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Green Human Resource Management and Sustainability Performance in UAE Manufacturing Firms: The Mediating Role of Green Innovation

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Abstract

This study examines the effect of Green Human Resource Management (GHRM) on Sustainability Performance and investigates the mediating role of Green Innovation in UAE manufacturing firms. Drawing on the Resource-Based View and Stakeholder Theory, the study proposes that green HRM practices develop internal environmental capabilities that support green product and process innovation, which in turn enhances sustainability outcomes. Data were collected through a structured survey of managers and professionals from UAE manufacturing firms, resulting in 306 valid responses. The data were analysed using partial least squares structural equation modelling. The findings show that GHRM has a positive and significant effect on Green Innovation and Sustainability Performance. Green Innovation also has a positive and significant effect on Sustainability Performance. In addition, Green Innovation partially mediates the relationship between GHRM and Sustainability Performance, indicating that green HRM improves sustainability outcomes both directly and indirectly through innovation capability. The model explains 59.9% of the variance in Green Innovation and 73.3% of the variance in Sustainability Performance, demonstrating substantial explanatory power. The study contributes to the green HRM and sustainability literature by providing empirical evidence from the UAE manufacturing sector,

an underexplored context in Middle Eastern sustainability research. Practically, the findings suggest that manufacturing firms should align HR practices with innovation strategies to strengthen environmental, economic, and social performance.

Keywords: Green Human Resource Management, Green Innovation, Sustainability Performance, UAE manufacturing firms, Resource-Based View, Stakeholder Theory, PLS-SEM, sustainable manufacturing

1. Introduction

The manufacturing sector remains a central driver of economic development, employment generation, industrial capability, export performance, and technological advancement. At the same time, manufacturing is one of the sectors most closely associated with environmental pressures, including high energy consumption, intensive use of raw materials, greenhouse gas emissions, waste generation, and pollution. This dual role has made sustainable manufacturing a major concern for policymakers, managers, and researchers. As climate concerns, environmental regulations, and stakeholder expectations continue to intensify, manufacturing firms are increasingly expected to reduce environmental harm while maintaining competitiveness and operational efficiency (Porter & van der Linde, 1995; Adams et al., 2016; Ganda, 2019).

In response to these pressures, green innovation has emerged as an important strategic pathway for improving sustainability in manufacturing. Green innovation refers to the development and implementation of environmentally oriented products, processes, and technologies that reduce ecological impact and improve resource efficiency (Chen et al., 2006; De Marchi, 2012; Adams et al., 2016). In manufacturing firms, green process innovation may involve cleaner production methods, energy-efficient technologies, waste reduction systems, and renewable energy integration, while green product innovation may include recyclable materials, low-carbon products, and environmentally friendly product designs. These innovations enable firms to transform sustainability commitments into practical operational and market outcomes (Xie et al., 2019; Singh et al., 2020; Wang & Liu, 2022).

However, sustainability transformation is not driven by technology alone. It also depends on employees' knowledge, skills, motivation, and participation. This has increased scholarly and managerial interest in Green Human Resource Management (GHRM). GHRM refers to the integration of environmental objectives into HR practices such as recruitment, training, employee involvement, performance management, and compensation (Renwick et al., 2013; Tang et al., 2018; Yong et al., 2020). Through these practices, organisations can build environmental awareness, encourage green behaviour, and develop the human capabilities needed to support green innovation and sustainability performance (Shafaei et al., 2020; Zacher et al., 2023). From the Resource-Based View perspective, GHRM can be understood as a strategic internal capability that helps firms develop valuable, rare, and difficult-to-imitate human resources for sustainability-oriented competitiveness (Barney, 2000; Hart, 1995; Khanra et al., 2022).

Although the relationship between GHRM, green innovation, and sustainability performance has attracted increasing academic attention, the existing evidence remains uneven across regions and sectors. Prior studies have shown that GHRM can enhance green behaviour, green innovation, and sustainable performance (Mousa & Othman, 2020; Al-Shammari et al., 2022; Ali et al., 2024; Bindeeba et al., 2025). However, much of the empirical literature is concentrated in Western and Asian economies, while the Middle East and North Africa region remains relatively underrepresented. This gap is important because institutional conditions, industrial structures, labour systems, environmental regulations, and sustainability priorities

may differ significantly across contexts. Therefore, findings from other regions may not fully explain how GHRM operates in the UAE manufacturing sector.

The UAE provides a particularly relevant context for examining these relationships. The country has placed sustainability and industrial diversification at the centre of its national development agenda through initiatives such as the UAE Green Agenda 2030, UAE Energy Strategy 2050, Dubai Industrial Strategy 2030, and UAE Net Zero 2050. These initiatives emphasise resource efficiency, clean energy, industrial innovation, and long-term carbon reduction. The manufacturing sector is a key component of this transformation, contributing to national economic diversification and industrial growth (Crupi & Schilirò, 2023). However, it is also associated with considerable environmental impacts due to energy-intensive production processes, material waste, emissions, and uneven adoption of green technologies. Evidence from the UAE context also shows that firms continue to face barriers in translating sustainability objectives into operational practice (Bashir et al., 2024).

Despite strong national policy direction, many UAE manufacturing firms still face challenges in embedding sustainability into organisational practice. These challenges include limited green skills, insufficient environmental awareness, high implementation costs, weak integration between HR strategy and sustainability objectives, and performance systems that often prioritise productivity over environmental outcomes. As a result, the adoption of GHRM remains uneven. Many firms continue to rely on traditional HR practices, with limited emphasis on green recruitment, green training, employee involvement in sustainability initiatives, or reward systems linked to environmental performance (Guerci et al., 2016; Renwick et al., 2013; Yong et al., 2020).

This creates an important research gap. While prior studies suggest that GHRM can support environmental behaviour, green innovation, and sustainable performance, limited empirical evidence explains how these relationships operate in UAE manufacturing firms (Mousa & Othman, 2020; Al-Shammari et al., 2022; Ali et al., 2024). In particular, it remains unclear whether green innovation acts as a mechanism through which GHRM improves sustainability performance. Understanding this mediating role is important because it helps explain not only whether GHRM influences sustainability outcomes, but also how this influence occurs.

Accordingly, this study examines the relationship between Green Human Resource Management, Green Innovation, and Sustainability Performance in the UAE manufacturing sector. Specifically, it investigates whether GHRM directly improves sustainability performance and whether green innovation mediates this relationship. Sustainability performance is considered in terms of environmental, economic, and social outcomes, reflecting the multidimensional nature of sustainable organisational performance and the triple bottom line perspective (Lozano, 2015; Purvis et al., 2019).

This study makes several contributions. First, it extends the GHRM literature by providing empirical evidence from an underexplored Middle Eastern manufacturing context. Second, it contributes to the green innovation literature by examining green innovation as a mediating mechanism between HR practices and sustainability outcomes. Third, it advances the Resource-Based View by showing how environmentally aligned HR practices can function as

internal capabilities that support innovation-led sustainability performance (Barney, 2000; Hart, 1995; Khanra et al., 2022). Finally, the study offers practical insights for UAE manufacturing firms seeking to align HR systems, innovation strategies, and national sustainability priorities.

2. Development of Conceptual Framework

This study develops a conceptual framework linking Green Human Resource Management, Green Innovation, and Sustainability Performance in UAE manufacturing firms. The framework is grounded in the Resource-Based View and Stakeholder Theory. The Resource-Based View explains how firms develop internal capabilities that support competitive and sustainability-oriented outcomes, while Stakeholder Theory explains why firms respond to environmental expectations from regulators, customers, employees, communities, and other external stakeholders (Barney, 2000; Hart, 1995; Guerci et al., 2016).

In this framework, Green Human Resource Management is conceptualised as a strategic internal mechanism that develops employees' environmental knowledge, skills, motivation, and behaviour. Green Innovation is positioned as a mediating capability through which green HRM practices are translated into improved sustainability outcomes. Sustainability Performance represents the environmental, economic, and social outcomes achieved by manufacturing firms. The proposed framework therefore suggests that GHRM enhances Sustainability Performance both directly and indirectly through Green Innovation (Al-Shammari et al., 2022; Ali et al., 2024; Bindeeba et al., 2025).

2.1 Green Human Resource Management and Green Innovation

Green Human Resource Management refers to the integration of environmental objectives into HRM practices such as green hiring, green training and involvement, and green performance management and compensation (Renwick et al., 2013; Tang et al., 2018). From the Resource-Based View perspective, these practices help firms develop valuable internal human capabilities that support environmental learning, problem-solving, and innovation (Barney, 2000; Hart, 1995).

The relationship between GHRM and Green Innovation is particularly relevant in manufacturing firms because green product and process innovation often depend on employees' operational knowledge and participation in improvement activities. Employees who are recruited with environmental awareness, trained in green practices, involved in sustainability initiatives, and rewarded for environmentally responsible behaviour are more likely to contribute to cleaner production processes and environmentally friendly products (Shafaei et al., 2020; Zacher et al., 2023). Thus, GHRM creates the organisational conditions under which Green Innovation is more likely to occur. Prior studies have similarly found that green-oriented HR systems can support green innovation and sustainability-related organisational outcomes (Al-Shammari et al., 2022; Acquah et al., 2021; Agyabeng-Mensah et al., 2024). Based on this reasoning, the following hypothesis is proposed:

H1: Green Human Resource Management has a positive effect on Green Innovation in UAE manufacturing firms.

2.2 Green Human Resource Management and Sustainability Performance

Sustainability Performance depends not only on technology and regulation, but also on employee behaviour, awareness, accountability, and routine organisational practices. Green HRM can directly support sustainability outcomes by embedding environmental values into recruitment, training, employee involvement, appraisal, and compensation systems (Renwick et al., 2013; Tang et al., 2018; Yong et al., 2020).

Through these practices, firms can encourage employees to reduce waste, conserve resources, comply with environmental standards, support workplace safety, and participate in sustainability initiatives. These outcomes are closely related to the environmental, economic, and social dimensions of Sustainability Performance (Lozano, 2015; Purvis et al., 2019). Previous empirical studies also indicate that GHRM contributes positively to sustainable performance by strengthening environmental responsibility, operational efficiency, and employee-level green behaviour (Mousa & Othman, 2020; Shafaei et al., 2020; Ali et al., 2024).

The Resource-Based View suggests that green-oriented human capabilities can become a source of organisational advantage, while Stakeholder Theory suggests that firms adopt such practices in response to growing environmental and social expectations (Hart, 1995; Guerci et al., 2016). Therefore, GHRM is expected to contribute positively to Sustainability Performance. Accordingly, the following hypothesis is proposed:

H2: Green Human Resource Management has a positive effect on Sustainability Performance in UAE manufacturing firms.

2.3 Green Innovation and Sustainability Performance

Green Innovation refers to the development and implementation of environmentally oriented products and processes (Chen et al., 2006; Adams et al., 2016). In manufacturing firms, Green Process Innovation may involve cleaner production technologies, energy-efficient processes, waste reduction, emissions control, and resource-saving production methods. Green Product Innovation may include recyclable materials, eco-friendly product design, and products with lower environmental impact (Xie et al., 2019; Singh et al., 2020).

Green Innovation can improve Sustainability Performance by enabling firms to reduce environmental harm while also improving efficiency, competitiveness, corporate reputation, and stakeholder acceptance. Process innovation can reduce energy consumption, emissions, and waste, while product innovation can enhance market opportunities and strengthen environmental credibility (De Marchi, 2012; Xie et al., 2019; Wang & Liu, 2022). Prior studies show that green innovation can improve firm performance, environmental performance, and broader sustainability outcomes (Singh et al., 2020; AlNuaimi et al., 2021; Khanra et al., 2022). Therefore, Green Innovation is expected to contribute positively to the environmental, economic, and social performance of UAE manufacturing firms. Thus, the following hypothesis is proposed:

H3: Green Innovation has a positive effect on Sustainability Performance in UAE

manufacturing firms.

2.4 Mediating Role of Green Innovation

The mediating role of Green Innovation is central to the proposed framework. This study argues that GHRM does not influence Sustainability Performance only through a direct behavioural route. It may also improve Sustainability Performance indirectly by strengthening Green Innovation.

This mediation logic is consistent with the Resource-Based View because GHRM builds internal human capabilities, while Green Innovation represents a strategic capability through which these human resources are converted into sustainability-related outcomes (Hart, 1995; Barney, 2000; Khanra et al., 2022). It is also consistent with Stakeholder Theory because Green Innovation enables firms to respond more effectively to stakeholder expectations for cleaner production, responsible products, and reduced environmental impact (Guerci et al., 2016).

In practical terms, employees who are recruited, trained, involved, evaluated, and rewarded in environmentally aligned ways may be more likely to support green product and process innovation. These innovations can then improve environmental, economic, and social performance. Therefore, Green Innovation acts as a transmission mechanism between GHRM and Sustainability Performance. This mediation argument is consistent with prior empirical evidence showing that green innovation helps explain the link between GHRM and sustainable performance (Al-Shammari et al., 2022; Bindeeba et al., 2025). Accordingly, the following hypothesis is proposed:

H4: Green Innovation mediates the relationship between Green Human Resource Management and Sustainability Performance in UAE manufacturing firms.

2.5 Proposed Conceptual Framework

As shown in Figure 1, the proposed conceptual framework positions Green Human Resource Management as the independent construct, Green Innovation as the mediating construct, and Sustainability Performance as the dependent construct. GHRM is represented by green hiring, green training and involvement, and green performance management and compensation, reflecting the view that GHRM operates as a bundle of mutually reinforcing practices (Renwick et al., 2013; Tang et al., 2018). Green Innovation is represented by green process innovation and green product innovation, which are widely recognised as core dimensions of innovation in sustainability-oriented manufacturing research (Chen et al., 2006; Xie et al., 2019). Sustainability Performance is represented by environmental, economic, and social performance, consistent with the multidimensional view of sustainability (Lozano, 2015; Purvis et al., 2019).

The model proposes both a direct and an indirect pathway. The direct pathway suggests that GHRM improves Sustainability Performance by shaping employees' environmental behaviour and organisational routines. The indirect pathway suggests that GHRM improves Sustainability Performance by promoting Green Innovation. This framework therefore

integrates internal capability-building and stakeholder-responsive innovation to explain sustainability performance in UAE manufacturing firms.

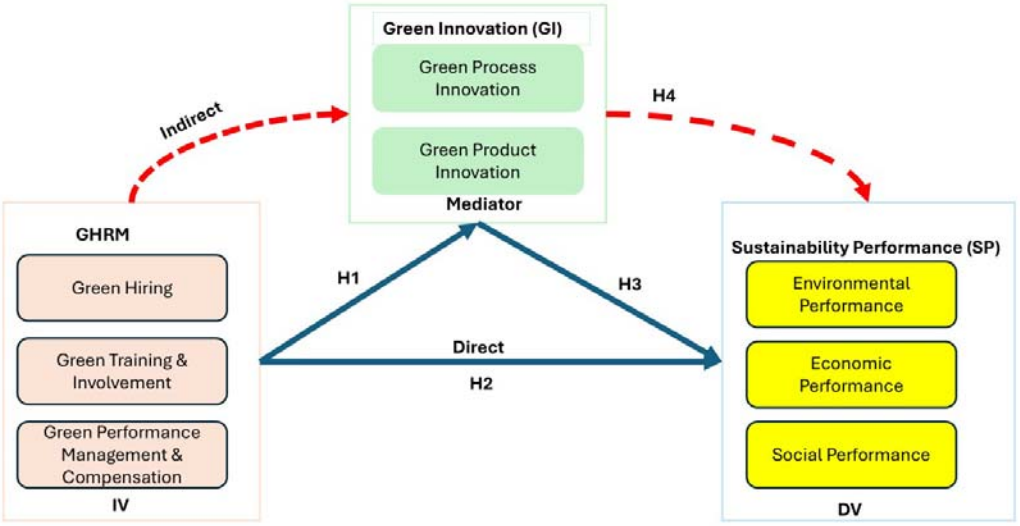

Figure 1. Proposed conceptual framework

Note. GHRM → Green Innovation → Sustainability Performance; GHRM → Sustainability Performance.

3. Data Collection and Sample Profile

This study employed a cross-sectional survey design to collect data from manufacturing firms in the United Arab Emirates. The UAE manufacturing sector was selected because of its growing strategic importance to national economic diversification and sustainability transformation. The sector includes a wide range of subsectors, such as metals, plastics, chemicals, construction materials, food processing, machinery, and advanced manufacturing. Given its economic significance and environmental impact, the sector provides an appropriate context for examining the relationships among Green Human Resource Management, Green Innovation, and Sustainability Performance.

3.1 Data Collection

The target population comprised manufacturing establishments operating in the UAE. In 2022, the sector consisted of approximately **39,046 firms** employing **823,534 workers**, reflecting its importance as a pillar of national industrial development. The sector is also central to the UAE's industrial strategy under Operation 300bn, which emphasises industrial growth, innovation, competitiveness, and sustainability.

The study targeted respondents from managerial and professional positions who were expected to possess relevant organisational-level knowledge. These included HR managers, sustainability managers, operations managers, production managers, plant managers, health, safety and environment managers, and department heads. Supervisory and specialist-level

respondents were included only when they had sufficient knowledge of organisational HR practices, innovation activities, and sustainability outcomes. This key-informant approach was adopted to improve the accuracy and relevance of the responses.

The sampling frame was developed using multiple sources, including registries from the Ministry of Industry and Advanced Technology, local Chambers of Commerce, industrial free zones such as JAFZA and KIZAD, and publicly available company directories. This approach helped ensure coverage across different emirates, manufacturing subsectors, firm sizes, and ownership types. A stratified random sampling approach was initially applied to capture variation by firm size and subsector. Where access to firms was limited, purposive and snowball sampling were used as supplementary approaches.

A total of **450 questionnaires** were distributed. Of these, **361 questionnaires** were returned, representing a gross response rate of **80.2%**. After screening, **36 incomplete responses** were removed, leaving **325 usable questionnaires**. A further **19 cases** were excluded after outlier assessment, resulting in **306 valid questionnaires** for final analysis. The final usable response rate was **68.0%**, which was considered adequate for PLS-SEM analysis.

Table 1. Data collection outcome and final sample

Stage	Frequency	Percent of distributed questionnaires
Questionnaires distributed	450	100.0
Questionnaires received	361	80.2
Incomplete questionnaires removed	36	8.0
Usable questionnaires before outlier screening	325	72.2
Outliers removed	19	4.2
Final valid questionnaires	306	68.0

Note. Percentages are calculated based on the total number of distributed questionnaires.

3.2 Respondent and Organisational Profile

Table 2 presents the demographic and organisational profile of the final sample. The respondents demonstrated strong relevance to the study because most occupied managerial, supervisory, or specialist roles related to HR, production, operations, engineering, quality, or sustainability. In terms of organisational tenure, the largest proportion of respondents had worked in their firms for **4–6 years** and **7–10 years**, indicating that many respondents had sufficient organisational experience to assess HR practices, innovation activities, and sustainability performance.

The job-function distribution shows that respondents came mainly from operations and production, engineering and maintenance, human resources, and HSE/sustainability. This spread is appropriate for the study because the research examines organisational practices that cut across HRM, innovation, and sustainability. In terms of position level, most respondents were from supervisory, middle management, and senior management positions, suggesting

that the sample had adequate knowledge of organisational policies and practices.

The educational profile also indicates a relatively qualified respondent base. More than half of the respondents held bachelor's degrees, while a substantial proportion held master's or doctoral qualifications. This supports the reliability of the responses, as the respondents were likely to understand the managerial and technical issues addressed in the questionnaire.

From an organisational perspective, the sample included local firms, multinational companies, and joint ventures, with local firms representing the largest group. Firm size varied from small establishments to large firms with more than 1,000 employees, although medium and large firms formed the majority of the sample. The participating firms represented diverse manufacturing subsectors, including chemicals and petrochemicals, electronics and advanced manufacturing, construction materials, metals and aluminium, and food and beverage.

Geographically, the sample covered all seven emirates, with Abu Dhabi and Dubai accounting for the largest shares. This distribution reflects the concentration of industrial activity in these emirates while still capturing broader representation across the UAE. In addition, most respondents had between **6 and 15 years** of sector experience, further supporting the suitability of the sample. Just over half of the firms reported having a formal environmental management system such as ISO 14001, indicating that sustainability-related practices were relevant within the participating organisations.

Table 2. Respondent demography and organisational profile

Variable	Category	Frequency	Percent
Length of employment	Less than 1 year	20	6.5
	1–3 years	75	24.5
	4–6 years	87	28.4
	7–10 years	74	24.2
	More than 10 years	50	16.3
Job function/department	Human Resources	57	18.6
	Operations/Production	81	26.5
	HSE/Sustainability	51	16.7
	Quality	31	10.1
	Engineering/Maintenance	61	19.9
	Other	25	8.2
Position level	Supervisory	85	27.8
	Middle management	103	33.7
	Senior management	79	25.8
	Executive/Director	28	9.2
	Other	11	3.6
Education level	Diploma	23	7.5
	Bachelor's degree	159	52.0
	Master's degree	85	27.8

	Doctorate	26	8.5
	Other	13	4.2
Firm ownership	Local	181	59.2
	International/MNC	84	27.5
	Joint venture	41	13.4
Firm size	<50 employees	30	9.8
	50–249 employees	91	29.7
	250–999 employees	106	34.6
	1000+ employees	79	25.8
Manufacturing subsector	Metals/Aluminium	48	15.7
	Chemicals/Petrochemicals	69	22.5
	Construction materials	57	18.6
	Food & Beverage	32	10.5
	Electronics/Advanced manufacturing	59	19.3
	Other	41	13.4
Emirate/location	Abu Dhabi	97	31.7
	Dubai	71	23.2
	Sharjah	52	17.0
	Ajman	25	8.2
	Ras Al Khaimah	26	8.5
	Fujairah	21	6.9
	Umm Al Quwain	14	4.6
Sector experience	<3 years	24	7.8
	3–5 years	66	21.6
	6–10 years	99	32.4
	11–15 years	71	23.2
	>15 years	46	15.0
Formal EMS	Yes	162	52.9
	No	73	23.9
	Not sure	71	23.2

Note. EMS = Environmental Management System, such as ISO 14001.

4. Modelling of framework

4.1 Measurement Model Assessment

Before testing the hypothesised structural relationships, the measurement model was assessed to establish reliability and validity. Since the model included higher-order constructs, the assessment was conducted in two stages. First, the first-order reflective constructs were evaluated for internal consistency reliability, indicator reliability, and convergent validity. Second, the higher-order constructs were assessed for reliability, convergent validity, and discriminant validity.

Internal consistency reliability was examined using Cronbach's alpha and composite

reliability, while convergent validity was evaluated using indicator loadings and the average variance extracted. As shown in Table 1, the first-order constructs demonstrated acceptable reliability. Cronbach's alpha values ranged from **0.661 to 0.806**, while composite reliability values ranged from **0.786 to 0.861**, exceeding the minimum acceptable level of 0.70 for composite reliability.

Indicator reliability was also considered acceptable, as all item loadings were above **0.60**, ranging from **0.621 to 0.759**. Although several loadings were slightly below the preferred threshold of 0.70, they were retained because they were theoretically relevant and contributed to acceptable construct reliability.

The AVE values for Green Hiring, Green Training and Involvement, Green Performance Management, and Green Product Innovation exceeded the recommended threshold of **0.50**. However, Green Process Innovation, Environmental Performance, Economic Performance, and Social Performance recorded AVE values slightly below 0.50. These constructs were retained because their composite reliability values exceeded 0.70 and their indicators remained theoretically meaningful. Therefore, the first-order measurement model was considered acceptable for further analysis.

The higher-order constructs also demonstrated strong reliability and convergent validity. Cronbach's alpha values ranged from **0.846 to 0.895**, composite reliability values ranged from **0.925 to 0.935**, and AVE values ranged from **0.804 to 0.867**. These results indicate that Green Human Resource Management, Green Innovation, and Sustainability Performance were measured reliably at the higher-order level.

Table 3. Reliability and convergent validity of measurement model

Construct	Construct type	Loading range	Cronbach's alpha	Composite reliability	AVE
GH	First-order	0.701–0.754	0.693	0.813	0.521
GTI	First-order	0.684–0.757	0.806	0.861	0.508
GPM	First-order	0.699–0.737	0.767	0.843	0.518
GPrI	First-order	0.639–0.759	0.727	0.821	0.479
GPI	First-order	0.697–0.728	0.751	0.834	0.502
ENV	First-order	0.621–0.712	0.672	0.792	0.433
ECO	First-order	0.622–0.702	0.680	0.796	0.439
SOC	First-order	0.621–0.675	0.661	0.786	0.424
GHRM	Higher-order	—	0.895	0.935	0.828
GI	Higher-order	—	0.846	0.929	0.867
SP	Higher-order	—	0.878	0.925	0.804

Note. GH = Green Hiring; GTI = Green Training and Involvement; GPM = Green Performance Management and Compensation; GPrI = Green Process Innovation; GPI = Green Product Innovation; ENV = Environmental Performance; ECO = Economic Performance; SOC = Social Performance; GHRM = Green Human Resource Management; GI = Green Innovation; SP = Sustainability Performance.

Discriminant validity was assessed at the higher-order construct level using the Fornell-Larcker criterion and the Heterotrait-Monotrait ratio. Table 4 presents the combined discriminant validity results. The diagonal values represent the square root of AVE, the lower triangle shows inter-construct correlations, and the upper triangle shows HTMT values.

The Fornell-Larcker results indicate that the square root of AVE for each construct was greater than its correlations with other constructs. Specifically, the square root of AVE was **0.910** for GHRM, **0.931** for GI, and **0.897** for SP, all exceeding the corresponding inter-construct correlations. This supports discriminant validity.

The HTMT values were **0.917** for GHRM–GI, **0.897** for GHRM–SP, and **0.928** for GI–SP. These values indicate strong relationships among the constructs. While two HTMT values were slightly above the conservative threshold of 0.90, this is not unexpected because GHRM, GI, and SP are theoretically related organisational capabilities. Given that the Fornell-Larcker criterion was satisfied and the constructs are conceptually distinct, discriminant validity was considered acceptable for proceeding with structural model assessment.

Table 4. Discriminant validity of higher-order constructs

Construct	GHRM	GI	SP
GHRM	**0.910**	0.917	0.897
GI	0.798	**0.931**	0.928
SP	0.795	0.800	**0.897**

Note. Diagonal values in bold are the square roots of AVE. Values below the diagonal are Fornell-Larcker correlations. Values above the diagonal are HTMT ratios.

Overall, the measurement model results provide adequate support for reliability, convergent validity, and discriminant validity. The first-order constructs demonstrated acceptable internal consistency and indicator reliability, while the higher-order constructs showed strong reliability and convergent validity. Although some HTMT values were high, the discriminant validity evidence was considered sufficient in light of the satisfactory Fornell-Larcker results and the theoretical distinction among the constructs. Therefore, the measurement model was deemed suitable for testing the hypothesised structural relationships.

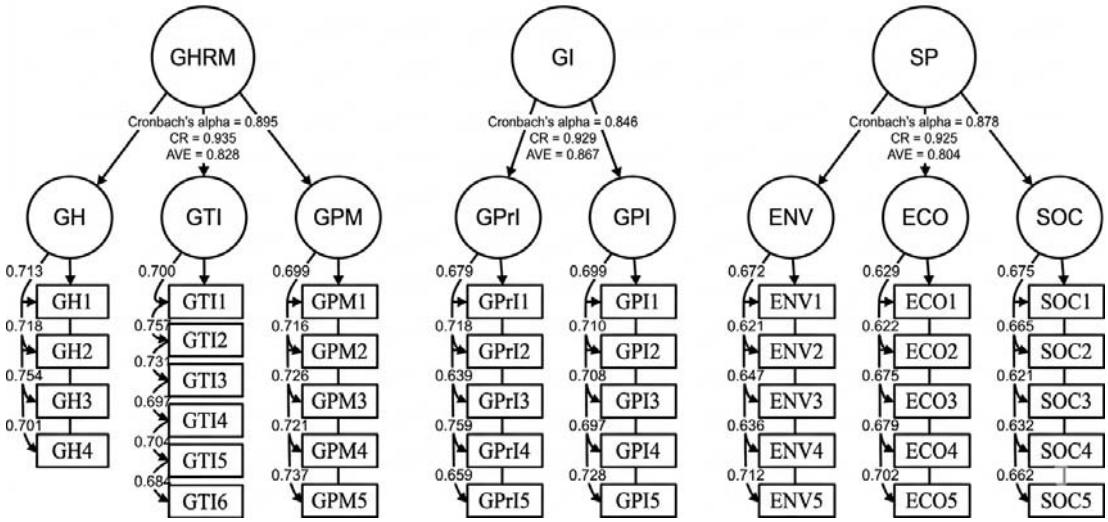

Figure 2. The measurement model

4.2 Structural Model Assessment

After confirming the adequacy of the measurement model, the structural model was assessed to test the hypothesised relationships among Green Human Resource Management, Green Innovation, and Sustainability Performance. The assessment included collinearity diagnostics, path coefficient estimation, explanatory power, effect size, predictive relevance, and mediation analysis.

Collinearity was first examined using the variance inflation factor. The VIF values for Green Human Resource Management and Green Innovation as predictors of Sustainability Performance were both **2.757**, which is below the conservative threshold of **3.3** and the commonly accepted threshold of **5.0**. This indicates that multicollinearity was not a concern in the structural model.

Bootstrapping with **5,000 resamples** was used to evaluate the significance of the hypothesised paths. As shown in Table 5, Green Human Resource Management had a positive and significant effect on Green Innovation (**β = 0.774, t = 41.600, p < 0.001**), supporting **H1**. This indicates that stronger green HRM practices are associated with higher levels of green innovation.

Green Human Resource Management also had a positive and significant direct effect on Sustainability Performance (**β = 0.401, t = 8.259, p < 0.001**), supporting **H2**. In addition, Green Innovation had a positive and significant effect on Sustainability Performance (**β = 0.507, t = 9.891, p < 0.001**), supporting **H3**. These findings confirm that both Green Human Resource Management and Green Innovation are important predictors of Sustainability Performance.

The effect size results further indicate that the relationships were substantively meaningful. The effect of Green Human Resource Management on Green Innovation was large (**f^2 =**

1.495). The effect of Green Human Resource Management on Sustainability Performance was medium to large (**f^2 = 0.344**), while the effect of Green Innovation on Sustainability Performance was also medium to large (**f^2 = 0.377**).

Table 5. Structural model results and hypothesis testing

Hypothesis	Relationship	β	SE	t-value	p-value	95% CI	f^2	Decision
H1	GHRM → GI	0.774	0.019	41.600	<0.001	[0.759, 0.833]	1.495	Supported
H2	GHRM → SP	0.401	0.052	8.259	<0.001	[0.325, 0.529]	0.344	Supported
H3	GI → SP	0.507	0.046	9.891	<0.001	[0.368, 0.547]	0.377	Supported
H4	GHRM → GI → SP	0.365	0.038	9.622	<0.001	[0.291, 0.439]	—	Supported

Note. GHRM = Green Human Resource Management; GI = Green Innovation; SP = Sustainability Performance; CI = confidence interval.

The explanatory power of the model was assessed using the coefficient of determination. As reported in Table 6, Green Human Resource Management explained **59.9%** of the variance in Green Innovation (**R^2 = 0.599; adjusted R^2 = 0.598**). Together, Green Human Resource Management and Green Innovation explained **73.3%** of the variance in Sustainability Performance (**R^2 = 0.733; adjusted R^2 = 0.731**). These values indicate substantial explanatory power for both endogenous constructs.

Predictive relevance was assessed using the Q^2 statistic. The Q^2 values were **0.634** for Green Innovation and **0.702** for Sustainability Performance. Since both values are greater than zero, the model demonstrates predictive relevance for the endogenous constructs.

Table 6. Explanatory power and predictive relevance

Endogenous construct	R^2	Adjusted R^2	Q^2
GI	0.599	0.598	0.634
SP	0.733	0.731	0.702

The mediation analysis showed that the indirect effect of Green Human Resource Management on Sustainability Performance through Green Innovation was positive and significant (**β = 0.365, t = 9.622, p < 0.001; 95% CI [0.291, 0.439]**). Therefore, **H4** was supported. Since both the direct effect of Green Human Resource Management on Sustainability Performance and the indirect effect through Green Innovation were significant, the mediation was interpreted as **complementary partial mediation**. This means that Green Human Resource Management improves Sustainability Performance both directly and indirectly by strengthening Green Innovation.

Overall, the structural model results provide strong empirical support for the proposed

framework. Green Human Resource Management significantly enhances Green Innovation and Sustainability Performance, while Green Innovation further contributes to Sustainability Performance. The findings also confirm that Green Innovation serves as an important transmission mechanism through which green HRM practices improve sustainability outcomes in UAE manufacturing firms.

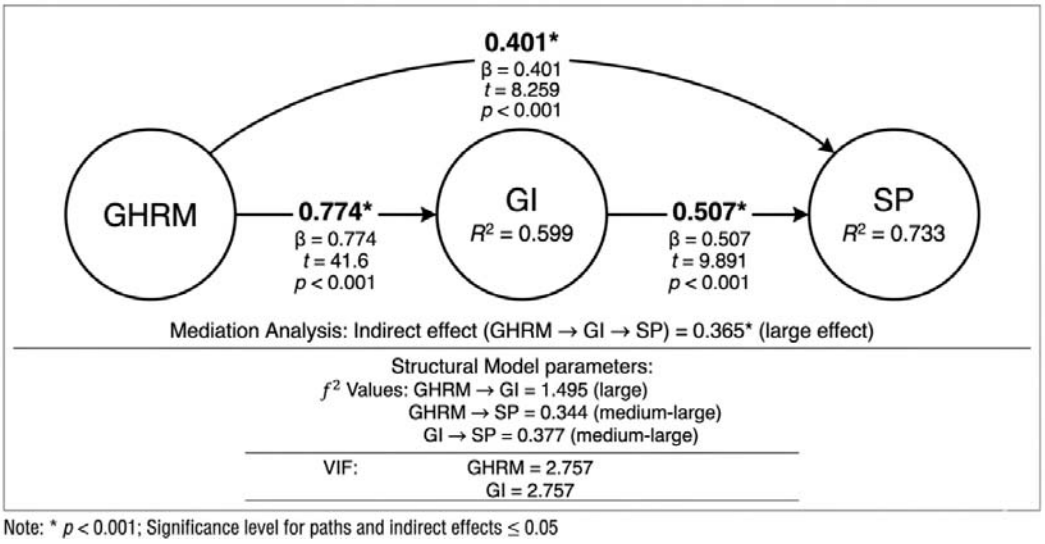

Figure 3. Structured model

5. Discussion of Findings

The purpose of this study was to examine the influence of Green Human Resource Management on Sustainability Performance and to determine whether Green Innovation mediates this relationship in UAE manufacturing firms. The structural model results provide strong empirical support for the proposed framework. All hypothesised relationships were positive and statistically significant, confirming that Green Human Resource Management contributes to Sustainability Performance both directly and indirectly through Green Innovation. These findings are consistent with the growing body of literature that views green HRM and green innovation as important organisational mechanisms for achieving sustainability-oriented performance outcomes (Mousa & Othman, 2020; Al-Shammari et al., 2022; Ali et al., 2024; Bindeeba et al., 2025).

5.1 Green Human Resource Management and Green Innovation

The results indicate that Green Human Resource Management has a strong positive effect on Green Innovation ($\beta = 0.774$, $p < 0.001$). This finding indicates that firms that adopt green hiring, green training and involvement, and green performance management and compensation are more likely to develop environmentally oriented product and process innovations.

This result supports the capability-building logic of the Resource-Based View. Green HRM

practices help firms develop valuable internal resources, including employees' environmental knowledge, green skills, commitment, and behavioural readiness (Barney, 2000; Hart, 1995). These human capabilities create favourable conditions for green innovation by supporting environmental learning, employee participation, and problem-solving within firms (Tang et al., 2018; Shafaei et al., 2020; Zacher et al., 2023). The finding is also consistent with prior studies showing that environmentally aligned HR systems can encourage green innovation and sustainability-related outcomes by embedding environmental awareness into employees' roles and responsibilities (Acquah et al., 2021; Al-Shammari et al., 2022; Ali et al., 2024).

In the UAE manufacturing context, this result is particularly important because sustainability-oriented innovation is often viewed mainly as a technological or operational issue. The findings suggest that green innovation also depends heavily on people management systems. Firms are more likely to innovate for sustainability when they recruit environmentally conscious employees, provide green training, involve employees in environmental initiatives, and reward green performance. This supports the argument that innovation capability is not only a technical resource but also a human and organisational capability (AlNuaimi et al., 2021; Khanra et al., 2022).

5.2 Green Human Resource Management and Sustainability Performance

Green Human Resource Management also had a positive and significant direct effect on Sustainability Performance ($\beta = 0.401$, $p < 0.001$). This means that firms with stronger green HRM systems are more likely to achieve better environmental, economic, and social performance.

This finding supports the argument that HRM serves as an internal implementation mechanism for sustainability strategy. Green HRM translates sustainability objectives into employee behaviours and organisational routines. Through green recruitment, training, involvement, appraisal, and compensation, firms can encourage employees to reduce waste, conserve resources, comply with environmental practices, and support broader sustainability goals (Renwick et al., 2013; Tang et al., 2018; Yong et al., 2020).

The result is consistent with prior empirical studies showing that green HRM practices contribute positively to sustainable organisational outcomes (Mousa & Othman, 2020; Shafaei et al., 2020; Ali et al., 2024). It also aligns with the view that sustainability performance should be understood as a multidimensional outcome that includes environmental, economic, and social dimensions (Lozano, 2015; Purvis et al., 2019). In practical terms, the finding implies that UAE manufacturing firms should not rely only on technology, regulatory compliance, or process redesign to improve sustainability performance. Instead, they should integrate sustainability into HR policies and everyday employee practices.

5.3 Green Innovation and Sustainability Performance

The study also found that Green Innovation has a positive and significant effect on Sustainability Performance ($\beta = 0.507$, $p < 0.001$). This finding confirms that green product and process innovations are important mechanisms for improving sustainability outcomes.

Green innovation can enhance environmental performance by reducing waste, emissions, energy consumption, and resource use. It can also improve economic performance by increasing efficiency, reducing operating costs, and strengthening competitiveness. In addition, green innovation may contribute to social performance by improving corporate reputation, stakeholder trust, employee engagement, and community acceptance. These arguments are consistent with the broader literature on sustainability-oriented innovation and green innovation performance (Chen et al., 2006; Adams et al., 2016; Xie et al., 2019).

This result is also consistent with studies reporting that green product and process innovation improve environmental and organisational performance (Singh et al., 2020; Wang & Liu, 2022). From a manufacturing perspective, process innovation can reduce energy use, waste, and emissions, while product innovation can strengthen market acceptance and environmental credibility (De Marchi, 2012; Xie et al., 2019). For UAE manufacturing firms, the finding suggests that green innovation is a practical pathway through which sustainability goals can be converted into measurable performance outcomes.

5.4 Mediating Role of Green Innovation

One of the key findings of this study is that Green Innovation significantly mediates the relationship between Green Human Resource Management and Sustainability Performance. The indirect effect was positive and significant ($\beta = 0.365$, $p < 0.001$), confirming the mediating role of Green Innovation.

Since the direct effect of Green Human Resource Management on Sustainability Performance remained significant, the mediation is interpreted as complementary partial mediation. This means that Green HRM improves Sustainability Performance in two ways. First, it has a direct effect by shaping employees' green behaviours, values, and organisational routines. Second, it has an indirect effect by strengthening Green Innovation, which then enhances Sustainability Performance.

This finding supports the theoretical argument that Green Innovation acts as a transmission mechanism through which green HRM practices generate sustainability outcomes. From the Resource-Based View perspective, GHRM builds internal human capabilities, while green innovation converts those capabilities into sustainability-related outcomes (Hart, 1995; Barney, 2000; Khanra et al., 2022). The result also aligns with prior empirical evidence showing that green innovation mediates the relationship between green HRM and sustainable performance (Al-Shammari et al., 2022; Bindeeba et al., 2025).

The mediation result has important practical implications. It shows that Green Innovation should not be treated as a separate technical function detached from HRM. Instead, innovation capability is partly developed through HR systems that build employees' green knowledge, motivation, and participation. Therefore, firms seeking sustainability improvements should align their HRM and innovation strategies.

5.5 Summary of Discussion

Overall, the findings present a coherent and theoretically meaningful pattern. Green Human

Resource Management functions as a strategic organisational capability that strengthens Green Innovation and Sustainability Performance. The strong effect of GHRM on Green Innovation demonstrates that green HR practices are important drivers of innovation capability. At the same time, the significant direct effect of GHRM on Sustainability Performance confirms that HRM contributes to sustainability outcomes beyond its influence on innovation. This interpretation is consistent with the view that firms can build sustainability-oriented advantage through internal capabilities and environmentally responsive innovation (Hart, 1995; Porter & van der Linde, 1995; Khanra et al., 2022).

The model also demonstrates substantial explanatory power. Green Human Resource Management explained 59.9% of the variance in Green Innovation, while Green Human Resource Management and Green Innovation together explained 73.3% of the variance in Sustainability Performance. These results indicate that the proposed framework explains a large proportion of sustainability-related outcomes among UAE manufacturing firms.

From a managerial perspective, the findings suggest that firms should adopt an integrated approach to sustainability. Green recruitment alone is not sufficient. It should be supported by green training, employee involvement, performance appraisal, and compensation systems that encourage sustainable behaviour. These HR practices can create the organisational conditions needed for green innovation to emerge and diffuse across the firm. This reinforces the importance of treating sustainability transformation as both a technological and human-capability challenge (Renwick et al., 2013; Tang et al., 2018; Yong et al., 2020).

6. Conclusion

This study examined the relationship between Green Human Resource Management, Green Innovation, and Sustainability Performance in UAE manufacturing firms. Based on 306 valid responses, the findings provide strong empirical support for the proposed framework. The measurement model demonstrated acceptable reliability and validity, while the structural model supported all hypothesised relationships.

The results showed that Green Human Resource Management significantly enhances Green Innovation and Sustainability Performance. Green Innovation also significantly improves Sustainability Performance and partially mediates the relationship between Green Human Resource Management and Sustainability Performance. These findings confirm that Green HRM is a strategic organisational mechanism for promoting innovation-led sustainability improvements.

The study contributes to the literature by showing that green HRM practices can strengthen sustainability outcomes both directly and through green innovation. For managers, the findings highlight the importance of integrating HRM and innovation strategies to achieve environmental, economic, and social performance objectives. UAE manufacturing firms seeking to improve sustainability performance should therefore invest not only in green technologies and operational systems, but also in HR practices that build employee capability, commitment, and participation in sustainability initiatives.

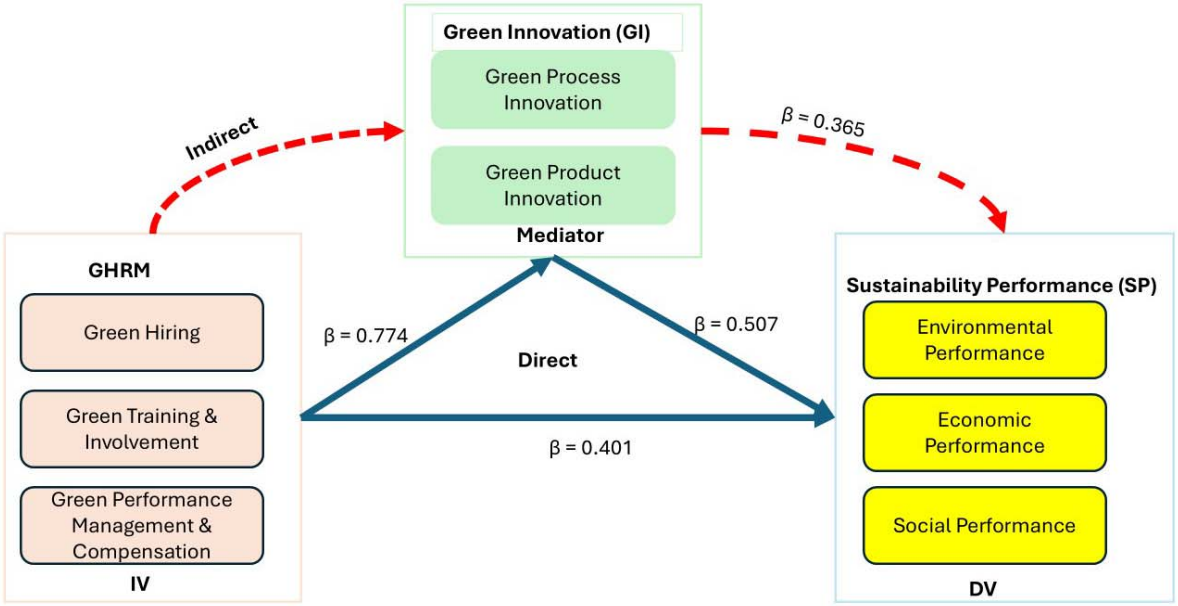

Figure 4. Framework after modelling procedure

Below are the **suggested references in APA 7th edition format**, based on the relevant sources selected for your paper.

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