

A Field Study on the Impact of Green Human Resource Management and Green Organizational Culture as Mediating Variables on the Relationship Between Green Leadership and Green Innovation in the General Authority of Customs in the State of Qatar

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Abstract

This study aims to investigate the relationship between green leadership and green innovation in government institutions, with a specific focus on the General Authority of Customs in Qatar as a case study. The study is grounded in the importance of adopting sustainable practices in governmental work environments, considering national and global trends toward sustainable development. It also aims to understand the role played by both green human resource management and green organizational culture in strengthening this relationship.

The study employed a quantitative methodology, with data collected through a questionnaire distributed to a sample of 380 employees at the General Authority of Customs in Qatar. The data was analyzed using structural equation modeling (PLS-SEM) through the SmartPLS software, in order to test the hypotheses developed based on the theoretical framework and previous studies.

The results revealed statistically significant direct effects of green leadership on green human resource management, green organizational culture, and green innovation. The findings also showed that these two mediating variables partially explain and enhance this relationship. Moreover, the results indicated a positive direct effect of green human resource management on green organizational culture, highlighting the reciprocal interaction between administrative policies and institutional culture.

The study's findings supported several theories, such as transformational leadership theory, dynamic resource theory, organizational culture theory, and stakeholder theory. These outcomes contributed to presenting an integrated conceptual model that helps understand the mechanisms enhancing environmental innovation within institutions.

Finally, the study concluded with a set of practical recommendations for the General Authority of Customs and similar institutions, including the development of green leadership programs, the strengthening of environmental policies in human resources, and the reinforcement of a sustainability-oriented organizational culture. It also proposed future research pathways to deepen understanding of the interactions among these variables in various organizational contexts.

1.1 Introduction:

In light of the growing environmental challenges and the increasing global focus on sustainability, green leadership and green human resource management have become central themes that institutions seek to adopt in order to achieve environmental and developmental goals (Alian et al., 2026). The world is witnessing a radical shift toward sustainable practices that reduce negative environmental impacts, prompting organizations to adopt innovative strategies and policies aligned with this trend. Green leadership is considered one of the key pillars enabling institutions to make the necessary transition toward sustainable practices, as it reinforces environmental values (Ghoneim, 2022) and guides employees toward adopting environmentally friendly work approaches that balance economic, social, and environmental objectives.

In this context, green human resource management plays a pivotal role in promoting environmental practices through effective workforce management strategies. Its aim is to integrate sustainability into all stages of the employee lifecycle, from recruitment to training, engagement, performance management, and compensation (Al-Swidi et al., 2021). The importance of this role lies in its ability to activate green leadership initiatives on the one hand, and to enhance green innovation on the other, which is considered a key driver of sustainable development. Additionally, green organizational culture—an overarching framework that shapes values, practices, and behaviors within institutions—acts as a fundamental factor influencing the relationship between green leadership and green innovation. Such a culture fosters employee commitment to environmental initiatives, and studies have shown that institutions adopting a green organizational culture are more capable of achieving environmental goals and adapting to climate-related challenges (Chen et al., 2019).

Nevertheless, institutions face significant challenges in strengthening the relationship between green leadership and green innovation. A knowledge gap persists regarding the mediating role of green human resource management and green organizational culture in explaining the nature of this relationship. In the State of Qatar, with its commitment to achieving the Qatar National Vision 2030—which emphasizes sustainable development (General Secretariat for Development Planning, 2008)—institutions, particularly government bodies such as the General Authority of Customs, are required to adopt a comprehensive approach that integrates leadership and innovation to achieve environmental sustainability and operational efficiency. The General Authority of Customs in Qatar plays a vital role in facilitating trade and enhancing supply chain efficiency (Qatar Customs, n.d.), placing it in a strategic position to lead the shift toward environmentally friendly practices. However, the extent to which green leadership impacts the promotion of green innovation within the Authority remains insufficiently explored.

Therefore, the significance of this study lies in analyzing the relationship between green leadership and green innovation in the General Authority of Customs, with a focus on the mediating roles of green human resource management and green organizational culture. The study aims to bridge the knowledge gap in this field by presenting a scientific framework that

deepens understanding of the interplay among these three elements, while also providing practical recommendations to improve the Authority's environmental performance and achieve its strategic goals.

Examining this topic represents a valuable contribution to academic literature on sustainability and innovation. It also provides recommendations to support decision-makers in both governmental and private institutions in Qatar in developing policies and programs that enhance their competitiveness and long-term sustainability.

1.3 Problem of the Study:

In light of the global trend toward achieving sustainable development, institutions are facing growing challenges in adopting environmentally friendly practices that support both their environmental and economic objectives (ESCWA, 2022). Green leadership plays a crucial role in guiding organizations toward sustainability by fostering an environmentally conscious work culture and encouraging employees to develop innovative green solutions. However, the relationship between green leadership and green innovation remains unclear, particularly regarding the mediating roles played by green human resource management and green organizational culture.

Recent reports indicate that institutions in Qatar, including the General Authority of Customs, have begun adopting green strategies to support Qatar National Vision 2030. Nevertheless, the challenges related to implementing these strategies highlight the need for a deeper understanding of the mechanisms that enhance environmental innovation. According to the 2023 report by the Ministry of Environment and Sustainable Development, 40% of governmental institutions in Qatar have not yet implemented comprehensive green practices, pointing to gaps in leadership guidance and institutional support (Al-Heeti & Al-Mohannadi, 2008).

Despite the growing body of literature addressing green leadership, green human resource management, or green organizational culture separately, studies that examine the combined effect of these factors on green innovation within organizations remain limited, particularly in Arab and Gulf contexts. This knowledge gap is crucial for understanding how these variables can interact to enhance organizational sustainability by supporting environmental innovation—a gap that this study aims to address.

The study's problem lies in the lack of clarity regarding how green leadership can positively influence green innovation within the General Authority of Customs, and the extent to which green human resource management and green organizational culture act as mediating variables that strengthen this relationship. This research gap raises several questions about the effectiveness of current strategies and whether new policies are needed to enhance environmental performance.

Therefore, the study aims to analyze this relationship and explore the role of green human resource management and green organizational culture in improving the environmental performance of the Authority. It also seeks to provide practical recommendations to support

green leadership and promote environmental innovation, contributing to the achievement of Qatar's national sustainability goals.

1.4 Research Questions:

1. How does green leadership affect green innovation in the General Authority of Customs in Qatar?
2. How does green leadership affect green human resource management?
3. How does green leadership affect green organizational culture?
4. To what extent does green human resource management affect green innovation?
5. To what extent does green organizational culture affect green innovation?
6. What is the nature of the relationship between green human resource management and green organizational culture?
7. What is the role of green human resource management in the relationship between green leadership and green innovation?
8. What is the role of green organizational culture in the relationship between green leadership and green innovation?

1.5 Objectives of the Study:

1.5.1 Main Objectives:

The study aims to achieve a set of main objectives aligned with the growing importance of sustainability practices and innovation in governmental institutions, specifically in the General Authority of Customs in Qatar. These objectives are as follows:

1. To analyze the effect of green leadership on green human resource management by examining how environmental leadership contributes to the development and activation of green administrative policies and practices in the institution.
2. To analyze the effect of green leadership on green organizational culture by identifying the extent to which green leadership can reinforce environmental values and beliefs within the workplace.
3. To analyze the effect of green leadership on green innovation among employees in the General Authority of Customs, by evaluating the role of leadership in motivating environmental innovation and guiding employees toward sustainable practices.
4. To analyze the effect of green human resource management on green innovation, by assessing the role of administrative practices (such as recruitment, training, and environmental performance evaluation) in supporting environmental innovation capabilities.

5. To analyze the effect of green organizational culture on green innovation, by examining the influence of the value system within the organization in shaping employee behaviors toward green innovation.
6. To analyze the effect of green human resource management on green organizational culture, to understand the extent of interaction between administrative policies and environmental organizational values and behaviors.
7. To explore the mediating role of green human resource management in the relationship between green leadership and green innovation, in order to determine whether green HR policies enhance or explain this effect.
8. To explore the mediating role of green organizational culture in the relationship between green leadership and green innovation, to understand how the institutional environment contributes to activating the effect of leadership on environmental innovation.

Theoretical Framework of the Study (Theories):

This study draws on several managerial and behavioral theories that explain the nature of the relationship between the core variables of the study, whether in terms of direct effects, mediating roles, or moderating roles, as follows:

Summary of Theories Related to the Study

1. Transformational Leadership Theory:

This theory posits that transformational leaders are capable of inspiring and motivating followers to move beyond traditional goals toward broader objectives. Its relevance to the study lies in explaining how green leadership influences employee behavior and encourages them to engage in environmental creativity through values and motivation.

2. Dynamic Capabilities Theory:

This theory emphasizes the capacity of organizations to reconfigure their resources in response to changes, thereby achieving a competitive advantage. The study explains the role of green human resource management as a mediator that strengthens the relationship between green leadership and innovation by developing employees' environmental skills.

3. Organizational Culture Theory:

This theory emphasizes the values, beliefs, and practices that shape individuals' behavior within organizations. It is used to clarify how green organizational culture contributes to creating an environment that encourages the adoption of sustainable practices, thereby strengthening the relationship between green leadership and green innovation.

4. Stakeholder Theory:

This theory assumes that organizations are accountable to a wide range of stakeholders, not just shareholders. It highlights the importance of adopting green leadership and

environmental innovation as a response to societal expectations and to Qatar National Vision 2030.

5. Green Innovation Theory:

This theory asserts that sustainable environmental practices foster innovation in eco-friendly products and processes. Its connection to the study is direct through the dependent variable (green innovation), emphasizing the role of leadership, HR practices, and organizational culture in stimulating environmental innovation.

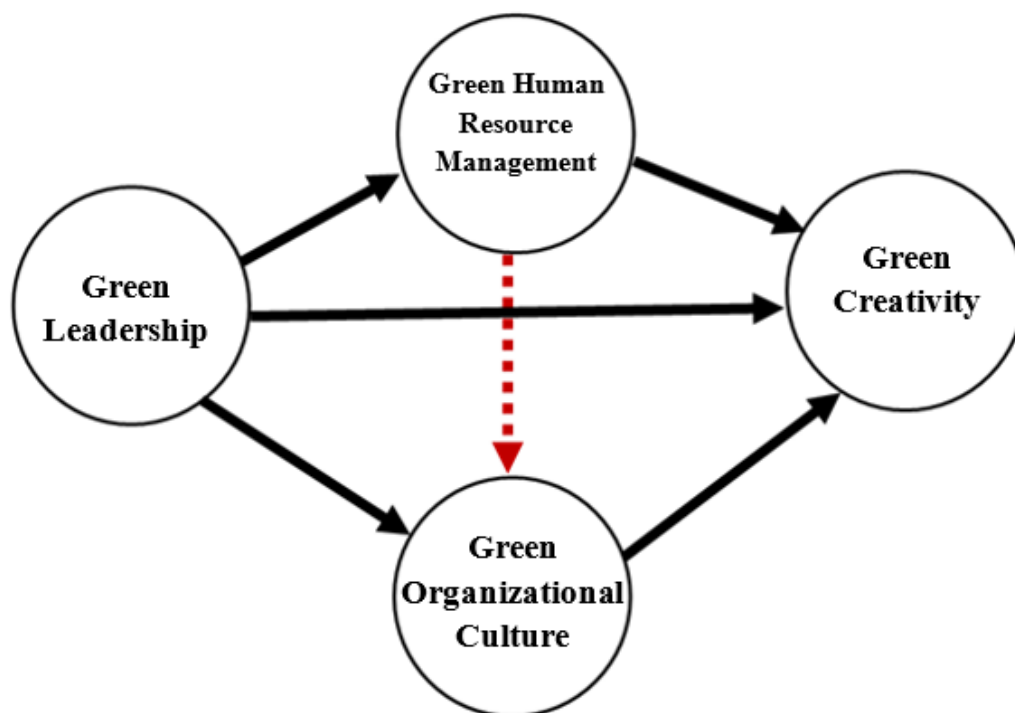


Figure 1. The Proposed Theoretical Model of the Relationships Between the Study Variables

The model includes eight hypotheses represented by the arrows in the figure, distributed as follows:

1. Three direct relationships from green leadership toward (green human resource management, green organizational culture, and green innovation).
2. Two direct relationships from green human resource management and green organizational culture toward green innovation.
3. Two indirect (mediated) relationships measuring the mediating role of green human resource management and green organizational culture in the relationship between green leadership and green innovation.

4. One sequential mediation relationship that runs through green human resource management and then green organizational culture between green leadership and green innovation.

The model reflects the theoretical integration of leadership behavior, organizational culture, and administrative practices that support sustainability. It is grounded in several theories, most notably transformational leadership theory, dynamic capabilities theory, organizational culture theory, and stakeholder theory.

Theoretical Definitions of the Key Variables:

The concepts related to the green approach have undergone remarkable development, encompassing multiple fields such as energy, economics, and management. The concept of green management has recently garnered the attention of policymakers, economic strategists, and governments seeking to achieve comprehensive development by enhancing human quality of life, protecting the environment, and conserving available natural resources (Al-Nusairat, 2018).

Accordingly, this section presents an expanded theoretical analysis of four main concepts adopted by the study: green leadership, green human resource management, green organizational culture, and green innovation.

1. First: Green Leadership

Green leadership refers to a leadership style that embraces environmental values and practices to promote sustainable development within the organization by encouraging the sustainable use of resources (Ghoneim, 2022). According to Chen et al. (2014), green leadership lies in the ability of leaders to guide and inspire employees to adopt environmentally friendly practices by focusing on improving processes to reduce environmental impact, fostering a culture of sustainable creativity, empowering employees, and encouraging them to contribute to achieving environmental goals. At the same time, Mittal & Dhar (2015) described green leadership more narrowly as transformational green leadership, directed toward the charismatic leadership of an individual in influencing others to engage in pro-environmental activities. Lee et al. (2014) and Crossman (2011) further explained that green leadership is also linked to decision-making guided by environmental values. Based on this understanding, green leadership can be defined as the leader's ability to formulate pro-environmental policies and to influence organizations to support these policies (Kardoyo et al., 2020).

2. Second: Green Human Resource Management (Green HRM)

Studies have explored the concept of Green HRM as a branch of green management that examines the role of human behavior in environmental management (Al-Ghrabli et al., 2021). The concept of Green HRM refers to a set of management practices designed to motivate employees to become more environmentally aware and engaged, thereby supporting the organization's environmental objectives and enhancing its contribution to environmental sustainability (Renwick, 2008). Al-Swidi et al. (2021) defined it as practices through which a company seeks to reduce the negative

environmental impacts of its operations. This form of management integrates green policies into the employee life cycle to achieve operational efficiency and reduce the organization's carbon footprint (Renwick et al., 2013).

Practices of Green HRM:

Green HRM practices involve integrating the organization's environmental management goals into HR practices, particularly in recruitment, training, performance management, and compensation (Guerci et al., 2016). The most important practices include:

- **Green Recruitment:** Attracting and hiring employees with environmental awareness, values, and willingness to work in alignment with the organization's environmental goals.
- **Green Training and Development:** Providing training programs to raise employees' awareness of the importance of environmental practices and their application at work.
- **Green Performance and Rewards:** Assessing employees' environmental performance as part of performance evaluation and motivating them to achieve environmental goals.
- **Green Job Design:** Adjusting and designing job tasks to align with the organization's environmental objectives.
- **Green Employee Relations:** Promoting a culture of environmental teamwork and collaboration among employees to achieve sustainability goals.
- **Green Exit Management:** Applying environmentally friendly practices even in the termination stage of the employment relationship.

3. Third: Green Organizational Culture (GOC)

The concept of Green Organizational Culture is relatively new, and its definition remains inconclusive, as this research field is still emerging in the literature (Afum et al., 2020). It can be defined as the shared values, principles, and beliefs that support environmentally responsible and sustainable practices within an organization, directing all organizational activities toward becoming environmentally friendly (Al-Swidi et al., 2021; Afum et al., 2020). Green culture is also considered an important mediator between green leadership and environmental performance outcomes (Kim et al., 2019).

4. Fourth: Green Innovation

Green innovation refers to the development and utilization of products, processes, services, or technologies designed to minimize negative environmental impacts. It combines traditional innovation with sustainable practices to achieve environmental, economic, and social goals simultaneously (Chang, 2016). Green innovation is crucial for organizations, both large and small, as it enables them to identify and address their negative environmental impacts (Al-Swidi et al., 2022).

Green innovation (also called eco-innovation or environmental innovation) can be defined as a process that contributes to the creation of new production methods and technologies to reduce environmental risks, such as pollution and the adverse effects of resource exploitation (e.g., energy) (Castellacci & Lie, 2017). Innovation has been classified into product/service innovation and process innovation, where the ultimate goal of product or service innovation is to enhance the performance of products and services for customers and clients. Process innovation, in turn, has led to greater cost efficiency and organizational flexibility (Albort-Morant et al., 2018), both of which can contribute to mitigating environmental risks (Castellacci & Lie, 2017) and enhancing resource efficiency (Burki & Dahlstrom, 2017).

2.5.2. The Relationship between Green Leadership and Green Human Resource Management

The literature indicates that leadership adopting a green vision is committed to enhancing sustainable human resource practices through the design of recruitment, training, and evaluation programs based on environmental criteria. Saleh and Zainal (2021) confirmed that leaders who support environmental orientation contribute significantly to the development of Green HRM. Similarly, Wahba et al. (2024) indicated that green leadership directly affects the extent to which environmental policies are implemented in HRM. Accordingly, the following hypothesis is proposed:

H1: There is a statistically significant relationship between green leadership and green human resource management.

2.5.3. The Relationship between Green Leadership and Green Organizational Culture

Leadership influences the shaping of organizational culture by transferring values and practices across different levels within the organization. Abou-AL-Ross & Abu Mahadi (2021) demonstrated that environmentally oriented leaders contribute to deepening the green culture within organizations. Likewise, Aggarwal & Agarwala (2021) suggested that green leadership is a key driver in spreading sustainability values and practices within organizational culture. Hence, the hypothesis is stated as follows:

H2: There is a statistically significant relationship between green leadership and green organizational culture.

2.5.4. The Relationship between Green Leadership and Green Innovation

The literature highlights that green leadership plays a stimulating role in creating an organizational environment that encourages employees to think creatively about environmental issues. Morsi (2022) showed a direct positive effect of transformational green leadership on green innovation among hotel employees. Khan (2023) further supported this by emphasizing that environmentally supportive leadership behavior enhances employees' motivation to generate creative green ideas. Evidence shows that leaders who adopt a green leadership style are capable of influencing values and creative behaviors related to sustainability. Thus, the hypothesis is formulated as follows:

H3: There is a statistically significant relationship between green leadership and green innovation.

2.5.5. The Relationship between Green Human Resource Management and Green Innovation

Green HRM practices are considered among the most important organizational drivers of green innovation. Al-Ghrabli et al. (2021) indicated that green recruitment and training contribute to developing employees' abilities for environmental creative thinking. Sami (2024) confirmed that sustainable HRM practices have a direct impact on green innovation through participation, empowerment, and environmental selection. The findings showed that strengthening such practices enhances competitiveness through environmental creativity. Accordingly, the following hypothesis is proposed:

H4: There is a statistically significant relationship between green human resource management and green innovation.

2.5.6. The Relationship between Green Organizational Culture and Green Innovation

Several studies have shown that an organizational culture based on environmental principles enhances employees' creative behaviors. Aboramadan (2022) explained that green culture forms a motivating environment for generating creative sustainability-related ideas. Similarly, Abou-AL-Ross & Abu Mahadi (2021) revealed that the depth and diffusion of greening within organizational culture enhances individuals' ability to produce environmentally friendly innovative solutions. Based on this, the hypothesis is:

H5: There is a statistically significant relationship between green organizational culture and green innovation.

2.5.7. The Mediating Role of Green HRM in the Relationship between Green Leadership and Green Innovation

Recent literature suggests that Green HRM represents the organizational channel through which green leadership is translated into tangible outcomes at the level of employees' behavior and creative contributions. Wahba et al. (2024) found that integrated practices in green recruitment and training enhance the effect of leadership on environmental innovation by empowering employees and fostering their engagement with environmental issues. Similarly, Al-Swidi et al. (2021) confirmed that Green HRM is a critical variable in explaining the indirect effect of green leadership on organizational outcomes, particularly environmental innovation, by building employees' environmental capabilities and creating an encouraging environment for sustainable creative behaviors. Accordingly, the hypothesis is formulated as follows:

H6: Green HRM plays a mediating role in the relationship between green leadership and green innovation.

2.5.8. The Mediating Role of Green Organizational Culture in the Relationship between Green Leadership and Green Innovation

Organizational culture supports the impact of leadership by embedding environmental work values, thereby enhancing employees' capacity to engage in creative behaviors. Abou-AL-Ross & Abu Mahadi (2021) showed that green culture is an effective mediating variable in transferring leadership's influence into environmental creative outcomes, particularly in service organizations. Based on this, the hypothesis is as follows:

H7: Green organizational culture plays a mediating role in the relationship between green leadership and green innovation.

2.5.9. The Sequential Mediating Role of Green HRM and Green Organizational Culture in the Relationship between Green Leadership and Green Innovation

The literature reveals that green leadership represents a managerial style that motivates employees to adopt environmentally friendly behaviors and promotes a culture of sustainability in the workplace (Chang, 2016). Through its directive and influential role, green leadership contributes to creating an organizational environment that supports the adoption of HRM policies and practices with an environmental dimension (Renwick et al., 2013). The effect of these practices extends to shaping organizational culture, as Green HRM enhances shared values, standards, and beliefs that encourage positive environmental behavior, leading to the establishment of a coherent green organizational culture.

In this context, the importance of the sequential mediation pathway is highlighted, where green leadership first influences Green HRM practices, which in turn shape green organizational culture, ultimately reflecting positively on the organization's ability to achieve environmental innovation and provide advanced green solutions (Al-Swidi et al., 2021).

H8: Green leadership has an indirect, sequential effect on green innovation through green human resource management (Green HRM) and green organizational culture.

Research Methodology

In this study, the descriptive–analytical method was adopted, as it is suitable for the research objectives based on describing the phenomenon under study (green leadership, green innovation, Green HRM, and green organizational culture) and analyzing the relationships among them as observed in the real environment of the General Authority of Customs' employees in the State of Qatar. This method was employed within a deductive philosophical framework, as the study began with a theoretical model constructed from scientific literature, from which clear and predefined hypotheses were formulated. These were tested empirically by collecting quantitative data and analyzing them using structural equation modeling (PLS-SEM).

This is consistent with Saunders et al. (2019) and Creswell & Creswell (2018), who argue that quantitative studies aiming to test relationships between specified variables are typically based on deductive reasoning and conducted within a descriptive–analytical approach. This method

enabled the researcher to examine the relationships among variables and achieve the study's objectives, specifically understanding the impact of green leadership on green innovation and determining the mediating roles of Green HRM and green organizational culture in a measurable and generalizable manner.

3.2.3 Theoretical Perspective

The theoretical foundation of this study was built upon several conceptual frameworks and administrative and behavioral theories that provided the scientific background for analyzing the relationships among the variables under investigation. These theories were employed to explain the direct and indirect effects between green leadership and green innovation, through the mediating roles of green human resource management and green organizational culture.

The Transformational Leadership Theory provided the conceptual framework for understanding the role of green leadership. This theory emphasizes leaders' ability to inspire and motivate individuals to adopt behaviors that go beyond the ordinary, thereby achieving higher goals. This aligns with green leadership, which aims to promote environmentally responsible behavior and innovation within the organization (Bass, 1985; Burns, 1978).

Additionally, the Dynamic Capabilities Theory was employed to explain how organizations can achieve a sustainable competitive advantage by investing in and developing their human resources in line with green principles, thereby enabling green innovation and adaptation to changing environmental requirements (Teece et al., 1997). Similarly, Organizational Culture Theory helps explain the impact of green beliefs and institutional practices in shaping a work environment supportive of green innovation.

Meanwhile, Stakeholder Theory supported the ethical and social aspects of the study, emphasizing that organizations, especially public ones, are obligated to respond to stakeholders' expectations by adopting environmentally responsible green practices (Freeman, 1984). Ultimately, the Green Innovation Theory clarifies how the adoption of integrated environmental practices within an organization enhances its innovation capacity by embedding environmental dimensions into its processes, products, and procedures.

This multiplicity of theoretical perspectives adds significant value to the study, as it enables a comprehensive understanding of the causal and contextual relationships among the variables, reflecting the multidimensional and multi-variable nature of the research.

3.4 Data Collection Tools

3.4.1 Development of the Questionnaire

The study employed a closed-ended electronic questionnaire as the most suitable tool for a quantitative approach, given its ease of administration and low cost. The instrument was designed to cover all study variables (independent, dependent, and mediating) based on validated measures in literature.

The questionnaire included demographic data on participants, such as nationality, gender, job title, years of experience, and educational qualifications. It also comprised four main sections:

- **Green Leadership:** six items measuring leaders’ environmental behaviors.
- **Green Human Resource Management:** eight items related to recruitment, training, evaluation, and rewards.
- **Green Organizational Culture:** eight items assessing the extent to which the organization adopts a sustainability-supportive culture.
- **Green Innovation:** six items measuring the application of environmentally friendly technologies and practices.

A five-point Likert scale was used to measure responses, ranging from (1) “Strongly Disagree” to (5) “Strongly Agree.”

3.4.2 Sources of Questionnaire Items

The items of the questionnaire were developed based on measurement tools used in prior reliable studies. They were translated into Arabic to suit the organizational and cultural context of the State of Qatar.

Table 1. Sources of Questionnaire Items

Variable	Number of Items	Main Source
Green Leadership	6	Al-Swidi et al. (2022)
Green HRM	8	Al-Swidi et al. (2022)
Green Organizational Culture	8	Al-Swidi et al. (2021)
Green Innovation	6	Al-Swidi et al. (2022)

Instrument Testing

The face validity of the questionnaire was confirmed by presenting it to the supervising professor, who reviewed the items in terms of wording and alignment with the theoretical framework and study variables. It was also submitted to the Institutional Review Board (IRB) at Qatar University to obtain the required ethical approval. The instrument was approved for use after ensuring compliance with ethical and methodological standards, which strengthened its credibility and structural soundness.

3.5 Population and Sample

The target population of this study consisted of all employees of the General Authority of Customs in the State of Qatar, one of the vital governmental bodies playing a pivotal role in implementing economic, regulatory, and environmental policies related to trade and cross-border goods movement. In recent years, the Authority has increasingly focused on adopting administrative and organizational practices that support sustainability.

According to information obtained directly by the researcher from the relevant departments at the Authority (as an employee there), the total number of staff is approximately 3,000 across different branches and departments.

The inclusion criteria for survey participation were as follows:

1. Current employees of the General Authority of Customs in Qatar.
2. Arabic-speaking employees.
3. Participants who provided full and informed consent to take part in the study.

The sample was selected using the stratified random sampling technique. The population was divided into strata based on key demographic characteristics (such as job title or administrative department), and a random sample was drawn from each stratum. This method ensured balanced representation of employees from different organizational levels, reflecting the Authority's structure and minimizing response bias. Stratified random sampling is particularly suitable for studies involving large or multi-departmental organizations, as it improves the accuracy and generalizability of results (Saunders et al., 2019).

The final sample size consisted of 279 valid respondents. This number was determined in accordance with the principles of path analysis using Structural Equation Modeling (PLS-SEM), which recommends that the sample size should be at least ten times the maximum number of indicators of any latent variable in the model (Hair et al., 2022). Furthermore, power analysis confirmed that this sample size was sufficient to detect medium effect sizes with a statistical power of 0.80 at a significance level of 0.05.

3.6 Data Analysis Methods

This study employed a quantitative approach to analyze the data and test the relationships between variables, utilizing structural equation modeling based on the partial least squares (PLS) method. This approach is considered suitable for complex models that involve multiple relationships among independent, dependent, and mediating variables.

The SmartPLS software was used for statistical analysis, given its high capacity to handle causal models, its suitability for relatively small sample sizes, and its flexibility in analyzing both reflective and formative models.

Ethical Considerations

The study adhered strictly to the ethical standards of scientific research, particularly those related to the collection of data from human participants. Official ethical approval was obtained from the Institutional Review Board at Qatar University, following the submission of a consent form that clarified the research objectives, instruments, and adopted methodology. Informed consent was also ensured, as the electronic questionnaire included on its first page a clear statement explaining the purpose of the study, the nature of participation, and the option to withdraw at any time without obligation. The statement also indicated that completing the questionnaire constituted explicit consent to participate.

The confidentiality of the data and the anonymity of the participants were fully guaranteed, as no personal identifying information was requested. The data were used exclusively for research purposes and were stored in a secure electronic environment, with no disclosure to third parties.

This process fully complied with the ethical principles of safeguarding participants' rights and privacy.

4.2 Demographic Characteristics of the Participants

The demographic characteristics of the study sample form an important basis for understanding the organizational context of the research, which seeks to measure the effects of green leadership, green human resource management, and organizational culture on green innovation within the Qatar General Authority of Customs. These characteristics are presented in Table 2.

Table 2. Demographic Characteristics of the Participants

Characteristic	Category	Frequency	Percentage
Nationality	Qatari	207	74.19%
	Non-Qatari	72	25.81%
Gender	Male	167	59.86%
	Female	112	40.14%
Age	18–25 years	2	1.54%
	25–30 years	13	10.00%
	30–40 years	44	33.85%
	40–55 years	71	54.62%
Job Position	Director General	6	2.15%
	Department Director	13	4.66%
	Head of Section	38	13.62%
	Senior Expert in Customs Training	1	0.36%
	Supervisor	57	20.43%
	Administrative Staff	110	39.43%
	Technical Staff	41	14.70%
Work Experience	Field Staff	13	4.66%
	Less than 5 years	13	4.66%
	5–10 years	69	24.73%
	10–20 years	141	50.54%

Characteristic	Category	Frequency	Percentage
	More than 20 years	56	20.07%
Education Level	Postgraduate Studies	31	11.11%
	Bachelor’s Degree	161	57.71%
	Secondary or Equivalent or Lower	80	28.67%
	No Qualification	7	2.51%

The sample shown in Table 2 consisted of 279 participants (N=279). The data revealed that the majority were Qatari nationals (74.19%), while non-Qataris accounted for 25.81%, reflecting the institution's local character. Regarding gender, males represented 59.86% and females 40.14%, indicating a relatively diverse participation pattern aligned with the organization's workforce dynamics. In terms of age, most respondents were between 40 and 55 years (54.62%), followed by those between 30 and 40 years (33.85%), highlighting the dominance of participants with considerable professional experience.

With respect to job position, administrative staff represented the largest share (39.43%), followed by supervisors (20.43%) and heads of sections (13.62%). Directors general formed only 2.15% of the sample. For work experience, more than half of the participants (50.54%) had 10–20 years of experience, while 20.07% had over 20 years of experience. Finally, the educational level distribution showed that most participants held a bachelor’s degree (57.71%), followed by those with a secondary school certificate or lower (28.67%), postgraduate qualifications (11.11%), and those without formal qualifications (2.51%).

Regarding years of work experience, the results showed that the most significant proportion of participants had between 10 and 20 years of experience (50.54%), followed by those with 5–10 years (24.73%). This reflects a mature professional base with accumulated knowledge of institutional contexts. Such a profile allows for strong assumptions about the participants’ awareness of the effects of institutional leadership and modern technologies on organizational performance, particularly given the limited representation of new employees (4.66%). Regarding the educational level of the participants, the results showed that 57.71% held a bachelor’s degree, 11.11% held postgraduate qualifications, while 28.67% held a secondary school certificate or lower. This indicates a sample with a medium to high educational background, which is assumed to directly influence the understanding of concepts such as green leadership, green human resource management, and organizational culture in relation to green innovation.

In conclusion, this demographic composition demonstrates statistically significant diversity that enhances the credibility of the study’s findings and enables some of them to be generalized to similar institutional sectors in the Gulf context. Education and experience levels, along with gender and job position, are assumed to represent interactive factors that influence the understanding and adoption of modern leadership practices, thereby supporting the study’s hypotheses related to dynamic capabilities, organizational culture, and adaptive flexibility.

4.3 Data Analysis Method

To analyze the hypothesized relationships between the studied variables, structural equation modeling using the partial least squares method (PLS-SEM) was employed with SmartPLS software version 4.0, due to its ability to handle complex models, its flexibility regarding data distribution assumptions, and its ease of use in exploratory studies (Hair et al., 2022; Sarstedt et al., 2017). The PLS-SEM analysis was carried out in two main stages: (1) analysis and evaluation of the measurement model, and (2) analysis and evaluation of the structural model.

In the first stage, the measurement model was analyzed through testing internal consistency, composite reliability, discriminant validity, and convergent validity. Internal consistency was verified using Cronbach’s Alpha (≥ 0.70) and Composite Reliability (≥ 0.70). Convergent validity was assessed using the Average Variance Extracted ($AVE \geq 0.50$), while discriminant validity was evaluated using the Fornell–Larcker criterion and the Heterotrait–Monotrait Ratio ($HTMT \leq 0.85–0.90$) (Hair et al., 2022).

Table 3. Cronbach’s Alpha for Each Construct in the Study

Dimension	Number of Items	Cronbach’s Alpha (α)
Green Leadership	6	0.804
Green Human Resource Management	8	0.859
Green Organizational Culture	8	0.877
Green Innovation	6	0.844

In the second stage, the structural model was evaluated by analyzing path coefficients (β), the coefficient of determination (R^2) to estimate the explanatory power of the model, as well as statistical significance tests (t-values & p-values), effect size (f^2), and predictive relevance (Q^2) using the blindfolding technique. A strong R^2 is ≥ 0.50 , with f^2 values of ≥ 0.02 indicating a small effect, ≥ 0.15 a medium effect, and ≥ 0.35 a significant effect. Positive Q^2 values indicate acceptable predictive ability of the model, as shown in the table (Hair et al., 2022; Sarstedt et al., 2017).

4.4 Analysis and Evaluation of the Measurement Model

4.4.1 Analysis of Outer Loadings, Internal Consistency, Reliability, and Validity

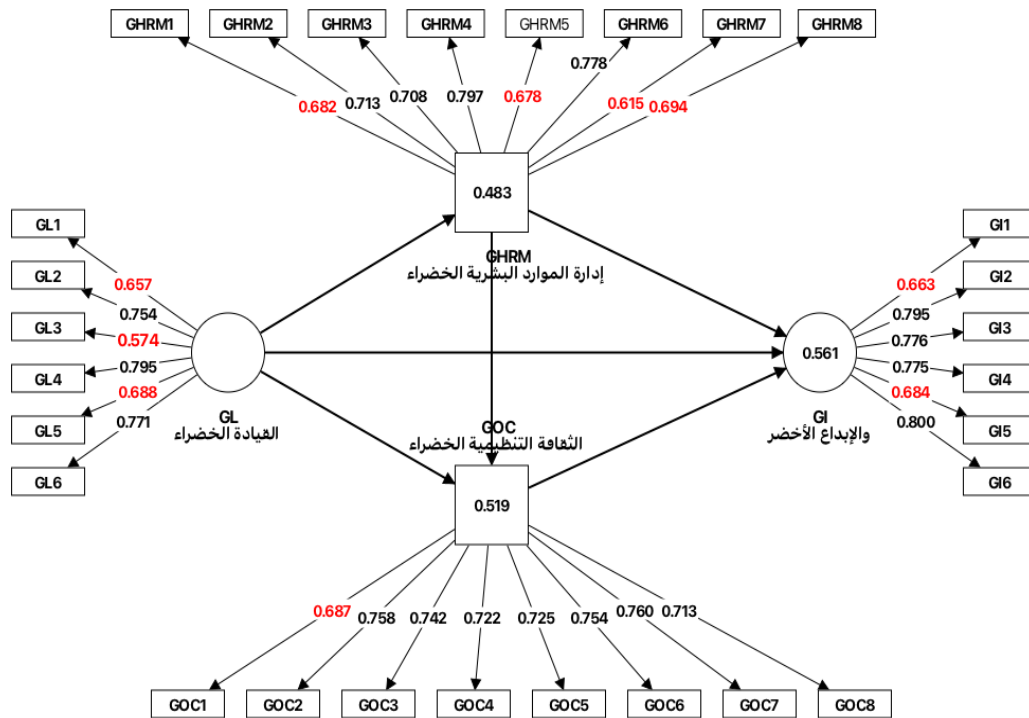


Figure 2. Measurement Model – Loadings

Figure (2) illustrates the results of the outer loadings analysis for the sub-variables related to Green Human Resource Management (GHRM), Green Innovation (GI), Green Leadership (GL), and Green Organizational Culture (GOC). This analysis was conducted using structural equation modeling with the PLS-SEM technique, aimed at verifying the convergent validity of the latent variables in the model. The results show that most of the items for Green Human Resource Management and Green Innovation achieved outer loadings above the accepted threshold of 0.70, such as GHRM4 (0.797), GHRM6 (0.778), GI2 (0.795), and GI6 (0.800), reflecting strong relationships between the items and their intended latent constructs. The remaining items in these constructs had loadings ranging between 0.615 and 0.713, which are within the acceptable range, particularly considering that some studies regard loadings between 0.60 and 0.70 as acceptable when overall validity and reliability indicators are strong.

To clarify, outer loadings represent the degree to which each observed variable is associated with the latent construct it measures. Loadings above 0.70 are generally considered good and acceptable, while those between 0.60 and 0.70 may still be acceptable in certain cases,

especially when the overall model quality is high. Loadings below 0.60, however, are considered weak and are often recommended for exclusion from the analysis (Hair et al., 2022).

Regarding the variable of Green Leadership, some sub-items exhibited good loadings, such as GL2 (0.754) and GL4 (0.795), while sub-item GL3 showed a relatively low loading (0.574). Although this value falls below the conventional threshold (0.70), the decision to retain this item was based on theoretical considerations, as well as its positive contribution to the overall stability of the construct. This was supported by the model's overall validity and reliability indicators, which also favored its inclusion.

Regarding Green Organizational Culture, all items (GOC1 to GOC8) exhibited outer loadings ranging from 0.687 to 0.760, indicating good reliability and stability of the indicators.

Based on the above, it can be concluded that the measurement instruments used in this study demonstrate a high degree of internal consistency and strongly support the convergent validity of all four constructs, thereby reinforcing the validity of the proposed conceptual model and its ability to explain the targeted phenomena in the study context.

Table 4. Reflective Outer Loadings – Reliability and Convergent Validity

Constructs	Items	Loadings	Cronbach's Alpha	CR	AVE
Green Leadership	GL1	0.657	0.804	0.858	0.505
	GL2	0.754			
	GL3	0.574			
	GL4	0.795			
	GL5	0.688			
	GL6	0.771			
Green HRM	GHRM1	0.682	0.859	0.890	0.504
	GHRM2	0.713			
	GHRM3	0.708			
	GHRM4	0.797			
	GHRM5	0.678			
	GHRM6	0.778			
	GHRM7	0.615			
Green Org. Culture	GOC1	0.687	0.877	0.878	0.538
	GOC2	0.758			

Constructs	Items	Loadings	Cronbach's Alpha	CR	AVE
	GOC3	0.742			
	GOC4	0.722			
	GOC5	0.725			
	GOC6	0.754			
	GOC7	0.760			
	GOC8	0.713			
Green Innovation	GI1	0.663	0.844	0.850	0.564
	GI2	0.795			
	GI3	0.776			
	GI4	0.775			
	GI5	0.684			
	GI6	0.800			

Table (4) presents the results of the measurement model evaluation for the reflective constructs in this study, which include: Green Leadership (GL), Green Human Resource Management (GHRM), Green Organizational Culture (GOC), and Green Innovation (GI). The evaluation relied on several indicators, including outer loadings, Cronbach's Alpha, Composite Reliability (CR), and Average Variance Extracted (AVE), to verify the quality of the employed measurement scales (Hair et al., 2022).

The results indicate that all four constructs achieved acceptable levels of reliability, with Cronbach's Alpha values ranging between 0.804 and 0.877, exceeding the minimum accepted threshold (0.70). This demonstrates strong internal consistency among the items associated with each construct. Composite Reliability (CR) values ranged between 0.850 and 0.890, surpassing the recommended benchmark (0.70), which signals acceptable reliability of the scales.

Regarding convergent validity, all constructs achieved AVE values slightly above 0.50, which is the minimum acceptable level according to PLS-SEM standards. This suggests that the sub-items explain a sufficient proportion of variance in their respective latent constructs. Regarding outer loadings, which were previously discussed in detail in the analysis, most items scored above 0.70, indicating the strength of the relationships between the items and their associated constructs. Although some items recorded loadings below 0.70, such as GL3 (0.574) and GHRM7 (0.615), they were retained based on theoretical justification, as well as their lack of negative impact on the overall reliability and validity of the measurement model.

Based on these results and indicators, it can be confirmed that the measurement model reflects high structural quality, fulfilling the requirements of reliability and convergent validity, thereby

supporting the appropriateness of the measurement instruments in representing the conceptual constructs of the study.

4.4.2 Discriminant Validity

Discriminant validity refers to the extent to which each construct in the model is distinct from the other constructs, meaning that it clearly measures a dimension different from the rest (Hair et al., 2022). This type of validity is verified through three main techniques: cross-loadings, the heterotrait–monotrait ratio (HTMT), and the Fornell–Larcker criterion. According to the cross-loading criterion, the loading of each item on its assigned construct should be higher than its loading on any other construct. For HTMT, a value below 0.90 is recommended to indicate acceptable discriminant validity between constructs (Henseler et al., 2015). Meanwhile, the Fornell–Larcker criterion requires that the square root of the AVE value for each construct be higher than its correlation with any other construct in the model.

Table (5) presents the cross-loading results for all items associated with the four constructs in the study model: Green Human Resource Management (GHRM), Green Innovation (GI), Green Leadership (GL), and Green Organizational Culture (GOC). These loadings serve as a key criterion for analyzing and assessing discriminant validity, ensuring that each item is more strongly related to its intended construct than to other constructs.

The data in Table 5 reveal that each item is more strongly associated with its theoretical construct compared to other constructs. For example, the loading of sub-item GHRM1 on GHRM was (0.682), which is higher than its loadings on the other constructs (GI = 0.438, GL = 0.515, and GOC = 0.522), thereby supporting discriminant validity. This pattern is consistent across other items, including GI items such as GI2, which showed its highest loading on GI (0.795), compared to its loadings on other constructs, as well as for GL and GOC sub-items.

Table 5. Cross Loadings – Items or Variables Indicators

	GHRM	GI	GL	GOC
GHRM1	0.682	0.438	0.515	0.522
GHRM2	0.713	0.489	0.545	0.611
GHRM3	0.708	0.330	0.481	0.397
GHRM4	0.797	0.460	0.550	0.525
GHRM5	0.678	0.437	0.478	0.429
GHRM6	0.778	0.491	0.516	0.485
GHRM7	0.615	0.391	0.408	0.360
GHRM8	0.694	0.463	0.439	0.526
GI1	0.373	0.663	0.405	0.472

	GHRM	GI	GL	GOC
GI2	0.481	0.795	0.454	0.572
GI3	0.452	0.776	0.456	0.494
GI4	0.471	0.775	0.460	0.589
GI5	0.472	0.684	0.400	0.498
GI6	0.533	0.800	0.518	0.617
GL1	0.416	0.307	0.657	0.341
GL2	0.516	0.570	0.754	0.597
GL3	0.345	0.242	0.574	0.277
GL4	0.557	0.495	0.795	0.482
GL5	0.510	0.309	0.688	0.383
GL6	0.576	0.516	0.771	0.534
GOC1	0.498	0.513	0.521	0.687
GOC2	0.540	0.550	0.526	0.758
GOC3	0.515	0.546	0.432	0.742
GOC4	0.467	0.495	0.393	0.722
GOC5	0.527	0.459	0.441	0.725
GOC6	0.466	0.525	0.396	0.754
GOC7	0.525	0.566	0.509	0.760
GOC8	0.490	0.578	0.501	0.713

These results indicate that all constructs accurately measure their intended dimensions, with no significant overlap among the latent constructs. Thus, the cross-loading results support the achievement of discriminant validity at the construct level in the reflective measurement model.

The Fornell–Larcker criterion was also applied to assess discriminant validity, as presented in **Table 6**. This criterion was used to examine the four conceptual constructs in the model: Green Human Resource Management (GHRM), Green Innovation (GI), Green Leadership (GL), and Green Organizational Culture (GOC). According to this criterion, the square root of the Average Variance Extracted (\sqrt{AVE}) for each construct (shown diagonally in italics in the table) should be greater than the correlations with other constructs in the same row or column (Fornell & Larcker, 1981; Hair et al., 2022).

The results in the table show that each diagonal value—for example, GHRM (0.710), GI (0.751), GL (0.710), and GOC (0.733)—exceeds the corresponding correlation values in its

row and column. For instance, the square root of AVE for GI (0.751) is greater than its correlation with GHRM (0.621), GL (0.600), and GOC (0.724). The same pattern applies to the other constructs. These results confirm that discriminant validity is achieved in the model, showing that each construct captures a unique conceptual dimension distinct from the others, thereby supporting the robustness of the measurement model (Hair et al., 2022).

Table 6. Fornell–Larcker Criterion

	GHRM	GI	GL	GOC
GHRM	<i>0.710</i>			
GI	0.621	<i>0.751</i>		
GL	0.697	0.600	<i>0.710</i>	
GOC	0.688	0.724	0.637	<i>0.733</i>

The final analysis of discriminant validity between the latent constructs of the model is presented in **Table 7**, based on the latest and more rigorous criterion, HTMT. This method is considered more precise than traditional measures such as the Fornell–Larcker criterion, with recommended HTMT values being below 0.90 (or 0.85 in more conservative studies) to confirm adequate discriminant validity between conceptual constructs (Henseler et al., 2015).

Table 7. Heterotrait–Monotrait Ratio (HTMT)

	GHRM	GI	GL	GOC
GHRM: Green Human Resource Management				
GI: Green Innovation	0.723			
GL: Green Leadership	0.823	0.693		
GOC: Green Organizational Culture	0.782	0.835	0.726	

The results indicate that the HTMT values for the latent constructs confirm adequate discriminant validity. Specifically, the HTMT between GHRM and GI is 0.723, below the critical threshold of 0.90. The HTMT value between GHRM and GL is 0.823, also below 0.90, indicating good differentiation. Similarly, the HTMT between GHRM and GOC is 0.782, within acceptable limits. Between GL and GI, the HTMT is 0.693, a relatively low value, demonstrating strong differentiation between these two dimensions. The highest value observed is between GOC and GI at 0.835, still within the acceptable range, while the HTMT between GL and GOC is 0.726, a statistically significant value indicating good discriminant validity.

All HTMT values suggest that each pair of latent constructs possesses sufficient discriminant validity, as none exceeds the recommended maximum threshold of 0.90.

4.5 Structural Model Analysis and Evaluation

After ensuring the quality of the measurement model through assessments of reliability, validity, and discriminant validity, the analysis of the structural model is a crucial step to understand causal relationships among latent constructs and test the study's hypotheses. This analysis aims to evaluate the strength and impact of independent variables on dependent

variables within the model, using statistical indicators such as path coefficients (β), R^2 to measure explanatory power, predictive relevance (Q^2), and effect size (f^2). This process determines the validity of the theoretical model in explaining the studied phenomenon. It assesses whether the observed data support hypothesized relationships, enabling accurate research conclusions and evidence-based practical recommendations (Hair et al., 2022).

4.6 Collinearity Assessment and Results

Assessing multicollinearity is essential to ensure the accuracy of interpreting relationships in the model. Values exceeding 5—or 3.3 in some studies—indicate potential excessive linear correlation. Evaluating the **Variance Inflation Factor (VIF)** ensures that the hypothesized causal relationships among independent variables are not biased due to overlapping explanatory power, thereby confirming the reliability and robustness of the structural model.

As part of the structural model analysis, multicollinearity among independent variables was examined using VIF values to ensure that path estimates were not affected by unwanted overlap between latent variables (Hair et al., 2022).

Table 8 shows that all VIF values range from 1.000 to 2.413, which is well below the critical thresholds, indicating no multicollinearity issues among the independent variables within the structural model.

Table 8. Collinearity Analysis

Relationships	VIF
GHRM <- GI	2.413
GHRM <- GOC	1.943
GL <- GHRM	1.000
GL <- GOC	1.943
GOC <- GI	2.092

These results indicate that the structural model exhibits a high degree of statistical stability and that the hypothesized causal relationships among latent constructs are not influenced by excessive linear overlap. Consequently, the path analysis results can be confidently relied upon for interpreting relationships between variables.

4.7 Relationships Between Variables and Their Statistical Significance

The structural model analysis presented in Table 9 and Figure 3 reveals that all path relationships among latent variables are statistically significant, indicating the robustness and validity of the model's paths. Relationships were interpreted based on path coefficients (β), T-statistics (T), and p-values (P). The results revealed a significant positive relationship between Green Human Resource Management (GHRM) and Green Innovation (GI) [$\beta = 0.151$, $T = 2.130$, $P = 0.033$], suggesting that the implementation of sustainable HR practices enhances environmental innovation capabilities within the General Authority of Customs.

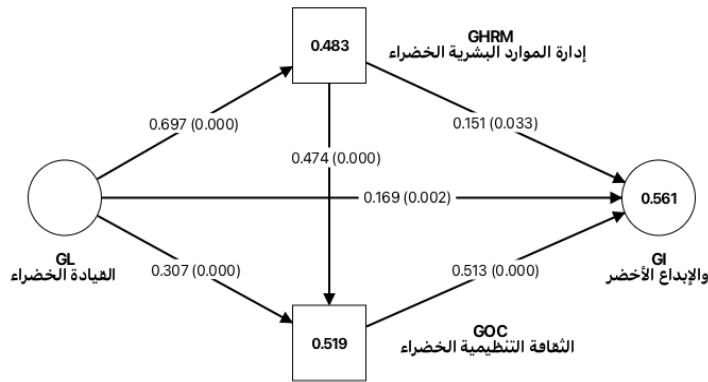


Figure 3. Structural Model

The results also indicate that GHRM has a stronger and highly significant effect on Green Organizational Culture (GOC) [$\beta = 0.474$, $T = 7.713$, $P = 0.000$], reflecting the role of management in embedding environmental values within organizational culture.

Additionally, Green Leadership (GL) has a highly significant and strong effect on GHRM [$\beta = 0.697$, $T = 20.974$, $P = 0.000$], suggesting that environmentally oriented leaders directly stimulate the adoption of sustainable HR practices. GL also has a significant direct effect on GI [$\beta = 0.169$, $T = 3.081$, $P = 0.002$] and GOC [$\beta = 0.307$, $T = 5.121$, $P = 0.000$], confirming its central role in supporting a green organizational environment and environmental innovation initiatives.

Finally, GOC represents one of the strongest determinants of GI, with a highly significant effect [$\beta = 0.513$, $T = 8.798$, $P < 0.001$], reinforcing the idea that a sustainability-oriented organizational culture serves as a powerful driver of innovative behavior in the environmental context.

Table 9. Path Relationships and Statistical Significance

Constructs Relationship	Path β	T-statistics	P-values	Significance
GHRM ← GI	0.151	2.130	0.033	Significant
GHRM ← GOC	0.474	7.713	0.000	Significant
GL ← GHRM	0.697	20.974	0.000	Significant
GL ← GI	0.169	3.081	0.002	Significant
GL ← GOC	0.307	5.121	0.000	Significant
GOC ← GI	0.513	8.798	0.000	Significant

Overall, these results collectively indicate the strength and suitability of the structural model for explaining relationships among the study variables, supporting the theoretical framework

that integrates green leadership, HR practices, culture, and environmental innovation in organizational contexts.

4.8 R² and Predictive Relevance (Q²) Analysis

The coefficient of determination (R²) is a key metric for evaluating the explanatory power of the structural model in accounting for variance in the dependent variable, reflecting the extent to which the independent variables explain the variance. Table 10 shows that R² for GHRM is 0.485, indicating that independent variables explain approximately 48.5% of the variance. R² for GOC is 0.522, explaining about 52.2% of the variance, indicating a satisfactory level of explanatory power. For GI, R² is 0.566, explaining 56.6% of the variance, reflecting strong explanatory capability.

Additionally, the model’s **predictive relevance (Q²)** was assessed to evaluate its ability to predict values of dependent variables outside the sample.

Table 10. R² and Q² Values

Variable	R ²	Adjusted R ²	T-statistics	Q ² predict	RMSE	MAE
GHRM	0.485	0.483	10.411	0.477	0.730	0.563
GI	0.566	0.561	14.143	0.352	0.811	0.650
GOC	0.522	0.519	12.783	0.398	0.783	0.614

The results show that all Q² values are positive and exceed the minimum acceptable threshold of 0.25, with GHRM = 0.477, GOC = 0.398, and GI = 0.352, indicating moderate to strong predictive relevance (Hair et al., 2022). Predictive error metrics, RMSE and MAE, also remain within acceptable levels, demonstrating reasonable predictive reliability. Therefore, these results confirm the validity of the structural model in explaining the proposed causal relationships among the studied variables within the context of institutional and environmental sustainability.

4.9 Effect Size (f²) Analysis

The effect size (f²) analysis complements the structural model evaluation by determining the relative strength of each independent variable’s effect on explaining variance in the dependent variables within the model (Hair et al., 2022). According to conventional benchmarks, effect sizes are classified into three levels: small (0.02), medium (0.15), and large (0.35). Table 11 presents the results:

- **Green Leadership (GL)** has a very large effect on **Green Human Resource Management (GHRM)** [f² = 0.943], highlighting the pivotal role of leadership in promoting environmental HR practices.
- Medium effects were found for the impact of **Green Organizational Culture (GOC)** on **Green Innovation (GI)** [f² = 0.290], and for GHRM on GOC [f² = 0.242].
- The effect of GL on GOC was small [f² = 0.102].

- Minimal effects were observed for GHRM on GI [$f^2 = 0.022$] and GL on GI [$f^2 = 0.031$], indicating these variables have a limited influence, despite some statistically significant values. For example, GL on GI [$p = 0.154$] and GHRM on GI [$p = 0.322$] were not statistically significant.

Table 11. Effect Sizes (f^2) Analysis

Effect Size	F^2	T statistics	P values
GHRM ← GI	0.022	0.990	0.322
GHRM ← GOC	0.242	3.084	0.002
GL ← GHRM	0.943	5.162	0.000
GL ← GI	0.031	1.426	0.154
GL ← GOC	0.102	2.417	0.016
GOC ← GI	0.290	3.358	0.001

These results underscore the importance of focusing on variables with medium to high effects in future organizational interventions, as they possess stronger explanatory power for changes in dependent variables.

4.10 Indirect Effects

Table 12. Indirect Effects

Effect Type	Path	β	T-statistics	P-values	Mediation
Total Effects	GHRM ← GI	0.394	6.188	0.000	---
	GHRM ← GOC	0.474	7.713	0.000	---
	GL ← GHRM	0.697	20.974	0.000	---
	GL ← GI	0.600	16.123	0.000	---
	GL ← GOC	0.637	18.673	0.000	---
	GOC ← GI	0.513	8.798	0.000	---
Total Indirect Effects	GHRM ← GI	0.243	6.151	0.000	Partial
	GL ← GI	0.432	9.500	0.000	Partial
	GL ← GOC	0.330	7.361	0.000	Full

Effect Type	Path	β	T-statistics	P-values	Mediation
Specific Indirect Effects	GL ← GHRM ← GI	0.105	2.088	0.037	Partial
	GL ← GHRM ← GOC ← GI	0.169	6.019	0.000	Sequential
	GL ← GHRM ← GOC	0.330	7.361	0.000	Full
	GHRM ← GOC ← GI	0.243	6.151	0.000	Partial
	GL ← GOC ← GI	0.158	4.324	0.000	Partial

4.11 Mediation Analysis in the Structural Model

Path analysis results indicate significant **direct effects** among the study variables:

- **GL** has a positive direct effect on GHRM [$\beta = 0.697, p = 0.000$], GOC [$\beta = 0.637, p = 0.000$], and GI [$\beta = 0.600, p = 0.000$].
- **GHRM** directly affects GOC [$\beta = 0.474, p = 0.000$] and GI [$\beta = 0.394, p = 0.000$].
- **GOC** has a strong direct effect on GI [$\beta = 0.513, p = 0.000$].

At the mediation level, results reveal both **full and partial mediations**:

- GHRM serves as a **full mediator** between GL and GOC [$\beta = 0.330, p = 0.000$].
- GHRM partially mediates the relationship between GL and GI via the path: GL ← GHRM ← GI [$\beta = 0.105, p = 0.037$].
- Sequential **mediation** occurs along the path: GL ← GHRM ← GOC ← GI [$\beta = 0.169, p = 0.000$], indicating effects pass through GHRM and GOC before reaching GI.
- GHRM also partially mediates the effect on GI through GOC [$\beta = 0.243, p = 0.000$].
- GL has an additional statistically significant indirect effect on GI via GOC alone [$\beta = 0.158, p = 0.000$].

These findings highlight the critical role of mediating variables—GHRM and GOC—in strengthening the relationship between GL and GI, confirming the presence of full, partial, and sequential mediations within the proposed study model (Hair et al., 2022).

Results and Hypotheses Evaluation

Table 13. Hypotheses and Results

Hypothesis (H#)	Path Relationship	β	p-value	Decision
H1	GL ← GHRM There is a positive effect of Green Leadership on Green Human Resource Management	0.697	0.000	Supported
H2	GL ← GOC There is a positive effect of Green Leadership on Green Organizational Culture	0.307	0.000	Supported
H3	GL ← GI There is a positive effect of Green Leadership on Green Innovation	0.169	0.002	Supported
H4	GHRM ← GI There is a positive effect of Green HRM on Green Innovation	0.151	0.000	Supported
H5	GOC ← GI There is a positive direct effect of Green Organizational Culture on Green Innovation	0.513	0.018	Supported
H6	GL ← GHRM ← GI There is a positive mediation through Green HRM between Green Leadership and Green Innovation	0.105	0.002	Supported
H7	GL ← GOC ← GI There is a positive mediation through Green Organizational Culture between Green Leadership and Green Innovation	0.158	0.000	Supported
H8	GL ← GHRM ← GOC ← GI There is a positive sequential mediation through Green HRM and Green Organizational Culture between Green Leadership and Green Innovation	0.169	0.000	Supported

The results of the hypothesis testing presented in Table 13 indicate the existence of statistically significant direct and indirect relationships among the variables in the proposed model.

- Green Leadership (GL) exhibited a strong positive effect on Green Human Resource Management (GHRM) [$\beta = 0.697$, $p = 0.000$, Supported], reflecting that leaders' adoption of environmental principles is directly manifested in sustainable HR practices.

- GL also positively contributes to shaping Green Organizational Culture (GOC).

The hypothesis testing results in Table 13 show strong support for all proposed relationships in the model:

- H1 (Supported): Positive and significant effect of GL on GHRM [$\beta = 0.697$, $p = 0.000$].
- H2 (Supported): Positive direct effect of GL on GOC [$\beta = 0.307$, $p = 0.000$].
- H3 (Supported): Positive direct effect of GL on Green Innovation (GI) [$\beta = 0.169$, $p = 0.000$].
- H4 (Supported): Positive relationship between GHRM and GI [$\beta = 0.151$, $p = 0.000$].
- H5 (Supported): Strong and statistically significant positive effect of GOC on GI [$\beta = 0.513$, $p = 0.018$].

Regarding mediating effects:

- H6 (Supported): Partial positive mediation by GHRM in the relationship between GL and GI [$\beta = 0.105$, $p = 0.000$].
- H7 (Supported): Partial positive mediation through GOC in the same relationship [$\beta = 0.158$, $p = 0.018$].
- H8 (Supported): Positive sequential mediation through both GHRM and GOC between GL and GI [$\beta = 0.169$, $p = 0.000$].

These results indicate that all proposed hypotheses are statistically supported, reflecting the integration of green leadership with internal organizational practices in promoting green innovation within institutions. The findings further confirm the validity of the proposed model for understanding mechanisms of green organizational influence (Hair et al., 2022).

5.2 Discussion of Results

5.2.1 Discussion of Results in Light of the Study Questions and Objectives

This study aimed to explore the relationship between Green Leadership (GL) and Green Innovation (GI) among employees at the General Authority of Customs in Qatar, while analyzing the mediating role of both Green Human Resource Management (GHRM) and Green Organizational Culture (GOC). The study aimed to address several research questions regarding the direct impact of Green Leadership on Green Innovation, as well as how HR practices and the organizational environment contribute to explaining or enhancing this effect.

The statistical analysis results indicate that all six direct relationships among the variables were statistically significant. This demonstrates that Green Leadership has a direct positive influence on Green Innovation, as well as on GHRM and GOC. Additionally, the relationships between GHRM and GOC on one side, and each of these variables with Green Innovation on the other, were significant. The results also show that both GHRM and GOC play partial mediating roles in the relationship between GL and GI, indicating an indirect mechanism that strengthens and deepens the connection between the two main variables. Thus, the study successfully achieved

its objectives and clearly addressed the research questions, confirming that achieving Green Innovation in government institutions depends not only on leadership but also on a supportive organizational environment and green management practices that reinforce this orientation.

Below is an analysis of the results in light of the research questions and objectives outlined in Chapter One, aiming to evaluate the extent to which the study objectives were achieved and the effectiveness of the model in explaining the relationships among variables:

- **Objective 1: Measure the effect of Green Leadership on Green HRM**
Result: Path analysis revealed a positive and statistically significant effect of GL on GHRM ($\beta = 0.697$, $P < 0.001$).

Interpretation: This reflects the ability of environmentally oriented leaders at the General Authority of Customs to design HR policies and practices that consider environmental standards, such as green recruitment and environmental training.
Theoretical Support: This finding aligns with Abu Ria et al. (2023) and Jabbour & Santos (2008), who highlighted that environmental leadership is a central driver for enhancing green HR practices.

- **Objective 2: Examine the effect of Green Leadership on Green Organizational Culture**

Result: The results support this relationship, with $\beta = 0.307$ and a high statistical significance ($P < 0.000$).

Interpretation: This indicates that Green Leadership can instill environmental values and institutional practices through role modeling, guidance, and exemplary behavior.
Supporting Studies: This result aligns with Abou-AL-Ross & Abu Mahadi (2021) and Harris & Crane (2002), which emphasized that environmentally enlightened leadership serves as a catalyst for building a green organizational culture.

- **Objective 3: Determine the effect of Green Leadership on Green Innovation**
Result: A statistically significant positive direct relationship was found ($\beta = 0.169$, $P < 0.002$) between GL and GI.

Interpretation: This suggests that environmentally oriented leaders at the General Authority of Customs successfully motivate employees to generate innovative environmental ideas and improve processes in eco-friendly ways.
Comparison: This finding is consistent with studies by Al-Swidi et al. (2021), Chen et al. (2019), and Sami (2024), demonstrating that Green Leadership enhances sustainable organizational innovation.

- **Objective 4: Measure the effect of Green HRM on Green Innovation**
Result: A significant direct relationship was found between GHRM and GI ($\beta = 0.151$, $P < 0.000$).

Interpretation: This indicates that investing in employees through green practices—such as training, evaluation, and environmental empowerment—stimulates environmentally creative behaviors.

Literature Support: This result aligns with Jabbour (2011) and Tang et al. (2018), both of which emphasized that Green HRM is essential for supporting green innovation within organizations.

- **Objective 5: Analyze the effect of Green Organizational Culture on Green Innovation**

Result: $\beta = 0.513$, statistically significant ($P < 0.018$), indicating a strong influence of environmental organizational culture on stimulating green innovation.

Interpretation: The finding reflects that an organizational environment grounded in environmental values encourages employees to develop eco-friendly solutions and initiatives.

Theoretical Support: This aligns with Aboramadan (2022) and Abou-AL-Ross & Abu Mahadi (2021), both of whom highlight the role of organizational culture in promoting environmental innovation.

- **Objective 6: Analyze the effect of Green HRM on Green Organizational Culture**

Result: $\beta = 0.474$, statistically significant ($P < 0.000$), indicating that improving green HR practices substantially contributes to embedding an environmentally oriented institutional culture.

Interpretation: This finding reflects that when the General Authority of Customs in Qatar adopts **green HRM practices**—such as green recruitment, environmental training, and performance-based environmental incentives—these practices contribute to creating a work environment that embraces organizational values and beliefs supportive of sustainability.

Theoretical Support: This result aligns with **Organizational Culture Theory** (Schein, 1985), which emphasizes that daily management practices, especially those related to human resources, are among the most effective means to embed a new organizational culture. It is also supported by **Dynamic Capabilities Theory** (Teece et al., 1997), which posits that human resources play a crucial role in building an organizational culture capable of sustainable environmental adaptation.

- **Objectives 7 and 8: Testing the mediating role of Green HRM and Green Organizational Culture in the relationship between Green Leadership and Green Innovation**

Results:

- Partial mediation by GHRM was statistically significant (Indirect $\beta \approx 0.105$).
- Partial mediation by GOC was also significant (Indirect $\beta \approx 0.158$).

Interpretation: These findings indicate that Green Leadership does not only affect Green Innovation directly but also indirectly by creating a supportive managerial and organizational environment that enhances these behaviors.

Support: These results are consistent with Dynamic Capabilities Theory (Teece et al., 1997) and Organizational Culture Theory (Schein, 1985).

- **Testing the sequential mediation role of Green HRM and Green Organizational Culture:**

Result: Sequential mediation was statistically significant, indicating that Green Leadership exerts its influence on Green Innovation through two consecutive pathways: first via Green HRM and then via Green Organizational Culture.

Interpretation: This complex mediation pattern reflects the interconnection and integration between administrative and cultural systems within the organization, supporting the hypothesis that leadership effectiveness requires internal supportive mechanisms to achieve the desired outcomes.

5.2.3 Interpretation of Results in Light of the Theoretical Framework

The study drew on several theories that provided a foundation for understanding the relationships between the variables:

1. **Transformational Leadership Theory:** Explains how leaders with an environmental vision can influence and motivate individuals to adopt environmentally creative values and practices. The results directly support this theory, showing that Green Leadership is positively associated with Green Innovation, Green HRM, and Green Organizational Culture.
2. **Dynamic Capabilities Theory:** Suggests that effectively leverage their internal resources—such as human resources—are better equipped to adapt and innovate. This dynamic is clearly reflected in the mediating role of Green HRM in promoting innovation.
3. **Organizational Culture Theory:** Posits that organizational practices and values shape overall employee behavior. The results confirmed that Green Organizational Culture acts as a catalyst for adopting environmentally creative practices.
4. **Stakeholder Theory:** Justifies the General Authority of Customs' focus on environmental leadership and management as a response to societal and governmental expectations, aligning with Qatar National Vision 2030.

Conclusion: These findings indicate that the conceptual model proposed in the study is supported both theoretically and practically, providing an effective framework for understanding how leadership can drive innovation through sustainable managerial and cultural mechanisms.

5.3 Conclusion

5.3.1 Summary of Key Findings

This study yielded several important findings that contribute to both theoretical and practical understanding of the relationships between Green Leadership, Green Human Resource Management (GHRM), Green Organizational Culture (GOC), and Green Innovation within

government institutions in Qatar, specifically the General Authority of Customs. The results revealed a statistically significant direct effect of Green Leadership on Green Innovation, indicating that environmental leadership orientations act as a catalyst for environmentally innovative behaviors within the organization.

The study also demonstrated that Green Leadership has a direct influence on both Green HRM and Green Organizational Culture, confirming the pivotal role of leaders in shaping organizational policies and fostering a culture that supports environmental initiatives. Furthermore, a positive direct relationship was observed between Green HRM and GOC, on the one hand, and Green Innovation, on the other, highlighting the importance of administrative and organizational environments in fostering innovation.

Regarding indirect relationships, the findings indicated a partial mediating role for both Green HRM and Green Organizational Culture in the link between Green Leadership and Green Innovation. This suggests that leadership impacts innovation not only through direct guidance but also by influencing workplace practices and institutional frameworks that create favorable conditions for sustainable innovation.

5.3.2 Theoretical and Practical Contributions

This study represents a pioneering attempt in the Gulf Arab context to integrate the concepts of Green Leadership, Green HRM, Green Organizational Culture, and Green Innovation into a single comprehensive model. It extends the application of Transformational Leadership Theory to include environmental dimensions, operationalizes Dynamic Capabilities Theory by emphasizing the role of Green HRM in supporting innovation, and provides a framework illustrating how organizational culture contributes to this pathway.

Practically, the study offers actionable recommendations for government institutions—particularly the General Authority of Customs—emphasizing the need to empower leaders to adopt green leadership practices, implement green HR policies (including recruitment, training, and evaluation), and reinforce a Green Organizational Culture as a key element in the transition toward sustainability.

Consequently, the study not only enriches the academic literature but also supports Qatar's National Vision 2030 by linking institutional innovation with environmental responsibility.

5.4 Recommendations

5.4.1 Practical Recommendations for Stakeholders

The study recommends strengthening Green Leadership by providing training programs for administrative leaders and integrating environmental principles into HR policies, encompassing recruitment, training, and performance evaluation. It also suggests consolidating Green Organizational Culture through collective initiatives and institutional values that support sustainability. Additionally, the creation of an institutional environmental governance structure is advised to monitor policies and measure the impact of initiatives, along with the adoption of environmental and innovation performance indicators to assess employees and encourage eco-friendly innovative solutions.

5.4.2 Recommendations for Future Research

The study proposes replicating the model in other sectors to verify the generalizability of the findings and incorporating additional mediating or moderating variables, such as organizational commitment or institutional pressure. It also encourages adopting qualitative or mixed-method designs to gain deeper insights into behavioral dimensions, conducting longitudinal studies to track changes over time, and investigating the impact of cultural and religious factors on leadership styles and Green Innovation patterns in Gulf and broader Arab contexts.

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