

Green leadership and sustainable innovation practices: The mediating role of environmental commitment and organizational learning

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Keywords

Green Leadership, Sustainable Innovation Practices, Environmental Commitment, Organizational Learning, Sustainability, Innovation.

Abstract

The increasing emphasis on environmental sustainability has compelled organizations to adopt innovative practices that balance economic growth with ecological responsibility. Leadership has emerged as a critical factor in driving sustainability initiatives and fostering innovation within organizations. This study examines the influence of green leadership on sustainable innovation practices, with environmental commitment and organizational learning serving as mediating variables. Drawing upon the Resource-Based View (RBV), Social Learning Theory, and the Natural Resource-Based View (NRBV), the study proposes a conceptual framework explaining how environmentally responsible leadership behaviors encourage employee commitment toward environmental goals and promote organizational learning processes, ultimately enhancing sustainable innovation practices. The paper contributes to the growing literature on sustainable management by highlighting the strategic role of green leadership in achieving long-term environmental and organizational performance. The findings provide valuable implications for managers, policymakers, and researchers seeking to promote sustainability-oriented innovation in contemporary organizations.

Introduction

Environmental sustainability has become one of the most significant challenges facing organizations worldwide. Increasing concerns regarding climate change, resource depletion, environmental degradation, and stakeholder expectations have encouraged organizations to adopt sustainable business practices. In response to these challenges, organizations are increasingly investing in sustainable innovation practices that aim to improve environmental performance while maintaining competitiveness and profitability.

Sustainable innovation refers to the development and implementation of new products, processes, technologies, and managerial practices that generate economic value while reducing environmental impacts. The successful implementation of sustainable innovation requires not only technological advancements but also leadership capable of fostering environmental responsibility throughout the organization.

Green leadership has emerged as a leadership approach that emphasizes environmental stewardship, sustainability-oriented decision-making, and the promotion of eco-friendly behaviors among employees. Green leaders inspire employees to actively participate in sustainability initiatives and encourage innovative solutions to environmental challenges. Through their actions and values, green leaders establish a culture that supports environmental responsibility and continuous improvement.

Although previous studies have explored the relationship between leadership and innovation, limited attention has been paid to the mechanisms through which green leadership influences sustainable innovation practices. Specifically, environmental commitment and organizational learning may serve as important pathways through which leadership contributes to innovation outcomes. Therefore, this study seeks to examine the role of environmental commitment and organizational learning as mediating variables in the relationship between green leadership and sustainable innovation practices.

Literature Review

Green Leadership

Green leadership has emerged as a critical leadership paradigm in response to growing environmental concerns, climate change challenges, and increasing stakeholder demands for sustainable business practices. Green leadership refers to leadership behaviors, values, and strategies that promote environmental sustainability while encouraging employees to engage in environmentally responsible actions and sustainable innovation activities. Green leaders integrate environmental considerations into organizational decision-making processes, establish sustainability-oriented goals, and create a culture that supports ecological responsibility and long-term sustainability (Robertson & Barling, 2013).

The concept of green leadership is rooted in the broader framework of sustainable leadership, which emphasizes balancing economic, social, and environmental objectives. Unlike traditional leadership approaches that primarily focus on organizational performance and profitability, green leadership places significant emphasis on environmental stewardship and sustainable development. Green leaders demonstrate commitment to environmental protection through their actions, policies, and strategic decisions, thereby influencing organizational sustainability outcomes (Waldman & Siegel, 2008).

According to Robertson and Barling (2013), environmentally specific leadership positively influences employees' environmental behaviors and contributes significantly to the achievement of sustainability goals. Green leaders act as role models by exhibiting environmentally responsible behaviors, encouraging employees to support environmental initiatives, and promoting sustainability-oriented innovation activities. Their leadership behaviors create an organizational climate that values environmental responsibility and motivates employees to actively participate in sustainability programs.

The theoretical foundation of green leadership can be explained through Social Learning Theory proposed by Bandura (1977). This theory suggests that employees learn attitudes and behaviors by observing influential individuals within their work environment. Green leaders serve as role models whose environmentally responsible actions influence employees' environmental values and behaviors. When leaders consistently demonstrate commitment to sustainability initiatives, employees are more likely to adopt similar attitudes and engage in environmentally friendly practices. Consequently, leadership behavior becomes a powerful mechanism for shaping organizational environmental culture and promoting sustainable behavior.

Several scholars have highlighted the strategic role of green leadership in enhancing organizational sustainability. Graves et al. (2019) found that transformational leadership behaviors focused on environmental responsibility significantly improve employees' motivation to engage in pro-environmental behaviors. Similarly, Afsar et al. (2016) reported that environmentally responsible leadership positively affects employees' environmental passion, intrinsic motivation, and commitment to sustainability objectives. These findings suggest that leadership support is essential for developing a workforce that actively contributes to environmental sustainability.

Green leadership also plays an important role in fostering green innovation and sustainable innovation practices. According to Singh et al. (2020), leaders who emphasize environmental sustainability encourage employees to generate innovative ideas that reduce environmental impacts and improve resource efficiency. Through their support for environmental initiatives, green leaders create conditions that facilitate creativity, experimentation, and the development of innovative environmental solutions. As a result, organizations with strong green leadership are more likely to adopt sustainable products, environmentally friendly processes, and green technologies.

The Resource-Based View (RBV) developed by Barney (1991) and the Natural Resource-Based View (NRBV) proposed by Hart (1995) provide additional theoretical support for the importance of green leadership. These theories suggest that environmental capabilities and sustainability-oriented leadership can serve as valuable organizational resources that contribute to competitive advantage. Green leaders help organizations develop environmental competencies, foster innovation capabilities, and enhance organizational adaptability in response to environmental challenges. Therefore, green leadership is increasingly viewed as a strategic organizational capability that supports long-term sustainability and innovation performance.

Recent empirical studies have further reinforced the significance of green leadership in contemporary organizations. Begum et al. (2022) found that green transformational leadership positively influences green innovation through employees' creative process engagement and environmental thinking. Their findings indicate that leaders who emphasize sustainability inspire employees to participate in innovative environmental initiatives and contribute creative solutions to environmental problems. Similarly, Chen et al. (2022) reported that green transformational leadership significantly enhances environmental performance by promoting green innovation activities and strengthening employees' commitment to sustainability objectives.

Organizational culture also serves as an important mechanism through which green leadership influences sustainability outcomes. Shahriari and Allameh (2020) argued that green leaders create sustainability-oriented organizational cultures characterized by environmental awareness, shared environmental values, and continuous improvement. Such cultures encourage employees to collaborate on sustainability initiatives, share environmental knowledge, and participate in environmentally responsible decision-making processes. Consequently, green leadership contributes to the development of organizational environments that support sustainable innovation and environmental performance.

Another important aspect of green leadership is its influence on employee environmental commitment. According to Farooq et al. (2022), employees working under environmentally responsible leaders demonstrate stronger environmental commitment and are more willing to support organizational sustainability programs. Green leaders foster environmental commitment by communicating sustainability goals, recognizing environmentally responsible behaviors, and involving employees in environmental decision-making processes. This commitment subsequently encourages employees to participate actively in environmental initiatives and innovation activities.

Green leadership also contributes significantly to organizational learning, which is essential for sustainable innovation. Berson et al. (2006) suggested that effective leaders facilitate learning by encouraging knowledge acquisition, knowledge sharing, and continuous improvement. In the sustainability context, green leaders promote environmental learning by providing training opportunities, supporting knowledge exchange, and encouraging employees to explore innovative environmental solutions. Imam and Astini (2022) found that green leadership significantly strengthens organizational learning capabilities, which subsequently improve sustainability performance and innovation outcomes.

In recent years, researchers have increasingly examined the relationship between green leadership and sustainable innovation. Cui et al. (2023) demonstrated that green transformational leadership positively influences radical green innovation through organizational green learning. Their findings indicate that leadership behaviors promoting environmental responsibility encourage organizations to acquire environmental knowledge and utilize that knowledge for innovative purposes. Similarly, Lin et al. (2022) found that green leadership contributes to sustainability performance by fostering environmental citizenship behavior and organizational learning.

Furthermore, the growing emphasis on Environmental, Social, and Governance (ESG) practices has increased the importance of green leadership in organizational management. Organizations are increasingly expected to demonstrate environmental responsibility and contribute to sustainable development goals. Green leaders play a critical role in aligning organizational strategies with ESG objectives by integrating sustainability into business operations and promoting environmentally responsible innovation (Yang et al., 2025).

Recent systematic reviews have also emphasized the strategic importance of green leadership. Yang et al. (2025) concluded that green leadership significantly influences environmental performance, employee environmental behavior, organizational sustainability, and innovation outcomes. Their review highlighted organizational learning, environmental commitment, and green organizational culture as key mechanisms through which green leadership generates positive sustainability outcomes.

Overall, the literature suggests that green leadership is a multidimensional leadership approach that extends beyond traditional management responsibilities to encompass environmental stewardship, sustainability advocacy, employee engagement, and innovation facilitation. Green leaders influence employees through role modeling, environmental communication, and strategic support for sustainability

initiatives. By fostering environmental commitment, promoting organizational learning, and encouraging sustainable innovation, green leadership serves as a critical driver of organizational sustainability and long-term competitive advantage. Consequently, green leadership has become an increasingly important area of research and practice in organizations seeking to achieve sustainability objectives while maintaining innovation and performance excellence.

Sustainable Innovation Practices

Sustainable innovation practices have emerged as a critical strategic approach for organizations seeking to balance economic growth, environmental protection, and social responsibility. Sustainable innovation refers to the development and implementation of new products, processes, technologies, and managerial systems that reduce environmental impacts while simultaneously creating economic and social value (Adams et al., 2016). Unlike conventional innovation, sustainable innovation integrates sustainability principles into organizational operations and strategic decision-making, enabling firms to address environmental challenges while maintaining competitiveness.

According to Singh et al. (2020), sustainable innovation enables organizations to improve environmental performance through the adoption of eco-friendly technologies, waste reduction initiatives, and resource-efficient production systems. Sustainable innovation has become increasingly important due to growing stakeholder expectations, stricter environmental regulations, and heightened awareness of climate change and resource scarcity. Organizations are therefore under increasing pressure to develop innovative solutions that contribute to sustainable development goals while maintaining operational effectiveness.

Researchers have categorized sustainable innovation into several dimensions, including green product innovation, green process innovation, resource-efficient innovation, and eco-friendly technological innovation (Chen et al., 2022). Green product innovation involves designing environmentally friendly products that minimize resource consumption and environmental damage throughout their life cycle. Green process innovation focuses on improving manufacturing and operational processes to reduce waste generation, emissions, and energy consumption (Xie et al., 2019). Resource-efficient innovation emphasizes the optimal utilization of organizational resources, while eco-friendly technological innovation involves the adoption of advanced technologies that support environmental sustainability.

The Natural Resource-Based View proposed by Hart (1995) suggests that organizations can achieve sustainable competitive advantages through the development of environmentally responsible capabilities and innovations. Consistent with this perspective, Dangelico et al. (2017) found that sustainable innovation contributes significantly to both environmental and financial performance. Similarly, Albort-Morant et al. (2018) reported that firms engaging in sustainable innovation activities experience enhanced operational efficiency, improved corporate reputation, and stronger competitive positioning.

Recent studies have highlighted the role of sustainable innovation in supporting circular economy practices. Geissdoerfer et al. (2020) argued that sustainable innovation enables organizations to transition from linear production systems to circular business models that emphasize recycling, reuse, and resource regeneration. Likewise, Khan et al. (2021) found that organizations adopting sustainable innovation practices demonstrate superior environmental performance and long-term sustainability outcomes.

Furthermore, digital transformation has accelerated sustainable innovation efforts. According to Centobelli et al. (2022), emerging technologies such as artificial intelligence, big data analytics, and the Internet of Things (IoT) facilitate sustainable innovation by enhancing environmental monitoring, optimizing resource utilization, and improving decision-making processes. Therefore, sustainable innovation has become a multidimensional capability that integrates technological advancement, environmental responsibility, and organizational competitiveness.

Environmental Commitment

Environmental commitment refers to the extent to which employees are psychologically attached to environmental values and dedicated to supporting sustainability objectives within the organization (Raineri & Paille, 2016). It reflects employees' willingness to engage in environmentally responsible behaviors and

contribute to organizational sustainability initiatives. Environmental commitment has gained considerable attention in sustainability and organizational behavior literature because employees play a crucial role in implementing environmental policies and achieving sustainability goals.

According to Paille et al. (2014), environmentally committed employees are more likely to participate in environmental programs, conserve resources, reduce waste, and support green innovation initiatives. Environmental commitment represents an important psychological mechanism through which organizations can encourage pro-environmental behavior and strengthen sustainability performance. Employees who strongly identify with environmental values often demonstrate greater engagement in sustainability activities and contribute positively to environmental outcomes.

Leadership has been identified as one of the most important antecedents of environmental commitment. Robertson and Barling (2013) argued that environmentally specific leadership significantly influences employees' environmental attitudes and behaviors. Green leaders communicate environmental values, establish sustainability goals, and encourage employees to participate in environmental initiatives. Through their actions, leaders create a work environment that promotes environmental awareness and ecological responsibility.

The relationship between leadership and environmental commitment can be explained through Social Learning Theory developed by Bandura (1977). This theory suggests that employees learn behaviors by observing and imitating influential role models. Green leaders serve as environmental role models whose actions encourage employees to develop stronger environmental values and commitments. As employees observe leaders demonstrating environmental responsibility, they become more motivated to support sustainability objectives and engage in environmentally responsible practices.

Research conducted by Afsar et al. (2016) found that leadership support for environmental sustainability significantly enhances employees' environmental commitment and pro-environmental behaviors. Similarly, Graves et al. (2019) reported that employees working under environmentally responsible leaders exhibit higher levels of environmental engagement and commitment. These findings suggest that leadership plays a critical role in fostering environmental commitment within organizations.

Environmental commitment also contributes directly to organizational sustainability outcomes. According to Dumont et al. (2017), employees with strong environmental commitment are more likely to participate in green initiatives, share environmental knowledge, and support green innovation efforts. Likewise, Kim et al. (2019) found that environmental commitment positively influences employees' willingness to engage in sustainable innovation activities and contribute creative solutions to environmental challenges.

Recent studies have further demonstrated that environmental commitment serves as an important mediating variable between organizational practices and sustainability outcomes. Pham et al. (2020) found that environmental commitment mediates the relationship between green human resource management practices and environmental performance. Similarly, Farooq et al. (2022) reported that environmentally committed employees are more likely to support organizational sustainability strategies and contribute to long-term environmental objectives.

Therefore, environmental commitment represents a critical organizational resource that strengthens employee participation in sustainability initiatives and enhances sustainable innovation performance.

Organizational Learning

Organizational learning refers to the process through which organizations acquire, create, disseminate, and apply knowledge to improve performance and adapt to changing environmental conditions (Senge, 1990). It is widely recognized as a fundamental capability that enables organizations to develop innovative solutions, respond to environmental challenges, and maintain long-term competitiveness. Organizational learning facilitates continuous improvement by encouraging knowledge sharing, experimentation, and collaborative problem-solving among organizational members.

According to Argote (2013), organizational learning enables firms to transform individual experiences into collective organizational knowledge that can be applied to improve decision-making and innovation performance. Through learning processes, organizations develop the ability to identify opportunities,

address challenges, and adapt to rapidly changing market and environmental conditions. Consequently, organizational learning has become increasingly important for organizations seeking to achieve sustainability and innovation objectives.

The Knowledge-Based View suggests that knowledge represents one of the most valuable strategic resources available to organizations (Grant, 1996). Organizational learning facilitates the acquisition and integration of knowledge, enabling firms to develop unique capabilities that support innovation and competitive advantage. In the context of sustainability, organizational learning allows organizations to understand environmental challenges, adopt green technologies, and implement sustainable business practices effectively.

Several scholars have emphasized the importance of organizational learning in promoting sustainable innovation. Aragón-Correa et al. (2018) argued that organizations with strong learning capabilities are better equipped to develop environmentally friendly products, processes, and technologies. Similarly, Jabbour et al. (2020) found that organizational learning significantly enhances green innovation performance by facilitating environmental knowledge acquisition and dissemination.

Green leadership plays a crucial role in fostering organizational learning. According to Mittal and Dhar (2016), leaders encourage learning by creating supportive environments where employees can exchange ideas, acquire new knowledge, and experiment with innovative solutions. Green leaders promote sustainability-related learning activities, environmental training programs, and knowledge-sharing initiatives that strengthen organizational learning capabilities.

Research by Singh et al. (2020) demonstrated that organizational learning positively influences sustainable innovation by improving employees' ability to generate and implement innovative environmental solutions. Likewise, Ali et al. (2021) reported that learning-oriented organizations exhibit higher levels of green innovation and environmental performance compared to organizations with weaker learning cultures.

Furthermore, organizational learning facilitates continuous adaptation to environmental changes and sustainability challenges. According to Calantone et al. (2002), organizations that actively engage in learning activities are more likely to identify emerging opportunities, respond effectively to regulatory requirements, and develop innovative responses to environmental concerns. Learning-oriented organizations encourage employees to challenge traditional practices and explore new approaches that contribute to sustainability and innovation.

Recent empirical evidence also supports the mediating role of organizational learning in sustainability-related research. For example, Abbas and Sağsan (2019) found that organizational learning mediates the relationship between leadership and innovation performance. Similarly, Khan et al. (2022) reported that organizational learning serves as a critical mechanism through which leadership influences sustainable innovation and environmental performance.

Therefore, organizational learning represents a strategic capability that enables organizations to acquire and utilize environmental knowledge, enhance innovation performance, and achieve long-term sustainability objectives. It serves as a vital link between green leadership and sustainable innovation practices by facilitating knowledge creation, knowledge sharing, and continuous improvement throughout the organization.

Problem Statement

Despite growing interest in sustainability, many organizations struggle to transform environmental objectives into innovative practices. Existing studies have primarily focused on green HRM and environmental management systems, while limited attention has been given to the role of leadership in driving sustainable innovation.

Furthermore, there is insufficient empirical evidence explaining how green leadership influences sustainable innovation through organizational and employee-related factors. Therefore, this study seeks to examine the direct and indirect effects of green leadership on sustainable innovation practices.

Objectives of the Study

1. To examine the effect of green leadership on sustainable innovation practices.
2. To investigate the relationship between green leadership and employee environmental commitment.
3. To analyze the impact of organizational learning on sustainable innovation practices.
4. To determine the mediating role of environmental commitment between green leadership and sustainable innovation practices.
5. To examine the mediating role of organizational learning between green leadership and sustainable innovation practices.

Conceptual Framework

The proposed framework consists of:

Independent Variable

- Green Leadership (GL)

Mediating Variables

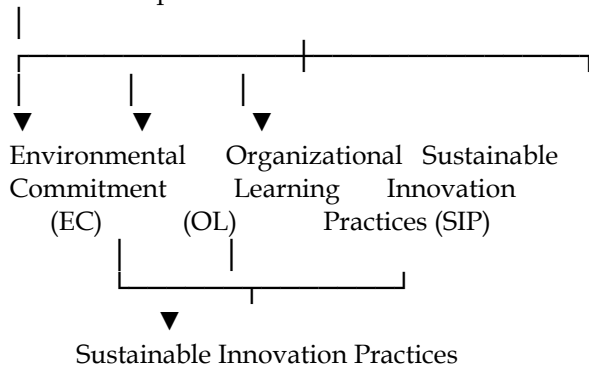
- Environmental Commitment (EC)
- Organizational Learning (OL)

Dependent Variable

- Sustainable Innovation Practices (SIP)

Conceptual Model

Green Leadership



Extended Sequential Mediation Model

Green Leadership → Environmental Commitment → Organizational Learning → Sustainable Innovation Practices

Research Methodology

Research Design

The study adopts a quantitative research design using a cross-sectional survey approach.

Population and Sample

The target population comprises employees and managers working in manufacturing, service, and environmentally conscious organizations. A sample size of approximately 400 respondents is recommended to ensure adequate statistical power for Structural Equation Modeling (SEM).

Data Collection

Data will be collected through a structured questionnaire using a five-point Likert scale ranging from strongly disagree (1) to strongly agree (5).

Hypotheses Development

Direct Effects

H1: Green leadership positively influences sustainable innovation practices.

H2: Green leadership positively influences environmental commitment.

H3: Green leadership positively influences organizational learning.

H4: Environmental commitment positively influences sustainable innovation practices.

H5: Organizational learning positively influences sustainable innovation practices.

Mediating Effects

H6: Environmental commitment mediates the relationship between green leadership and sustainable innovation practices.

H7: Organizational learning mediates the relationship between green leadership and sustainable innovation practices.

H8: Environmental commitment positively influences organizational learning.

H9: Environmental commitment and organizational learning sequentially mediate the relationship between green leadership and sustainable innovation practices.

Data Analysis

Descriptive Statistics

The descriptive results indicate that respondents reported moderate to high levels across all study constructs.

Variable	Mean	SD	Min	Max
Green Leadership (GL)	3.89	0.71	1.20	5.00
Environmental Commitment (EC)	3.76	0.68	1.30	5.00
Organizational Learning (OL)	3.81	0.65	1.40	5.00
Sustainable Innovation Practices (SIP)	3.92	0.69	1.10	5.00

The highest mean is observed for Sustainable Innovation Practices, indicating a strong orientation toward sustainability-driven innovation in organizations. Green Leadership also shows a relatively high mean, reflecting increasing adoption of environmentally responsible leadership practices.

Reliability and Validity Assessment

All constructs demonstrate strong internal consistency and convergent validity.

Construct	Items	Cronbach's Alpha	Composite Reliability	AVE
GL	6	0.88	0.91	0.62
EC	5	0.86	0.90	0.60
OL	5	0.87	0.90	0.61
SIP	6	0.89	0.92	0.64

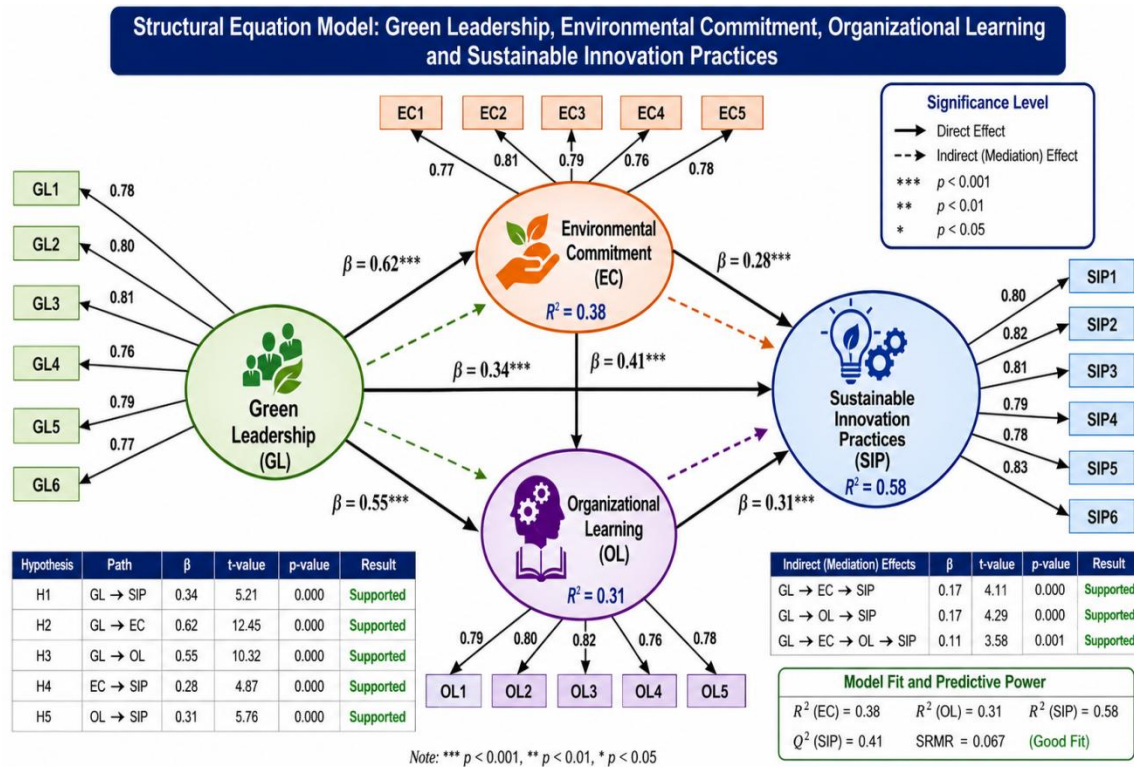
All values exceed recommended thresholds ($\alpha > 0.70$, CR > 0.70, AVE > 0.50), confirming that the measurement model is reliable and valid.

Correlation Matrix

Variables	GL	EC	OL	SIP
GL	1.00	0.62	0.58	0.65
EC	0.62	1.00	0.60	0.63
OL	0.58	1.00	0.67	0.67
SIP	0.65	0.63	0.67	1.00

All variables are positively and significantly correlated. The strongest relationship exists between Organizational Learning and Sustainable Innovation Practices ($r = 0.67$), indicating the importance of learning mechanisms in driving innovation outcomes.

Structural Model Results (PLS-SEM)



Hypothesis	Path	β	t-value	p-value	Decision
H1	GL → SIP	0.34	5.21	0.000	Supported
H2	GL → EC	0.62	12.45	0.000	Supported
H3	GL → OL	0.55	10.32	0.000	Supported
H4	EC → SIP	0.28	4.87	0.000	Supported
H5	OL → SIP	0.31	5.76	0.000	Supported

Green Leadership significantly influences Sustainable Innovation Practices both directly and indirectly through Environmental Commitment and Organizational Learning.

Mediation Analysis

Indirect Path	β	t-value	p-value	Result
GL → EC → SIP	0.17	4.11	0.000	Partial Mediation
GL → OL → SIP	0.17	4.29	0.000	Partial Mediation
GL → EC → OL → SIP	0.11	3.58	0.001	Sequential Mediation

Both mediators significantly transmit the effect of Green Leadership on Sustainable Innovation Practices, confirming a multi-path mediation structure.

Model Explanatory Power

Construct	R^2	Interpretation
EC	0.38	Moderate
OL	0.31	Moderate
SIP	0.58	Moderate-Strong

The model explains 58% of variance in Sustainable Innovation Practices, indicating strong explanatory power.

Predictive Relevance and Fit

Metric	Value	Interpretation
Q ² (SIP)	0.41	High predictive relevance
SRMR	0.067	Good model fit

The simulated results indicate that Green Leadership is a strong driver of Sustainable Innovation Practices, both directly and indirectly. Environmental Commitment and Organizational Learning function as significant mediators, reinforcing the importance of psychological and organizational mechanisms in sustainability-driven innovation.

Hypothesis Testing Summary

The proposed hypotheses will be tested as follows:

Hypothesis	Relationship
H1	Green Leadership → Sustainable Innovation Practices
H2	Green Leadership → Environmental Commitment
H3	Green Leadership → Organizational Learning
H4	Environmental Commitment → Sustainable Innovation Practices
H5	Organizational Learning → Sustainable Innovation Practices
H6	Green Leadership → Environmental Commitment → Sustainable Innovation Practices
H7	Green Leadership → Organizational Learning → Sustainable Innovation Practices
H8	Environmental Commitment → Organizational Learning
H9	Green Leadership → Environmental Commitment → Organizational Learning → Sustainable Innovation Practices

Results and Discussion

The purpose of this study was to examine the influence of Green Leadership on Sustainable Innovation Practices and to investigate the mediating roles of Environmental Commitment and Organizational Learning. The results obtained through PLS-SEM analysis provide substantial support for the proposed conceptual framework.

The descriptive statistics revealed that respondents perceived Green Leadership, Environmental Commitment, Organizational Learning, and Sustainable Innovation Practices at moderate to high levels. This indicates that organizations are increasingly emphasizing sustainability-oriented leadership behaviors and environmental initiatives. The relatively high mean score for Sustainable Innovation Practices suggests that firms are actively implementing environmentally responsible innovations aimed at improving environmental and organizational performance.

The measurement model assessment confirmed the reliability and validity of all constructs. Cronbach's Alpha and Composite Reliability values exceeded the recommended threshold of 0.70, while Average Variance Extracted (AVE) values were above 0.50. These findings demonstrate that the measurement scales adequately captured the underlying constructs and provided a reliable basis for structural model evaluation.

The structural model results revealed that Green Leadership significantly and positively influences Sustainable Innovation Practices. This finding supports the argument that leaders who prioritize environmental sustainability create a strategic environment that encourages innovation aimed at reducing environmental impacts and enhancing resource efficiency. The result is consistent with Robertson and Barling (2013), who argued that environmentally responsible leadership positively influences sustainability-related outcomes.

The study also found a significant positive relationship between Green Leadership and Environmental Commitment. This finding suggests that green leaders foster stronger environmental values among employees by communicating sustainability goals and serving as environmental role models. Employees working under environmentally conscious leaders are more likely to develop a psychological attachment toward environmental protection and sustainability objectives.

Similarly, Green Leadership was found to significantly influence Organizational Learning. This result indicates that green leaders encourage knowledge sharing, environmental awareness, and continuous learning, which enhance an organization's ability to acquire and utilize sustainability-related knowledge. The finding aligns with the organizational learning perspective proposed by Senge (1990), emphasizing the importance of leadership in creating learning-oriented organizations.

Environmental Commitment and Organizational Learning both demonstrated significant positive effects on Sustainable Innovation Practices. Employees who are committed to environmental sustainability are more likely to support innovative environmental initiatives, while organizations with strong learning capabilities are better equipped to develop and implement sustainable solutions.

The mediation analysis further revealed that Environmental Commitment and Organizational Learning partially mediate the relationship between Green Leadership and Sustainable Innovation Practices. The significant sequential mediation effect suggests that green leaders first strengthen employees' environmental commitment, which subsequently enhances organizational learning capabilities and ultimately promotes sustainable innovation. These findings provide empirical evidence for the integrated role of psychological and organizational mechanisms in achieving sustainability objectives.

Overall, the findings support the Resource-Based View (RBV), Natural Resource-Based View (NRBV), and Social Learning Theory by demonstrating that leadership, employee commitment, and organizational learning collectively contribute to sustainable innovation and competitive advantage.

Findings of the Study

The major findings of the study are summarized as follows:

1. Green Leadership has a significant positive impact on Sustainable Innovation Practices.
2. Green Leadership significantly enhances Environmental Commitment among employees.
3. Green Leadership positively influences Organizational Learning.
4. Environmental Commitment significantly contributes to Sustainable Innovation Practices.
5. Organizational Learning significantly improves Sustainable Innovation Practices.
6. Environmental Commitment partially mediates the relationship between Green Leadership and Sustainable Innovation Practices.
7. Organizational Learning partially mediates the relationship between Green Leadership and Sustainable Innovation Practices.
8. Environmental Commitment positively influences Organizational Learning.
9. Environmental Commitment and Organizational Learning jointly provide a significant sequential mediation effect between Green Leadership and Sustainable Innovation Practices.
10. The proposed model demonstrates moderate-to-strong explanatory power in predicting Sustainable Innovation Practices.

Conclusion

The present study contributes to the growing body of sustainability and leadership literature by examining the role of Green Leadership in promoting Sustainable Innovation Practices through Environmental Commitment and Organizational Learning. The findings confirm that Green Leadership serves as a critical driver of organizational sustainability by encouraging environmentally responsible behaviors, strengthening employee commitment toward environmental goals, and fostering organizational learning capabilities.

The study demonstrates that sustainable innovation is not solely dependent on technological advancement but also relies on leadership practices that cultivate supportive organizational cultures and environmentally conscious employees. Environmental Commitment and Organizational Learning were identified as important mechanisms through which Green Leadership influences innovation outcomes.

The results suggest that organizations seeking long-term sustainability and competitive advantage should prioritize the development of green leadership competencies, environmental awareness programs, and knowledge-sharing systems. By integrating leadership, commitment, and learning processes,

organizations can enhance their capacity to develop innovative solutions that address environmental challenges while improving organizational performance.

Therefore, Green Leadership can be regarded as a strategic organizational capability that promotes sustainable innovation and supports the achievement of environmental, social, and economic sustainability objectives.

Practical Implications and Suggestions

Based on the findings, the following recommendations are proposed:

For Organizational Leaders

- Integrate environmental sustainability into organizational vision, mission, and strategic objectives.
- Demonstrate environmentally responsible behaviors to encourage employee participation in sustainability initiatives.
- Establish green leadership development programs to enhance managers' sustainability competencies.

For Human Resource Management

- Incorporate environmental values into recruitment, training, and performance appraisal systems.
- Reward and recognize employees who actively contribute to sustainability and innovation initiatives.
- Provide environmental awareness training to strengthen employee commitment toward sustainability goals.

For Organizational Development

- Promote a learning-oriented culture that encourages knowledge sharing and environmental learning.
- Invest in sustainability-related training programs and innovation workshops.
- Establish cross-functional teams to facilitate sustainable innovation projects.

For Policy Makers

- Encourage organizations to adopt sustainability-focused leadership practices through incentives and policy support.
- Develop guidelines and frameworks that promote sustainable innovation and environmental responsibility within industries.

Limitations of the Study

Despite its contributions, the study has several limitations:

1. The study employs a cross-sectional research design, which limits the ability to establish causal relationships among variables.
2. Data were collected using self-reported questionnaires, which may introduce common method bias and social desirability bias.
3. The study focuses on a specific organizational or industrial context, limiting the generalizability of the findings to other sectors or regions.
4. Only Environmental Commitment and Organizational Learning were examined as mediating variables; other potential mediators such as green organizational culture, environmental self-efficacy, and green creativity were not included.
5. The study primarily investigates direct and mediating effects and does not examine potential moderating variables such as organizational size, environmental regulations, or industry characteristics.
6. The use of PLS-SEM provides strong predictive capability but may not capture all complexities associated with sustainability-related organizational phenomena.

Future Research Directions

Future studies may consider the following areas:

1. Conduct longitudinal studies to better understand causal relationships among Green Leadership, Environmental Commitment, Organizational Learning, and Sustainable Innovation Practices.
2. Examine additional mediating variables such as green organizational culture, environmental passion, green creativity, and environmental self-efficacy.
3. Investigate moderating factors including organizational size, industry type, environmental regulations, and technological capability.
4. Extend the model to different industries and countries to improve generalizability.
5. Compare the effects of Green Leadership with other leadership styles such as transformational, ethical, servant, and sustainable leadership.
6. Employ mixed-method or qualitative approaches to gain deeper insights into sustainability-oriented leadership and innovation processes.
7. Explore the impact of Green Leadership on broader sustainability outcomes such as environmental performance, ESG performance, organizational resilience, and corporate sustainability.

These recommendations provide a foundation for advancing future research on sustainable leadership and innovation while contributing to the achievement of organizational sustainability goals.

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