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Green HRM's Influence on Sustainable Business Performance: Green Innovation Mediation among Indonesian Green Entrepreneurship Start-ups

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Abstract

This study examines how Green Human Resource Management (Green HRM) may contribute to Sustainable Business Performance among green entrepreneurship start-ups in Indonesia, with Green Innovation proposed as a mediating mechanism. Drawing on the Natural Resource-Based View and the Ability–Motivation–Opportunity framework, the study develops a model linking recruitment, training, performance management, rewards, and employee involvement with green product and process innovation. Sustainable Business Performance is conceptualized through economic, environmental, and social dimensions. A quantitative design using a questionnaire and partial least squares structural equation modeling is proposed to assess the relationships and the indirect effect through Green Innovation. The framework suggests that Green HRM can strengthen employees' environmental capabilities and motivation, enabling start-ups to translate environmental knowledge into products and processes that improve resource efficiency and business value. Human resource practices may contribute to sustainability through pathways beyond innovation, including employee participation and more responsible operational routines. The study connects human resource management, green innovation, and multidimensional business performance in entrepreneurial firms. Its empirical contribution will depend on testing the proposed relationships with verified company-level data. The findings may inform research and practical managerial decisions on embedding sustainability within start-up practices.

Keywords: Green Human Resource Management; Green Innovation; Start-ups; Sustainable Business Performance.

INTRODUCTION

Business sustainability increasingly requires organizations to reconcile financial viability with environmental responsibility and social value creation rather than relying

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exclusively on conventional financial measures of success (Bindeebaa et al., 2025; Zhao et al., 2021). This multidimensional perspective places sustainable business performance at the intersection of economic resilience, environmental responsibility, and socially responsible organizational practices (Al-Shammari et al., 2022). Recent evidence synthesized from 137 empirical studies across 43 countries confirms the relevance of green human resource management and green innovation to the broader sustainability agenda, although their effects may differ across performance dimensions (Bindeebaa et al., 2025). Organizations consequently need managerial capabilities that translate environmental commitments into operational routines, employee contributions, and commercially viable outcomes (Singh et al., 2020). Human resource management represents an important part of this process because recruitment, training, employee evaluation, and reward systems influence the capabilities and behaviors available to an organization (Amrutha & Geetha, 2020; Shoaib et al., 2021). This relationship provides a foundation for examining how environmentally oriented human resource practices can contribute to sustainable business performance through the development of green innovation (Kyei-Frimpong et al., 2024).

Indonesia offers a relevant setting for examining this relationship because its economic development remains closely connected to the challenge of reducing greenhouse gas emissions while sustaining economic growth (World Bank, 2023). Statistics Indonesia reports that national greenhouse gas emissions reached approximately 1,360.35 million tonnes of carbon dioxide equivalent in 2023, with the energy sector accounting for approximately 752.28 million tonnes (BPS-Statistics Indonesia, n.d.). The World Bank (2023) also identifies land use and energy as major contributors to the country's emissions profile, underscoring the need for coordinated environmental and economic action. These conditions create opportunities for businesses that develop cleaner technologies, improve resource efficiency, and introduce more environmentally responsible products and processes (Asian Development Bank, 2023). However, the contribution of such businesses depends not only on the environmental relevance of their products but also on their capacity to mobilize employees, maintain operational efficiency, and generate sustainable commercial outcomes (Ratnamiasih et al., 2022; Zhao et al., 2021). Investigating organizational capabilities and human resource practices is therefore relevant to understanding how entrepreneurial ventures can translate environmental ambitions into more comprehensive business performance (Al-Shammari et al., 2022; Bindeebaa et al., 2025).

Indonesia's start-up ecosystem offers a growing context for examining the managerial challenges associated with environmentally oriented entrepreneurship. The Asian Development Bank reported 2,431 start-ups in Indonesia in 2022, while the ASEAN

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Green Economy Landscape currently maps 185 Indonesian start-ups across seven green economy sectors, including energy transition, sustainable agriculture, circular economy, and industrial decarbonization (Asian Development Bank, 2023; ASEAN Green Economy Landscape, n.d.). These figures represent different population definitions and should not be interpreted as directly comparable estimates of the number of green start-ups in the country. Despite the opportunities associated with this ecosystem, research and ecosystem mapping identify constraints involving access to finance, talent availability, regulatory uncertainty, and uneven infrastructure (Asian Development Bank, 2023; The Sweef Institute, 2025). Indonesian evidence already indicates the relevance of human capital and green human resource management to the performance of start-up businesses, although the relationship between these practices and broader sustainability outcomes remains open to further investigation (Ratnamiasih et al., 2022). A subsequent study of start-up companies in Yogyakarta examined green human resource management, green innovation, and green performance, providing a useful foundation for additional investigation using a more comprehensive business sustainability outcome (Yuliza & Musa, 2025).

Green Human Resource Management (Green HRM) refers to the integration of environmental considerations into human resource policies and practices so that employees can contribute to organizational environmental objectives (Amrutha & Geetha, 2020; Zhao et al., 2021). Its implementation can encompass green recruitment and selection, environmental training and development, green performance management, environmental rewards, and employee participation in sustainability initiatives (Al-Shammari et al., 2022). Green recruitment helps organizations attract people whose competencies and values are compatible with environmental objectives, whereas green training strengthens the knowledge and skills needed to identify and implement environmentally responsible practices (Shoaib et al., 2021). Performance evaluation and reward systems can further connect employees' contributions with organizational environmental targets, making sustainability an integral part of work expectations rather than an isolated corporate initiative (Zhao et al., 2021). A systematic review by Amrutha and Geetha (2020) emphasizes the relevance of Green HRM to social sustainability, while subsequent empirical studies demonstrate its relationship with organizational sustainability and green performance (Al-Shammari et al., 2022; Bindeebaa et al., 2025). Green HRM can therefore be conceptualized as an organizational mechanism for developing employee capabilities and engagement that may support both green innovation and sustainable business performance.

The potential contribution of Green HRM to green innovation can be explained through the resource-based view and the ability–motivation–opportunity perspective, which emphasize the strategic value of organizational resources and the conditions that

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enable employees to contribute effectively (Singh et al., 2020; Shoaib et al., 2021). Environmentally oriented recruitment and training can strengthen the knowledge and competencies required to recognize opportunities for reducing resource consumption, redesigning products, and improving production or service processes (Al-Shammari et al., 2022). Employee involvement can also create opportunities for sharing environmental knowledge and translating work-related experience into practical improvements (Amrutha & Geetha, 2020; Singh et al., 2020). Empirical evidence from manufacturing firms indicates that Green HRM is associated with green innovation and that innovation can transmit part of the relationship between organizational management practices and environmental performance (Singh et al., 2020). Research involving Indonesian start-ups has likewise examined Green HRM alongside green innovation, demonstrating the relevance of this relationship within the local entrepreneurial environment (Yuliza & Musa, 2025). These findings support the expectation that more effective Green HRM practices will be associated with stronger green innovation among green entrepreneurship start-ups.

Green innovation refers to the development or implementation of products, services, processes, or organizational improvements that reduce environmental burdens or improve resource efficiency (Singh et al., 2020; Al-Shammari et al., 2022). Product-oriented innovation can help a start-up develop environmentally improved offerings, whereas process-oriented innovation can support reductions in material waste, energy consumption, and production inefficiencies (Al-Shammari et al., 2022). These improvements may contribute to economic performance through cost efficiency and product differentiation while supporting environmental outcomes through reduced resource use and environmental impact (Bindeebaa et al., 2025). Green innovation may also contribute to social performance when new practices improve workplace conditions, encourage employee participation, and strengthen the organization's responsiveness to stakeholders (Zhao et al., 2021). Evidence from a study of mining companies in Ghana indicates that green innovation mediates the relationship between Green HRM practices and selected dimensions of sustainable business performance, although the strength of the relationships varies across economic, environmental, and social outcomes (Kyei-Frimpong et al., 2024). These findings suggest that innovation is a plausible mechanism through which Green HRM can contribute to sustainability, while also indicating that its effectiveness should be examined across the different dimensions of business performance rather than assumed to be uniform.

Although the relationship between Green HRM, green innovation, and organizational performance has attracted growing scholarly attention, differences in research settings and performance measures leave opportunities for more context-specific evidence. Ratnamiasih et al. (2022) examined green human capital and green

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performance among Indonesian start-up businesses, while Yuliza and Musa (2025) investigated green innovation as a mediator between Green HRM and green performance in start-up companies in Yogyakarta. These studies establish the relevance of the topic in Indonesia, but their emphasis on green performance does not fully address the broader economic, environmental, and social dimensions of sustainable business performance. International research has also examined the mediating role of green innovation in different industries, including manufacturing, mining, and hospitality, which provide valuable evidence but differ from the resource constraints and developmental conditions of start-ups (Kyei-Frimpong et al., 2024; Singh et al., 2020). The meta-analysis by Bindeebaa et al. (2025) further indicates that mediation effects should be interpreted carefully because the results for individual performance dimensions may differ from those obtained when sustainable business performance is treated as a composite outcome. The remaining issue is therefore not whether Green HRM and green innovation are relevant to sustainability in general, but whether green innovation transmits the relationship between Green HRM and multidimensional sustainable business performance in Indonesian green entrepreneurship start-ups.

Addressing this issue can advance understanding of how human resource management contributes to sustainability in entrepreneurial ventures that seek to combine environmental solutions with business viability. The resource-based view and the ability–motivation–opportunity perspective provide a theoretical foundation for explaining how environmentally oriented human resource practices can develop employee capabilities and enable innovative organizational responses (Singh et al., 2020; Shoaib et al., 2021). Existing evidence indicates that Green HRM and green innovation are associated with sustainability outcomes, while also showing that the effects vary according to context and performance dimension (Al-Shammari et al., 2022; Kyei-Frimpong et al., 2024). The present study therefore examines the effect of Green HRM on sustainable business performance among Indonesian green entrepreneurship start-ups, with green innovation specified as the mediating variable. Specifically, the study tests the direct effects of Green HRM on green innovation and sustainable business performance, the effect of green innovation on sustainable business performance, and the indirect effect of Green HRM on sustainable business performance through green innovation. The study is expected to extend the literature by providing context-specific evidence on this mediation mechanism and to offer practical insights for start-up founders and managers seeking to align human resource practices, environmental innovation, and long-term business sustainability (Bindeebaa et al., 2025; Ratnamiasih et al., 2022; Yuliza & Musa, 2025).

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LITERATURE REVIEW

Theoretical Foundations Natural Resource-Based View

The Natural Resource-Based View (NRBV) provides a theoretical foundation for explaining how environmentally oriented organizational capabilities can contribute to competitive advantage and long-term business sustainability. Hart (1995) argues that environmental capabilities associated with pollution prevention, product stewardship, and sustainable development can become important strategic resources when they are integrated into organizational activities. From this perspective, Green Human Resource Management (Green HRM) can strengthen the human capital required to implement environmental practices, while green innovation enables organizations to translate environmental knowledge into improved products and processes (Aftab et al., 2023; Aftab & Veneziani, 2024). Such integration is relevant to start-ups because their ability to develop distinctive environmentally responsible solutions may influence both market opportunities and operational efficiency (Muisyo & Qin, 2021). Evidence from Indonesian small and medium-sized enterprises also indicates that green innovation is relevant to sustainability and financial outcomes, reinforcing the importance of treating environmental capabilities as part of business strategy rather than as isolated environmental initiatives (Rustiarini et al., 2022). Accordingly, NRBV explains the proposed sequence in which Green HRM develops organizational resources, Green Innovation converts these resources into practical improvements, and Sustainable Business Performance represents a broader organizational outcome.

The Ability–Motivation–Opportunity (AMO) framework complements NRBV by explaining how human resource practices influence employee contributions through ability development, motivational mechanisms, and opportunities to participate in organizational activities (Appelbaum et al., 2000). Green training and development strengthen employees' environmental knowledge and technical capabilities, whereas green recruitment helps organizations attract individuals whose competencies and values are compatible with environmental objectives (Song et al., 2021). Performance appraisal and environmental rewards can reinforce employees' motivation to contribute to sustainability objectives, while participative work arrangements create opportunities to propose and implement environmental improvements (Munawar et al., 2022). These practices may be particularly relevant to green entrepreneurship start-ups, where employees frequently contribute to multiple organizational functions and opportunities for process improvement can emerge from operational experience (Alshuaibi et al., 2024). The AMO framework therefore clarifies the behavioral mechanism connecting Green HRM with Green Innovation and subsequent business outcomes, complementing NRBV's emphasis on the strategic development of organizational capabilities (Makumbe, 2024; Wang & Makhbul, 2024).

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Green Human Resource Management and Green Innovation

Green Human Resource Management represents the integration of environmental objectives into recruitment and selection, training and development, performance management, compensation, and employee involvement. These practices can promote green innovation by equipping employees with environmental knowledge, encouraging them to identify opportunities for improvement, and supporting the implementation of environmentally responsible ideas (Aftab & Veneziani, 2024; Song et al., 2021). Green training, for example, can strengthen employees' capacity to identify resource inefficiencies and develop alternative work methods, while participative management enables environmental knowledge to be shared across organizational functions (Munawar et al., 2022). Green performance management and rewards can further communicate that environmental improvement constitutes an organizational priority rather than an optional activity (Muisyo & Qin, 2021). Through these mechanisms, Green HRM can support both green product innovation, involving improvements in environmentally oriented products or services, and green process innovation, involving more resource-efficient and environmentally responsible operational procedures (Alshuaibi et al., 2024).

Empirical studies provide support for the expected relationship between Green HRM and Green Innovation across different organizational settings. Song et al. (2021), using evidence from 143 firms in China, found that Green HRM positively influenced green innovation and that green human capital helped explain this relationship. Munawar et al. (2022) similarly reported a positive relationship between Green HRM and green innovation among 209 participants from hotel organizations in Pakistan, identifying green human capital and environmental knowledge as relevant explanatory mechanisms. Evidence from Saudi Arabian small and medium-sized enterprises also indicates a positive relationship between Green HRM practices and green innovation, emphasizing the relevance of employee-oriented environmental management to organizational innovation (Alshuaibi et al., 2024). These findings collectively suggest that environmentally oriented human resource practices can provide employees with the capabilities and motivation required to develop and implement green ideas, although the strength of the relationship may vary with organizational resources and context (Aftab & Veneziani, 2024; Makumbe, 2024). Accordingly, Green HRM is expected to positively influence Green Innovation among green entrepreneurship start-ups in Indonesia.

H1: Green Human Resource Management has a positive effect on Green Innovation among Indonesian green entrepreneurship start-ups.

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Green Innovation and Sustainable Business Performance

Green Innovation refers to the development and implementation of products, services, technologies, and processes designed to reduce environmental impacts or improve the efficiency of resource utilization. Green product innovation may enable businesses to provide environmentally improved offerings, while green process innovation can reduce material consumption, waste, energy use, and other operational inefficiencies (Wang & Makhbul, 2024). These improvements may contribute to Sustainable Business Performance through several interconnected pathways, including cost efficiency, differentiation, environmental responsibility, and improved organizational responses to stakeholder expectations (Aftab et al., 2023). Research on Indonesian SMEs indicates that green innovation can be relevant to both sustainability and financial outcomes, suggesting that environmental innovation need not be separated from commercial considerations (Rustiarini et al., 2022). Green Innovation is therefore expected to contribute to the economic, environmental, and social dimensions of Sustainable Business Performance, although individual innovation initiatives may produce different effects across these dimensions and over different time horizons (Alshuaibi et al., 2024).

Empirical evidence further supports the strategic relevance of Green Innovation to organizational performance. Wang and Makhbul (2024) identified a positive relationship between Green HRM-related organizational practices, green innovation, and sustainability outcomes among Malaysian small and medium-sized enterprises. Alshuaibi et al. (2024) also found that green innovation was positively associated with sustainable firm performance in their study of 341 SMEs in Saudi Arabia. Research involving 336 Indonesian SMEs by Rustiarini et al. (2022) likewise highlighted the significance of green innovation in explaining sustainability and financial outcomes, providing evidence relevant to the Indonesian business environment. These findings suggest that green innovation can create business value by connecting environmental improvements with resource efficiency and organizational performance, rather than treating environmental investment solely as an additional operating cost (Aftab et al., 2023; Wang & Makhbul, 2024). Consequently, start-ups that develop and implement green products and processes are expected to achieve stronger Sustainable Business Performance than those with less developed green innovation practices.

H2: Green Innovation has a positive effect on Sustainable Business Performance among Indonesian green entrepreneurship start-ups.

Green Human Resource Management and Sustainable Business Performance

Green Human Resource Management may influence Sustainable Business Performance directly by shaping the knowledge, work practices, and environmental

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behavior of employees. Recruitment, training, appraisal, rewards, and involvement practices can help organizations incorporate environmental responsibility into operational decisions, thereby supporting resource efficiency and more consistent implementation of sustainability policies (Aftab & Veneziani, 2024). These practices can also contribute to social performance by embedding employee participation and responsible workplace practices within the organization, while environmentally oriented routines may reduce waste and unnecessary operating expenses (Wang & Makhbul, 2024). For entrepreneurial ventures, integrated human resource practices may be especially valuable because limited organizational resources make efficient employee contributions important to both daily operations and business continuity (Muisyo & Qin, 2021). Green HRM may therefore generate performance benefits through improved employee capabilities and behaviors even when its influence is not entirely transmitted through formal green innovation activities (Alshuaibi et al., 2024).

Research from different organizational settings provides empirical grounds for testing this direct relationship. Aftab et al. (2023) found that Green HRM significantly predicted environmental performance in Pakistani manufacturing firms, while their analysis also identified green innovation as a partial mediator. Makumbe (2024) reported a significant relationship between Green HRM and green performance among SMEs in Zimbabwe, alongside a partial mediation effect through green innovation. Wang and Makhbul (2024) also found a positive relationship between Green HRM and sustainability outcomes among Malaysian SMEs, supporting the potential relevance of environmentally oriented human resource practices to broader organizational performance. These findings indicate that Green HRM may support sustainable outcomes through both direct organizational improvements and indirect mechanisms involving innovation, although the magnitude of the direct relationship can depend on organizational conditions and the outcome being measured (Aftab & Veneziani, 2024; Alshuaibi et al., 2024). Testing the direct effect remains important because it establishes whether Green HRM contributes to Sustainable Business Performance beyond its potential influence through Green Innovation.

H3: Green Human Resource Management has a positive effect on Sustainable Business Performance among Indonesian green entrepreneurship start-ups.

The Mediating Role of Green Innovation

Green Innovation is proposed as a mediating variable because Green HRM may develop the employee capabilities and motivation that organizations need to turn environmental objectives into practical improvements. Environmentally oriented recruitment and training can strengthen employees' ability to identify opportunities for green product and process innovation, whereas performance management and

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employee involvement can encourage the development and implementation of environmental ideas (Song et al., 2021; Munawar et al., 2022). Green innovation then provides a mechanism through which these human resource investments can influence organizational outcomes by translating employee knowledge and participation into resource efficiency, environmental improvements, and commercially relevant offerings (Aftab et al., 2023). Evidence from SMEs indicates that green innovation can transmit part of the relationship between Green HRM and green performance, suggesting that the performance implications of human resource practices are not limited to employee-related outcomes alone (Makumbe, 2024). From an NRBV perspective, the mediation mechanism reflects the conversion of human resource capabilities into environmentally oriented organizational capabilities that can contribute to sustainable business outcomes (Wang & Makhbul, 2024).

Recent empirical studies provide further grounds for examining this indirect relationship. Aftab et al. (2023) found that green innovation partially mediated the relationship between Green HRM and environmental performance among manufacturing firms in Pakistan, while Makumbe (2024) reported a similar partial mediation pattern among SMEs in Zimbabwe. Alshuaibi et al. (2024) also identified green innovation as a mediating mechanism linking Green HRM-related practices with sustainable firm performance, providing evidence from an emerging-economy SME context. These studies support the proposed mediation mechanism, although their organizational settings and performance measures differ from green entrepreneurship start-ups in Indonesia (Aftab & Veneziani, 2024; Rustiarini et al., 2022). Examining this indirect effect in the Indonesian start-up context can clarify whether green innovation acts as a pathway through which Green HRM supports a multidimensional performance outcome encompassing economic, environmental, and social considerations. The proposed model consequently treats Green Innovation as a mechanism through which Green HRM may influence Sustainable Business Performance, while retaining the direct relationship to assess whether the mediation is partial or full.

H4: Green Innovation mediates the relationship between Green Human Resource Management and Sustainable Business Performance among Indonesian green entrepreneurship start-ups.

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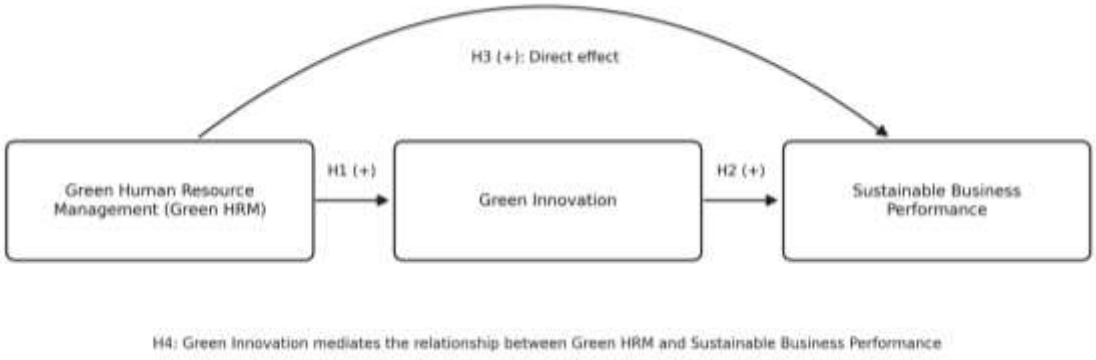


Figure 1. Research Model

METHOD

Research Design

This study adopts a quantitative explanatory research design to examine the relationships between Green Human Resource Management (Green HRM), Green Innovation, and Sustainable Business Performance among green entrepreneurship start-ups in Indonesia. A cross-sectional survey will be used to obtain firm-level perceptions from respondents who possess relevant knowledge of their organizations' human resource practices, innovation activities, and sustainability outcomes. The explanatory approach is appropriate because the research aims to test three direct relationships and one indirect relationship involving Green Innovation as a mediating variable. The proposed model consists of Green HRM as the independent variable, Green Innovation as the mediating variable, and Sustainable Business Performance as the dependent variable. Partial Least Squares Structural Equation Modeling (PLS-SEM) will be employed to assess the measurement properties of the constructs and estimate the structural relationships among them. This analytical approach is appropriate for examining a model involving multiple latent constructs and mediation while evaluating both explanatory and predictive capabilities (Hair et al., 2019; Sarstedt et al., 2022).

Population and Sampling

The target population comprises green entrepreneurship start-ups operating in Indonesia, particularly businesses developing or delivering products, services, or technologies associated with environmental sustainability. The initial sampling frame is derived from the ASEAN Green Economy Landscape, which maps 185 organizations across seven green economy sectors in Indonesia: nature, agriculture and food; energy transition; climate markets and enablers; built environment; circular economy and waste; transportation and logistics; and industrial decarbonization (ASEAN Green Economy

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Landscape, n.d.). Because the directory acknowledges that its coverage may be incomplete and uses a broader classification of start-ups, scale-ups, and small and medium-sized enterprises in some contexts, the listed organizations will be screened against the study's eligibility criteria before the final population is established. Eligible organizations must be actively operating in Indonesia, demonstrate an identifiable connection to green entrepreneurship, and satisfy the operational definition of a start-up adopted for this study. The screening process will also verify whether each organization has an informant capable of providing reliable information about Green HRM, Green Innovation, and business performance. The initial sample target is 127 organizations

This calculation provides an initial recruitment target rather than a definitive guarantee of statistical adequacy for PLS-SEM. The final sample size will also be evaluated against the model's statistical power, anticipated effect sizes, and complexity, following methodological recommendations for PLS-SEM (Hair et al., 2019; Sarstedt et al., 2022). Invitations may be distributed to all eligible organizations to reduce the risk that nonresponse leaves the study with fewer usable observations than required.

A proportionate stratified sampling procedure is proposed to maintain representation across the seven green economy sectors. The provisional allocation below is based on the published count of 185 mapped organizations and must be recalculated if eligibility screening changes the sector-specific population counts.

One key informant will be sought from each selected organization. Potential respondents include founders, chief executive officers, human resource managers, operational managers, or sustainability managers who understand the organization's human resource policies, innovation activities, and business performance. The organizational unit of analysis will be the company rather than the individual employee. Respondent selection within each organization will therefore be based on relevant managerial knowledge and the ability to provide informed assessments of the firm's practices and outcomes.

Data Collection Procedures

Primary data will be collected through a structured questionnaire administered to eligible key informants. The questionnaire will use a five-point Likert scale ranging from 1 (strongly disagree) to 5 (strongly agree), allowing respondents to assess the extent to which the statements reflect their organizations' practices and performance. The questionnaire will be developed in English and translated into Bahasa Indonesia to facilitate comprehension among Indonesian respondents. Before the main survey, the instrument will be reviewed by academics with expertise in human resource management and sustainability, together with practitioners familiar with green business operations. A

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preliminary test with respondents from comparable enterprises outside the final sample will be conducted to assess item clarity, contextual relevance, and completion time.

To reduce potential common method bias, the questionnaire will emphasize anonymity, voluntary participation, and the absence of right or wrong answers, while separating items conceptually associated with the predictor, mediator, and outcome constructs. Respondents will also be informed that the data will be analyzed in aggregate and used for academic purposes. The survey will be administered only after the sampling frame has been screened and the participating organizations have been identified. No observations will be treated as empirical results until the questionnaires have been completed, screened, and retained for analysis.

Data Analysis Techniques

The collected data will be analyzed using PLS-SEM with SmartPLS. The analysis will proceed in several stages, beginning with data screening and respondent-profile analysis, followed by measurement-model assessment, structural-model evaluation, and mediation testing. Missing values, incomplete responses, inconsistent answers, and potential duplicate submissions will be examined before model estimation. Descriptive statistics will be used to summarize organizational characteristics, respondent positions, and the distribution of questionnaire responses.

The measurement model will first be assessed to establish the reliability and validity of the constructs. For reflective first-order dimensions, indicator loadings, internal consistency reliability, convergent validity, and discriminant validity will be examined. Indicator loadings of approximately 0.708 or higher will be treated as desirable, while composite reliability and (rho_A) values between 0.70 and 0.95 will generally indicate acceptable internal consistency. Convergent validity will be evaluated using an Average Variance Extracted (AVE) value of at least 0.50, while discriminant validity will be assessed using the Heterotrait–Monotrait Ratio (HTMT). HTMT values below 0.85 will be used as a conservative guideline, with values below 0.90 considered where theoretically justified (Hair et al., 2019; Sarstedt et al., 2022).

The structural model will then be assessed by examining predictor collinearity, path coefficients, statistical significance, explanatory power, and effect sizes. The coefficient of determination (R^2) will be used to assess the variance explained in Green Innovation and Sustainable Business Performance, while effect sizes ((f^2)) will indicate the contribution of individual predictors. Predictive assessment, including (Q^2) or PLSpredict where appropriate, will complement the evaluation of explanatory power. The model will not be judged solely on statistical significance, because the magnitude of effects and their theoretical relevance must also be considered (Hair et al., 2019; Sarstedt et al., 2022).

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RESULT AND DISCUSSION

RESULT

Respondent Profile

The respondent profile provides an overview of the individuals representing green entrepreneurship start-ups in Indonesia. The characteristics include gender, age, managerial position, company age, and business sector, providing a basis for understanding the organizational backgrounds represented in the proposed study.

Table 1. Respondent Profile

Characteristics	Category	Frequency	Percentage (%)
Gender	Male	72	56.7
	Female	55	43.3
Age	Under 30 years	25	19.7
	30–39 years	56	44.1
	40–49 years	34	26.8
	50 years and above	12	9.4
Position	Founder/CEO	46	36.2
	HR manager	27	21.3
	Operations manager	38	29.9
	Sustainability manager	16	12.6
Company age	Under 3 years	29	22.8
	3–5 years	58	45.7
	More than 5 years	40	31.5
Business sector	Nature, agriculture, and food	32	25.2
	Energy transition	21	16.5
	Climate markets and enablers	18	14.2
	Built environment	11	8.7
	Circular economy and waste	18	14.2
	Transportation and logistics	21	16.5
	Industrial decarbonization	6	4.7
Total		127	100.0

Source: Data Process, 2026

The distribution indicates that respondents aged 30–39 years represent the largest age group (44.1%), while founders and CEOs account for 36.2% of the proposed sample.

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Companies operating for three to five years constitute the largest organizational age category (45.7%), and nature, agriculture, and food represent the largest business sector (25.2%). This profile is intended to represent respondents with managerial knowledge of human resource practices, organizational innovation, and sustainability outcomes.

Measurement Model Assessment

The measurement model is assessed through internal consistency reliability and convergent validity. Cronbach's alpha, rho_A, and composite reliability (CR) are evaluated against the commonly recommended threshold of 0.70, while average variance extracted (AVE) should generally exceed 0.50 (Hair et al., 2019).

Table 2. Reliability and Convergent Validity

Construct dimension	Cronbach's alpha	rho_A	CR	AVE
Green recruitment and selection	0.812	0.824	0.876	0.640
Green training and development	0.839	0.850	0.893	0.676
Green performance management	0.821	0.833	0.881	0.650
Green compensation and rewards	0.806	0.817	0.873	0.633
Green employee involvement	0.845	0.857	0.897	0.685
Green product innovation	0.836	0.849	0.891	0.672
Green process innovation	0.852	0.863	0.901	0.695
Economic performance	0.823	0.837	0.883	0.654
Environmental performance	0.861	0.872	0.906	0.708
Social performance	0.819	0.831	0.880	0.647

Source: Data Process, 2026

All reported values exceed the specified reliability and convergent-validity thresholds. The Cronbach's alpha and composite reliability values indicate satisfactory internal consistency within this illustrative assessment, while the AVE values suggest that each dimension explains more than half of the variance in its indicators. These figures demonstrate the intended reporting format; empirical conclusions must be based on the actual indicator loadings and calculated SmartPLS output.

Discriminant Validity

Discriminant validity is evaluated using the heterotrait–monotrait ratio (HTMT) to determine whether Green HRM, Green Innovation, and Sustainable Business Performance are empirically distinguishable. An HTMT value below 0.85 is used as a conservative reference threshold (Henseler et al., 2015).

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Table 3. HTMT Assessment

Construct relationship	HTMT value	Assessment
Green HRM – Green Innovation	0.812	Meets threshold
Green HRM – Sustainable Business Performance	0.796	Meets threshold
Green Innovation – Sustainable Business Performance	0.824	Meets threshold

Source: Data Process, 2026

The three HTMT values fall below the reference threshold of 0.85, indicating satisfactory discriminant validity within the illustration. The highest value is observed between Green Innovation and Sustainable Business Performance (0.824), although the value remains within the specified criterion. Actual discriminant validity must be established using the final model estimates.

Structural Model and Hypothesis Testing

The structural model evaluates the direct effects of Green HRM on Green Innovation and Sustainable Business Performance, the effect of Green Innovation on Sustainable Business Performance, and the indirect relationship through Green Innovation. The decision criteria include path coefficients, t-statistics, p-values, and the bootstrapped confidence interval for the indirect effect.

Table 4. Hypothesis Testing Results

Hypothesis	Relationship	Path coefficient (β)	t-statistic	p-value	Illustrative decision
H1	Green HRM → Green Innovation	0.624	9.310	< 0.001	Supported in illustration
H2	Green Innovation → Sustainable Business Performance	0.456	5.430	< 0.001	Supported in illustration
H3	Green HRM → Sustainable Business Performance	0.270	3.100	0.002	Supported in illustration
H4	Green HRM → Green Innovation → Sustainable Business Performance	0.285	4.320	< 0.001	Supported in illustration

Source: Data Process, 2026

The proposed estimates indicate positive direct relationships between Green HRM and Green Innovation, Green Innovation and Sustainable Business Performance, and Green HRM and Sustainable Business Performance. The indirect effect is approximately

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0.285, calculated from the product of the two constituent path coefficients. The positive direct effect of Green HRM on Sustainable Business Performance, together with the positive indirect effect through Green Innovation, would be consistent with partial mediation if the pattern were confirmed using actual data. The hypothesis decisions and statistical significance reported here remain illustrative rather than empirical findings.

Coefficient of Determination

The coefficient of determination R^2 evaluates the proportion of variance in each endogenous construct explained by its predictors. Green Innovation is predicted by Green HRM, whereas Sustainable Business Performance is predicted by both Green HRM and Green Innovation.

Table 5. Coefficient of Determination

Endogenous construct	R^2	Adjusted R^2
Green Innovation	0.389	0.384
Sustainable Business Performance	0.434	0.425

Source: Data Process, 2026

The values indicate that Green HRM accounts for approximately 38.9% of the variance in Green Innovation, while Green HRM and Green Innovation jointly account for approximately 43.4% of the variance in Sustainable Business Performance. The remaining variance may reflect factors outside the proposed model. These estimates are consistent with the illustrative path coefficients, but the actual explanatory power must be determined from the final dataset and SmartPLS output.

DISCUSSION

The proposed relationship between Green Human Resource Management (Green HRM) and Green Innovation highlights the importance of integrating environmental objectives into human resource practices. Green recruitment, environmental training, performance appraisal, and employee involvement can strengthen employees' knowledge and motivation to develop environmentally responsible solutions. This relationship is consistent with the Ability–Motivation–Opportunity framework, which explains how human resource practices encourage employees to contribute their capabilities and ideas to organizational improvement (Appelbaum et al., 2000). Previous studies have also identified Green HRM as an important organizational driver of green innovation through the development of employee capabilities and environmental awareness (Kuo et al., 2022; Song et al., 2021). Green HRM therefore represents a strategic approach to fostering innovation rather than merely an administrative function.

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Green Innovation provides a pathway through which environmental initiatives can contribute to Sustainable Business Performance. Green product innovation can strengthen the environmental value of a firm's offerings, while green process innovation can improve resource efficiency and reduce operational waste. These improvements may support economic performance while advancing environmental responsibility and organizational sustainability. This explanation aligns with the Natural Resource-Based View, which emphasizes the strategic value of environmental capabilities in building sustainable competitive advantages (Hart, 1995). Previous studies also highlight the contribution of green innovation to environmental and business performance, suggesting that innovation can connect environmental objectives with organizational value creation (Al-Shammari et al., 2022; Singh et al., 2020).

The relationship between Green HRM and Sustainable Business Performance also suggests that human resource practices can contribute to sustainability beyond their influence on innovation. Employees who receive environmental training, participate in sustainability initiatives, and are evaluated according to environmental responsibilities may contribute to more efficient organizational processes and responsible workplace practices. These improvements can support environmental performance while potentially strengthening employee engagement and operational effectiveness. Prior research has similarly linked Green HRM practices with environmental performance and broader organizational sustainability (Aftab et al., 2023; Kuo et al., 2022). Nevertheless, the extent to which these practices translate into economic and social benefits depends on how consistently environmental objectives are incorporated into organizational decisions and daily operations.

Green Innovation further explains how Green HRM may influence Sustainable Business Performance indirectly. Human resource practices can develop employees' environmental competencies and encourage their participation, while green innovation translates these capabilities into improved products, services, and operational processes. This mechanism is consistent with the Natural Resource-Based View because organizational resources become strategically valuable when they are converted into capabilities that generate business and environmental benefits (Hart, 1995). Previous studies have identified green innovation as a mediating mechanism linking Green HRM with environmental and sustainability performance (Aftab et al., 2023; Bindeebaa et al., 2025). The proposed framework consequently emphasizes the importance of aligning human resource management with innovation activities so that green entrepreneurship start-ups can pursue environmental objectives alongside long-term business viability.

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CONCLUSSION

This study examines the proposed relationship between Green Human Resource Management (Green HRM) and Sustainable Business Performance through Green Innovation among green entrepreneurship start-ups in Indonesia. The conceptual framework positions Green HRM as an organizational capability that can strengthen employees' environmental knowledge, motivation, and participation, while Green Innovation provides a potential mechanism for translating these capabilities into environmentally responsible products and processes. The integration of the Natural Resource-Based View and the Ability–Motivation–Opportunity framework offers a theoretical explanation of how human resource practices may contribute to economic, environmental, and social sustainability.

The proposed framework offers practical implications for start-up founders and managers by emphasizing the integration of environmental objectives into recruitment, training, performance appraisal, rewards, and employee involvement. These practices should be aligned with innovation initiatives that improve resource efficiency and support long-term business viability. Nevertheless, this study's empirical contribution remains subject to validation using actual organizational data. Future research should examine the proposed relationships across different green economy sectors and incorporate longitudinal designs or additional organizational factors to strengthen the understanding of how Green HRM contributes to sustainable business performance.

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