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DETERMINANTS OF SUSTAINABLE PERFORMANCE IN SMALL AND MEDIUM INDUSTRIES: THE ROLE OF GREEN HUMAN RESOURCE MANAGEMENT THROUGH GREEN OPERATIONAL DIMENSIONS

Mauledy Ahmad[a*], Hapzi[a], Tri Widyastuti[a], Hadita[a]
[a]*Faculty of Economics and Business, Universitas Bhayangkara Jakarta Raya, Indonesia*
mauledyahmad67@gmail.com

Abstract

This study investigates the determinants of sustainable performance in small and medium industries (SMIs) in Jambi Province, Indonesia, focusing on the role of Green Human Resource Management (GHRM) and the mediating role of green operational dimensions, namely Green Input (GI), Green Process (GP), and Green Product (GPro). A quantitative explanatory design was employed using Partial Least Squares Structural Equation Modeling (PLS-SEM). Data were collected from 224 managers or owners of SMIs registered with the Jambi Provincial Department of Industry and Trade, selected through stratified purposive sampling across six regencies/cities. The results show that GHRM has a positive and significant effect on Green Input, Green Process, Green Product, and Sustainable Performance, with the strongest effect on Green Input. Green Input, Green Process, and Green Product each have a positive and significant effect on Sustainable Performance and partially mediate the relationship between GHRM and Sustainable Performance, with Green Input providing the strongest mediation. The model explains 83% of the variance in Sustainable Performance. This study contributes by integrating all three green value chain dimensions simultaneously as mediators of the GHRM–Sustainable Performance relationship within a single model and by extending GHRM theory to the context of Indonesian SMIs outside Java. The findings indicate that green human capital capabilities are most effective in transforming procurement and resource utilisation at the initial stage of the value chain and offer actionable guidance for policymakers and practitioners seeking to embed green practices into human capital management.

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1. Introduction

Accelerating global industrialisation over recent decades has generated environmental pressures that can no longer be disregarded. Carbon dioxide emissions from the industrial sector account for approximately 24% of total global greenhouse gas emissions (Bashmakov et al., 2022; Lamb et al., 2021), while natural resource degradation, water pollution, and industrial solid waste continue to increase at an alarming rate. Against this backdrop, the concept of sustainable development, defined as development that meets the needs of the present without compromising the ability of future generations to meet their own needs (Redclift, 2005), has become the central paradigm in global industrial policy.

In Indonesia, small and medium industries (SMIs) play an undeniably strategic role. According to the Ministry of Industry of the Republic of Indonesia (2023), SMIs absorb more than 87% of the manufacturing workforce and contribute approximately 61% of national gross domestic product (GDP). Nevertheless, this substantial economic contribution is accompanied by significant environmental challenges, as most Indonesian SMIs continue to operate under conventional production patterns that are not yet aligned with the principles of environmental sustainability (Ministry of Environment and Forestry, 2022).

Jambi Province, one of Sumatra's resource-rich provinces, faces a similar dilemma. Data from the Jambi Provincial Department of Industry and Trade (2022) record 12,847 active SMI units across its regencies and cities. However, between 2019 and 2022, Jambi's SMI sector experienced considerable economic pressure: average asset values declined by 12.7%, turnover fell by 8.3%, and the number of workers employed decreased by 6.9%. This downturn was driven not only by the COVID-19 pandemic but also by an inability to adapt to evolving environmental regulations, rising consumer demand for eco-friendly products, and weak managerial capacity to implement green operational practices.

This situation highlights the relevance of Green Human Resource Management (GHRM) as a strategic solution. GHRM is defined as the integration of human resource management policies and practices with an organisation's environmental objectives, encompassing environmentally conscious recruitment, green training, environment-based performance appraisal, green compensation, and employee involvement and empowerment in environmental programmes (Renwick et al., 2013; Yong et al., 2020). In line with the Ability–Motivation–Opportunity (AMO) framework developed by Appelbaum et al. (2000), GHRM serves as a mechanism to develop capabilities, motivate behaviour, and create opportunities for employees to support organisational sustainability goals.

Prior research on the relationship between GHRM and sustainable performance has generally been conducted in large multinational corporations or in specific manufacturing sectors in countries such as China (Zhang et al., 2019), Malaysia (Yong et al., 2020), and Pakistan (Abbas & Khan, 2023). These studies affirm that GHRM contributes positively to various performance dimensions, including environmental, operational, and financial performance. However, significant research gaps remain, particularly regarding (1) how GHRM operates in resource-constrained SMI contexts; (2) the specific mediation mechanisms through green value chain dimensions (green input, green process, and green product); and (3) empirical

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validation in the Indonesian context, especially in regions outside Java whose industrial characteristics differ substantially from those of major industrial centres.

This study responds to these gaps by proposing a conceptual model with GHRM as the exogenous variable; green input, green process, and green product as mediating variables; and sustainable performance as the endogenous variable. The theoretical integration of the Triple Bottom Line (TBL) (Elkington, 1997), the Resource-Based View (RBV) (Barney, 1991), and AMO Theory (Appelbaum et al., 2000) provides a robust foundation for understanding how environmentally oriented human resources manage production inputs, optimise operational processes, and generate products that comprehensively enhance the sustainable performance of SMIs. This study aims to empirically test a model of the determinants of SMI sustainable performance through GHRM and the mediation of green operational dimensions. It offers theoretical contributions to the development of GHRM theory in the Indonesian SMI context and practical contributions in the form of evidence-based policy recommendations for industrial stakeholders and the local government of Jambi Province.

2. Literature Review and Hypothesis Development

2.1. Triple Bottom Line (TBL) Theory

The Triple Bottom Line (TBL) was developed by Elkington (1997) as an organisational performance evaluation framework that transcends the purely financial dimension. TBL integrates three interconnected performance pillars: profit (economic performance), people (social performance), and planet (environmental performance). In this study, TBL serves as the framework for operationalising sustainable performance as a multidimensional construct encompassing (a) profitability and cost efficiency (economic); (b) employee welfare, customer satisfaction, and community responsibility (social); and (c) carbon footprint reduction, energy efficiency, and waste minimisation (environmental). TBL provides the theoretical justification for why GHRM practices that promote green input, green process, and green product ultimately enhance the sustainable performance of SMIs holistically (Elkington et al., 2019; Fonseca et al., 2020).

The relevance of TBL in the SMI context is growing in tandem with increasing regulatory pressure for environmental compliance and market demand for sustainable products. Svensson et al. (2018) demonstrate that firms adopting a TBL orientation can enhance long-term competitiveness by minimising regulatory risk, accessing the growing green market segment, and attracting and retaining high-quality human resources who are increasingly attentive to sustainability values.

2.2. Resource-Based View (RBV)

The Resource-Based View (RBV), popularised by Barney (1991), posits that sustainable competitive advantage derives from the ownership and utilisation of resources that are valuable, rare, inimitable, and non-substitutable, collectively known as the VRIN criteria. In this study, RBV is employed to explain how GHRM practices build human resources with unique green capabilities that are difficult for competitors to imitate.

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An extension of RBV by Teece et al. (1997) introduced the concept of dynamic capabilities, that is, an organisation's ability to integrate, build, and reconfigure internal competencies in response to changes in the external environment. In the GHRM context, dynamic capabilities are manifested in the ability of SMIs to adapt recruitment, training, and performance appraisal processes to the continually evolving demands of environmental sustainability. Green input, green process, and green product can be viewed as concrete expressions of GHRM-based dynamic capabilities that ultimately contribute to sustainable performance.

2.3. AMO Theory

Ability–Motivation–Opportunity (AMO) Theory was developed by Appelbaum et al. (2000) to explain the mechanisms through which human resource management practices influence employee behaviour and performance. The theory posits that employee performance is a function of three components: ability, acquired through recruitment and training; motivation, developed through compensation, recognition, and involvement; and opportunity, facilitated through job design and empowerment.

The application of AMO Theory in the GHRM context has been extensively discussed in the literature (Iftikar et al., 2022; Renwick et al., 2013). These studies demonstrate that GHRM operates through the AMO mechanism: (1) ability, as environmental training enhances employees' green knowledge and skills; (2) motivation, as green incentives and compensation encourage environmentally friendly behaviour; and (3) opportunity, as employee involvement in green programmes and environmentally oriented job design create opportunities to contribute to sustainability objectives. In this study, AMO Theory explains how GHRM influences the ability, motivation, and opportunity of SMI employees to manage green input, optimise green processes, and generate green products.

2.4. Research Variables

2.4.1. Green Human Resource Management (GHRM)

Green Human Resource Management (GHRM) is defined as HRM policies, practices, and systems that promote employees' environmentally responsible behaviour and thereby support the achievement of the organisation's overall environmental objectives (Boselie et al., 2001; Renwick et al., 2013). This concept represents an evolution of strategic HRM (SHRM) that integrates the environmental dimension as a strategic component of human capital management. Tang et al. (2018) identify the core dimensions of GHRM as (1) green recruitment and selection; (2) green training and development; (3) green performance management; (4) green compensation and rewards; (5) green employee involvement; and (6) green organisational culture.

Recent research increasingly affirms the role of GHRM as a primary enabler of sustainable business practices. In a study conducted in Malaysia, Yong et al. (2020) found that GHRM has a positive and significant influence on sustainability in manufacturing organisations. Zhang et al. (2019) demonstrate that GHRM promotes green employee behaviour in Chinese firms. In Indonesia, Ahmad (2023) indicates that SMIs implementing GHRM, albeit at an early stage, show improvements in environmental compliance and reductions in operational costs in the medium term.

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2.4.2. Green Input (GI)

Green input refers to the use of environmentally friendly raw materials, energy, and natural resources in the industrial production process (Krajnc & Glavič, 2003; Zhu et al., 2008). This dimension encompasses the selection of raw materials with minimal environmental impact, the use of renewable energy, efficient water management, and the selection of suppliers based on environmental criteria (green procurement). Within the sustainable value chain, green input constitutes a critical starting point, as the quality and sustainability of output are largely determined by the environmental characteristics of the inputs employed.

Liu et al. (2019) found that environmental concerns drive green supply chain management practices in China's manufacturing sector, which in turn improve environmental and financial performance through reductions in material costs and gains in energy efficiency. Srivastava (2007) affirms that green input is a fundamental component of green supply chain management with positive effects across various performance dimensions. In the SMI context, effective management of green input not only reduces environmental impact but also lowers production costs and enhances competitiveness (Henao et al., 2019).

2.4.3. Green Process (GP)

Green process refers to the transformation and optimisation of production processes to achieve greater resource efficiency and minimise waste and pollution (Diabat & Govindan, 2011). This dimension encompasses the implementation of cleaner production technologies, optimisation of energy efficiency, responsible waste management, reduction of carbon emissions from manufacturing processes, and the adoption of international environmental standards such as ISO 14001 (Oliveira et al., 2016; Oyelakin, 2025).

From a theoretical perspective, green process represents the manifestation of a cleaner production strategy that integrates environmental considerations into every stage of production. Darnall et al. (2008) demonstrate that organisations adopting environmental management systems (EMS) in their operational processes exhibit significant improvements in resource efficiency and reductions in compliance costs. Green process also functions as a bridge between green input and green product, as the quality of green production processes determines the extent to which the environmental advantages of inputs are transferred to the final product.

2.4.4. Green Product (GPro)

A green product is designed, manufactured, and distributed with consideration for its environmental impact throughout its life cycle, from raw material extraction to end-of-life disposal (Chen, 2008). Characteristics of green products include the use of recyclable or biodegradable materials, reduced hazardous substance content, energy efficiency during use, environmentally friendly packaging, and ease of disassembly and recycling at end of life (Diwekar, 2005).

Recent research demonstrates that green product innovation significantly affects not only environmental performance but also financial and market performance. Chang (2011) and Halme and Korpela (2014) found that green innovation positively affects competitive advantage and firm performance. Chen et al. (2006) show that firms with strong green

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innovation capabilities tend to enjoy a better corporate image and competitive advantage. In the SMI context, green products are becoming increasingly relevant in response to growing consumer awareness and eco-labelling regulations in both domestic and export markets.

2.4.5. Sustainable Performance (SP)

In this study, sustainable performance (SP) is operationalised using the TBL framework, integrating economic, social, and environmental performance into a single comprehensive construct. Economic performance encompasses profitability, sales growth, cost efficiency, and market competitiveness (Govindan et al., 2013). Social performance includes employee welfare, relationships with local communities, compliance with labour standards, and corporate social responsibility. Environmental performance encompasses emission reductions, resource use efficiency, waste minimisation, and compliance with environmental regulations.

Pearlman and Molloy (2003) emphasise that a comprehensive measurement of sustainable performance must include both leading (predictive) and lagging (historical) indicators across all three TBL dimensions. In the Indonesian SMI context, sustainable performance also includes the capacity to adapt to evolving environmental regulations and increasingly green-oriented consumer preferences. Setyaningsih et al. (2021) indicate that Indonesian SMIs that successfully integrate environmental and social performance tend to exhibit more stable long-term sales growth than SMIs that focus solely on short-term financial performance.

2.5. Hypothesis Development

Based on the theoretical and empirical review above, ten hypotheses are formulated to constitute an integrated conceptual model. The argument underpinning H1 rests on AMO Theory: GHRM, particularly green training and environmentally conscious recruitment, enhances employees' ability and motivation to procure environmentally friendly raw materials, select green suppliers, and improve energy efficiency. Liu et al. (2019) and Zhu et al. (2008) provide empirical support demonstrating that environment-oriented practices directly influence the quality of production inputs.

H1: *Green human resource management has a positive and significant effect on the green input of SMIs in Jambi Province.*

Employees trained in environmental management (ability) and motivated by green incentives (motivation) are inclined to implement cleaner, energy-efficient, and low-waste production processes. Darnall et al. (2008) and Vázquez-Brust et al. (2023) confirm that GHRM is a strong predictor of the adoption of environmental management practices in operational processes.

H2: *Green human resource management has a positive and significant effect on the green process of SMIs in Jambi Province.*

GHRM that integrates environmental innovation into performance appraisal and employee development fosters creativity in the design of eco-friendly products. Chang (2011), Chen (2008), and Veerasamy and Joseph (2023) demonstrate that green human capital is an important antecedent of green product innovation.

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H3: *Green human resource management has a positive and significant effect on the green product of SMIs in Jambi Province.*

Beyond indirect pathways, GHRM also has a direct effect on sustainable performance through an enhanced environmental reputation, reduced regulatory risk, and improved employee commitment. Khan et al. (2021) and Yong et al. (2020) confirm the direct influence of GHRM on various dimensions of sustainable performance.

H4: *Green human resource management has a positive and significant direct effect on the sustainable performance of SMIs in Jambi Province.*

H5, H6, and H7 are grounded in the TBL and RBV frameworks. Green input, green process, and green product each contribute to improvements in economic performance (cost reduction and efficiency gains), environmental performance (reduction of negative impacts), and social performance (enhanced image and stakeholder trust), which collectively constitute sustainable performance.

H5: *Green input has a positive and significant effect on the sustainable performance of SMIs in Jambi Province.*

H6: *Green process has a positive and significant effect on the sustainable performance of SMIs in Jambi Province.*

H7: *Green product has a positive and significant effect on the sustainable performance of SMIs in Jambi Province.*

H8, H9, and H10 are formulated on the basis of mediation logic: GHRM builds employees' green capabilities through the AMO mechanism, which are subsequently applied in managing green inputs, optimising green processes, and generating green products that ultimately enhance the sustainable performance of SMIs. This mediation model constitutes a novel contribution to the GHRM literature, as it integrates the entire green value chain (input → process → product) within a single model.

H8: *Green input mediates the effect of green human resource management on the sustainable performance of SMIs in Jambi Province.*

H9: *Green process mediates the effect of green human resource management on the sustainable performance of SMIs in Jambi Province.*

H10: *Green product mediates the effect of green human resource management on the sustainable performance of SMIs in Jambi Province.*

3. Research Methods

3.1. Research Design and Approach

This study employs an explanatory quantitative research design aimed at explaining causal relationships among variables through hypothesis testing based on empirical data (Hair et al., 2019). The quantitative approach was selected because it enables systematic measurement, replication, and generalisation of findings. A cross-sectional design was adopted, with data

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collected at a single point in time (February–April 2023), given the constraints of research resources and the relative stability of the constructs over the measurement period.

The analysis employed Partial Least Squares Structural Equation Modeling (PLS-SEM) using SmartPLS version 4.1. PLS-SEM was selected because of (1) the predictive orientation of the research; (2) the complexity of the model, which features reflective latent constructs and multiple mediation pathways; (3) the absence of a multivariate normality requirement; and (4) its capacity to handle moderate sample sizes with robust estimation (Hair et al., 2019; Ringle et al., 2015). PLS-SEM is particularly recommended for exploratory–confirmatory research in management science, especially when theoretical models involve multiple mediators (Sarstedt et al., 2019).

3.2. Population, Sample, and Sampling Technique

The study population comprises all managers or owners of SMIs actively registered with the Jambi Provincial Department of Industry and Trade in 2022, totalling 12,847 SMI units distributed across six regencies/cities: Jambi City, Muaro Jambi Regency, Batanghari Regency, Bungo Regency, Tebo Regency, and Kerinci Regency. SMIs in Jambi Province operate across various sectors, including rubber processing, wood products, batik crafts, food processing, and the creative industries.

The sample size was determined using the Slovin formula with a margin of error (e) of 7%, yielding a minimum of 196 respondents. To account for possible incomplete data and attrition, the final sample was set at 224 respondents. Stratified purposive sampling was employed based on the proportional distribution of SMIs in each regency/city to ensure adequate geographical and sectoral representation. The sample distribution is presented in Table 1.

Table 1. Sample Distribution by Regency/City in Jambi Province

Regency/City	Number of SMIs	Proportion (%)	Sample (n)
Jambi City	3,421	26.7	60
Muaro Jambi Regency	2,156	16.8	38
Batanghari Regency	1,987	15.5	35
Bungo Regency	1,843	14.3	32
Tebo Regency	1,742	13.6	30
Kerinci Regency	1,698	13.2	29
Total	**12,847**	**100.0**	**224**

Source: Jambi Provincial Department of Industry and Trade (2022), processed by the authors (2023).

3.3. Operational Definitions and Variable Measurement

All constructs were measured using a five-point Likert scale (1 = strongly disagree to 5 = strongly agree), with instruments adapted from validated scales in the international literature and adjusted to the Indonesian SMI context. The operational definitions and instrument sources are presented in Table 2.

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Table 2. Operational Definitions and Measurement Sources of Research Variables

Variable	Notation	Operational Definition	Dimensions/Indicators	Source
Green HRM	X	Integration of HRM policies and practices with organisational environmental objectives to develop green-competent human capital	Green recruitment, green training, environmental performance appraisal, green compensation, environmental involvement (15 items)	Renwick et al. (2013); Tang et al. (2018)
Green Input	Z1	Use of environmentally friendly raw materials, energy, and resources in the production process	Green raw materials, renewable energy, water efficiency, green supplier selection (12 items)	Zhu et al. (2008); Liu et al. (2019)
Green Process	Z2	Transformation and optimisation of production processes for resource efficiency and minimal environmental impact	Cleaner production, energy efficiency, waste management, emission reduction, ISO 14001 (12 items)	Diabat & Govindan (2011); Darnall et al. (2008)
Green Product	Z3	Products designed and manufactured with consideration for environmental impact throughout their life cycle	Recyclable materials, reduction of hazardous substances, green packaging, eco-friendly design (12 items)	Chen (2008); Chang (2011)
Sustainable Performance	Y	SMI performance integrating economic, social, and environmental dimensions (TBL)	Economic, social, and environmental performance (18 items)	Elkington (1997); Fonseca et al. (2020)

Source: Compiled from the literature and adapted by the authors (2023).

3.4. Data Collection Procedure and Research Ethics

Primary data were collected through a structured questionnaire distributed both face-to-face and via a digital survey platform (Google Forms) during February–April 2023. Direct distribution was conducted through visits to SMI locations to ensure respondents' comprehension of the instrument and to improve the response rate. Trained research assistants provided on-site facilitation in each regency/city to ensure uniform questionnaire administration.

Before the main survey, the instrument was pilot tested on 30 SMI respondents who were not included in the final sample to evaluate language clarity, question relevance, and preliminary reliability. All respondents received an informed consent form explaining the study objectives, guaranteeing confidentiality, and stating that the data would be used only in aggregate form. Ethical clearance was obtained from the research ethics committee of Universitas Bhayangkara Jakarta Raya.

3.5. Data Analysis

Data analysis followed the two-stage PLS-SEM approach recommended by Hair et al. (2019) and Sarstedt et al. (2019). The first stage evaluates the outer (measurement) model, encompassing (1) convergent validity, assessed through average variance extracted (AVE ≥ 0.50) and factor loadings (≥ 0.70); (2) reliability, evaluated through Cronbach's alpha (≥

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0.70), composite reliability rho_A (≥ 0.70), and composite reliability rho_C (≥ 0.70); and (3) discriminant validity, tested using the heterotrait–monotrait ratio (HTMT < 0.85), which is more stringent than the classical Fornell–Larcker criterion (Henseler et al., 2015).

The second stage evaluates the inner (structural) model, encompassing (1) the coefficient of determination (R^2) to assess the model's explanatory power; (2) effect size (f^2) to measure the relative magnitude of each predictor's effect; (3) path coefficients (β) and their significance, tested through bootstrapping (5,000 resamples, two-tailed, $\alpha = 0.05$); (4) predictive relevance (Q^2) using blindfolding; and (5) the variance inflation factor (VIF < 5.0) to detect multicollinearity. Mediation analysis followed the procedure recommended by Preacher and Hayes (2008), examining indirect effects and the variance accounted for (VAF) to determine the type of mediation.

4. Results and Discussion

4.1. Respondent Profile

Of the 240 questionnaires distributed, 224 were returned complete and valid (response rate: 93.3%). The respondent profile reflects the characteristics of Jambi Province's SMI population: 58.9% were male; the dominant age range was 36–50 years (52.2%); the highest educational attainment was senior high school/vocational high school (47.3%) or diploma/undergraduate (38.4%); most SMIs had been operating for 5–15 years (61.6%); 54.9% were small-scale and 45.1% medium-scale enterprises; and the largest sectors were agricultural/plantation product processing (33.5%) and craft/creative industries (28.1%).

4.2. Descriptive Statistics of Research Variables

The descriptive statistics show that all research variables fall within the moderate to good range (means of 3.42–3.89 on a five-point scale). Within GHRM, the green training dimension records the highest mean (3.89), indicating that SMIs in Jambi Province are beginning to invest in developing employees' environmental competencies. Within Sustainable Performance, the environmental performance dimension records the lowest mean (3.42), indicating that substantial room for improvement remains in environmental compliance and management among SMIs in Jambi Province.

4.3. Outer Model Evaluation (Measurement Model)

The outer model was evaluated to ensure the validity and reliability of the measurement instruments prior to hypothesis testing. The results are summarised in Table 3.

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Table 3. Outer Model Evaluation Results (Measurement Model)

Construct	Cronbach's α	rho_A	rho_C	AVE	√AVE	Remark
GHRM	0.878	0.891	0.911	0.657	0.810	Valid and reliable
Green Input	0.903	0.917	0.928	0.672	0.820	Valid and reliable
Green Process	0.912	0.924	0.936	0.681	0.825	Valid and reliable
Green Product	0.894	0.906	0.921	0.664	0.815	Valid and reliable
Sustainable Performance	0.937	0.948	0.947	0.694	0.833	Valid and reliable
Threshold	*≥ 0.70*	*≥ 0.70*	*≥ 0.70*	*≥ 0.50*	*> r*	*Hair et al. (2019)*

Source: SmartPLS 4.1 output, processed by the authors (2023).

All constructs meet the convergent validity requirements, with AVE values ranging from 0.657 to 0.694 (threshold ≥ 0.50) and all item loadings exceeding 0.70. Construct reliability is also confirmed, with Cronbach's alpha values ranging from 0.878 to 0.937 and rho_C values ranging from 0.911 to 0.947, all exceeding the 0.70 threshold. Discriminant validity is confirmed by the HTMT criterion, with all HTMT values below 0.85, indicating that each construct is sufficiently distinct from the other constructs in the model.

4.4. Inner Model Evaluation and Hypothesis Testing

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

Table 4 presents the coefficient of determination (R^2) and predictive relevance (Q^2) for each endogenous variable in the model.

Table 4. Coefficient of Determination (R^2) and Predictive Relevance (Q^2)

Endogenous Variable	R^2	Adjusted R^2	Q^2	R^2 Category
Green Input (GI)	0.710	0.704	0.453	Strong
Green Process (GP)	0.740	0.734	0.478	Strong
Green Product (GPro)	0.690	0.683	0.431	Strong
Sustainable Performance (SP)	0.830	0.824	0.541	Strong

Source: SmartPLS 4.1 output, processed by the authors (2023).

The R^2 values for all endogenous variables fall in the strong category according to Cohen's (1988) criteria: Green Input (R^2 = 0.71), Green Process (R^2 = 0.74), Green Product (R^2 = 0.69), and Sustainable Performance (R^2 = 0.83). The model thus explains 83% of the variance in the sustainable performance of SMIs in Jambi Province, a substantial level of explanatory

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power for management research. Q^2 values greater than zero for all endogenous constructs confirm that the model has adequate predictive relevance (Hair et al., 2019).

4.4.2. Direct Effect Hypothesis Testing (H1–H7)

The direct effect hypotheses were tested using bootstrapping with 5,000 resamples. Table 5 presents the path coefficients, standard errors, t-statistics, p-values, and conclusions for each hypothesis.

Table 5. Direct Effect Hypothesis Testing Results (H1–H7)

Hyp.	Path	β	SE	t-Statistic	p-Value	Conclusion
H1	GHRM → Green Input	0.612	0.048	7.463	< 0.001	Positive, significant; supported
H2	GHRM → Green Process	0.587	0.051	6.596	< 0.001	Positive, significant; supported
H3	GHRM → Green Product	0.543	0.054	5.967	< 0.001	Positive, significant; supported
H4	GHRM → Sustainable Performance	0.361	0.062	4.628	< 0.001	Positive, significant; supported
H5	Green Input → Sustainable Performance	0.342	0.067	4.071	< 0.001	Positive, significant; supported
H6	Green Process → Sustainable Performance	0.315	0.070	3.580	< 0.001	Positive, significant; supported
H7	Green Product → Sustainable Performance	0.298	0.063	3.679	< 0.001	Positive, significant; supported

Source: SmartPLS 4.1 output, bootstrapping with 5,000 resamples (2023).

All seven direct effect hypotheses (H1–H7) are supported at $p < 0.001$. GHRM has the strongest effect on Green Input ($\beta = 0.612$), followed by Green Process ($\beta = 0.587$), Green Product ($\beta = 0.543$), and Sustainable Performance ($\beta = 0.361$). Among the mediating variables, Green Input has the largest effect on Sustainable Performance ($\beta = 0.342$), followed by Green Process ($\beta = 0.315$) and Green Product ($\beta = 0.298$).

4.4.3. Mediation Test Results (H8–H10)

Mediation was tested through indirect effect analysis using bootstrapping (5,000 resamples, 95% bias-corrected confidence intervals). The type of mediation was determined based on the significance of the direct and indirect effects and the VAF value. The results are presented in Table 6.

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Table 6. Mediation Test Results (H8–H10): Indirect Effect Analysis

Hyp.	Mediation Path	Indirect Effect	SE	t-Statistic	p-Value	VAF	Conclusion
H8	GHRM → GI → SP	0.612 × 0.342 = 0.209	0.044	4.750	< 0.001	37%	Partial mediation; supported
H9	GHRM → GP → SP	0.587 × 0.315 = 0.185	0.062	2.980	0.003	34%	Partial mediation; supported
H10	GHRM → GPro → SP	0.543 × 0.298 = 0.162	0.053	3.060	0.002	31%	Partial mediation; supported

Source: SmartPLS 4.1 output, bias-corrected bootstrapping with 95% CI (2023).

The results confirm that H8, H9, and H10 are supported, with partial mediation indicated by (1) significant indirect effects ($p \leq 0.003$) across all three pathways; (2) the continued significance of the direct GHRM → SP effect after the inclusion of the mediators; and (3) VAF values below 80%, indicating a significant but not total contribution of the indirect pathways. Green Input provides the strongest mediation effect (VAF = 37%), followed by Green Process (VAF = 34%) and Green Product (VAF = 31%), demonstrating that the management of green production inputs is the most potent mechanism linking GHRM to the sustainable performance of SMIs in Jambi Province.

4.5. Discussion

4.5.1. GHRM and Green Input

The support for H1 ($\beta = 0.612$, $t = 7.463$, $p < 0.001$) indicates that GHRM is the strongest predictor of green input management among all the pathways tested. This finding is consistent with AMO Theory: SMI employees who receive green training (ability) possess better knowledge of the criteria for selecting green raw materials and suppliers; green incentives and compensation (motivation) encourage them to proactively seek more sustainable input alternatives; and involvement in green procurement programmes (opportunity) provides a platform for applying that knowledge in real operational decisions.

This finding is highly relevant for SMIs in Jambi Province, most of which operate in natural resource-based processing sectors (rubber, timber, and agricultural products). Effective green input management, including the use of sustainably certified raw materials and reduced dependence on hazardous chemicals, not only mitigates environmental impact but also improves access to export markets that increasingly require supply chain sustainability standards. This finding is consistent with Liu et al. (2019), Zhu et al. (2008), and Sakikawa et al. (2017), who found positive effects of green and management practices on production inputs and performance in Asian manufacturing contexts.

4.5.2. GHRM and Green Process

The support for H2 ($\beta = 0.587$, $t = 6.596$, $p < 0.001$) affirms the critical role of GHRM in promoting the adoption of cleaner and more efficient production processes. GHRM that

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integrates training on cleaner production technologies, waste reduction procedures, and environmental safety standards (ability) provides the knowledge that SMI employees need to identify and implement environmentally friendly process improvements. The somewhat smaller effect of GHRM on Green Process than on Green Input (β = 0.587 vs. 0.612) can be attributed to the greater technical complexity of transforming production processes relative to changing inputs, which requires not only human capital capabilities but also technological investment, a frequent constraint for resource-limited SMIs.

This finding carries important practical implications: an effective GHRM strategy in SMIs cannot stand alone but must be supported by green technology assistance programmes from government and research institutions (Marshall et al., 2015; Mishra, 2017). The Jambi Provincial Department of Industry and Trade could design a green process voucher programme that subsidises the adoption of cleaner production technology by SMIs that have already implemented GHRM, thereby bridging the gap between human capital and technological capabilities.

4.5.3. GHRM and Green Product

The support for H3 (β = 0.543, t = 5.967, p < 0.001) demonstrates that GHRM positively affects SMIs' capacity to produce environmentally friendly products. The relatively smaller effect of GHRM on Green Product than on Green Input and Green Process (β = 0.543 vs. 0.612 and 0.587) reflects the fact that green product innovation requires more complex, multi-level capabilities: not only individual employee knowledge and motivation but also design capabilities, access to innovative material technologies, and more comprehensive R&D infrastructure. SMIs with limited R&D resources face additional barriers to developing green products compared with large corporations (Halme & Korpela, 2014).

Nevertheless, this finding corroborates Chang (2011), Chen (2008), and Munawar et al. (2022), who show that investment in green human capital through GHRM is an important antecedent of green product innovation, even in limited-scale SMIs. This opens a policy opportunity for a green innovation acceleration programme that combines human capital development (GHRM) with R&D support and green product certification through collaboration among SMIs, universities, and regional research institutions.

4.5.4. GHRM and Sustainable Performance

The direct effect of GHRM on Sustainable Performance (H4: β = 0.361, t = 4.628, p < 0.001) confirms that, in addition to the pathways mediated by green operational dimensions, GHRM has a significant direct effect on SMI sustainable performance. This direct effect operates through several mechanisms: (1) enhanced employee commitment and engagement that translate into productivity and service quality gains; (2) an improved organisational environmental reputation that broadens market access and reinforces stakeholder trust; and (3) reduced regulatory risk through improved environmental compliance, which lowers compliance costs and the potential for penalties.

Although the direct effect (β = 0.361) is larger than any single indirect pathway (e.g., 0.612 × 0.342 = 0.209 through Green Input), the total indirect effect through the three mediators (0.209 + 0.185 + 0.162 = 0.556) exceeds the direct effect. This suggests that the primary

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mechanism through which GHRM enhances sustainable performance is the optimisation of green operations (input, process, and product). Accordingly, GHRM programmes in Jambi SMIs should be designed with a concrete orientation towards enhancing green operational capabilities rather than being confined to abstract organisational values and cultural dimensions.

4.5.5. Green Operational Dimensions and Sustainable Performance

The effect of Green Input on Sustainable Performance (H5: $\beta = 0.342$, $t = 4.071$, $p < 0.001$) is the largest among the three green operational dimensions. This indicates that, for SMIs in Jambi Province, improvements at the initial stage of the value chain, namely the use of more sustainable raw materials and energy, yield the greatest impact on overall sustainable performance. This finding is consistent with the green supply chain literature, which emphasises that resource efficiency at the input stage generates a multiplier effect across the entire value chain.

Green Process (H6: $\beta = 0.315$, $t = 3.580$, $p < 0.001$) and Green Product (H7: $\beta = 0.298$, $t = 3.679$, $p < 0.001$) also contribute significantly to Sustainable Performance. Notably, although the coefficient for Green Product is slightly lower than that for Green Process, its t-statistic is higher (3.679 vs. 3.580), indicating greater precision in the estimation of Green Product's effect. This may reflect that, in an increasingly competitive SMI market in Jambi, differentiation through green products is beginning to deliver measurable competitive advantages in terms of consumer loyalty and access to premium markets.

4.5.6. Mediation of Green Input, Green Process, and Green Product (H8–H10)

The confirmation of partial mediation in H8, H9, and H10 constitutes the most novel finding of this study. Partial mediation, as opposed to full mediation, indicates that the GHRM → Sustainable Performance relationship is not entirely mediated by the green operational dimensions; a significant direct effect remains, operating through other mechanisms such as reputation, employee commitment, and regulatory risk reduction. This pattern is consistent with the RBV perspective, which views GHRM as a strategic resource with a dual impact: a direct effect on performance through human capital and an indirect effect through the transformation of operational capabilities.

The hierarchy of mediation strength, GI (VAF = 37%) > GP (VAF = 34%) > GPro (VAF = 31%), reflects value chain logic: transformation initiated at the input stage generates broader ripple effects across the entire operational system than transformations occurring only at the process or product level. This multiple mediation finding offers an important theoretical contribution: in the SMI context, GHRM operates as an enabler of an integrated green operational system rather than merely as an initiator of change at a single point in the value chain (Gereffi & Lee, 2016). The implication is that comprehensive GHRM interventions encompassing all stages of the value chain will have a greater impact on sustainable performance than partial interventions.

4.5.7. Novelty and Contributions of the Study

This study offers four main contributions that distinguish it from prior research. **First**, it integrates all three green value chain dimensions (Green Input, Green Process, and Green

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Product) simultaneously as mediators of the GHRM–Sustainable Performance relationship within a single model, whereas previous studies have typically examined only one or two mediators, providing a partial depiction of the mediation mechanisms of the green operational system in SMIs. **Second**, it fills an empirical gap in the GHRM literature on Indonesian SMIs outside the major industrial centres of Java; the natural resource-based industry of Jambi Province provides a unique perspective on how GHRM and green practices operate in an industrial environment that is highly dependent on the local ecosystem. **Third**, the use of the HTMT criterion for discriminant validity and bias-corrected bootstrapping for mediation analysis adheres to recent methodological standards in PLS-SEM (Hair et al., 2019; Henseler et al., 2015), enhancing the rigour and credibility of the findings. **Fourth**, the R^2 of 0.83 for Sustainable Performance indicates that the integrated TBL–RBV–AMO model has strong explanatory power compared with partial models incorporating only one or two theoretical frameworks.

5. Conclusion and Suggestion

5.1. Conclusion

This study provides empirical evidence on the determinants of sustainable performance in SMIs in Jambi Province through GHRM and the mediation of green operational dimensions. The principal conclusions are as follows. First, GHRM has a positive and significant effect on Green Input, Green Process, and Green Product, with path coefficients ranging from 0.543 to 0.612 ($p < 0.001$). Its strongest effect is on Green Input, indicating that green human capital capabilities are most effective in transforming procurement and resource utilisation at the initial stage of the value chain.

Second, GHRM has a significant direct effect on Sustainable Performance ($\beta = 0.361$, $p < 0.001$), confirming that investment in green HRM practices yields a measurable direct impact on the economic, social, and environmental performance of SMIs beyond the pathways mediated by green operations. Third, Green Input, Green Process, and Green Product each have a positive and significant effect on Sustainable Performance ($\beta = 0.342$, 0.315, and 0.298, respectively; $p < 0.001$), with Green Input contributing the most, confirming the relevance of the TBL framework in explaining the contribution of green value chain dimensions to SMI sustainable performance. Fourth, Green Input, Green Process, and Green Product each partially mediate the GHRM–Sustainable Performance relationship (H8–H10 supported; VAF = 37%, 34%, and 31%; $p \leq 0.003$), confirming that green operational dimensions are important, though not exclusive, transmission mechanisms. Overall, the model explains 83% of the variance in the sustainable performance of SMIs in Jambi Province.

5.2. Suggestion

The managerial implications of this study encompass four recommendations for SMI stakeholders in Jambi Province:

1. **Institutionalisation of GHRM.** SMI owners and managers should integrate environmental dimensions into all HRM functions, from recruitment criteria based on

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environmental competence and regular green training programmes (at least twice a year) to performance appraisals incorporating environmental indicators and rewards for employees who excel in green innovation. Investment in GHRM should be treated as a long-term strategic investment rather than an operational cost.

2. **Prioritisation of green input.** Given that Green Input has the greatest mediation effect on sustainable performance, Jambi SMIs should prioritise the transformation of their supply chains towards green procurement by establishing a verified green supplier list, certifying raw materials to sustainability standards (e.g., FSC for timber products and RSPO for palm oil), and transitioning towards increasingly affordable renewable energy sources (e.g., government-subsidised solar panels).
3. **Local government assistance programmes.** The Jambi Provincial Department of Industry and Trade could design an integrated programme comprising (a) a GHRM training centre providing subsidised environmental management training for SMI operators; (b) a green process technology voucher to subsidise the adoption of cleaner production technology; (c) a green product certification fund to help SMIs obtain eco-friendly product certifications that expand market access; and (d) an annual Green SMI Award as a non-financial incentive that drives positive competition.
4. **Triple helix collaboration.** Accelerating the green transformation of Jambi SMIs requires collaboration among industry (SMIs), government (the Department of Industry and Trade, the Ministry of Environment and Forestry, and BPOM), and academia (universities in Jambi Province). This triple helix model can generate innovative programmes, such as applied research on local green raw material substitution, incubation of green products based on Jambi's local wisdom, and a green SMI data platform for aggregate environmental performance monitoring.

5.3. Limitations and Future Research Directions

This study has several limitations that also constitute opportunities for future research. First, the cross-sectional design limits the strength of causal inference; longitudinal research with at least two measurement points would provide more compelling causal evidence. Second, the data were self-reported by SMI managers/owners, which carries the potential for common method bias; future research could combine survey data with secondary data, such as financial reports and environmental audit data. Third, the study's coverage is limited to six regencies/cities in Jambi Province; comparative studies across provinces in Sumatra would enhance the generalisability of the findings. Future research could (1) test the moderating role of contextual variables such as SMI size, industry type, and local environmental regulation intensity in the GHRM–Sustainable Performance relationship; (2) explore green organisational culture and green employee behaviour as additional mediating mechanisms; (3) integrate a stakeholder theory perspective, particularly the role of external pressure from consumers, suppliers, and regulators in driving GHRM adoption in SMIs; and (4) develop GHRM measurement instruments that are more appropriate for Indonesian SMIs, taking into account their unique organisational culture and national employment regulations.

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