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Green Human Resource Management Practices and Triple Bottom Line Performance in Vietnamese Manufacturing SMEs: The Mediating Role of Green Innovation

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Abstract. Green human resource management has become increasingly important for improving business performance and supporting sustainability. Accordingly, this study examines the effects of green human resource management practices (GHRMP) on economic, environmental, and social performance in Vietnamese manufacturing small and medium-sized enterprises (SMEs). Data were collected from 275 senior and human resource managers, and the proposed research model was tested using a two-stage PLS-SEM approach. The results reveal that GHRMP positively affects all three performance dimensions. Among these dimensions, GHRMP has the strongest direct effect on economic performance, followed by environmental and social performance. Moreover, green innovation (GIN) partially mediates the relationships between GHRMP and all three performance dimensions. Based on these findings, the study highlights the role of integrating GHRMP with GIN in improving economic, environmental, and social performance in Vietnamese manufacturing SMEs.

1. Introduction

Amid growing challenges from climate change, sustainable development has become an important requirement for businesses. Firms also face pressure from customers, regulators, and supply chain partners. These pressures encourage firms to adjust their activities toward greater environmental responsibility. In this context, GHRMP helps firms integrate environmental objectives into human resource management, including recruitment, training, performance appraisal, rewards, and employee green involvement [1–4]. GHRMP can enhance employees' environmental awareness, motivation, and capabilities. These practices can also encourage employee involvement in green innovation.

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Green innovation (GIN) involves developing products and improving processes to reduce environmental impacts. Empirical evidence indicates that GHRMP is positively associated with GIN [5,6]. Existing research further suggests that GIN mediates the effect of GHRMP on sustainable business performance (SBP) [2, 7, 8]. Evidence from Vietnam also indicates that GHRM is positively associated with the green innovation process [9].

According to Dynamic Capabilities Theory (DCT), firms need to develop and reconfigure their resources to respond to changing environmental conditions [10]. In this context, GHRMP enables firms to develop and mobilize human resources for green activities, thereby strengthening their capacity to develop and implement GIN. GIN can therefore serve as a mechanism through which GHRMP contributes to economic, environmental, and social performance.

The context of Vietnamese manufacturing SMEs is particularly relevant for examining these relationships. SMEs make significant contributions to economic growth and employment in Vietnam. However, they often operate with limited financial, technological, and human resources, which may restrict their ability to invest in innovation and environmental protection. At the same time, SMEs must pursue economic objectives while addressing environmental and social considerations. Global supply-chain participation also places greater demands on SMEs regarding quality, environmental performance, and social responsibility [11, 12].

SBP comprises three dimensions: economic performance (ECP), social performance (SCP), and environmental performance (EVP). This three-dimensional view is grounded in the Triple Bottom Line perspective [13]. Much of the existing research has either examined individual sustainability dimensions separately or treated sustainability performance as a single aggregate construct [5, 12, 14,15]. Other studies have examined the mediating role of GIN in linking GHRMP to sustainability performance [2,7,8]. However, studies in Vietnam have mainly focused on aggregate sustainability performance, environmental performance, or the relationship between GHRM and GIN [16, 17]. Therefore, it remains unclear whether the mediating role of GIN differs across ECP, SCP, and EVP in SMEs.

Considering these dimensions separately is relevant because ECP, SCP, and EVP may be affected differently by GHRMP and GIN. ECP concerns financial and operational outcomes, while EVP captures improvements in environmental performance and SCP reflects benefits to employees and other stakeholders. Treating these outcomes as a single aggregate construct may therefore obscure differences in how GHRMP and GIN contribute to each dimension. Separating SBP into its individual dimensions can offer clearer insights into how GHRMP contributes to sustainable business performance through GIN.

The research gap can be identified in two areas. First, previous studies have mainly examined SBP at an aggregate level or focused on a single outcome. This approach limits the identification of differences in the effects of GHRMP across dimensions of sustainable business performance. Second, evidence on the role of GIN in the relationships between GHRMP and ECP, SCP, and EVP in SMEs remains limited.

Accordingly, this study examines the relationships between GHRMP and economic, environmental, and social performance in Vietnamese manufacturing SMEs. It also examines the mediating role of GIN in each relationship. The study contributes to clarifying whether the effects of GHRMP through GIN differ across ECP, SCP, and EVP. Practically, the findings provide implications for SMEs seeking to align green human resource practices and green innovation with economic, environmental, and social objectives.

2. Literature Review

2.1. **Dynamic Capabilities Theory (DCT).** This study is grounded in Dynamic Capabilities Theory (DCT) proposed by Teece [10]. DCT emphasizes three capabilities that enable firms to adapt: sensing opportunities and threats, seizing opportunities, and reconfiguring resources. Applied to sustainability, DCT explains how firms reconfigure their resources in response to environmental requirements and develop new capabilities for innovation. In this study, GHRMP is viewed as a managerial mechanism through which firms develop and mobilize human resources to support environmental objectives. These practices strengthen employees' environmental knowledge, skills, awareness, and motivation, which can support the development of organizational capabilities for green innovation. These capabilities can strengthen the firm's ability to sense and seize environment-related opportunities and to reconfigure resources and processes to support GIN. Accordingly, GIN can be understood as an outcome of the firm's ability to mobilize and reconfigure resources toward environmental goals. This process may contribute to firms' economic, environmental, and social performance.

2.2. **Green human resources management practices and green innovation.** The combination of GHRMP helps firms develop human resources with environmental knowledge, skills, and awareness. These resources provide a foundation for green innovation activities. From a DCT perspective, green human resources help firms sense and seize environment-related innovation opportunities. They also support firms in reconfiguring existing resources to implement GIN [5,18].

Through green-oriented recruitment and training, GHRMP enhances employees' environmental knowledge and awareness. These factors may encourage employees to participate in GIN activities. GIN can involve product development and process improvement [5, 18]. Empirical studies have also shown that GHRMP has a positive effect on firms' GIN [5, 7, 8, 18, 19].

However, evidence on the relationship between GHRMP and GIN remains limited in the SME context. These firms often face resource constraints when investing in innovation. Effective GHRMP can help address these constraints by developing employees' green knowledge, skills, and motivation. These human resources can support employees in identifying environmental problems, generating green ideas, and participating in the development and implementation of green products and processes. Examining this relationship in SMEs can provide further evidence on the role of GHRMP in GIN. Based on DCT and previous empirical evidence, this study proposes the following hypothesis:

H1: Green human resource management practices positively affect green innovation.

2.3. **The impact of GHRMP on economic, social, and environmental performance.** GHRMP integrates environmental considerations into human resource management practices. These practices include green recruitment and selection, green training and development, green performance management, green compensation and rewards, and employee involvement. They enhance employees' abilities, motivation, and opportunities to participate in organizational environmental activities [20]. These practices also encourage employees to act in ways that support environmental and sustainability goals.

In this study, SBP is examined across three dimensions: ECP, SCP, and EVP. The effect of GHRMP is assessed separately for each dimension to determine whether its effect varies across economic, social, and environmental performance. According to DCT, GHRMP helps firms develop and mobilize human resources toward environmental goals [10]. Practices such as green recruitment, green training, green performance management, and green compensation enhance employees' environmental knowledge, skills, and awareness. They also encourage employees to participate in green activities. Through these practices, firms can better respond to environmental and sustainability requirements. Empirical studies have also reported a positive relationship between GHRMP and SBP [2,7,8].

Economic performance: GHRMP can improve economic performance by enhancing resource efficiency and reducing waste [21, 22]. Green training and green performance appraisal help employees use resources more efficiently. These improvements can help reduce costs and improve productivity. From the DCT perspective, developing and mobilizing human resources enables firms to use resources more efficiently and adapt to changes in the business environment. Previous studies also report a positive relationship between GHRMP and ECP [6,14,23].

Social performance: GHRMP can improve social performance by enhancing employee participation and well-being. Green performance appraisal and green rewards can encourage employees to participate in environmental activities and strengthen their organizational commitment [24–26]. GHRMP also provides opportunities for employees to participate in firms' green initiatives. Such participation can contribute to better working conditions and SCP [6,12,23]. From the DCT perspective, mobilizing human resources and encouraging employee participation can help firms respond more effectively to social requirements.

Environmental performance: GHRMP enhances employees' environmental knowledge, skills, and motivation. These factors encourage employees to participate in environmental activities and use resources more efficiently. GHRMP can also promote behaviors that reduce waste, emissions, and resource consumption [5,12,27,28]. GHRMP practices further support environmentally friendly behaviors in the workplace [29–31]. From the DCT perspective, mobilizing and adjusting resources toward environmental goals helps firms adapt to environmental requirements. This can contribute to improved EVP.

Overall, previous studies indicate that GHRMP is positively associated with ECP, SCP, and EVP. Some studies report direct effects of GHRMP on EVP [12, 32]. However, Suleman et al. [6] show that the effect of GHRMP on EVP is transmitted through GIN. This difference suggests the need to further examine the direct effects of GHRMP on individual performance dimensions in the SME context. Therefore, this study separately examines the effects of GHRMP on ECP, SCP, and EVP. Accordingly, the following hypotheses are proposed:

H2: Green human resource management practices positively affect economic performance.

H3: Green human resource management practices positively affect social performance.

H4: Green human resource management practices positively affect environmental performance.

2.4. **The role of green innovation.** According to DCT, GIN reflects a firm's ability to exploit opportunities related to sustainable development. Firms can do so by improving products, processes, and technologies in an environmentally friendly manner. These activities help firms adjust and redeploy resources to meet environmental requirements.

Previous studies have shown that GIN is positively associated with SBP. GIN enables firms to replace inefficient processes, technologies, and products with new or improved solutions. These improvements can help firms reduce costs and improve operational efficiency [7, 8, 33].

Regarding ECP, previous studies have reported a positive relationship between GIN and economic performance. Guo et al. [34] found that GIN mediates the relationship between corporate environmental ethics and economic performance. This finding indicates that GIN can serve as a mechanism linking environmental orientations to economic performance. Suleman et al. [6] also found that GIN partially mediates the relationship between GHRMP and economic performance among mining firms in Ghana. Similarly, Altassan [14] showed that GIN contributes to sustainable business performance among manufacturing firms in Saudi Arabia. Despite differences in research contexts, these findings provide evidence of the positive role of GIN in firm performance. Based on this evidence, the following hypothesis is proposed:

H5: Green innovation has a positive effect on economic performance.

Regarding EVP, from a DCT perspective, firms can reconfigure their resources and processes to respond to changing environmental requirements. As environmental pressures increase, firms can use GIN to improve their products and processes to reduce their environmental impacts. These improvements can help reduce waste, emissions, and resource consumption.

Empirical evidence generally indicates a positive relationship between GIN and EVP. Fang et al. [28] and Singh et al. [5] found that GIN contributes to improved EVP. Similar findings were reported by Rana and Arya [35] and Suleman et al. [6] across different research contexts. Although these studies were conducted in different contexts, their findings indicate a relatively consistent relationship between GIN and EVP. However, evidence on the effect of GIN on EVP in Vietnamese manufacturing SMEs remains limited. This contextual gap provides a basis for further examining whether GIN contributes to EVP in this setting. Accordingly, the following hypothesis is proposed:

H6: Green innovation has a positive effect on environmental performance.

Regarding SCP, GIN can contribute to improving working conditions and reducing adverse social impacts of business activities. Empirical evidence indicates a positive relationship between GIN and social performance. Suleman et al. [6] found that GIN partially mediates the relationship between GHRMP and social performance among mining firms in Ghana. Baquero [36] also found that green innovation has a significant effect on the social dimension of sustainable performance among hotels in Spain. Although these studies were conducted in different industries and countries, they both indicate a positive role of GIN in improving social performance. However, previous studies have often examined social performance as a component of sustainable performance. Evidence on the effect of GIN on social performance in Vietnamese SMEs remains limited. Therefore, this study examines the relationship between GIN and social performance in Vietnamese SMEs. Based on the theoretical rationale and empirical evidence, the following hypothesis is proposed:

H7: Green innovation has a positive effect on social performance.

Empirical studies show that GIN mediates the relationship between GHRMP and environmental performance [6, 8, 28]. Awwad Al-Shammari et al. [7] also confirmed the mediating role of GIN between GHRMP and sustainable performance among SMEs in Saudi Arabia. These findings suggest that GIN can serve as a mechanism linking GHRMP to sustainable performance.

However, previous studies have mainly focused on EVP or sustainable performance at the aggregate level. Evidence on the mediating role of GIN between GHRMP and individual ECP, SCP, and EVP remains limited. This gap is particularly relevant in the context of SMEs. Therefore, this study examines the mediating role of GIN in the relationships between GHRMP and each performance dimension.

H8: Green innovation mediates the relationship between GHRMP and economic performance.

H9: Green innovation mediates the relationship between GHRMP and social performance.

H10: Green innovation mediates the relationship between GHRMP and environmental performance.

Based on the theoretical arguments and proposed hypotheses, the research model is presented in Figure 1.

3. Methodology

3.1. **Data collection.** This study focuses on small and medium-sized manufacturing enterprises in Ho Chi Minh City, Vietnam. Ho Chi Minh City is a major economic center with growing innovation and green economic activities. These characteristics provide an appropriate context for examining GHRMP, GIN, and SBP. Data were collected using a convenience sampling technique from March to June 2026. The respondents were senior human resource managers who were selected because they had sufficient knowledge of their firms' GHRMP, GIN, and SBP. After confirming managers' eligibility, the questionnaires were distributed to the managers either in person or via Zalo. A total of 297 responses were received, of which 275 were deemed valid.

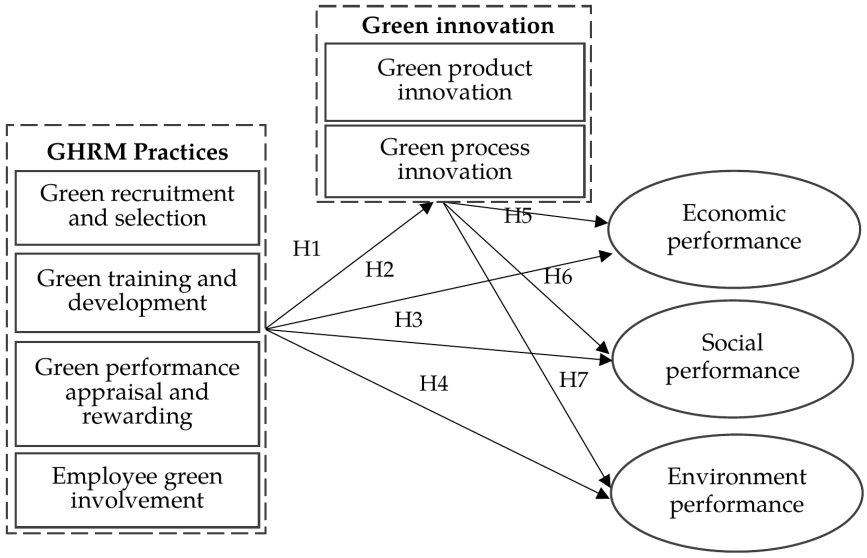


FIGURE 1. Theoretical model

Note:

Direct hypotheses: *H1: GHRMP → GIN; H2: GHRMP → ECP; H3: GHRMP → SCP; H4: GHRMP → EVP; H5: GIN → ECP; H6: GIN→ SCP; H7: GIN→ EVP.*

Mediating hypotheses: *H8: GHRMP → GIN → ECP; H9: GHRMP → GIN → SCP; H10: GHRMP → GIN → EVP.*

According to [37], a sample size of 100 or more is generally recommended for structural equation modeling. A commonly used rule of thumb suggests a ratio of five to ten observations per measurement item. As the questionnaire comprised 37 measurement items, the minimum sample size based on the 5:1 ratio was 185 observations (37×5). The 275 valid responses exceeded this minimum requirement and were therefore considered adequate for the subsequent PLS-SEM analysis. The characteristics of the sample are presented in Table 1.

TABLE 1. Demographic characteristics of the respondents

Category	Information	Frequency	Percentage (%)
Position	Senior manager	252	91.6
	Human resource	23	8.4
Organization size (Number of Employees)	10-50	105	38.1
	51-100	138	50.2
	101-200	32	11.7
Years of Experience in Current Organization	3-5	69	25.1
	6-10	165	60.0
	>10	41	14.9

Note: n = 275

3.2. **Measurements.** A preliminary questionnaire was developed based on measurement scales adapted from prior studies. The questionnaire was reviewed by experts in green human resource management and green innovation to ensure content validity. Based on their feedback, the questionnaire items were revised to improve clarity, cultural relevance, and suitability for respondents in the Vietnamese context.

Dependent variables: The study examined three separate outcomes: ECP, EVP, and SCP. A total of 12 measurement items were used to assess these three outcomes. ECP was measured using four items [2,38]. EVP was measured using four items adopted from Lin et al. [39]. SCP was measured using four items [40,41].

Independent variable: GHRMP was used as the independent variable. GHRMP was operationalized as a second-order reflective-reflective construct comprising four first-order dimensions: green recruitment and selection, green training and development, green performance appraisal and compensation, and employee green participation. It was measured using 16 items across four dimensions. The measurement items were adopted from Tang et al. [1] and Wang and Makhbul [2].

Mediating variable: GIN was used as the mediating variable. GIN was operationalized as a second-order reflective-reflective construct comprising two first-order dimensions: green product innovation and green process innovation. It was measured using nine items across two dimensions: green product innovation (four items) and green process innovation (five items). The measurement items were adopted from [39,42,43].

All measurement items were assessed using a five-point Likert scale (1 = strongly disagree, 2 = disagree, 3 = neutral, 4 = agree, 5 = strongly agree).

3.3. **Analysis procedure.** The study used the full collinearity VIF proposed by Kock [44] to assess common method bias and multicollinearity. SmartPLS was used to assess the measurement and structural models. The measurement model was assessed before testing the research hypotheses. PLS-SEM was selected because it is suitable for models involving multiple latent variables and moderate sample sizes. The method also does not require the data to follow a normal distribution. The hypotheses were tested using the bootstrapping procedure. Because GHRMP and GIN were modeled as second-order reflective-reflective higher-order constructs, the study employed a two-stage approach as recommended by Hair et al. [45].

In Stage 1, the measurement model of the lower-order constructs was assessed. The assessment criteria included outer loadings, Cronbach's alpha, composite reliability (CR), average variance extracted (AVE), and discriminant validity, which was assessed using the heterotrait–monotrait ratio (HTMT). These criteria were evaluated based on the thresholds recommended in previous studies [45–48]. The satisfactory results indicated that the measurement scales achieved adequate reliability, convergent validity, and discriminant validity.

In Stage 2, the higher-order constructs were assessed using the latent variable scores of the lower-order constructs as indicators. These scores were used to estimate the measurement model of the higher-order constructs in PLS-SEM. The two-stage approach simplifies the model and

facilitates the assessment of higher-order constructs [45]. The structural model was then estimated to test the research hypotheses. The relationships among the constructs were assessed based on the path coefficients, statistical significance, and bootstrap confidence intervals.

The structural model was assessed after the measurement models were established. Collinearity was assessed using VIF values. The hypothesized relationships were evaluated using path coefficients (β), t-values, p-values, and confidence intervals obtained through bootstrapping. R^2 values were used to assess the model's explanatory power. Effect sizes were assessed using f^2. The mediation effects were evaluated using the significance and confidence intervals of the indirect effects.

4. Results

4.1. **Measurement model assessment.** The results presented in Table 2 show that all Cronbach's alpha values exceeded the recommended threshold of 0.70 [47]. The CR values also exceeded 0.70. These results indicate adequate internal consistency reliability of the measurement scales [45].

Regarding convergent validity, the outer loadings of the measurement items were assessed. As shown in Table 3, the outer loadings ranged from 0.687 to 0.904 and were all statistically significant at $p < 0.001$. All AVE values exceeded 0.50. All CR values were above 0.70. These results meet the recommended criteria for convergent validity and construct reliability [45, 47]. Therefore, no measurement item was removed from the model. Regarding discriminant validity, the results in Table 3 show that all HTMT values were below 0.85. These results indicate adequate discriminant validity among the constructs [45, 48].

Table 2: Reliability and validity results for first-order measures

Construct	Items	Loading	CA	CR	AVE
GRS: Green recruitment and selection			0.837	0.891	0.672
	GRS1	0.833			
	GRS2	0.816			
	GRS3	0.818			
	GRS4	0.812			
GTD: Green training and development			0.848	0.898	0.687
	GTD1	0.846			
	GTD2	0.795			
	GTD3	0.850			
	GTD4	0.823			
GPR: Green performance appraisal and reward			0.846	0.896	0.684
	GPR1	0.863			
	GPR2	0.788			

Construct	Items	Loading	CA	CR	AVE
	GPR3	0.811			
	GPR4	0.844			
GEI: Employee green involvement			0.787	0.861	0.609
	GEI1	0.811			
	GEI2	0.800			
	GEI3	0.758			
	GEI4	0.750			
GPI: Green product innovation			0.894	0.926	0.759
	GPI1	0.868			
	GPI2	0.883			
	GPI3	0.853			
	GPI4	0.881			
GPRI: Green process innovation			0.809	0.868	0.567
	GPRI1	0.699			
	GPRI2	0.773			
	GPRI3	0.758			
	GPRI4	0.760			
	GPRI5	0.774			
ECP: Economic performance			0.801	0.87	0.626
	ECP1	0.809			
	ECP2	0.794			
	ECP3	0.811			
	ECP4	0.749			
EVP: Environmental performance			0.807	0.872	0.634
	EVP1	0.904			
	EVP2	0.687			
	EVP3	0.857			
	EVP4	0.716			
SCP: Social performance			0.773	0.854	0.596
	SCP1	0.807			
	SCP2	0.816			
	SCP3	0.770			
	SCP4	0.688			

Table 3. Discriminant validity results based on the HTMT criterion for first-order measures

Constructs	ECP	EVP	GEI	GPI	GPR	GPRI	GRS	GTD	SCP
ECP									
EVP	0.660								
GEI	0.459	0.424							
GPI	0.649	0.617	0.571						
GPR	0.500	0.434	0.491	0.424					
GPRI	0.672	0.584	0.610	0.762	0.399				
GRS	0.491	0.434	0.494	0.375	0.511	0.417			
GTD	0.767	0.629	0.398	0.595	0.440	0.541	0.472		
SCP	0.696	0.799	0.356	0.633	0.270	0.573	0.377	0.680	

The results presented in Table 4 show that the criteria for assessing the higher-order measurement model were satisfied. The loadings of all GHRMP and GIN dimensions exceeded 0.70. The CR values were above 0.70, and the AVE values exceeded 0.50. These results indicate that the measurement model achieved satisfactory reliability and convergent validity. In addition, all HTMT values between the constructs were below 0.85, and the 95% confidence intervals did not include 1 (Table 5). These results confirm the discriminant validity of the constructs [45, 48].

Table 4. Reliability and validity results for second-order measures

Construct	Dimensions	Loading	CA	CR	AVE
GHRMP: Green human resource management practices			0.724	0.825	0.542
	GRS	0.730			
	GTD	0.786			
	GPR	0.717			
	GEI	0.708			
GIN: Green innovation			0.787	0.904	0.824
	GPI	0.915			
	GPRI	0.901			

Table 5. Discriminant validity results based on the HTMT criterion for second-order measures

Constructs	ECP	EVP	GHRMP	GIN	SCP
ECP					
EVP	0.660				
	[0.487; 0.796]				
GHRMP	0.810	0.700			
	[0.708; 0.891]	*[0.532; 0.826]*			
GIN	0.755	0.687	0.817		
	[0.604; 0.878]	*[0.497; 0.836]*	*[0.698; 0.912]*		
SCP	0.696	0.799	0.618	0.691	
	[0.534; 0.833]	*[0.666; 0.910]*	*[0.439; 0.764]*	*[0.517; 0.841]*	

Note: Values in brackets represent the 95% bias-corrected and accelerated confidence intervals [2.5%; 97.5%] obtained from 5,000 bootstrap resamples.

4.2. **Structural model assessment. Assessment of common method Bias:** Common method bias was assessed using the full collinearity VIF approach. The results show that all VIF values range from 1.989 to 2.219 (Table 6), which are below the recommended threshold of 3.3 [44]. These results suggest that common method bias is unlikely to affect the study findings.

Table 6. Full collinearity test

	GHRMP	GIN	ECP	SCP	EVP
FCVIF	1.989	2.028	2.060	2.219	2.028

Note: FCVIF **=** Variance Inflation Factor values in a full collinearity test.

Hypothesis testing: the study tested seven direct hypotheses and three mediation hypotheses. Path coefficients and statistical significance were used to assess the hypotheses. The results are presented in Figure 2 and Table 7.

Following Hair et al. [45], bootstrapping with 5,000 resamples was used to assess the structural model. First, the direct relationships were examined. The results show that GHRMP has positive effects on GIN ($\beta = 0.631$, $p < 0.001$), ECP ($\beta = 0.444$, $p < 0.001$), EVP ($\beta = 0.261$, $p < 0.001$), and SCP ($\beta = 0.346$, $p < 0.01$). Therefore**,** H1, H2, H3, and H4 were supported**.** Next, the effects of GIN on ECP, EVP, and SCP were examined. The results indicate that GIN has positive effects on ECP ($\beta = 0.322$, $p < 0.001$), EVP ($\beta = 0.352$, $p < 0.001$), and SCP ($\beta = 0.380$, $p < 0.001$). Therefore, H5, H6, and H7 were supported**.**

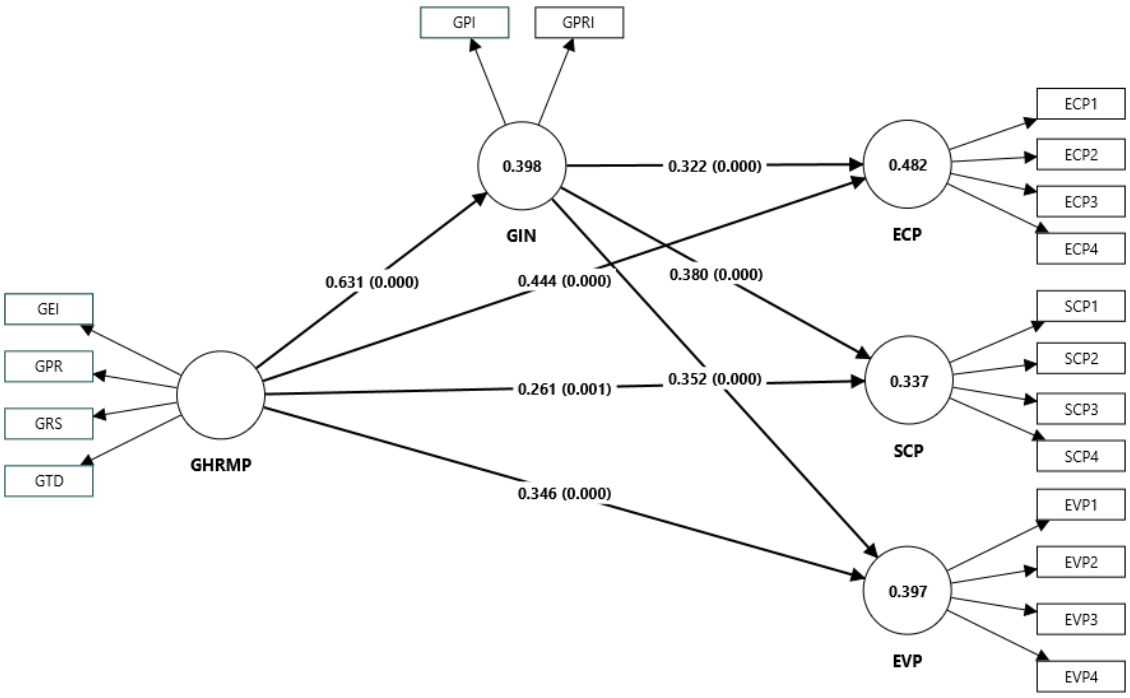


FIGURE 2. Structural model incorporating higher-order constructs

Next, the mediation effects were assessed using bootstrapping to estimate the indirect effects. The results show that the indirect effect of GHRMP on ECP through GIN was statistically significant ($\beta = 0.203$, $p < 0.001$). Similarly, the indirect effect of GHRMP on SCP through GIN was statistically significant ($\beta = 0.240$, $p < 0.001$). The indirect effect of GHRMP on EVP through GIN was also statistically significant ($\beta = 0.222$, $p < 0.01$). Therefore, H8, H9, and H10 were supported.

TABLE 7. Hypothesis Results

Statistical paths	β	SD	t -value	p -values	Confidence interval 2.5%	97.5%	Decision
Direct effect							
H1: GHRMP → GIN	0.631	0.054	11.721	0.000	0.517	0.726	Supported
H2: GHRMP → ECP	0.444	0.064	6.923	0.000	0.317	0.568	Supported
H3: GHRMP → SCP	0.261	0.078	3.353	0.001	0.103	0.409	Supported
H4: GHRMP → EVP	0.346	0.081	4.296	0.000	0.177	0.491	Supported
H5: GIN → ECP	0.322	0.080	4.048	0.000	0.164	0.479	Supported
H6: GIN → SCP	0.380	0.088	4.328	0.000	0.214	0.556	Supported
H7: GIN → EVP	0.352	0.088	3.992	0.000	0.184	0.529	Supported
Mediating effect							
H8: GHRMP → GIN → ECP	0.203	0.056	3.629	0.000	0.124	0.382	Supported
H9: GHRMP → GIN → SCP	0.240	0.067	3.594	0.000	0.099	0.32	Supported
H10: GHRMP → GIN → EVP	0.222	0.067	3.317	0.001	0.104	0.364	Supported

Note: Authors' analysis using SmartPLS, 2026

In addition, the variance accounted for (VAF) was used to assess the extent of GIN mediation in the relationships between GHRMP and ECP, EVP, and SCP. According to the VAF criteria, values below 20% indicate a weak mediation effect, values between 20% and 80% indicate partial mediation, and values above 80% indicate full mediation [45]. As shown in Table 8, the VAF values were 31.37% for ECP, 47.90% for SCP, and 39.08% for EVP. All three values fall within the 20% to 80% range. Therefore, GIN partially mediates the relationships between GHRMP and ECP, EVP, and SCP.

Table 8. Summary of mediating effects analysis

Mediating paths	Indirect effects	Total effects	VAF (%)	Conclusion
GHRMP → GIN → ECP	0.203	0.647	31.37	Partial mediation
GHRMP → GIN → SCP	0.240	0.501	47.90	Partial mediation
GHRMP → GIN → EVP	0.222	0.568	39.08	Partial mediation

The effect size results presented in Table 9 show that GHRMP has a large effect on GIN (f^2 = 0.662). GHRMP has a medium effect on ECP (f^2 = 0.229). Its effects on SCP and EVP are smaller. GIN has small effects on ECP, SCP, and EVP. The R^2 values of the endogenous constructs range from 0.337 to 0.482, indicating that the model explains between 33.7% and 48.2% of the variance in the endogenous constructs. All Q^2 values are greater than zero, confirming the model's predictive relevance for the endogenous constructs [45]. These findings are consistent with previous research suggesting that GHRMP can contribute to economic, social, and environmental performance [1, 20, 24].

Table 9. Effect size (f^2), R^2, and predictive relevance (Q^2)

Construct	GIN(f^2)	ECP(f^2)	SCP(f^2)	EVP(f^2)	R^2	Q^2
GHRMP	0.662	0.229	0.062	0.119		
GIN		0.121	0.131	0.121	0.398	0.319
ECP					0.482	0.287
SCP					0.337	0.188
EVP					0.397	0.238

Note: f^2 values of 0.02, 0.15, and 0.35 indicate small, medium, and large effect sizes, respectively [45].

5. Discussion of Findings and Implications

The results show that GHRMP has the strongest effect on GIN, followed by ECP and EVP, while its effect on SCP is the weakest. From a DCT perspective, GHRMP helps firms develop employees'

green knowledge, skills, and motivation. Green recruitment and training can strengthen employees' ability to identify and implement green solutions. Green participation and rewards can further encourage employees to engage in green innovation. These mechanisms may explain the strong effect of GHRMP on GIN. This finding is consistent with previous studies showing that GHRMP promotes green capabilities and green innovation [6,7,49,50].

GHRMP also has positive effects on ECP, EVP, and SCP, consistent with previous studies [12,23, 50]. This consistency may reflect the role of GHRMP in developing employees' green knowledge, skills, and behaviors. However, the effect of GHRMP on ECP is weaker than its effect on GIN. One possible explanation is that the economic benefits of GHRMP may take longer to materialize. Firms may initially incur costs for green recruitment, employee training, and process changes. These costs may limit short-term economic benefits [34].

GIN has a positive effect on SCP, EVP, and ECP, with the strongest effect observed for SCP, followed by EVP and ECP. From a DCT perspective, GIN can be viewed as an outcome of firms' ability to reconfigure resources and capabilities in response to changing sustainability requirements [10,51]. Green product and process innovation can encourage employee participation in sustainability activities and strengthen corporate social responsibility. This may partly explain why GIN has a stronger effect on SCP. Green process innovation can also reduce waste, improve energy efficiency, and promote more efficient resource use. This may partly explain the positive effect of GIN on EVP.

This finding is consistent with previous studies examining the effects of GIN on SCP [6,52], ECP [19,42], and EVP [5,28,34]. These findings suggest that GIN can contribute to sustainability performance by supporting the development and implementation of green solutions. However, the weaker effect of GIN on ECP may reflect the investment costs and time required before financial benefits become evident. Resource constraints may further limit the economic returns from GIN during its early implementation.

The results show that GIN partially mediates the relationships between GHRMP and ECP, EVP, and SCP. From a DCT perspective, GHRMP helps develop and mobilize green human resources, while GIN enables firms to use these resources through green product and process innovation [10,51]. Thus, GIN provides an important mechanism through which GHRMP contributes to ECP, EVP, and SCP. This finding is consistent with Awwad Al-Shammari et al. [7] and Kanan et al. [8], who reported that GIN mediates the relationship between GHRMP and sustainable performance**.** Similarly, Suleman et al. [6] found that GIN partially mediates the relationships between GHRMP and ECP and SCP. However, Suleman et al. [6] reported full mediation for EVP, whereas this study found partial mediation. This difference may reflect differences in research contexts and resource constraints among SMEs**.**

These findings suggest that SMEs should integrate GHRMP with green innovation. Firms should strengthen GHRMP to develop employees' green knowledge and skills and encourage their participation in environmental activities. They should also support green product and process

innovation. Integrating these practices may help SMEs improve economic, environmental, and social performance.

Theoretical Implications. This study provides empirical support for DCT by showing that GHRMP contributes to GIN in SMEs. GHRMP helps develop employees' green knowledge, skills, and motivation. These resources can contribute to the development and implementation of GIN. Thus, the findings provide further support for the relevance of DCT in explaining how GHRMP contributes to GIN.

The positive effects of GIN on SCP, EVP, and ECP provide further empirical support for DCT. The findings show that green innovation can contribute to social, environmental, and economic performance. Thus, the benefits of GIN are not limited to environmental performance. GIN can help firms pursue multiple dimensions of sustainable business performance.

Finally, the partial mediating effects of GIN show that green innovation is an important mechanism linking GHRMP to SCP, EVP, and ECP. This finding provides empirical evidence that is consistent with DCT by showing how GHRMP can contribute to sustainable business performance through green innovation. The partial mediation also suggests that other mechanisms may explain the relationships between GHRMP and the three dimensions of sustainable business performance.

Managerial Implications. The findings provide several managerial implications for SMEs. First, GHRMP has the strongest effect on GIN and a stronger direct effect on ECP than on EVP and SCP. Therefore, SMEs should consider GHRMP as a foundation for developing green human resources and the development of GIN. Green recruitment, training, performance appraisal, and rewards should be aligned with firms' innovation objectives.

Second, GIN has the strongest effect on SCP, followed by EVP and ECP. Therefore, SMEs should not evaluate green innovation based only on economic benefits. Firms should prioritize initiatives that can enhance employee participation and environmental performance. Process improvements, efficient use of materials, and energy saving can be suitable options for SMEs.

Third, the partial mediating role of GIN suggests that GHRMP should be combined with green innovation to improve SBP. SMEs should create conditions for employees to translate green knowledge and initiatives into specific product and process improvements. This approach may help firms use green human resources more effectively and improve economic, environmental, and social performance.

6. Conclusion

This study provides empirical evidence on the relationships among GHRMP, GIN, and the dimensions of SBP in SMEs. GHRMP has the strongest effect on GIN. Regarding SBP, the direct effect of GHRMP on ECP is stronger than its effects on EVP and SCP. GIN also has positive effects on ECP, EVP, and SCP, with the strongest effect observed for SCP, followed by EVP and ECP. GIN partially mediates the relationships between GHRMP and the dimensions of SBP. These findings

indicate that GHRMP contributes to SBP through both direct effects and the mediating role of GIN. Overall, the findings suggest that GHRMP contributes to sustainable business performance through both its direct effects and its indirect effects through GIN.

From a theoretical perspective, this study contributes to DCT by showing that GIN mediates the relationships between GHRMP and the dimensions of SBP. The findings suggest that GHRMP can contribute to green innovation by developing and mobilizing employees' green knowledge, skills, and motivation.

This study has several limitations. The cross-sectional data from SMEs in Ho Chi Minh City limit causal inference. The data are mainly based on managers' assessments, which may introduce perceptual bias. Future research could use longitudinal designs and data from multiple sources. Further studies could also examine moderating variables to identify factors that may strengthen or weaken the relationships among GHRMP, GIN, and the dimensions of SBP.

Appendix A

Table A1: Measurement items and sources

Constructs	**Code**	**Measurement items**	**Sources**
Green recruitment and selection (GRS)	GRS1	Our company integrates environmental criteria into employee recruitment practices	[2]
	GRS2	Our company attracts employees through commitments to sustainability and environmental protection.	[2]
	GRS3	Our company incorporates environmental awareness-related questions into recruitment interviews.	[2]
	GRS4	Our company combines online and traditional recruitment methods to support greener recruitment processes.	[20,53]
Green training and development (GTD)	GTD1	Our company organizes training programs to enhance employees' environmental awareness.	[2]
	GTD2	Our company organizes activities to promote awareness of environmental sustainability.	[2]
	GTD3	Our company conducts training sessions and knowledge-sharing activities to develop employees' green skills.	[2]
	GTD4	Our company implements both face-to-face and online training programs to conserve resources.	[20,53]
Green performance appraisal and reward (GPR)	GPR1	Our company considers employees' job performance and environmental achievements in compensation policies.	[54]
	GPR2	Our company rewards and recognizes employees' contributions to environmental management.	[1]

Table A1: Measurement items and sources

Constructs	Code	Measurement items	Sources
	GPR3	Our company uses green performance indicators in evaluating employees' job performance.	[1]
	GPR4	Our company establishes environmental goals, targets, and responsibilities as part of employee performance evaluation.	[1]
Employee green involvement (GEI)	GEI1	Our company encourages employees to propose environmentally friendly initiatives in their work.	[1]
	GEI2	Our company provides opportunities for employees to participate in environmental improvement activities.	[1]
	GEI3	Our company encourages discussion of environmental issues during meetings and within work teams.	[5]
	GEI4	Our company uses digital platforms to collect, store, and share employees' green improvement ideas.	[20, 53]
Green product innovation (GPI)	GPI1	Our company selects and uses environmentally friendly materials in developing its products/services.	[42]
	GPI2	Our company develops products/services that enable reuse or recycling to minimize waste.	[42]
	GPI3	Our company improves existing products/services to reduce their negative environmental impacts.	[39]
	GPI4	Our company develops products/services with environmentally friendly features.	[39]
Green process innovation (GPRI)	GPRI1	Our company applies environmentally friendly technologies and equipment in operational activities.	[42]
	GPRI2	Our company improves operational processes to reduce the consumption of water, energy, and raw materials.	[42]
	GPRI3	Our company applies technologies and equipment that enhance energy efficiency in operational processes.	[43]
	GPRI4	Our company adopts environmentally friendly waste treatment and recycling processes.	[43]
	GPRI5	Our company improves operational processes to reduce environmental impacts.	[43]
Economic performance (ECP)	ECP1	The company has experienced a reduction in energy and material consumption costs.	[2]
	ECP2	Customer satisfaction with the company is at a high level.	[38]
	ECP3	The company's sales revenue shows an increasing trend.	[38]

Table A1: Measurement items and sources

Constructs	Code	Measurement items	Sources
Environmental performance (EVP)	ECP4	The company's profitability shows an increasing trend.	[38]
	EVP1	Our company improves compliance with environmental regulations.	[39]
	EVP2	Our company reduces environmental emissions.	[39]
	EVP3	Our company reduces the amount of hazardous waste and operational scrap generated in operational activities.	[39]
	EVP4	Our company reduces fuel consumption in operations.	[39]
Social performance (SCP)	SCP1	Employee satisfaction has increased in recent years	[41]
	SCP2	Employees' work motivation has increased in recent years.	[41]
	SCP3	Occupational health and safety outcomes have improved in recent years.	[40]
	SCP4	The company is concerned with the quality of life of its employees.	[40]

Note: All items were measured using a five-point Likert scale ranging from 1 (strongly disagree) to 5 (strongly agree). Items were adapted from prior validated scales with minor modifications to fit the context of Vietnamese SMEs and the integration of digital transformation in green human resource management practices.

Ethical Approval Statement: This study did not require formal ethical approval in accordance with the applicable institutional requirements. Participation was voluntary and anonymous. The research focused exclusively on organisational and managerial practices within the Vietnamese manufacturing SMEs sector and did not collect any personal or sensitive information. All participants were informed about the purpose of the study, the confidentiality of the information provided, and their right to withdraw from the study at any time.

AI Use: During the preparation of this work, the authors used ChatGPT to improve language clarity and readability. After using this tool, the authors reviewed and edited the content as needed and take full responsibility for the content of the published article.

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