LEADERSHIP AND GREEN INNOVATION ADOPTION: A SYSTEMATIC REVIEW

Pao VIROJPHAN[1]
1 School of Management Science, Sukhothai Thammathirat Open University, Thailand; pao.vir@stou.ac.th

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ABSTRACT
The accelerating urgency of climate change has made green innovation a strategic imperative. Defined as the design, development, and implementation of sustainable products, processes, and practices, green innovation enables firms to combine environmental stewardship with competitive advantage. Leadership has emerged as a critical enabler, guiding organizations toward proactive sustainability strategies and innovation adoption. This systematic review, conducted in line with PRISMA 2020 guidelines, analyzed thirty peer-reviewed studies published between 2015 and 2025. The synthesis addresses three guiding research questions. First, leadership styles--including entrepreneurial, transformational, servant, ethical, and authentic--differentially influence adoption by reframing environmental challenges, motivating pro-environmental behavior, and fostering long-term responsibility. Second, mediating and moderating mechanisms such as organizational learning, dynamic capabilities, absorptive capacity, strategic flexibility, and institutional conditions explain how leadership intent translates into innovation outcomes and why effects vary across contexts. Third, theoretical frameworks including the Resource-Based View, Dynamic Capabilities Theory, and Upper Echelons Theory clarify how leadership shapes sustainability transitions, though integration across levels remains limited. This review advances understanding of leadership's role in green innovation and identifies gaps for future research, including the need for longitudinal, multi-level, and cross-cultural studies. Practically, the findings highlight the importance of embedding sustainability in leadership development, governance systems, and policy ecosystems. Overall, leadership emerges as a strategic asset for enabling green innovation adoption and advancing organizational and societal sustainability transitions.
Keywords: Leadership Styles, Green Innovation Adoption, Sustainability-oritented Leadership, Dynamic Capabilities, Upper Echelons Theory

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INTRODUCTION

The accelerating urgency of environmental degradation and climate change has transformed green innovation from a peripheral concern into a strategic imperative. Green innovation--encompassing the design, development, and implementation of sustainable products, processes, and practices--enables firms to integrate environmental stewardship with competitiveness (Chen, 2008; Dangelico & Pujari, 2010). As regulatory frameworks tighten and stakeholder expectations evolve, organizations increasingly view sustainability as a source of strategic advantage (Graves et al., 2013).

Within this context, leadership has emerged as a decisive factor in advancing sustainability-oriented innovation. Leaders shape organizational vision, allocate resources, foster environmental values, and mobilize change. Transformational, servant, ethical, and authentic leadership have each been linked to pro-environmental behavior and innovation outcomes (Bass & Riggio, 2006; Walumbwa et al., 2008; Zafar et al., 2025). Yet leadership influence does not operate in isolation. Organizational learning, dynamic capabilities, and absorptive capacity mediate these effects (Ali et al., 2023; Taleb & Pheniqi, 2023; Riaz et al., 2024), while contextual moderators such as institutional conditions and strategic flexibility shape outcomes (Ha et al., 2022; Owolabi et al., 2025).

Theoretical perspectives further clarify this nexus. The Resource-Based View emphasizes leadership as a rare and inimitable resource (Barney, 1991). Dynamic Capabilities Theory highlights leaders' roles in sensing, seizing, and reconfiguring resources for sustainability (Teece, Pisano, & Shuen, 1997; Lin & Wu, 2014). Upper Echelons Theory underscores how executives' values and cognitive frames shape green innovation strategies (Hambrick & Mason, 1984).

Despite these insights, scholarship remains fragmented, with limited integration across individual, organizational, and institutional levels. To address this gap, this review systematically examines how leadership styles influence green innovation adoption, through what mechanisms, and under which theoretical lenses. It responds to three guiding research questions:

RQ1: How do different leadership styles influence green innovation adoption?
RQ2: What mediating and moderating mechanisms shape this relationship?
RQ3: What theoretical frameworks underpin this relationship?

LITERATURE REVIEWS

Leadership Styles and Green Innovation Adoption

Leadership styles are central to understanding how organizations adopt green innovation. Transformational leadership motivates employees to align creativity with sustainability goals through vision, inspiration, and intellectual stimulation (Bass & Riggio, 2006; AlNuaimi et al., 2021; Lee & Huang, 2024). Servant leadership emphasizes stewardship and long-term stakeholder commitment, fostering conditions conducive to sustainable innovation (Zafar et al., 2025). Ethical leadership shapes organizational culture through moral modeling (Hameed et al., 2023), while authentic leadership promotes transparency and psychological safety, enabling pro-environmental practices (Walumbwa et al., 2008). Chen and Chang (2013) link green transformational leadership to dynamic capabilities and creativity, illustrating how leadership vision translates into sustainable product innovation.

Mediating and Moderating Mechanisms

Leadership effectiveness in driving green innovation operates through mediators and is shaped by moderators. Organizational learning culture enables knowledge exchange and experimentation (Ali et al., 2023). Green dynamic capabilities and absorptive capacity enhance adaptability and integration of environmental knowledge, translating leadership intent into tangible outcomes (Taleb & Pheniqi, 2023; Riaz et al., 2024). Contextual moderators condition

these effects: environmental turbulence, institutional pressures, and strategic flexibility influence whether leadership behaviors translate into innovation success (Ali et al., 2023; Ha et al., 2022; Owolabi et al., 2025). Singh et al. (2020) show that green transformational leadership enhances innovation when supported by green human resource management practices, highlighting employee empowerment as a key mediator. The hierarchical nature of factors influencing green innovation has also been explored. de Medeiros et al. (2018) proposed a relationship system for green innovation in Brazilian manufacturing, identifying R&D investments and leader proactivity as foundational elements, followed by intermediate conditions such as elimination of cultural barriers and critical reflexive analysis, which then enable cross-functional collaboration and market knowledge to drive compliance and customer satisfaction.

Theoretical Perspectives

Several theoretical frameworks underpin the study of leadership and green innovation. The Resource-Based View positions leadership as a rare and valuable resource that builds strategic advantage (Barney, 1991). Dynamic Capabilities Theory expands this by emphasizing leaders' roles in sensing, seizing, and reconfiguring resources for sustainability (Teece et al., 1997; Lin & Wu, 2014). Upper Echelons Theory explains how executives' values, experiences, and cognitive frames shape strategic innovation decisions (Hambrick & Mason, 1984). While the Resource-Based View (RBV), Dynamic Capabilities Theory, and Upper Echelons Theory (UET) each provide distinct insights, their interrelationships remain underexplored. Collectively, these perspectives suggest that leadership acts as a strategic resource (RBV), enables the sensing, seizing, and reconfiguring of capabilities (Dynamic Capabilities), and reflects leaders' values and cognitive frames (UET). An integrative perspective positions leadership at the nexus of resources, dynamic adaptability, and executive cognition, thereby offering a multi-level explanation of how leaders advance green innovation adoption.

Context-Specific Considerations

The applicability of innovation diffusion factors varies across contexts, particularly in resource-constrained settings. Chaudhary and Kumar (2021) in a study of hospitals in Bihar, India, found that innovation characteristics (relative advantage, compatibility, simplicity, trialability) significantly predicted adoption of environmental sustainability innovations, while adopter characteristics (innovativeness, environmental opinion leadership) showed no significant impact. This suggests that in resource-scarce environments, the tangible attributes of innovations may matter more than organizational or individual change readiness.

Research Gaps

Despite growing evidence, several critical gaps warrant attention. First, the literature exhibits limited diversity in leadership constructs, with transformational leadership dominating empirical work. Second, theoretical integration remains fragmented, with studies typically invoking single theoretical lenses rather than integrating micro-level (individual traits), meso-level (organizational capabilities), and macro-level (institutional forces) explanations. Third, methodological limitations persist: over 70% of studies employ cross-sectional designs that preclude causal inference, and most focus on developed economies. Fourth, the interplay between formal governance structures and informal leadership practices requires deeper examination. Finally, few studies explore how digital transformation reshapes the leadership-green innovation nexus. Addressing these gaps requires longitudinal, multi-level, and cross-cultural designs.

RESEARCH METHODOLOGY

This study adopts a systematic review approach following PRISMA 2020 guidelines (Page et al., 2021). The review process involved four stages: identification, screening, eligibility assessment, and synthesis. The eligibility criteria included peer-reviewed journal articles

published in English between January 2015 and June 2025 that explicitly examined the relationship between leadership models and green innovation adoption. Non-peer-reviewed sources such as conference papers, dissertations, and reports were excluded. A comprehensive search was conducted across seven databases--Web of Science, Scopus, EBSCOhost, Emerald Insight, ScienceDirect, JSTOR, and SpringerLink. Boolean search strings combining keywords on leadership and green innovation were adapted to each database's features. All records were exported to reference management software, de-duplicated, and initially screened by title and abstract. The remaining studies underwent full-text review to confirm eligibility. The selection process is summarized in Figure 1.

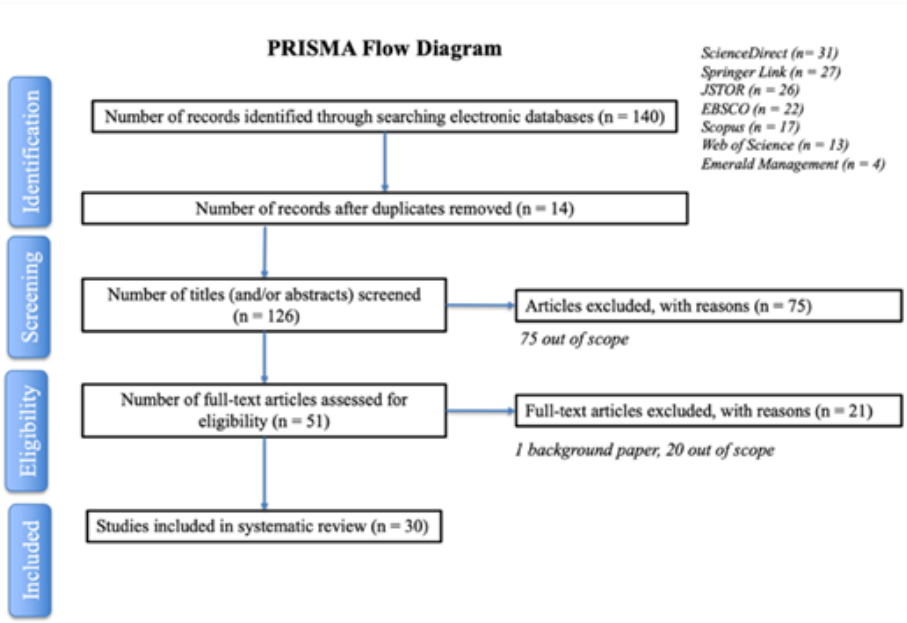


Figure 1 The PRISMA Flow Diagram

For each included study, data were systematically extracted into a structured spreadsheet capturing bibliographic details, methodology, leadership style(s), and key findings. Thematic analysis was employed through iterative coding, theme generation, and refinement.

Although this review did not apply a standardized risk-of-bias tool, methodological rigor was maintained through explicit inclusion and exclusion criteria, triangulation across diverse study designs, and reliance on peer-reviewed sources. Established tools such as the ROBIS framework (Whiting et al., 2016) and the Cochrane Risk of Bias tool (Higgins et al., 2011) represent valuable directions for future reviews.

RESEARCH RESULTS

This systematic review reveals that leadership plays a pivotal role in green innovation adoption through five key dimensions: leadership styles and attributes, strategic actions, organizational capability development, contextual moderators, and institutional structures.

Leadership Styles and Attributes

Different leadership styles influence green innovation through distinct mechanisms. Entrepreneurial leaders reframe environmental challenges as opportunities (Ali et al., 2023), while green transformational leaders motivate employees and align vision with sustainability goals (Ahsan, 2023; Huang et al., 2021; Tian et al., 2023). Innovative and ambidextrous leadership support adaptability (Al-Ayed, 2024; Hossain et al., 2024), whereas stewardship leadership emphasizes long-term moral responsibility (Dominguez-Escrig et al., 2019). Individual traits such as environmental values, gender, education, and cognitive framing shape sustainability decisions (Ha et al., 2022; H. Zhang et al., 2020). Female leadership strengthens

the market-innovation link (Galbreath, 2019), while CEO hubris undermines outcomes (Zhang et al., 2020).

Strategic Actions and Mechanisms

Leaders advance green innovation by articulating sustainability-oriented vision and mobilizing resources. Vision aligns innovation with long-term goals (Ali et al., 2023; Wijethilake et al., 2018), while commitment ensures financial, technological, and human resources (Al-Ayed, 2024). Leaders shape culture by fostering experimentation and psychological safety (Harasis et al., 2024; Paluseri, 2025). At the organizational level, leadership facilitates supply chain learning and trust-building (Ahmadi-Gh & Bello-Pintado, 2024).

Organizational Capability Development

Leadership strengthens capabilities critical to green innovation. Entrepreneurial and transformational leaders embed sustainability into learning and knowledge systems (Ali et al., 2023). Green knowledge management mediates the link between leadership support and innovation (AlNuaimi et al., 2021), while green transformational leadership enhances adaptability and collaboration (Dzhengiz & Niesten, 2020; Taleb & Pheniqi, 2023).

Contextual Moderators

Leadership impact is contingent on organizational and external conditions. Internally, strategic flexibility and absorptive capacity amplify leadership effects (Huang et al., 2021; Riaz et al., 2024). Externally, institutional pressures, policy uncertainty, and market turbulence shape outcomes (Galbreath, 2019; Owolabi et al., 2025).

Institutional Structures and Systems

Leadership operates through institutional systems that embed sustainability into governance. CSR-linked executive compensation aligns managerial incentives with environmental goals (Flammer et al., 2019). Board independence and founder CEOs strengthen advanced innovations (Xia et al., 2024). Chief Sustainability Officers act as institutional anchors, integrating environmental objectives across functions (Wiengarten et al., 2017).

DISCUSSION & CONCLUSION

This review examined how leadership contributes to green innovation adoption by synthesizing evidence across styles, mechanisms, and theoretical foundations, directly addressing the three research questions. First, regarding leadership styles (RQ1), entrepreneurial, transformational, servant, ethical, and authentic leadership foster green innovation through distinct pathways. Entrepreneurial leaders frame environmental issues as opportunities, while transformational leaders inspire pro-environmental behavior. Servant and stewardship leaders emphasize long-term responsibility, and ethical or authentic leaders shape organizational climates that encourage transparency and engagement.

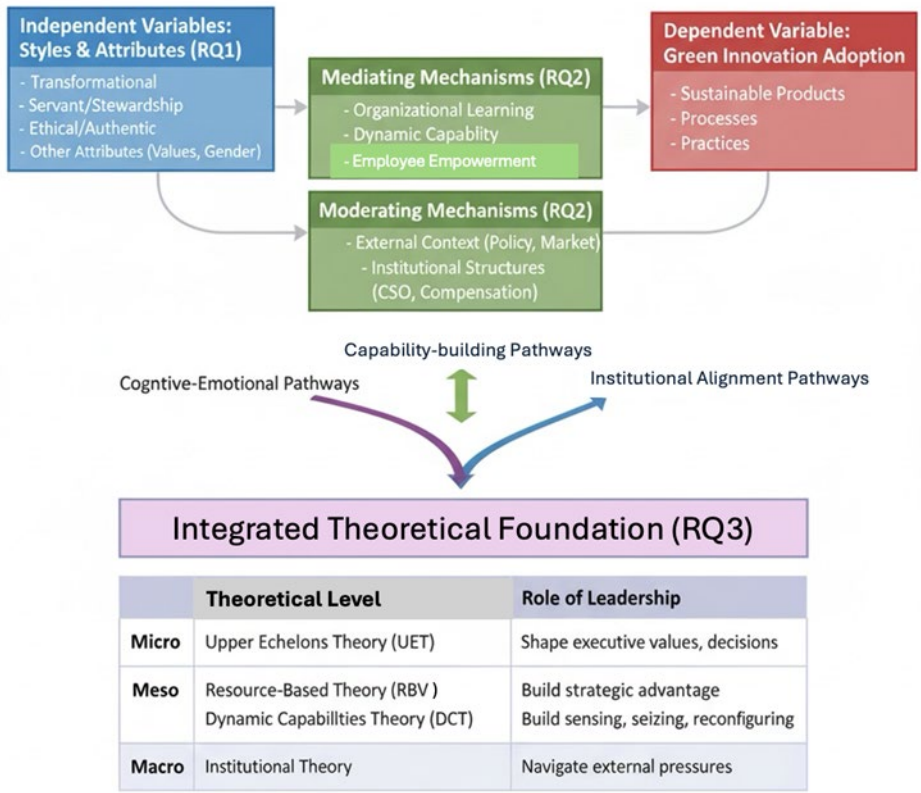
Second, with respect to mediating and moderating mechanisms (RQ2), leadership operates through organizational learning, green dynamic capabilities, absorptive capacity, and employee empowerment, while outcomes are shaped by strategic flexibility, institutional pressures, and political risk. This underscores a contingency perspective: leadership effectiveness depends on both leader behavior and organizational readiness.

Third, concerning theoretical foundations (RQ3), the literature draws on RBV, DCT, and UET to explain how leadership shapes innovation. These frameworks highlight leadership as both a strategic resource and a driver of adaptability, while linking executive cognition to sustainability decisions. Yet theoretical integration remains limited, with few multi-level models connecting individual agency, organizational processes, and institutional structures.

Theoretical Integration: A Multilevel Framework

To advance understanding beyond fragmented perspectives. This study proposes an integrated multilevel framework connecting RBV, DCT, and UET. At the micro level, UET explains how individual leader characteristics shape strategic attention to sustainability. At the meso level,

RBV positions leadership as a rare, valuable resource, while DCT explains how leaders build organizational capabilities for sensing, seizing, and reconfiguring operations. At the macro level, institutional theory contextualizes how external pressures condition leadership effectiveness. Strategic flexibility and absorptive capacity moderate these relationships by determining organizational readiness to translate leadership vision into innovation outcomes.
This framework reveals three key mechanisms: 1) cognitive-emotional pathways, where leaders frame sustainability as opportunity; 2) capability-building pathways, where leaders develop learning cultures and knowledge systems; and 3) institutional alignment pathways, where leaders navigate regulatory landscapes through governance structures. Leadership effectiveness is contingent on organizational readiness and external conditions. Figure 2 illustrates this conceptual integration.



	Theoretical Level	Role of Leadership
Micro	Upper Echelons Theory (UET)	Shape executive values, decisions
Meso	Resource-Based Theory (RBV) Dynamic Capabillties Theory (DCT)	Build strategic advantage Build sensing, seizing, reconfiguring
Macro	Institutional Theory	Navigate external pressures

Figure 2 Integrated Theoretical Framework of Leadership and Green Innovation Adoption

Practical Implications

The findings offer concrete guidance for organizations. First, leadership development programs should embed sustainability competencies explicitly, including environmental literacy, systems thinking, stakeholder engagement, and change management. Second, succession planning should incorporate green leadership criteria, assessing candidates' track records and values alignment. Third, governance mechanisms should align incentives with sustainability outcomes through environmental performance metrics in executive compensation, board-level sustainability committees, and environmental criteria in capital allocation. Fourth, organizations should invest in infrastructure supporting green innovation: establishing Chief Sustainability Officer positions, creating green knowledge management systems, building absorptive capacity, and fostering psychological safety.
For policymakers, regulatory frameworks should create enabling conditions: providing tax incentives for green R&D, establishing knowledge exchange platforms, supporting leadership training programs, and reducing uncertainty through clear policy signals. Industry associations can facilitate peer learning networks where leaders share sustainability strategies.

Limitations and Future Research

Despite encouraging evidence, several limitations warrant caution. Much research is geographically concentrated in Asia and Europe, raising concerns about generalizability. Methodological diversity is evident, yet publication bias may privilege positive results. Furthermore, while transformational and entrepreneurial leadership are frequently examined, evidence on servant, authentic, and ethical leadership remains inconclusive.

The evidence regarding the relative importance of different leadership styles remains mixed. While transformational leadership shows the strongest empirical support across contexts, the effectiveness of servant, authentic, and ethical leadership appears more context-dependent, with outcomes varying significantly based on organizational culture, industry sector, and geographic region. Additionally, most studies report positive associations between leadership and green innovation, potentially reflecting publication bias favoring significant results over null findings. This imbalance may overestimate the strength and consistency of leadership effects, underscoring the need for more balanced reporting of both positive and non-significant outcomes.

Future research should employ longitudinal, multi-level, and cross-cultural designs that integrate micro-, meso-, and macro-level perspectives. In particular, future studies should extend beyond transformational and entrepreneurial leadership by explicitly examining shared leadership, responsible leadership, and distributed leadership models. These approaches emphasize collaborative decision-making, ethical responsibility, and the diffusion of authority, which may offer new insights into how leadership fosters green innovation adoption across diverse organizational contexts.

In conclusion, leadership emerges as a strategic asset for advancing green innovation adoption. By shaping vision, building capabilities, and navigating contextual challenges, leaders play a pivotal role in driving organizational and societal sustainability transitions.

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