

# Building green performance through green HRM and green transformational leadership: The mediation role of green innovation

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## Abstract

This study aims to analyze the effect of green human resource management (GHRM) and green transformational leadership on green performance with green innovation mediation. This study was conducted at start-up companies in the Yogyakarta area, involving 180 respondents. GHRM, green transformational leadership, green innovation, and green performance are measured using indicators adapted from previous research. The analysis shows that GHRM and green transformational leadership positively influence green performance. In addition, green innovation has been proven to mediate the relationship between GHRM and green transformational leadership and green performance. These findings make a new contribution to the literature by reinforcing the role of green innovation as a linking mechanism between GHRM policies and transformational leadership styles on corporate environmental performance. Proposed managerial implementations include strengthening GHRM practices and adopting green-based transformational leadership to encourage innovation and improve environmental performance. This research also allows further exploration of other variables that may influence this relationship.

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## Introduction

In recent decades, growing awareness of environmental sustainability has driven many organizations to adopt eco-friendly policies and align their operations with green goals. One approach gaining popularity is the implementation of green human resource management (GHRM) and green transformational leadership (GTL) to improve green performance (Awan et al., 2023). GHRM refers to human resource management practices that promote environmentally friendly workplace behaviors, while GTL describes leadership styles that inspire and motivate employees to achieve sustainable goals. Both variables have contributed to improved green performance individually; however, how GHRM and GTL interact to influence green innovation as a mediator remains underexplored.

Previous research has established the significant role of GHRM in promoting environmentally responsible behaviors through embedded policies in HR functions such as recruitment, training, and performance management (Malik et al., 2021). On the other hand, GTL demonstrates how environmentally focused leadership can inspire employees to contribute more proactively to the organization's sustainability initiatives (Singh et al., 2020). While much research has explored the individual impacts of GHRM and GTL on green performance, few studies have examined how these variables interact and how green innovation mediates their effects on achieving green performance.

Research on green innovation has shown that organizations successful in achieving better environmental performance often rely on sustainable innovation, both in products and processes (Sobaih et al., 2022). Several studies highlight green innovation's role in enhancing green

performance. Syafri et al. (2021) found that green innovation improves green performance in SMEs by fostering workplace green behavior. Organizations prioritizing green innovation are more likely to enhance their green performance by developing and adopting eco-friendly technologies and sustainable business practices. Abbas and Khan (2023) emphasized that green knowledge management and organizational green culture drive green innovation, leading to better sustainability outcomes.

On the other hand, Kuo et al. (2022) found that green innovation serves as a critical mediator between GHRM practices and environmental performance, suggesting that innovation is essential for translating green policies into practical outcomes. Similarly, Begum et al. (2022) highlighted that GTL fosters engagement in green thinking and creative processes, which enhances green innovation and ultimately improves environmental performance. This indicates that green innovation is not merely a byproduct of leadership but a crucial mediator that converts green visions into real-world outcomes.

Despite these findings, a gap exists in understanding how GHRM and GTL interact through green innovation to drive green performance. Much of the literature still treats GHRM and GTL in isolation, focusing on either one of the variables (Malik et al., 2021; Singh et al., 2020). There is a need to understand how these two approaches complement each other in fostering green innovation, especially considering the challenges organizations face in meeting sustainability targets.

Recent research by Awan et al. (2023) emphasized the importance of examining the interaction between GHRM, GTL, and green innovation. They found that green innovation catalyzes achieving optimal green performance when GHRM and GTL are implemented simultaneously. However, the study did not delve deeply into how green innovation mediates the relationship between GHRM and GTL, highlighting the need for further research.

The novelty of this research lies in its integrated approach to examining the combined effects of GHRM and GTL on green performance, with green innovation as the mediating variable. This study seeks to fill the gap by comprehensively analyzing how GHRM and GTL work together to foster green innovation, enhancing organizational environmental performance. Organizations can design leadership strategies and HR policies more effectively by understanding this mechanism to achieve better sustainability outcomes.

Thus, this study aims to fill the existing gap in the literature by exploring how GHRM and GTL, through the mediating role of green innovation, can jointly improve organizational green performance. The research will contribute significantly to the theoretical understanding of these relationships and offer practical insights for leaders and practitioners in designing more effective sustainability strategies.

## **Literature Review and Hypotheses Development**

### **Green Human Resource Management (GHRM)**

The phrase GHRM was introduced by Wehrmeyer in 2017 with the publication of his book "Green People: Human Resource and Environmental Management," aiming to integrate environmental management with human resource management. GHRM encompasses all actions and procedures to enhance, develop, implement, and refine systems to cultivate environmentally conscious personnel (Arshad, 2020). GHRM has been implemented to enhance eco-friendly behavior, employee attitudes and competencies, worker motivation towards environmental consciousness, and opportunities for employees to acquire information and skills pertinent to environmental sustainability (Renwick et al., 2012). GHRM practice is a methodology incorporating environmentally sustainable principles through human resource policies that enhance employee engagement and promote cost-effective leadership, fostering organizational sustainability. GHRM encompasses eco-friendly competencies, attitudes, behaviors, and results. These standards necessitate attaining the company's environmental objectives (Arulrajah & Opatha, 2016).

### **Green Transformational Leadership (GTL)**

Robbins and Judge (2019) elucidate that GTL is a leadership approach designed to inspire and empower followers to foster creativity and enhance their confidence, improving their capabilities to attain superior performance. This transformative leadership serves as a paradigm for employees, enabling them to inspire others to actualize the vision and fostering support for effective environmental utilization and preservation. According to Zsóka et al. (2013), Cheng and Wu (2022), Kumar et al. (2019), and Ausat et al. (2022), GTL is the most effective leadership style utilized in enterprises when compared to alternative leadership styles (Mahdinezhad et al., 2013). GTL significantly impacts employee performance more than other leadership approaches. The transformational leadership style articulates a vision of a positive, attainable future, inspiring people to elevate their aspirations (Mahfouz et al., 2020; Zhu, 2020).

GTL can enhance employee performance and foster positive interactions with the environment. A transformational leader who values the environment can influence their team to adopt eco-friendly behaviors. They motivate employees to overcome challenges, focus on actions that help the organization's environment, think about sustainable development, and find new solutions to environmental problems. This approach improves employees' green performance. actions (Mittal & Dhar, 2016).

### **Green Innovation (GI)**

GI is a crucial environmental management element relevant to enterprises and institutions' environmental innovation. GI pertains to the creation of eco-friendly products and processes (Morant et al., 2023; Cepeda-Carrión et al., 2016) via the adoption of organizational practices, specifically the utilization of sustainable raw materials, minimizing material usage in product design through environmentally conscious principles, and striving to decrease emissions, as well as the consumption of water, electricity, and other resources (Gunasekaran & Spalanzani, 2012).

Research in this field has predominantly had an upward trajectory in recent years. Furthermore, environmental degradation has become a significant hazard to human existence. Many organizations and localities have adopted GI for environmental protection and economic development. Environmental sustainability and economic profitability are highly significant (Fliaster & Kolloch, 2017); green initiatives can guide firms in achieving sustainable competitive advantages. An effective GI enhances market positioning, attracts clientele, offers sustainable services, and secures a competitive edge. Due to these advantages, GI is a priority for management in numerous firms and for researchers. Innovation studies are predominantly grounded in Schumpeter's theory of innovation.

### **Green Performance (GP)**

According to Arulrajah and Opatha (2016), GP is how much an employee has done to follow environmentally friendly habits and reach goals related to environmental projects over a specific period. The ecological performance of personnel inside a business during a designated timeframe is GP. Implementing environmentally sustainable practices can enhance the long-term competitiveness of chemical firms and decrease energy consumption expenses, including power and water costs, thereby facilitating sustainable development. The environmental performance of each employee is crucial for maintaining business compliance with legislation and standards (Shammre et al., 2023). Every employee is accountable for the organization's environmental performance. Consequently, an employee's quantitative and qualitative contributions in mitigating the organization's negative environmental impact and enhancing its positive environmental impact over time can be regarded as the employee's green work performance. This interpretation accurately conveys the significance of employee green performance within the organizational setting.

### **Green HRM on Green Performance**

According to Mansour (2023), environmental awareness plays a pivotal role in shaping GP, and GHRM practices help cultivate this awareness among employees. By embedding eco-friendly

policies and promoting environmental consciousness, organizations can drive employee behaviors that align with sustainability goals, ultimately contributing to improved GP. Mansour's study underscores the direct correlation between GHRM and enhanced organizational performance in the environmental domain. Similarly, Hameed et al. (2020) highlight that GHRM initiatives, such as green training, green leadership, and environmentally conscious recruitment practices, motivate employees to engage in eco-friendly activities. This alignment of individual and organizational objectives facilitates a cohesive approach to achieving sustainability targets, making GHRM a vital component in driving organizational GP. Furthermore, Wahyuni et al. (2023) emphasize that GHRM, combined with green knowledge management and green competencies, enables organizations to develop a workforce that is both environmentally aware and equipped with the necessary skills to implement green practices. Ong and Riyanto (2020) focus on the manufacturing sector, where GHRM practices help minimize the environmental impact of production processes. Additionally, Lathabhavan and Kaur (2023) demonstrate that GHRM enhances green work engagement, improving employee performance.

H<sub>1</sub>: GHRM has a positive effect on GP.

### **Green Transformational Leadership on Green Performance**

Tosun et al. (2022) highlight the mediating role of CSR in the relationship between GTL and GP, emphasizing that transformational leaders instill environmental values and a sense of responsibility, which enhances green employee performance. Lathabhavan and Kaur (2023) further support this by demonstrating that GTL improves GP through increased green work engagement, as employees feel more motivated and involved in sustainability initiatives. Chen et al. (2014) add to this by showing that GTL enhances GP through green mindfulness and green self-efficacy, as employees become more aware of environmental issues and confident in addressing them. Khan and Khan (2023) reinforce the importance of green mindfulness as a mediator, linking GTL to sustainable behaviors and improved GP. Finally, Bano et al. (2022) emphasize the role of psychological contract fulfillment, showing that when employees perceive their environmental values are supported by leadership, their job performance and GP improve.

H<sub>2</sub>: GTL has a positive effect on GP.

### **Green HRM on Green Innovation**

Malik et al. (2021) demonstrate that GHRM practices, such as green recruitment and training, enhance green creativity, which drives GI. Their study also highlights the moderating role of a green shared vision, showing that when employees share a common goal for sustainability, the impact of GHRM on GI is strengthened. Khan et al. (2023) further support this by identifying green human capital as a key mediator, emphasizing that GHRM enhances employees' environmental knowledge and skills, which are essential for GI. They also stress the moderating role of organizational culture, which reinforces the link between GHRM and GI. Yasmeen and Tan (2024) add to this by showing how GHRM synergizes with corporate entrepreneurship to foster green innovation, creating an environment where employees are encouraged to take initiative in developing sustainable solutions. Finally, Singh et al. (2020) emphasize the combined effect of GHRM and GTL, demonstrating that organizations with strong GHRM practices and leaders who champion environmental initiatives are more likely to achieve GI.

H<sub>3</sub>: GHRM has a positive effect on GI.

### **Green Transformational Leadership on Green Innovation**

By promoting an organizational culture centered around sustainability, GTL provides the foundation for employees to engage in GI, ensuring that businesses meet regulatory standards and drive long-term environmental improvements (Sidney et al., 2022). Singh et al. (2020) emphasize the role of GTL in promoting GI by inspiring employees to embrace environmentally conscious practices. Furthermore, Begum et al. (2022) explore the mechanisms through which GTL promotes GI, explicitly focusing on the role of green thinking and creative process engagement. Their

research shows that GTL encourages employees to adopt a green mindset, enabling them to think critically about sustainability and engage in creative processes that lead to innovative environmental solutions. Similarly, Nilam et al. (2024) provide additional insights by examining the mediating role of GI in the relationship between GTL and environmental performance. Chen et al. (2025) further highlight how GTL catalyzes the initiation of GI, particularly in the context of corporate sustainability. Their study shows that green transformational leaders, by embedding sustainability into the organizational vision, encourage employees to innovate in ways that contribute to long-term sustainability goals.

H<sub>4</sub>: GTL has a positive effect on GI.

### **Green Innovation and Green Performance**

Syafri et al. (2021) found that GI positively influences GP in small and medium enterprises (SMEs) by fostering workplace green behavior and implementing sustainable business strategies. Similarly, Al-Romeedy and El-Sisi (2024) demonstrated that GI mediates the relationship between GTL and GP in travel agencies, indicating its essential role in sustainability efforts. Abbas and Khan (2023) emphasized the interaction between green knowledge management and organizational green culture in driving both GI and GP, suggesting that organizations with strong knowledge-sharing cultures are more effective in implementing innovative sustainability initiatives. Additionally, Wang (2020) highlighted that an environmental perspective on market orientation fosters GI, leading to improved sustainability outcomes. Awan et al. (2023) further validated this relationship by demonstrating that GI mediates the effects of GHRM and GTL on environmental performance, reinforcing its significance in achieving organizational sustainability goals.

H<sub>5</sub>: GI has a positive effect on GP.

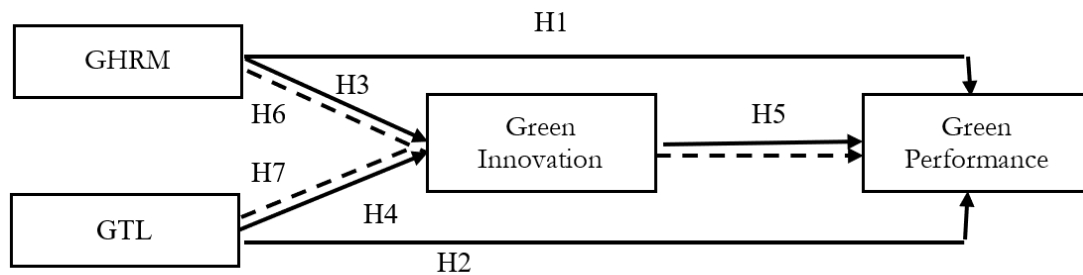
### **Mediating Role of Green Innovation**

Al Doghan et al. (2022) highlight the importance of GI as a mediating factor, arguing that GHRM practices may not fully achieve their potential in improving sustainability without fostering innovation. Malik et al. (2021) further explore this mediating role by examining the influence of green creativity in driving the relationship between GHRM and environmental performance. Their findings suggest GHRM enhances green creativity, leading to innovative processes and products that improve GP. Similarly, Sobaih et al. (2020) investigate the impact of GHRM on small lodging enterprises, emphasizing that while GHRM promotes eco-friendly behaviors among employees, GI is necessary to operationalize these behaviors into real environmental improvements. Kuo et al. (2022) also affirm the mediating role of GI, showing that GHRM practices alone may not be sufficient to improve environmental performance. Instead, GI is an essential intermediary transforming GHRM-driven initiatives into actionable strategies and improvements.

H<sub>6</sub>: GI mediates the relationship between GHRM and GP.

GI acts as a mechanism that translates leadership-driven environmental values into concrete sustainability outcomes. Singh et al. (2020) argue that the impact of GTL on GP is significantly enhanced through GI, which acts as a mediating factor. GTL promotes environmentally sustainable goals and encourages employees to innovate, leading to improved environmental outcomes. Awan et al. (2023) argue that GTL, when combined with GHRM practices, fosters an innovation-friendly environment where employees are empowered to develop new, eco-friendly processes and products. Sobaih et al. (2022) provide additional insight into the mediating role of GI by demonstrating how transformational environmental leadership encourages GI behaviors among employees. Their study shows that employees under GTL are more likely to engage in innovative behaviors to reduce environmental impact. This innovation, in turn, leads to enhanced GP by implementing creative solutions that address sustainability challenges. Similarly, Niazi et al. (2023) highlight the critical function of GI as a mediator between GTL and environmental performance.

H<sub>7</sub>: GI mediates the relationship between GTL and GP.



**Figure 1.** Research Framework

## Research Methods

The method used in this research is quantitative research to test the influence of the variables studied. The population in this study consisted of employees and managers of a start-up in the Yogyakarta area. The research sample was determined through the method formulated by Hair et al. (2017), which is 5 times the number of research indicators, so that with 22 indicators, the minimum sample size in this study is 110 respondents. Furthermore, researchers collected 180 respondents so that they had met the minimum sample limit according to Hair et al. (2017). The primary data for the research was collected through distributing questionnaires. Potential bias in research can occur with self-report measures because of the tendency of respondents to choose answers that are in the middle of the scale, avoiding extreme answers. This study used a Likert scale, and some respondents may always choose the "neutral" or "somewhat agree/disagree" option, even if they have a strong opinion. However, to avoid this, testing the outer and inner models is necessary (Azam & Jamil, 2024).

GHRM is measured by six indicators adapted from Singh et al. (2020). These include selecting the right personnel, hiring employees with strong environmental values, emphasizing a green staffing process, implementing mandatory environmental training, designing training programs to enhance environmental skills and knowledge, and ensuring employees apply environmental training.

Furthermore, GTL is measured by six indicators adapted from Singh et al. (2020), which assess how leaders inspire subordinates with environmental plans, provide a clear environmental vision, encourage subordinates to work on environmental plans, motivate employees to achieve environmental goals, consider the environmental beliefs of their subordinates, and stimulate employees to think creatively and share green ideas. GI is measured by four indicators adapted from Shah and Soomro (2023). These focus on minimizing material usage in product development and design, ensuring products are easy to recycle, reuse, and decompose, and reducing hazardous emissions or waste in manufacturing processes.

Finally, GP is measured by six indicators adapted from Shah and Soomro (2023), which include setting green targets, goals, and responsibilities for managers and employees, incorporating green performance indicators in appraisals, considering workplace green behavior in employee promotions, imposing dis-benefits for non-compliance with environmental management goals, and recognizing the impact of environmental activities in reducing costs and lead time.

## Results and Discussion

### Respondent's Characteristic

The respondents of this study consist of employees and managers from start-up companies in Yogyakarta. The gender distribution includes male and female participants, ensuring diverse perspectives in green business practices. Regarding age, the respondents come from various age groups, with a significant proportion in the 25–35 years old category, reflecting the dominance of young professionals in start-ups. Regarding education level, most respondents hold a bachelor's or master's degree, indicating a well-educated workforce with the potential to effectively understand and implement green innovation strategies. For job positions, the respondents are divided between

employees and managers, allowing the study to capture insights from operational and strategic perspectives regarding green transformational leadership, HRM, innovation, and performance.

**Table 1.** Characteristics of Respondents

Characteristic	Category	Frequency (n=180)	Percentage (%)
Gender	Male	100	55.6
	Female	80	44.4
Ages	< 25 years old	30	16.7
	25 – 35 years old	85	47.2
	36 – 45 years old	45	25.0
	> 45 years old	20	11.1
Education Level	High School	20	11.1
	Diploma	25	13.9
	Bachelor's Degree	90	50.0
	Master's Degree	40	22.2
	Doctorate	5	2.80
Job Position	Employee	130	72.2
	Manager	50	27.8

### Outer Model Analysis

This research uses structural equation model analysis with SmartPLS. The first stage in PLS analysis is outer model analysis. Outer model analysis aims to test the data quality and measurements in the research model. Several tests include convergent validity, construct validity, construct reliability, and discriminant validity. The first analysis is convergent validity to test the validity of research indicators. Convergent validity refers to the loading factor value on each research indicator, with the criteria for the loading factor value  $>0.5$  or ideally  $>0.7$  (Hair et al., 2017). This research analysis shows that two invalid indicators were found in the first stage, namely GI2 and GP6, so they had to be dropped from the analysis. After the invalid indicators were dropped, a re-analysis was carried out.

**Table 2.** Loading Factors, AVE, and Composite Reliability

Constructs	Items Code	Indicators Theme	Loading Factor	AVE	Composite Reliability
Green Human Resource Management	GHRM1	Selection	0.798	0.664	0.922
	GHRM2	Hiring	0.829		
	GHRM3	Staffing	0.843		
	GHRM4	Training	0.831		
	GHRM5	Skills	0.705		
	GHRM6	Application	0.872		
Green Transformational Leadership	GTL1	Inspiration	0.790	0.670	0.924
	GTL2	Vision	0.787		
	GTL3	Encouragement	0.786		
	GTL4	Goals	0.799		
	GTL5	Beliefs	0.864		
	GTL6	Ideas	0.879		
Green Innovation	GI1	Materials	0.724	0.560	0.792
	GI3	Recycling	0.798		
	GI4	Manufacturing	0.720		
Green Performance	GP1	Targets	0.812	0.606	0.885
	GP2	Efficiency	0.730		
	GP3	Promotion	0.766		
	GP4	Compliance	0.785		
	GP5	Cost	0.797		

Table 2 shows that all indicators in this study have factor loading values ranging from 0.543 to 0.932. Therefore, all indicators have a loading factor value  $>0.5$ , so they have met the threshold for the loading factor value. It can be concluded that all indicators meet convergent validity. Furthermore, after the indicator is declared valid, each construct in this study must meet construct validity with the criteria for AVE value  $>0.5$  and construct reliability with the criteria for composite reliability value  $>0.7$ . Furthermore, the average variance extracted (AVE) value in this study in all variables has met the construct validity criteria, namely  $>0.5$ . Also, the composite reliability value in this study has met the construct reliability standard, which is  $>0.7$ . So that all variables in this study can be categorized as valid and reliable.

The subsequent analysis is a test of discriminant validity to determine whether the indicators in this study have been measured correctly on each variable. Discriminant validity in this study refers to two tests, namely the Fornell-Larcker criterion. The Fornell-Larcker criterion refers to the AVE root of each construct. The square root of the AVE indicates good discriminant validity for each construct, being more significant than the correlation between constructs in the model.

**Table 3.** Fornell-Larcker Criterion

	GHRM	GTL	GI	GP
Green Human Resource Management	0.815			
Green Transformational Leadership	0.791	0.818		
Green Innovation	0.643	0.659	0.748	
Green Performance	0.777	0.854	0.673	0.778

Table 3 shows the value of the Fornell-Larcker criterion to test discriminant validity. The results show that all research variables have a value (root AVE) higher than the correlation between variables. So, based on Table 3, this study has met discriminant validity.

### Inner Model Analysis

Inner model analysis is a test to analyze the relationship between variables in research. It includes testing the coefficient of determination and path analysis to test the hypothesis. The inner model testing procedure uses bootstrapping in SmartPLS, with the output shown in Figure 2.

#### 1. Coefficient of Determination ( $R^2$ )

The first analysis is the coefficient of determination, which refers to the  $R^2$  value in the study. It was found that the  $R^2$  value of GI was 0.474, or 47.4%, which indicated that GHRM and GTL had an influence of 47.4% from other variables in the model. The  $R^2$  value of GP was 0.768, or 76.8%, which indicated that GHRM, GTL, and GI had an influence of 76.8% from other variables in the model. Overall, this study has a good coefficient of determination.

#### 2. Effect Size ( $F^2$ )

Based on the effect size ( $F^2$ ) test results, it can be seen in the following table.

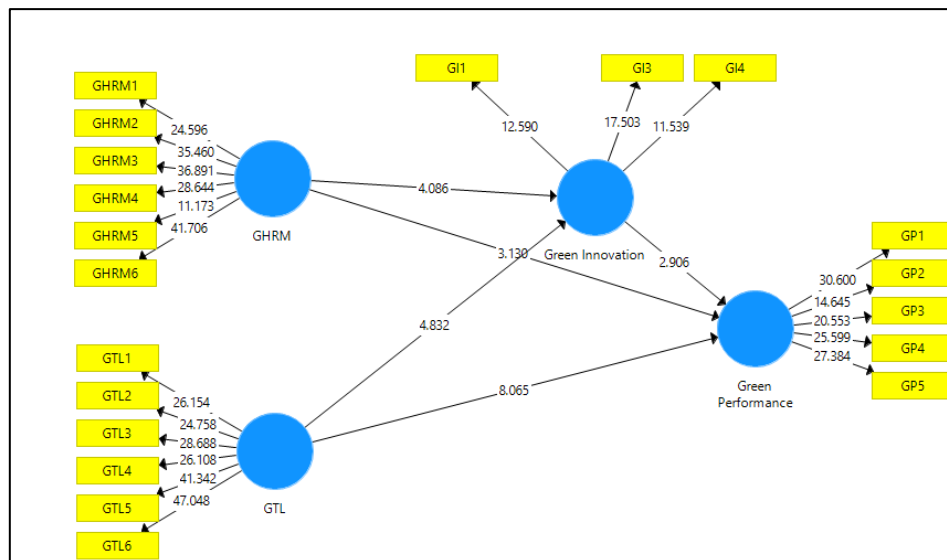
**Table 4.** Effect Size ( $F^2$ )

	F-Square	Result
Green HRM $\rightarrow$ Green Performance	0.040	H1 Lower
GTL $\rightarrow$ Green Performance	0.303	H2 Higher
Green HRM $\rightarrow$ Green Innovation	0.472	H3 Higher
GTL $\rightarrow$ Green Innovation	0.191	H4 Higher
Green Innovation $\rightarrow$ Green Performance	0.223	H5 Higher

#### 3. Predictive Relevance ( $Q^2$ )

Predictive relevance has a function to validate the model with a  $Q^2$  value  $>0$ . The results of  $Q^2$  data processing show 0.485 and 0.481, so it can be concluded that the model has a relevant predictive value.





**Figure 2.** Output of Bootstrapping with SmartPLS

The following analysis is a path analysis to test the research hypothesis. This study uses significant criteria if the t-statistic value is greater than 1.96 and the p-value is less than 0.05 at the 5% significance level. The parameter coefficient shows the direction of influence by looking at the positive or negative original sample and the magnitude of the influence of the independent variable on the dependent variable. The results of path analysis testing to test the research hypothesis are shown in Table 5.

**Table 5.** Path Analysis

	Original Sample	t-statistics	p-value	Decision
Green HRM → Green Performance	0.220	3.182	0.001	H1 Supported
GTL → Green Performance	0.581	8.263	0.000	H2 Supported
Green HRM → Green Innovation	0.336	3.966	0.000	H3 Supported
GTL → Green Innovation	0.403	4.617	0.000	H4 Supported
Green Innovation → Green Performance	0.147	2.635	0.004	H5 Supported

### Mediation Analysis

This study further analyzes the mediating effect of digital innovation, using a 95% confidence interval.

**Table 6.** Mediation Analysis

	Original Sample	t-statistics	LLCI	ULCI	p-value	Decision
Green HRM → Green Innovation → Green Performance	0.049	2.162	0.10587	0.671	0.016	H6 Supported
GTL → Green Innovation → Green Performance	0.059	2.180	0.42121	0.932	0.015	H7 Supported

Mediation analysis also uses significance criteria, namely t-statistics greater than 1.96 and p-values less than 0.05 at the 5% significance level. The results of mediation testing are shown in Table 6. It is known that the influence of GHRM on GP, mediated by GI, has a t-statistic value of 2.162 in a positive direction. The upper and lower limits of this t-statistic value at a 95% confidence interval are both positive (CI 95%, LLCI = 0.10587; ULCI = 0.671). The effect of GTL on GP through GI has a t-statistic value of 2.180, also going in a positive direction, with positive upper and lower limits (CI 95%, LLCI 0.42121; ULCI 0.932). This means that GHRM and GTL on GP are linked in a positive way, which is through green innovation.

### **Green HRM and Green Performance**

The positive effect of GHRM on GP is supported by our findings, indicating that environmentally oriented HR practices, such as green recruitment, training, and performance management, enhance environmental awareness and behavior among employees. This result is aligned with previous studies (Mansour, 2023; Hameed et al., 2020), yet our study extends these findings by highlighting that GHRM alone may not be sufficient to maximize GP. Unlike prior research that assumes a direct relationship, our study suggests that without a strong organizational culture that fosters green innovation, the impact of GHRM on GP may be limited. This suggests a need for further exploration into the contextual factors that enhance or constrain GHRM effectiveness.

### **Green Transformational Leadership on Green Performance**

Our findings confirm that GTL significantly enhances GP, aligning with previous research (Tosun et al., 2022; Lathabhavan & Kaur, 2023). However, our study deepens the understanding of this relationship by demonstrating that transformational leaders do not directly improve GP; they only improve through motivation and inspiration. Instead, their influence works by embedding sustainability into the corporate vision, facilitating structural changes, and integrating green initiatives into daily business operations. This challenges simplistic views of leadership influence and suggests that future research should explore additional moderating or mediating variables that affect the strength of this relationship.

### **Green HRM and Green Innovation**

While previous literature has recognized the role of GHRM in promoting GI (Malik et al., 2021; Khan et al., 2023), our study provides further evidence that this relationship is more complex than previously thought. Our findings indicate that GHRM contributes to GI primarily by fostering an organizational culture that values sustainability-driven creativity. However, this effect may not always be automatic, as contextual variables such as organizational structure and leadership support may moderate its impact. This highlights a theoretical gap in understanding how HRM practices interact with innovation at different organizational levels.

### **Green Transformational Leadership and Green Innovation**

The significant relationship between GTL and GI is consistent with earlier studies (Begum et al., 2022; Nilam et al., 2024). However, rather than viewing transformational leadership as a mere catalyst for innovation, our study suggests that the nature of leadership practices can shape the extent and quality of GI. Specifically, leaders who provide autonomy and encourage risk-taking tend to create more impactful GI than those who adopt a rigid approach. This raises important questions about leadership styles and their varying effects on sustainability-driven innovation.

### **Green Innovation and Green Performance**

Our findings demonstrate that GI has a significant impact on GP. This aligns with prior research (e.g., Chen et al., 2025; Sobaih et al., 2022), which suggests that GI fosters sustainable business practices and enhances environmental efficiency. However, our study expands on these findings by highlighting that not all GIs translate into performance gains; their effectiveness depends on how well they are integrated into organizational strategy and operations. Companies that develop GI but lack the infrastructure to implement it effectively may not achieve substantial improvements in GP. This suggests a need for further research into the organizational enablers that ensure GI leads to tangible environmental benefits.

### **The Mediating Role of Green Innovation**

A key theoretical contribution of this study is demonstrating that GI mediates the relationship between GHRM and GP, as well as GTL and GP. While previous studies (Al Doghan et al., 2022; Singh et al., 2020) have hinted at this mediating effect, our findings explicitly show that GI is a

bridge that amplifies the impact of HRM and leadership on performance outcomes. This underscores the need for organizations to implement sustainability-oriented HRM and leadership practices and actively invest in innovation capabilities to maximize their environmental performance (Nguyen & Nguyen, 2024).

## Implication and Conclusion

This study makes several theoretical contributions to the literature on sustainability-oriented management. It refines how GHRM and GTL interact with GI and GP, emphasizing that their effectiveness is not automatic but contingent upon complementary organizational mechanisms. By introducing GI as a mediating variable, we contribute to a more holistic framework that explains how firms can achieve superior environmental outcomes. Furthermore, our findings highlight that leadership styles and HRM practices must be aligned with broader organizational structures and cultural enablers to maximize their sustainability impact. These insights contribute to the evolving discourse on strategic sustainability management by offering a more nuanced perspective on the interdependencies between HRM, leadership, and innovation (Puspa Gustiah & Nurhayati, 2023).

From a practical perspective, the findings underscore the importance of integrating GHRM and GTL with organizational innovation strategies. Organizations seeking to improve their GP should focus on recruiting and training employees with environmental competencies and cultivating a work environment encouraging experimentation and risk-taking in GI. Additionally, leaders should adopt transformational practices that empower employees to engage in sustainability-driven creative problem-solving. Companies should also establish structural support mechanisms, such as cross-functional collaboration teams and innovation funding, to ensure that green initiatives translate into tangible environmental performance improvements.

Despite its contributions, this study has several limitations that should be acknowledged. First, the cross-sectional nature of the research design prevents us from making definitive causal inferences. Future studies could employ longitudinal designs to examine how the relationships between GHRM, leadership, innovation, and performance evolve. Second, our study focuses on a specific organizational context, which may limit the generalizability of the findings to other industries or regions. Future research should explore whether these relationships hold in different sectors, particularly those with varying degrees of environmental regulation and competitive pressures. Lastly, while this study identifies GI as a key mediator, other potential mechanisms, such as employee engagement, corporate social responsibility initiatives, or technological advancements, could further explain the link between leadership, HRM, and sustainability outcomes. Future studies should incorporate these factors to develop a more comprehensive understanding of sustainable organizational practices.

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