

Leadership in Leveraging Carbon Finance to Empower Green Startups and Drive Sustainable Entrepreneurship

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Abstract

This conceptual paper explores how leadership enables green startups to effectively leverage carbon finance mechanisms and advance sustainable entrepreneurship. Anchored in illustrative case analysis, the study identifies key leadership behaviors that facilitate engagement with emissions trading systems, carbon credit markets, and green bond financing. By examining how leadership influences organizational strategy, resource acquisition, and external positioning, the paper highlights the pivotal role of leadership in overcoming institutional and financial barriers to low-carbon innovation. The resulting propositions offer a foundation for future empirical research and contribute to the broader understanding of leadership's role in shaping entrepreneurial outcomes within emerging sustainability-oriented financial ecosystems.

Keywords: Leadership, Carbon Finance, Green Startups, Sustainable Entrepreneurship, Conceptual Framework

Introduction

Background and Context

The accelerating global imperative to limit climate change has placed green startups at the forefront of sustainable innovation (Kothari, 2024). These ventures, spanning sectors such as renewable energy, sustainable agriculture, and cleantech, bridge technological ingenuity with environmental stewardship (Eshbayev et al., 2024). At the same time, carbon finance mechanisms-namely emissions trading systems (ETS), voluntary carbon credit markets, and green bond issuance-have emerged as critical channels for mobilizing capital toward decarbonization. Yet, while these instruments can unlock investment, their complexity and institutional requirements often place them beyond the reach of resource-constrained startups. Leadership within green ventures thus occupies a central position in translating

high-level policy architectures into actionable strategies that secure carbon-finance resources and catalyze low-carbon growth (Shapoval & Niedziółka, 2025).

Research Problem and Significance

Despite extensive research on the design and market impacts of carbon finance, the organizational dynamics that facilitate or impede startup participation remain underexamined. In particular, there is limited understanding of how specific leadership behaviors and strategic orientations enable green startups to overcome regulatory hurdles, build credibility with investors, and integrate carbon finance into their growth trajectories. Addressing this gap is essential: without effective leadership, promising low-carbon technologies may stall in pilot phases, and the broader diffusion of sustainable business models may be constrained. By illuminating the leadership dimensions that underpin successful carbon-finance engagement, this study aims to enrich sustainable entrepreneurship theory and inform practitioners and policymakers seeking to strengthen the innovation ecosystem.

Research Objectives and Questions

This paper adopts a qualitative, illustrative case methodology to develop a conceptual framework linking leadership behaviors to carbon-finance utilization and startup performance. It seeks to: (1) identify the leadership practices that most effectively secure access to ETS, carbon credits, and green bonds; (2) explain how these practices shape organizational strategy, resource acquisition, and external positioning; and (3) articulate propositions that capture the pathways through which leadership drives low-carbon innovation. Accordingly, the study addresses three core questions: Which leadership behaviors enable green startups to navigate complex carbon-finance architectures? How do these behaviors translate policy instruments into operational and financial outcomes? And in what ways does leadership-driven carbon-finance engagement contribute to revenue growth, market expansion, and emissions reduction? By answering these questions, the paper provides a theoretical foundation and practical guidance for leveraging leadership to empower green startups within evolving sustainability-oriented financial ecosystems.

Literature Review

Carbon Finance Mechanisms

Carbon finance encompasses a suite of market-based instruments designed to internalize the external costs of greenhouse gas emissions and direct capital toward decarbonization (Shapoval & Niedziółka, 2025). Emissions Trading Systems (ETS) establish a capped allowance that firms can buy and sell, creating a price signal for emissions reduction (Grosjean, 2017). Voluntary carbon credit markets enable entities to purchase verified offsets—each representing one tonne of CO₂-equivalent reduction—from projects such as reforestation or renewable energy installations (Long & Goulder, 2023). Green bonds extend debt capital earmarked specifically for environmentally beneficial investments, including clean-energy infrastructure and carbon capture technologies (Chesini & Poufinas, 2023). While these mechanisms have matured in major jurisdictions, their administrative complexity, high transaction costs, and stringent verification requirements often hinder participation by small and early-stage firms (Nikpay & Halvorson, 2023).

Green Startups and Sustainable Entrepreneurship

Green startups integrate environmental objectives into their core business models, seeking to deliver both economic returns and measurable sustainability outcomes (Sanyal, 2024). Characterized by mission-driven cultures, these ventures operate under conditions of high uncertainty due to evolving regulatory landscapes and nascent market infrastructures (Malynovskyy et al., 2023). Empirical research highlights two interrelated challenges: securing early-stage funding in the face of long payback periods and demonstrating credibility to investors and customers (Dumont, 2024). Moreover, fragmented carbon-finance markets and institutional voids in many regions exacerbate resource constraints, delaying the commercialization and scaling of low-carbon innovations (Polzin, 2017).

Strategic Leadership in Sustainable Innovation

Leadership has emerged as a pivotal driver of sustainable innovation, shaping organizational capabilities and stakeholder relationships necessary for green ventures to thrive (Salgado Escobar et al., 2022). Transformational leadership—characterized by vision articulation and inspirational motivation—aligns internal teams around a sustainability agenda (Bangbon et al., 2023). Transactional leadership reinforces compliance and performance through rewards and penalties. Beyond these paradigms, institutional entrepreneurship theory highlights leaders' capacity to reshape regulatory and normative frameworks, while network leadership emphasizes the role of boundary-spanning activities in forging cross-sector partnerships (Dong, 2023). However, most studies focus on large corporations or policy actors, leaving a theoretical lacuna regarding how leadership behaviors concretely enable green startups to access and deploy carbon-finance tools.

Research Gap

Despite robust literature on carbon finance design and leadership in sustainability transformations, there is limited research integrating these domains to explain how leadership within green startups mediates the complex pathways into ETS, carbon credit markets, and green bond issuance. Specifically, the mechanisms by which visionary articulation, stakeholder advocacy, and network mobilization translate high-level policy architectures into tangible financing outcomes remain underdeveloped. This paper responds to this gap by employing an illustrative case approach to develop and refine a conceptual framework that explicates the leadership-driven processes enabling sustainable entrepreneurship through carbon finance.

Theoretical Framework

Theoretical Foundations

This paper draws on three complementary streams of leadership theory to ground our analysis of green startups' engagement with carbon finance:

Transformational and Transactional Leadership

Transformational leaders articulate a compelling vision and inspire followers to transcend short-term self-interest for collective goals, while transactional leaders emphasize goal setting and reward-based compliance (Praneeth & M.D., 2023; Bass & Avolio, 1993). In the context of green startups, visionary articulation may align internal efforts around decarbonization strategies, whereas transactional practices ensure operational rigor in navigating carbon-finance processes.

Institutional Entrepreneurship

Institutional entrepreneurs leverage agency to challenge, reinterpret, or reshape prevailing regulatory and normative regimes, thereby creating new opportunity spaces (Gresock, 2024; Garud et al., 2007). Green startup leaders acting as institutional entrepreneurs can influence policy interpretation or advocate for more inclusive carbon-finance provisions, reducing systemic barriers to market entry.

Network Leadership

From a network perspective, leaders serve as boundary spanners who cultivate and mobilize interorganizational ties to access resources and knowledge (Beeson, 2024). For carbon finance, network leadership may facilitate partnerships with technical experts, financial intermediaries, and certification bodies, enhancing startups' capacity to participate in ETS and voluntary credit markets.

Core Leadership Dimensions in Green Startups

Core leadership behaviors that enable green startups to leverage carbon finance encompass three interrelated dimensions. (1) Visionary articulation means developing and communicating a compelling sustainability vision, setting decarbonization targets, and integrating carbon-finance milestones into strategic planning to align organizational culture with market-based environmental governance. (2) Stakeholder advocacy involves engaging proactively with policymakers, regulators, investors, and industry bodies through activities such as policy consultations, participation in public forums, and coalition building to establish institutional conditions that favor startup entry into carbon markets. (3) Network mobilization refers to the cultivation and activation of cross-sector partnerships, including collaborations with technology providers, financial intermediaries, certification agencies, and corporate offtakers, in order to secure the technical expertise, capital, and market channels necessary for effective participation in emissions trading systems, voluntary credit schemes, and green bond issuances.

Conceptual Framework

The conceptual framework (as is shown in figure 1) posits that three leadership behaviors—visionary articulation, stakeholder advocacy, and network mobilization—jointly enhance a green startup's ability to engage with carbon finance mechanisms, such as emissions trading, voluntary credit markets, and green bond issuance. This carbon-finance engagement then drives improvements in financial returns, market expansion, and environmental impact. By shaping both strategic direction and resource access, these leadership dimensions indirectly influence sustainable entrepreneurship outcomes through their effect on carbon-finance utilization.

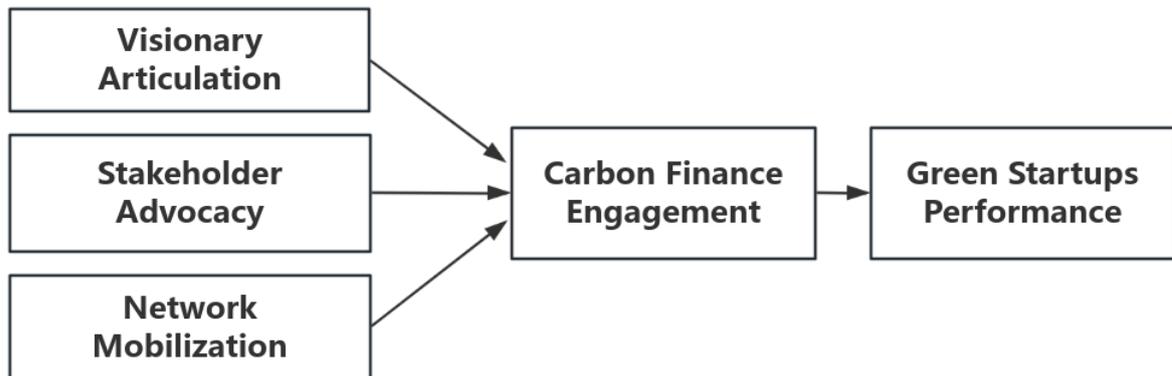


Figure 1. Conceptual Framework

Propositions

Based on the conceptual framework, we advance the following propositions to guide our illustrative case analysis:

P1: Green startups led by entrepreneurs who excel in visionary articulation will demonstrate higher strategic alignment with carbon-finance instruments and clearer roadmaps for decarbonization.

P2: Startups whose leaders engage extensively in stakeholder advocacy will face lower institutional and regulatory barriers to carbon-finance participation.

P3: Active network mobilization by green startup leaders enhances the firm's ability to access diverse carbon-finance channels, including voluntary credit and green bond markets.

P4: Carbon-finance engagement mediates the relationship between each core leadership dimension (visionary articulation, stakeholder advocacy, network mobilization) and green startup performance in financial, market, and environmental metrics.

Methodology

This chapter outlines the illustrative case approach used to develop and refine the conceptual framework linking leadership behaviors to carbon-finance engagement and sustainable entrepreneurship outcomes.

Research Design

A qualitative, multiple-case methodology is adopted to explore how leadership dimensions manifest in real-world green startups and facilitate carbon-finance utilization. Comparative vignettes enable pattern identification and theory elaboration without quantitative modeling.

Case Selection

We purposively select four green startups—Climeworks, Carbon Clean, Pachama, and CarbonCure—that exemplify our core leadership dimensions and have demonstrable carbon-finance engagement. Selection criteria are:

(1) Leadership Behaviors: Each firm's founders or executive teams clearly exhibit at least one of the dimensions (visionary articulation, stakeholder advocacy, network mobilization).

(2) Carbon-Finance Participation: All firms have active projects in ETS allowance trading, voluntary credit markets, or green bond issuance.

(3)Contextual Diversity: The cases span technology focus (direct air capture, modular capture, forestry, building materials) and geographies (Europe, UK/India, North America, Canada), ensuring breadth of institutional environments and industry regulatory regimes.

Illustrative Cases of Leadership-Driven Carbon Finance Engagement

To explore how leadership behaviors influence carbon finance utilization in green startups, this study draws on four illustrative cases: Climeworks, Carbon Clean, Pachama, and CarbonCure. These ventures operate across different technological domains—including direct air capture, modular carbon capture, forestry-based offsets, and low-carbon concrete—and are based in varied geographic contexts such as Europe, Asia, and North America. Each case demonstrates strategic engagement with carbon finance mechanisms and reflects one or more of the core leadership dimensions introduced in Chapter 3.

The following comparative summary highlights how each firm aligns with the theoretical propositions (P1–P4), showing how leadership enables access to carbon markets and contributes to startup performance:

| Case | Industry/Focus | Region | Visionary Articulation (P1) | Stakeholder Advocacy (P2) | Network Mobilization (P3) | Startup Performance via Carbon Finance (P4) |
|--------------|------------------------|---------------|---|--|---|--|
| Climeworks | Direct Air Capture | Europe | Strategic framing of DAC as climate infrastructure ; long-term vision integrated with ETS policy. | Active engagement with EU regulators to expand eligibility under ETS. | Partnerships with utilities, investors, and public institutions to secure financing and access markets. | >60,000 tonnes of CO ₂ removed and monetized through long-term carbon credit contracts. |
| Carbon Clean | Modular Carbon Capture | UK / India | Clear commercial targets linked to decarbonization financing. | Advocacy in India's regulatory landscape for small-scale credit recognition. | Collaborations with cement/steel companies to co-deploy systems and co-finance projects. | Significant cost reductions; project bond issuance tied to carbon credit delivery. |
| Pachama | Forestry-based Offsets | North America | Technology-driven vision for nature restoration and carbon tracking. | Representation at global climate forums; advocacy for digital verification. | Ecosystem of partners including registries, satellite tech firms, and NGOs. | >1 million verified credits issued; substantial revenue generated |

| | | | | | | |
|------------|---------------------|--------|--|--|---|---|
| | | | | | | from credit sales. |
| CarbonCure | Low-Carbon Concrete | Canada | Vision integrated into R&D and product strategy with explicit climate goals. | Active voice in building standards reform to include embedded carbon reductions. | Partnerships with concrete producers and green investors. | >500,000 tonnes CO ₂ reductions reported; credit sales supported revenue growth. |

Case Vignettes and Cross-Case Synthesis

Overview

This chapter presents four illustrative case vignettes that demonstrate how leadership behaviors influence carbon finance engagement and shape sustainable outcomes in green startups. Each case is analyzed with reference to the theoretical propositions (P1–P4) and leadership dimensions (visionary articulation, stakeholder advocacy, and network mobilization) developed in Chapter 3.

Climeworks: Visionary ETS Integration

Climeworks, based in Switzerland, specializes in direct air capture (DAC) technologies. From its inception, the firm's leadership framed carbon removal as essential climate infrastructure, aligning its corporate mission with emerging ETS policies in Europe. The company secured partnerships with governments, utilities, and climate-focused investors to scale operations and finance projects through advanced carbon credit sales. Climeworks' high-level advocacy—through policy dialogues and collaborations with the EU Innovation Fund—reinforced its institutional legitimacy. This case strongly validates P1 and P2, showing that a long-term vision supported by stakeholder engagement enables early access to carbon finance markets and drives operational scaling.

Carbon Clean: Advocacy for Carbon Credits

Carbon Clean operates across the UK and India, offering modular carbon capture systems for industrial clients. The leadership's strategy emphasized regulatory adaptation, working directly with Indian authorities to recognize small-scale projects in carbon credit protocols. This advocacy unlocked access to credits and enabled hybrid financing, including green project bonds. The firm's collaborative model—partnering with cement and steel firms—allowed co-development and co-financing. This case confirms P2 and P3, highlighting the importance of advocacy in overcoming institutional constraints and network mobilization in resource-intensive sectors.

Pachama: Networks for Forestry Offsets

Pachama, a California-based startup, leverages AI and satellite imagery to validate and monitor forestry-based carbon offsets. The firm's leadership built a bold, tech-driven vision centered on restoring ecosystems through digital transparency. Pachama's executives

actively advocated for reforming verification standards at global climate events, influencing industry discourse on digital MRV (Monitoring, Reporting, Verification). Strategic alliances with Verra and remote sensing firms allowed it to build credibility and issue over one million credits. This case affirms all three propositions—vision, advocacy, and networks—as reinforcing mechanisms for credit market success.

CarbonCure: Leadership in Credit Integration

CarbonCure, based in Canada, integrates captured CO₂ into concrete production, reducing lifecycle emissions. Its leadership embedded climate targets into product development and made carbon credit generation part of the business model. The firm worked with building code authorities to incorporate carbon reduction metrics into standards, enabling credit eligibility. By collaborating with concrete producers and financial institutions, CarbonCure accessed credit markets and raised green-linked capital. This case reflects a hybrid model where all three leadership dimensions interact synergistically, validating the full conceptual pathway from leadership to performance (P1–P4).

Cross-Case Synthesis

The comparative analysis reveals three core insights:

- (1) Leadership as Strategic Translator: In all cases, leadership acts as a translator of policy into market opportunity, aligning carbon finance with long-term strategy (supporting P1).
- (2) Advocacy as Gate-Opener: Regulatory advocacy—whether formal or informal—is key to market access, especially in emerging or complex carbon regimes (supporting P2).
- (3) Network Capital as Enabler: Startups with well-developed cross-sector partnerships had faster and more credible carbon finance engagement (supporting P3).

Additionally, performance outcomes—measured through credit volumes, capital raised, and emissions reduced—demonstrate the mediating role of carbon finance (supporting P4). The interaction among the three leadership behaviors appears cumulative rather than isolated, suggesting leadership configurations may offer greater explanatory power than individual traits alone.

Discussion, Implications, and Future Research

Theoretical Contributions

This study extends existing leadership and sustainable entrepreneurship literature by integrating carbon finance as a mediating mechanism. It introduces a refined conceptual framework that connects leadership behaviors to tangible climate finance outcomes and organizational performance, offering a novel contribution to both green innovation and environmental finance theory.

Managerial Implications

Leaders of green startups should embed carbon finance within their core strategy, using policy shifts as business opportunities rather than merely funding channels. Engaging regulators and investors through clear sustainability targets builds necessary credibility, while partnerships with technology, certification, and financial entities supply the expertise and capital for carbon-finance participation. Integrating carbon-finance milestones into product and operational planning ensures that environmental goals drive innovation and market expansion.

Policy Recommendations

Policymakers can foster inclusive carbon finance ecosystems by recognizing the role of leadership in enabling startup participation. This includes reducing procedural complexity, incentivizing partnerships, and offering sandbox environments where early-stage ventures can test carbon-finance instruments with limited risk.

Limitations and Future Research

As a conceptual study grounded in illustrative case analysis, this research does not claim statistical generalizability. Future studies could test these propositions empirically using survey data or longitudinal case studies. Additional work may also examine sector-specific dynamics or leadership configurations over time.

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