal that GHRM has a significant impact on GI (β=0.828) and GSP (β=0.446), while GI also significantly influences GSP (β=0.417), with GI partially mediating the relationship between GHRM and GSP (β=0.345). These results underscore that GHRM practices serve as a dominant catalyst in fostering innovation that promotes sustainability within the SME sector. The study offers policy implications, including the formulation of SME-friendly adaptive regulations, the development of localized GHRM training programs, the provision of green incentives, and the establishment of collaborative innovation networks.
Keywords: green human resource management; green innovation; green sustainable performance; SMEs; policy.

INTRODUCTION

Over the past decade, sustainability has become a central focus in the business world, particularly for Small and Medium-sized Enterprises (SMEs) that face multidimensional pressures to adopt environmentally friendly practices. [1]. In Indonesia, SMEs contribute approximately 61 percent to the national Gross Domestic Product [2] [3], yet they are also responsible for 65 percent of industrial waste [4]. Tanjung Balai, a prominent SME hub in North Sumatra, presents an intriguing dynamic: SME growth has reached 8.2 percent annually, accompanied by a 15 percent increase in environmental pollution [5]. This situation reflects a paradox between economic growth and environmental degradation, highlighting the urgent need for integrated solutions.

Green Human Resource Management (GHRM) has developed as a strategic method that integrates sustainability values into human resource practices [6]. Prior studies indicate that the implementation of GHRM in large enterprises can improve environmental performance by up to 23 percent [7] [8]. However, the adoption of GHRM in SMEs faces significant challenges, including limited financial resources, cultural resistance to change, and a lack of managerial capabilities [9]. Research by [10] further reveals that only around 12 percent of SMEs in developing countries have structured GHRM programs in place.

Empirical findings also indicate a dominant focus on large corporations in GHRM-related research, with approximately 89 percent of studies concentrating on organizations with ample resources [11]. Ironically, SMEs despite accounting for 97 percent of the global workforce remain significantly underexplored. While several studies have examined the direct relationship between GHRM and Green Sustainable Performance (GSP), the mediating role of Green Innovation (GI) remains only partially understood, particularly in clarifying how green HR practices translate into innovation within the SME context [12]. Furthermore, studies on GHRM in Southeast Asia are still scarce, with over 90 percent of research predominantly situated in European and North American contexts [10] [13]

Given these critical gaps, this study seeks to contribute by developing an integrated mediation model that connects GHRM with Green Innovation and Sustainable Performance, adapting the Ability-Motivation-Opportunity (AMO) theory within the framework of a green economy. In the specific context of SMEs in Tanjung Balai, Indonesia, a developing region with limited resources and coastal-specific SME challenges. This study emphasizes the implementation of low-cost GHRM practices and the role of local institutions in fostering innovation.

The expected contribution of this study is the development of an integrated GHRM–GI–GSP framework tailored to the specific context of green economies in coastal areas of developing countries, such as Tanjung Balai. The practical implications for SMEs include a step-by-step guide to implementing GHRM and a low-cost protocol for green innovation. For policymakers, the study offers insights for designing green performance-based incentives and developing a structured SME mentoring model.

To address these issues, this study poses the following research questions: How do GHRM practices (green recruitment, training, and incentives) influence the development of green innovation among SMEs in Tanjung Balai? To what extent does green innovation mediate the relationship between GHRM and sustainable performance? And what contextual factors moderate the effectiveness of GHRM implementation in micro-scale SMEs?

LITERATURE REVIEW

Green Human Resource Management (GHRM)

The concept of GHRM has evolved into a critical paradigm within contemporary HR management. GHRM refers to the integration of conventional HR practices with environmental sustainability principles, fostering synergy between organizational objectives and ecological responsibility. This definition emphasizes the transformation of traditional HR functions into strategic instruments for enhancing environmental performance. In the SME context, the implementation of GHRM carries distinct characteristics that differentiate it from its application in large corporations [6] [9].

In practice, GHRM in SMEs encompasses three interrelated core dimensions. First, green recruitment, which refers to the hiring process that explicitly considers environmental awareness as a selection criterion [7]. This approach evaluates not only technical competencies but also the sustainability values held by candidates. Second, green training, which focuses on developing employee competencies related to environmentally friendly practices [14]. Training content includes areas such as energy efficiency, waste management, and the application of circular economy principles. Third, green incentives, which involve reward systems linked to the achievement of organizational environmental targets [15]. These three GHRM activities are strategically designed to motivate employees to be more conscious of environmental issues in their daily work routines.

However, the implementation of GHRM in SMEs faces several critical challenges that warrant close attention. The foremost challenge is budget constraints, as many SMEs struggle to allocate dedicated financial resources for GHRM programs [16] [17]. The second challenge is resistance to change, particularly among employees who are accustomed to conventional systems and work procedures [18] [19]. The third challenge is a lack of managerial awareness, where many SME owners have yet to fully recognize the strategic benefits of GHRM implementation for their business sustainability [9]. These challenges are often interrelated and collectively create complex barriers to the effective adoption of GHRM at the SME level.

Recent studies suggest that these challenges can be addressed through appropriate and context-sensitive approaches. A phased implementation of GHRM, beginning with low-cost initiatives that deliver measurable and immediate impact [20]. Emphasis is also placed on shaping organizational culture by fostering effective communication about the benefits of GHRM among all stakeholders [6] [21]. Meanwhile, Mousa and Othman (2020) propose managerial capacity-building programs specifically tailored for SME owners, with a focus on sustainability-related competencies [9].

In a broader context, the implementation of GHRM in SMEs is not only beneficial to the organizations themselves but also contributes to the achievement of the Sustainable Development Goals (SDGs). Therefore, it is essential for governments and relevant institutions to actively promote the adoption of GHRM among SMEs through supportive policies and enabling programs.

Based on the Resource-Based View (RBV) theory, Green Human Resource Management (GHRM) can function as a strategic resource that builds organizational capabilities for green innovation through three core mechanisms: environmental knowledge developed via green training [6], employee motivation driven by sustainability-based incentive systems [15], and green organizational culture fostered through environmentally oriented recruitment processes [14]. Recent empirical studies reinforce this relationship. Ali et al., (2024) found that GHRM can enhance Green Innovation (GI) by 34 percent in manufacturing firms [22]. This finding is supported by Tran, (2023), who reported an even stronger effect (45 percent) in organizations with flexible structures [23]. However, within the SME context, this dynamic may differ. Therefore, the following hypothesis is proposed **H1**: GHRM has a positive effect on Green Innovation (GI) in SMEs.

Green Sustainable Performance (GSP)

The concept of Green Sustainable Performance (GSP) has become a critical benchmark for evaluating the success of sustainable business practices. GSP refers to a firm's ability to achieve operational objectives while minimizing its negative environmental impact [20]. The measurement of GSP generally includes three interrelated key indicators. The first indicator is energy efficiency, which reflects systematic efforts by firms to reduce energy consumption through various initiatives, such as applying energy-efficient technologies, streamlining production processes, and adopting energy management systems [24]. An improvement in energy efficiency by 10 percent can reduce SME operational costs by approximately 5–8 percent. The second indicator is waste reduction, which involves strategies aimed at minimizing hazardous outputs through approaches such as recycling, cleaner production, and the circular economy [25]. SMEs implementing integrated waste management systems can reduce disposal costs by up to 30 percent [26].

The third indicator is regulatory compliance, which assesses the extent to which firms adhere to applicable environmental standards and regulations. Compliance not only protects SMEs from legal sanctions but also enhances their reputation and brand equity [27]. The implementation of GSP in SMEs poses distinct challenges compared to large enterprises, primarily due to limited capital for green technology investments, a shortage of skilled human resources, and the complexity of environmental certification procedures [22].

The Natural Resource-Based View (NRBV) theory, as elaborated by Riaz et al., (2023), explains how GI contributes to sustainable competitive advantage through mechanisms such as process efficiency (e.g., reduced energy consumption), product differentiation (e.g., eco-label certification), and green reputation, which enhances customer loyalty [28]. Evidence shows that green innovation can improve Green Sustainable Performance (GSP) by 28 percent in SMEs that adopt such practices (T. Zhang & Chi, 2020; Bhatti et al., 2024). Accordingly, the following hypothesis is proposed **H2**: Green Innovation (GI) has a positive effect on Green Sustainable Performance (GSP) in SMEs.

The Concept of Green Innovation (GI) in the Context of SMEs

The concept of Green Innovation (GI) has been extensively studied as a key element in driving business sustainability in the modern era. GI refers to the development of products, processes, or business models that significantly reduce negative environmental impacts while enhancing resource efficiency ([31]. This definition reflects a holistic approach that not only focuses on technical aspects but also entails systemic transformation within business operations. In the context of SMEs, the implementation of GI exhibits distinct characteristics compared to its adoption in larger firms.

RESEARCH METHODOLOGY

This study employed a quantitative explanatory approach to examine the causal relationships among variables. The research design was selected to align with the objective of verifying the impact and mediating mechanism of GI in the relationship between GHRM and GSP [42] [44]. This design also enables generalization to similar SME populations and facilitates the quantification of abstract constructs such as GHRM and GI. For this purpose, empirical testing was conducted using Structural Equation Modeling (SEM) with the Partial Least Squares (PLS) technique, utilizing version 3.0 of the software.

Field Research Design

The study was conducted in Tanjung Balai City, North Sumatra, located on the eastern coast of Sumatra Island, from March to June 2025. The target population comprised all SMEs in the city that met the following criteria: (1) had been operational for at least three years, (2) held a valid business license, and (3) had implemented at least one practice related to GHRM or GI. Sampling was based on the official SME database from the Department of Cooperatives and SMEs of Tanjung Balai, which listed 1,250 SMEs that met these inclusion criteria, operating in the manufacturing, trade, or service sectors; employing between 5 and 100 workers; and willing to participate.

A purposive sampling technique was used to select SMEs that met the inclusion criteria, followed by proportional stratified sampling to allocate the sample across sectors and business scales. The sample was distributed as follows: 50 percent manufacturing, 30 percent trade, and 20 percent services; and 60 percent small-scale, 40 percent medium-scale enterprises. The final sample size was determined using Slovin's formula (with $\alpha = 5$ percent):

$$n = N/(1+Ne^2)$$
$$= 1{,}250/(1+1{,}250\times 0.05^2)$$
$$= 300 \text{ SMEs}$$

Accounting for an anticipated 30 percent of incomplete or ineligible responses, the final valid sample consisted of 200 SMEs. Primary data were collected using a structured research questionnaire, which included demographic information (business age, number of employees, business sector) and measurement items for GHRM (12 items), GI (9 items), and GSP (8 items). To ensure the validity of the research instrument, a pilot test was conducted involving a subset of respondents to refine the questionnaire items based on clarity and relevance.

Procedure

GHRM was assessed based on three core activities: green recruitment**,** green training**,** and green incentives**.** Green recruitment refers to the process implemented by SMEs in Tanjung Balai that prioritizes environmental values and sustainability during the hiring of new employees. This includes screening candidates for attributes such as environmental commitment and awareness. Green training involves initiatives carried out by SMEs to promote environmentally friendly practices among employees. These programs are designed to build competencies related to green behavior and eco-efficiency within daily operations. Green incentives refer to the rewards provided to employees to encourage and reinforce pro-environmental behaviors. These may include recognition programs, bonuses, or other motivational tools linked to environmental performance targets.

Meanwhile, green product innovation relates to the development of eco-friendly goods; green process innovation involves improving operational processes to reduce environmental impact; and green organizational innovation includes the integration of sustainability values into management systems and organizational structures. Green sustainable performance was assessed through three primary indicators reflecting SME environmental practices: energy efficiency**,** waste reduction, and compliance with environmental regulations.

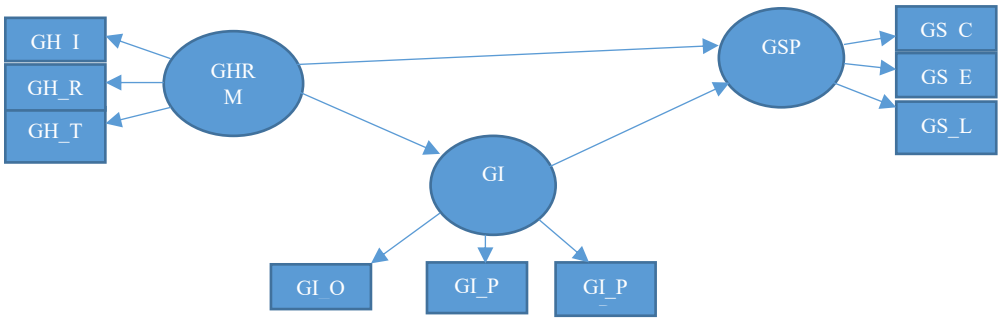

Figure 1. Model of the relationship between GHRM and GSP moderated by GI

The proposed conceptual model is illustrated in **Figure 1**, representing the hypothesized relationships between GHRM, GI, and GSP, along with associated indicators (Table 1). Primary data were collected through a hybrid survey method (online and offline) over a three-month period (April–June 2025).

Table 1. Research variables and indicators

Variable	Definition	Indicators	Scala	Source
GHRM (X)	Environment-based HR practices	1. Green Incentives (GH_I) (3 item) 2. Green recruitment (GH_R) (4 item) 3. Green Training (GH_T) (5 item)	Likert Scale 1–5	[20]); [24]; [45]
GI (M)	Innovation in eco-friendly products and processes	1. Green Organizational Innovation (GI_O) (2 item) 2. Green Product Innovation (GI_P) (3 item) 3. Green Process Innovation (GI-PR) (4 item)	Likert Scale 1–5	[46]; [47]; [36]
GSP (Y)	Long-term environmental performance outcomes	1. Green compliance (GS_C) (2 item) 2. Green Energy Efficiency (GS_E) (3 item) 3. Green Waste Reduction (GS_L) (3 item)	Likert Scale 1–5	[42]; [7]; [24]

Data Analysis

Data were analyzed using PLS-SEM to examine the relationships between GHRM and GSP, with GI as a mediating variable. This approach aimed to evaluate the extent to which GI influences GSP and to assess the strength of the

causal mechanisms. As GSP represents a strategic outcome for SMEs in Tanjung Balai, the role of green innovation becomes critical in sustaining performance under resource-constrained conditions. Understanding the implementation of GHRM in SMEs is essential, given their limitations in capital and technical capacity. PLS-SEM was selected because it is appropriate for relatively small sample sizes, supports complex models with latent variables, and does not require the assumption of data normality.

Model evaluation was conducted through several key steps. 1) Measurement model evaluation assessed construct validity and reliability using the following criteria: Convergent validity, indicated by Average Variance Extracted (AVE) values greater than 0.5; Discriminant validity, assessed using the Fornell-Larcker criterion; and Reliability, assessed through Composite Reliability (CR) with acceptable thresholds above 0.7. Structural model evaluation was performed by analyzing Path coefficients to estimate the strength of relationships, Statistical significance (t-values and p-values), and R^2 values to determine predictive accuracy and explanatory power. The main objective of the structural model assessment was to determine the indirect effect of GI in mediating the relationship between GHRM and GSP, with mediation classified as full or partial based on the significance of direct and indirect paths [48].

RESULT

Respondent Characteristics

The respondents in this study consisted of SMEs located in Tanjung Balai City, categorized into three sectors: manufacturing, trade, and services (Table 2).

Table 2. Characteristics of SMEs in Tanjung Balai

Category	Classification	Frequency (%)
Business Sector	Manufacturing	104 (52%)
	Trade	62 (31%)
	Services	34 (17%)
Business Scale	Micro (5–10 employees)	86 (43%)
	Small (11–30 employees)	74 (37%)
	Medium (31–100 employees)	40 (20%)
Years in Operation	< 5 years	56 (28%)
	5–10 years	90 (45%)
	> 10 years	54 (27%)

The findings indicate that the majority of SMEs in Tanjung Balai operate in the manufacturing sector (52 percent), are micro-sized (43 percent), and have been in operation for 5 to 10 years (45 percent). This suggests that many of the SMEs are engaged in the food and handicraft industries, which are prevalent in Tanjung Balai. As a growing city in North Sumatra, Tanjung Balai functions as a center for small-scale manufacturing and trade, though it remains largely dominated by micro and small enterprises. As is widely recognized, manufacturing SMEs are predominantly engaged in food products derived from fish, which represent the largest natural resource in coastal areas.

These SMEs have demonstrated efforts to develop their organizations using the Ability-Motivation-Opportunity (AMO) framework, as seen in Table 3. This includes Ability: green training that improves environmental competencies, Motivation: green incentives that build employee commitment, and Opportunity: green recruitment that shapes a pro-environmental organizational culture. However, micro and small enterprises face limitations in fully implementing GHRM strategies due to resource constraints.

Based on the structure of the identified variables, SMEs in Tanjung Balai have generally adopted an Ability-Motivation-Opportunity (AMO) approach to organizational development. Specifically, ability is reflected in training programs that enhance green skills; motivation is driven by incentives that foster employee commitment; and opportunity is embedded in recruitment practices that help build an organizational culture aligned with sustainability values, thus supporting the implementation of GHRM (Table 3). However, micro and small enterprises face considerable resource constraints, which limit their capacity to implement these practices comprehensively.

Table 3. Statistics Deskriptif of research variable

Variabel	Number of Item	Mean (Scala 1-5)	Deviasion Standard	Skewness
Green Human Resourch Management	12	3.42	0.78	-0.32

- Green Incentives	3	3.21	0.92	-0.18
- Green recruitment	4	2.98	0.85	0.15
- Green Training	5	3.67	0.71	-0.41
Green Innovation	9	3.15	0.83	-0.25
- Green Organization	2	3.12	0.87	-0.12
- Green product	3	2.89	0.91	0.22
- Green processes	4	3.34	0.79	-0.33
Green Sustainable Performance	8	3.28	0.76	-0.29
- Green compliance	2	3.18	0.75	-0.21
- Green energy	3	3.45	0.82	-0.38
- Green litter	3	3.11	0.88	-0.05

Evaluation of the Measurement and Structural Model

The structural model was assessed by examining the reliability and validity of the latent constructs. All constructs recorded Cronbach's Alpha values above the 0.7 benchmark, confirming internal consistency and the reliable representation of their corresponding latent variables. Thus, the indicators employed in this study were considered suitable for forming the endogenous variables of GHRM, GI, and GSP (Table 4). In addition, AVE values exceeded 0.5, demonstrating convergent validity and verifying that the indicators effectively captured their constructs (Tables 4 and 5).

Table 4. Construct Reliability and Validity

	Cronbach's Alpha	rho_A	Composite Reliability	AVE
GHRM	0.941	0.942	0.949	0.607
GSP	0.892	0.894	0.914	0.571
Green Innovation	0.903	0.904	0.921	0.565

All CR values exceeded 0.7 and AVE values were above 0.5, indicating acceptable levels of reliability and validity. In addition, all factor loadings were greater than 0.7, confirming that each indicator strongly represented its respective construct (Figure 2). Thus the model was acceptable, with Green Recruitment (GR1) had the highest loading at 0.843, making it the most critical indicator for GHRM—suggesting that recruitment is the most influential GHRM practice in the SME context. While Green Product Innovation (GP1) had a loading of 0.803, higher than Green Process Innovation (GPR2 = 0.790), indicating that SMEs in this study prioritized product-based improvements over process modifications. The AVE for GHRM (0.607) was the highest among the constructs, demonstrating strong internal consistency in green HR practices. These results confirm that each construct is distinct from the others, fulfilling the requirement for discriminant validity.

Table 5. Discriminant validity based Forner lacker criterion

	GHRM	GSP	Green Innovation
GHRM	0.779		
GSP	0.791	0.756	
Green Innovation	0.828	0.786	0.751

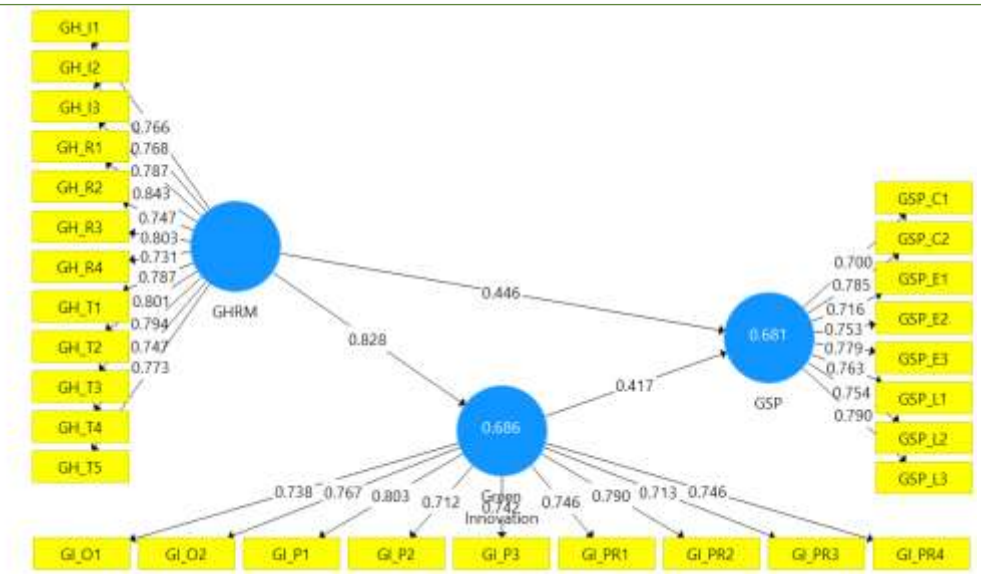

Figure 2. The loadings factor for each indicator, the path coefficients, and R^2 values

Path Analysis

The relationships among variables were examined using path coefficient analysis to evaluate both direct and indirect effects. The direct path relationships are presented in Table 6.

Table 6. Path Coefficients between Endogenous Variables

	Original Sample (O)	Sample Mean (M)	Standard Deviation (STDEV)	T Statistics (|O/STDEV|)	P Values
GHRM -> GSP	0.446	0.448	0.063	7.129	0.000
GHRM -> Green Innovation	0.828	0.831	0.022	36.816	0.000
Green Innovation -> GSP	0.417	0.416	0.066	6.277	0.000

The results show a positive and statistically significant direct relationship between GHRM and GSP, with a coefficient of 0.446. Since the confidence interval does not include zero, this confirms that the effect is significant at the 0.05 level. The coefficient, approaching 0.5, indicates a moderate to strong influence.

A particularly strong and significant relationship was also observed between GHRM and GI ($\beta = 0.828$, $p < 0.01$). This indicates that GHRM practices specifically green recruitment, training, and incentives play a crucial role in driving green innovation, especially within resource-constrained SMEs. A one-unit increase in GHRM is associated with a 0.828-unit increase in GI, reflecting a high-impact strategic linkage.

Similarly, the path from GI to GSP ($\beta = 0.417$, $p < 0.01$) demonstrates that GI is a key driver of sustainable performance. SMEs that successfully translate GHRM practices into tangible innovations such as waste recycling technology achieve significantly higher GSP outcomes. These results underscore the strategic role of GI as a transformative mechanism between GHRM and GSP, reinforcing the theoretical proposition that sustainable innovation is a pivotal bridge between human resource strategy and organizational sustainability outcomes.

Tabel 7. Tabel Specific Indirect Effects

	Original Sample (O)	Sample Mean (M)	Standard Deviation (STDEV)	T Statistics (|O/STDEV|)	P Values
GHRM -> Green Innovation -> GSP	0.345	0.345	0.056	6.203	0.000

The indirect effect of GHRM on GSP through GI was positive ($\beta = 0.345$) and statistically significant (Table 7). Since the confidence interval does not include zero, the mediation is confirmed at the 0.05 significance level. Because both

the direct effect (GHRM → GSP = 0.446) and the indirect effect (GHRM → GI → GSP = 0.345) are significant, the mediation is classified as partial mediation. This implies that part of GHRM's influence on GSP occurs directly, while another part is channeled through green innovation. Further analysis showed that 43.6 percent of the total effect of GHRM on GSP is mediated by GI, with the remaining impact attributed to the direct effect of GHRM.

These findings suggest that GHRM practices not only contribute directly to sustainable performance but also create enabling conditions for innovation that amplify sustainability outcomes. This supports RBV which emphasizes that internal capabilities such as green HR practices can be transformed into competitive advantage through innovation. Additionally, the results align with the Dynamic Capability Theory, positioning GI as a strategic capability that links GHRM with organizational performance.

Based on the results, H1 and H2 are accepted, as the paths GHRM → GI and GI → GSP are both significant and strong ($\beta > 0.45$). H3 is also accepted, with partial mediation confirmed. Model validation was consistent across the full sample and sectoral subgroups (manufacturing and trade).

Coefficient of Determination (R^2) and Effect Size (f^2)

The R^2 value indicates the degree to which independent variables explain the variance in the dependent variables. Table 8 presents the R^2 values for both endogenous constructs in the model.

Table 8. R Square and Adjusted R Square Values

	R Square	R Square Adjusted
GSP	0.681	0.678
Green Innovation	0.686	0.685

An R^2 of 0.681 for GSP means that 68.1% of the variation in Green Sustainable Performance can be explained by GHRM and Green Innovation. Similarly, the R^2 of 0.686 for Green Innovation indicates that 68.6% of its variance is explained by GHRM alone. According to Hair et al., (2021), R^2 values between 0.67 and 0.75 are considered substantially strong, indicating that the model has a high predictive power. These results confirm that the structural model is capable of accurately explaining the relationships between GHRM as dependent variable to GI, and GSP as independent variable in the context of SMEs, particularly under resource-constrained conditions.

In addition to R^2, the f^2 effect size was analyzed to determine the magnitude of each predictor variable's contribution to the dependent constructs (Table 9). Based to Table 9, The GHRM → GSP path shows a moderate effect size ($f^2 = 0.196$), suggesting that GHRM plays a meaningful but not exclusive role in influencing sustainable performance. The GHRM → Green Innovation path exhibits a very large effect size ($f^2 = 2.186$), indicating that GHRM is a dominant factor in driving green innovation. The Green Innovation → GSP path also shows a moderate effect ($f^2 = 0.171$), affirming the importance of innovation in enhancing sustainable outcomes.

These findings underscore the strategic role of GHRM in shaping green innovation, which in turn significantly contributes to sustainable performance. The strength of these relationships reinforces the theoretical proposition that green-oriented HR practices act as a catalyst for innovation, which then translates into improved environmental, social, and operational performance among SMEs.

Tabel 9. F Square effect size

	GHRM	**GSP**	**Green Innovation**
GHRM		0.196	2.186
GSP			
Green Innovation		0.171	

1. DISSCUSSION

The PLS-SEM analysis confirms that GHRM significantly influences GI (H1 is accepted). This finding supports RBV [35], that strategic HR practices can serve as a source of sustainable competitive advantage.

In the context of SMEs in Tanjung Balai, several mechanisms were identified. First, training programs specifically designed to enhance technical competencies in environmental management (e.g., waste reduction and energy efficiency), aligned with the findings of [7]; [6]. Second, incentive systems that successfully motivate employees to generate eco-innovative ideas [49]. Third, environmentally oriented recruitment that helps establish an organizational culture conducive to green innovation [46].

The most prominent result in this study is the dominant mediating role of GI in the relationship between GHRM and GSP, with a strong path coefficient of $\beta = 0.828$ ($p < 0.01$). This finding extends the application of RBV theory within the context of SMEs in developing countries, showing that the effectiveness of GHRM especially training, incentives, and recruitment is heavily dependent on context-specific factors, such as practical content, participatory learning methods, and integration with day-to-day operations [50][35]. The structure of GHRM practices in Tanjung Balai resembles patterns observed in Malaysia, where green training emerges as the most critical dimension [51] [6]. However, in this study, short-duration training sessions (2–4 hours), local case-based content, and integration into daily work processes were found to be particularly effective.

This study also adds depth to the literature by incorporating contextual factors typical of developing countries [34] where Local networks increased GI effectiveness by up to 25%, particularly through collaboration with local suppliers and universities. In contrast, the role of adaptive regulation differs from the findings of de Moura et al., (2024) in Europe. This study reveals that rigid regulations tend to hinder innovation. A phased or incremental approach proves to be more effective, and non-financial incentives such as certificationnhave a significant impact on SMEs.

The analysis confirms a significant positive relationship between GI and GSP ($\beta = 0.417$, $p < 0.01$) (H2 is accepted), aligning with the Natural Resource-Based View (NRBV) [35] [36] where green innovation enables SMEs to create added value through Process efficiency by adoption of energy-saving technologies led to a reported 15–20 percent reduction in operational costs [53] [54]; Product differentiation such as environmentally friendly packaging enhanced export competitiveness [44][55]; and Green reputation such as Eco-label certifications improved customer loyalty by approximately 25 percent [56].

Sectoral differences were also observed in Tanjung Balai. The effect of GI on GSP was stronger in the manufacturing sector ($\beta = 0.58$) compared to services ($\beta = 0.42$), consistent with studies by Ngoc Huynh et al., (2024) and Obuobi et al., (2024) which highlight the complexity of GI implementation in service-based enterprises. Moreover, the presence of green innovation can also be reinforced by the green culture embedded within SMEs [57].

Mediation analysis confirms the partial mediating role of GI in the relationship between GHRM and GSP ($\beta = 0.345$, $p < 0.01$) (H3 is accepted). The strong direct path from GHRM to GI ($\beta = 0.828$) and the significant direct effect from GHRM to GSP ($\beta = 0.446$) indicate that GHRM has both direct and indirect impacts on sustainable performance. This suggests that human capital development plays a central role in advancing sustainability outcomes in SMEs by improving performance directly and enabling eco-innovation.

This finding makes a notable theoretical contribution by integrating the AMO Framework, where ability (training), motivation (incentives), and opportunity (culture) synergistically drive innovation, and the NRBV Theory, where innovation acts as a dynamic mechanism converting HRM into measurable performance outcomes. The result is consistent with findings in the service industry, which also found partial mediation highlighting the unique characteristics of SMEs, where effective GHRM must be coupled with innovation initiatives to realize sustainability goals [24] [58].

This may be explained by SMEs' reliance on adaptive innovation, low levels of process formalization, and a heavy dependence on human capital. The mediating mechanism identified in this study aligns with findings by Sun and Wei, (2025), who emphasized that the impact of GI varies by sector, type, and scale of business [47]. Similarly, found that GI has a significant and positive effect on SME financial performance [59].

Implications

This study contributes to the literature by extending the application of the Resource-Based View (RBV) and Natural Resource-Based View (NRBV) in the context of SMEs in developing countries. It integrates micro-level perspectives (AMO framework) and macro-level resource theories (NRBV) within a mediation analysis, and validates the GHRM–GI–GSP model under resource-constrained conditions. The findings strongly support the AMO framework, in which green training (ability) plays a pivotal role in enhancing innovation-related competencies, green incentives (motivation) stimulate innovative experimentation in SME product development, and green recruitment (opportunity) helps shape a sustainability-oriented organizational culture. Meanwhile, green human resources (GHRM) must be strategically converted into innovative capabilities (GI) to achieve sustainable competitive advantage, consistent with the NRBV theory.

The managerial implications for SMEs include prioritizing green technical training based on operational needs, developing non-financial incentive systems (e.g., recognition, promotion), and establishing cross-functional teams to accelerate innovation. For government policymakers, this entails providing SME-specific GHRM training modules, offering fiscal incentives for the adoption of simple green technologies, and facilitating collaborative networks with higher education institutions.

This study reinforces a growing body of literature emphasizing the strategic value of innovation in enhancing SME competitiveness [60] [61]. It highlights the importance of green training in developing environmentally oriented human capital [62], though sectoral and locational differences such as enterprise size and geographic context can significantly influence implementation outcomes [63] [7].

The findings suggest that fostering green innovation is crucial for enabling SMEs especially micro and small enterprises to grow and survive. In Tanjung Balai, most SMEs are in the manufacturing sector, primarily producing food and handicrafts, which are highly susceptible to market saturation due to limited demand. Therefore, continuous innovation is required to ensure sustainability. These insights also imply that the process of developing GHRM practices in small enterprises differs substantially from that in medium-sized firms. Small businesses often require guided capacity-building programs with an environmental focus, as their limited resources constrain the development of new innovations. Thus, support from external stakeholders particularly policymakers is essential in encouraging creativity and innovation, for example, through targeted training initiatives.

The resource constraints observed in micro and small enterprises directly impact their innovation capabilities, thereby necessitating a strong mediating role of green innovation to support sustainable SME performance. The GHRM implementation patterns identified in this study diverge significantly from those observed in large corporations, underscoring the need for context-sensitive strategies tailored to the unique conditions of SMEs.

CONCLUSION AND RECOMMENDATIONS

Conclusion

This study provides empirical evidence that GHRM plays a strategic role in enhancing GSP in SMEs, mediated by GI. Drawing on RBV, NRBV, and AMO framework, the findings demonstrate that GHRM significantly influences GI ($\beta = 0.828$), particularly through structured practices such as green recruitment, green training, and green incentives.

Moreover, GI has a significant effect on GSP ($\beta = 0.417$), especially in the manufacturing sector, through its contributions to energy efficiency**,** regulatory compliance, and waste reduction. GI was found to partially mediate the relationship between GHRM and GSP (indirect effect $\beta = 0.345$), indicating that green innovation is a critical mechanism for transforming HR practices into sustainable outcomes.

The structural model demonstrated strong predictive accuracy, with R^2 values of 0.681 for GSP and 0.686 for GI, confirming that the model effectively explains sustainable performance in SMEs operating in resource-constrained environments. These findings reaffirm that the development of environmentally oriented human capital is a key driver of competitive advantage and resilience, especially for SMEs in developing countries like Indonesia.

Recommendations

Based on the findings, several policy recommendations are proposed to strengthen GHRM implementation and encourage green innovation among SMEs, particularly in coastal and developing regions such as Tanjung Balai are design adaptive environmental regulations governments should develop flexible environmental policies tailored to the characteristics of SMEs. Rather than imposing rigid compliance standards, a phased policy approach should be adopted to allow incremental and realistic adoption of sustainable practices; Develop SME-Specific GHRM Training Modules. Training programs should be designed with short durations (2–4 hours per session), grounded in local case studies, and integrated into daily operations to ensure relevance and practicality. These should be delivered through public–private partnerships and local institutions; Build Local Green Innovation Ecosystems. Policymakers and development agencies should support the formation of local innovation networks, facilitating collaboration among SMEs, universities, NGOs, and local governments. These networks can promote knowledge sharing, skill development, and co-innovation in green products and processes. GHRM should be embedded within broader national strategies for SME growth, positioning human capital and environmental sustainability as core pillars of long-term economic development.

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