

# Decarbonisation of the Built Environment: the CEO Factor

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**Abstract:** Previous studies identified key barriers to implementing decarbonisation strategies in change resistant organizational structures. Consequently this paper proposes a strategic research agenda focused on the decision-making behaviours of CEOs. Central to which being their risk perceptions and leadership models adopted. The analysis highlights five priority research areas: (1) how CEOs integrate regulatory pressures, financial constraints, and stakeholder expectation in decision-making; (2) evaluating leadership training programmes aimed at executives driving decarbonization initiatives; (3) Investigating board-level sustainability mandates on corporate environmental strategies; (4) assessing CEO-driven innovation accelerating adoption of low-carbon practices; and (5) exploring how corporate leadership actively facilitates or impedes sustainable transformation. By synthesizing economic, organizational, and policy considerations, this research agenda provides a framework for understanding CEO influence on corporate commitments to successful sustainability transitions.

**Keywords:** Decarbonization, Built Environment, Green Hydrogen, CEO decision-making, Sustainable Transformation.

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## 1. INTRODUCTION

The urgency for decarbonization has increased significantly, driven by the need to address climate change and fulfil commitments made under the Paris Agreement (United Nations, 2015). The built environment represents a critical sector in this transition, contributing approximately 40% of global carbon emissions (IEA, 2021), with figures exceeding 20% in specific regions such as New Zealand (Ministry for the Environment, 2021). The successful implementation of low-carbon building practices and technologies is therefore essential for meeting international climate targets and transitioning toward a sustainable future. Recent research by Lozova et al. (2024) has identified green hydrogen as a promising energy carrier with substantial potential to transform building operations and contribute to sustainable energy systems. Their empirical investigation into hydrogen adoption in New Zealand's built environment highlighted significant opportunities across various applications, including heating, power generation, and energy storage. However, their findings also revealed a concerning disconnect: while technical specialists demonstrated high familiarity and confidence in hydrogen technologies, key decision-makers, such as CEOs and general managers, exhibited markedly lower levels of understanding and confidence regarding implementation potential. This observation aligns with broader research on sustainability transitions, which has increasingly recognized the pivotal role of executive leadership in either facilitating or impeding organizational transformation toward more sustainable practices (Eccles et al., 2014; Waldman & Siegel, 2008). As Kurucz et al. (2017) argue, the successful implementation of sustainability initiatives frequently depends on top-down commitment and strategic integration. Despite this recognition, there remains a significant research gap concerning the specific decision-making processes, risk perceptions, and leadership models employed by CEOs when considering major decarbonization initiatives, particularly those involving emerging technologies such as green hydrogen.

This knowledge gap presents an urgent research opportunity and forms the foundation of this paper. While previous studies have explored the technical, economic, safety and policy dimensions of building decarbonization, the crucial role of organizational leadership, specifically CEO decision-making behaviours and leadership models, remains underexplored. This paper contends that understanding and addressing the factors influencing executive-level decision-making regarding sustainable technologies is essential for accelerating the transition to a low-carbon built environment.

Building on findings from Lozova et al. (2024), which identified CEOs as expressing notably higher scepticism toward decarbonization technologies, this paper proposes a comprehensive research agenda aimed at examining how CEO attitudes, perceptions, and leadership approaches influence corporate commitment to sustainable transformation. By focusing on this critical yet underexplored dimension, this research agenda aims to provide actionable insights for addressing organizational resistance to change and accelerating the adoption of decarbonization strategies in the built environment sector.

## **2. BACKGROUND AND LITERATURE REVIEW**

### **2.1 Decarbonization Pathways for the Built Environment**

Multiple decarbonization pathways have emerged for transforming building operations and supporting sustainable energy systems (International Renewable Energy Agency, 2020; International Energy Agency, 2019). These include electrification of heating and cooling, green hydrogen applications, energy efficiency measures, on-site renewable generation, and low-carbon building materials. Each offers multiple benefits for reducing the carbon footprint of the built environment.

The technical feasibility of various green hydrogen approaches has been well-documented. Research indicates potential for integration into existing infrastructure, application in on-site power plants, utilization in combined heat and power systems, and employment as backup power for critical facilities (Karchiyappan, 2019; HM Government, 2021). These applications represent significant opportunities for reducing carbon emissions in the building sector.

### **2.2 Barriers to Decarbonization Adoption**

Despite their potential benefits, hydrogen technologies face multiple barriers. Previous research by Lozova et al. (2024) identified several key challenges:

1. **Economic barriers:** High upfront costs and concerns about economic viability represent significant obstacles, with 72.2% of survey respondents identifying cost-effectiveness as a crucial factor in decision-making.
2. **Knowledge and awareness gaps:** Lack of familiarity with hydrogen technologies, particularly among non-technical decision-makers, contributes to low confidence in their potential.
3. **Implementation concerns:** Perceptions around safety risks and operational disruption inhibit acceptance, with 60% of respondents citing concerns as a barrier to adoption.
4. **Regulatory uncertainty:** The absence of clear regulatory frameworks creates hesitation among potential adopters, with 65.6% supporting the development of robust regulations.

Notably, the study revealed a troubling pattern wherein participants with limited familiarity with decarbonization technologies demonstrated low confidence levels in their ability to meet energy demands. Most significantly, outliers were observed among decision-makers, specifically CEOs and general managers, who expressed negativity across all responses regarding new technologies (Lozova et al., 2024).

### **2.3 The Role of Leadership in Sustainability Transitions**

Corporate leadership, particularly at the CEO level, plays a decisive role in determining organizational commitment to sustainability initiatives. Research indicates that CEOs significantly influence their organizations' environmental strategies and performance (Walls & Berrone, 2017; Shahab et al., 2019). CEO values, perceptions, and leadership styles can either facilitate or impede the adoption of sustainable practices (Wu et al., 2020; Robertson & Barling, 2013).

Several factors influence CEO decision-making regarding sustainability:

1. **Value orientation:** CEOs with stronger pro-environmental values tend to prioritize sustainability initiatives (Ng et al., 2016).
2. **Risk perception:** How CEOs perceive risks associated with climate change and emerging technologies impacts their willingness to invest in sustainable solutions (Delmas & Toffel, 2008).
3. **Temporal orientation:** Future-focused CEOs are more likely to support long-term sustainability investments (Slawinski & Bansal, 2015).
4. **External pressures:** Stakeholder expectations, regulatory requirements, and market demands shape CEO decisions regarding sustainability (Flammer et al., 2019).
5. **Leadership models:** Transformational, servant, and authentic leadership styles appear more conducive to driving sustainability initiatives (Metcalf & Benn, 2013).

However, there remains a critical gap in understanding how these factors specifically influence CEO decision-making regarding decarbonization technologies in the built environment. The research agenda proposed in this paper aims to address this gap by systematically investigating the interplay between CEO characteristics, organizational contexts, and sustainability outcomes related to decarbonization adoption.

### **3. THEORETICAL FRAMEWORK**

This research agenda is grounded in several complementary theoretical perspectives that together provide a comprehensive framework for understanding CEO influence on sustainable transformation:

#### **3.1 Upper Echelons Theory**

Upper Echelons Theory (Hambrick & Mason, 1984; Hambrick, 2007) posits that organizational outcomes are partially predicted by managerial background characteristics. In the context of sustainability initiatives, this theory suggests that CEO cognitive frames, values, and experiences significantly shape organizational responses to environmental challenges (Chin et al., 2013; Lewis et al., 2014). Applied to built environment decarbonization, this theoretical lens enables examination of how CEO attributes, including educational background, industry experience, age, and values, influence their receptiveness to innovative sustainability technologies.

#### **3.2 Stakeholder Theory**

Stakeholder Theory (Freeman, 1984; Mitchell et al., 1997) provides insight into how CEOs prioritize and respond to diverse stakeholder demands. This perspective is particularly relevant for understanding how CEOs balance pressures from shareholders, customers, regulators, employees, and community members when making decisions about investing in decarbonization technologies (Sharma & Henriques, 2005; Flammer & Bansal, 2017). The theory helps explain why some CEOs prioritize sustainability initiatives despite short-term costs, while others remain resistant.

#### **3.3 Transformational Leadership Theory**

Transformational Leadership Theory (Bass & Riggio, 2006) offers a framework for understanding how CEOs can motivate and inspire organizational commitment to sustainability goals. Transformational leaders articulate compelling visions, stimulate intellectual engagement with environmental challenges, and inspire followers to transcend self-interest for collective environmental goals (Robertson & Barling, 2013; Chen & Chang, 2013). This theoretical perspective helps explain how leadership styles influence organizational adoption of decarbonization technologies beyond purely economic considerations.

#### **3.4 Organizational Change Theory**

Theories of organizational change, particularly Lewin's (1947) three-stage model (unfreezing-changing-refreezing) and Kotter's (1996) eight-step process, provide frameworks for understanding how CEOs can overcome organizational inertia and resistance to change when implementing decarbonization initiatives. These theories highlight the importance of creating urgency, building coalitions, communicating vision, and embedding changes in organizational culture (Armenakis & Bedeian, 1999; By, 2005).

#### **3.5 Integrated Theoretical Model**

By integrating these theoretical perspectives, we propose a comprehensive framework for investigating CEO influence on decarbonization adoption in the built environment. This integrated model recognizes that CEO decision-making regarding sustainable technologies is shaped by individual attributes (Upper Echelons), stakeholder pressures (Stakeholder Theory), leadership approach (Transformational Leadership), and change management capabilities (Organizational Change Theory). Together, these factors determine organizational receptiveness to decarbonization technologies and, ultimately, their contribution to sustainability goals.

### **4. RESEARCH METHODOLOGY**

To investigate the role of CEOs in driving sustainable transformation through decarbonization adoption, the researchers propose a mixed-methods research design that combines qualitative and quantitative approaches. This methodology builds upon the approach used by Lozova et al. (2023) while focusing specifically on CEO decision-making processes.

#### 4.1 Research Questions

The proposed study aims to address the following overarching research question:

How do CEO decision-making behaviours and leadership models influence organizational adoption of hydrogen technologies for the built environment?

This primary research question is further divided into five sub-questions corresponding to the priority research areas identified in the abstract:

1. How do CEOs integrate regulatory pressures, financial constraints, and stakeholder expectations when making decisions about decarbonization investments?
2. What leadership development approaches effectively prepare executives to drive decarbonization initiatives in the built environment sector?
3. How do board-level sustainability mandates influence CEO commitment to environmental strategies, particularly regarding decarbonization adoption?
4. What mechanisms enable CEO-driven innovation to accelerate the adoption of low-carbon practices in organizations?
5. How does corporate leadership actively facilitate or impede sustainable transformation in the context of built environment decarbonization?

#### 4.2 Research Design

The proposed study will employ a sequential exploratory mixed-methods design conducted in four phases:

Phase 1: Qualitative Exploration

- In-depth interviews with 15-20 CEOs from organizations across the built environment value chain, including building developers, energy providers, technology suppliers, and facility management companies
- Focus groups with board members, sustainability officers, and other key stakeholders to provide contextual understanding
- Document analysis of corporate sustainability reports, strategic plans, and public statements related to decarbonization

Phase 2: Instrument Development

- Development of a survey instrument based on qualitative findings
- Validation of the instrument through expert review and pilot testing

Phase 3: Quantitative Investigation

- Survey of CEOs and senior executives in the built environment sector
- Collection of organizational data on sustainability performance, innovation adoption, and financial metrics

Phase 4: Integration and Validation

- Integration of qualitative and quantitative findings
- Validation workshops with industry experts and academic researchers
- Development of practical frameworks and recommendations

#### 4.3 Data Collection Methods

Qualitative Methods:

- Semi-structured interviews with CEOs exploring their decision-making processes, risk perceptions, values, and leadership approaches regarding decarbonization
- Focus groups with board members, sustainability officers, and technical experts to provide multiple perspectives on the role of leadership in decision-making process

- Document analysis of corporate sustainability reports, strategic plans, and public communications and literature review

#### Quantitative Methods:

- Online survey administered to CEOs and senior executives in the built environment sector
- Psychometric scales measuring leadership styles, risk orientation, environmental values, and decision-making approaches
- Collection of organizational data on sustainability performance, innovation adoption, and financial metrics

#### 4.4 Data Analysis

##### Qualitative Analysis:

- Thematic analysis of interview and focus group transcripts using NVivo software
- Content analysis of corporate documents
- Development of conceptual models linking CEO characteristics to organizational outcomes

##### Quantitative Analysis:

- Descriptive statistics to characterize the sample
- Factor analysis to identify underlying dimensions of CEO decision-making
- Multiple regression and structural equation modelling to test relationships between CEO characteristics, organizational contexts, and sustainability outcomes
- Cluster analysis to identify distinct CEO profiles regarding sustainability leadership

##### Integrated Analysis:

- Triangulation of qualitative and quantitative findings
- Development of typologies of CEO approaches to sustainable transformation
- Identification of best practices and barriers in leadership for decarbonization adoption

#### 4.5 Ethical Considerations

The research will adhere to strict ethical guidelines, including obtaining informed consent from all participants, ensuring confidentiality of sensitive information, and providing opportunities for participants to review and comment on findings. The research design will be submitted for approval by AUT ethics committee prior to commencement.

### 5. PRIORITY RESEARCH AREAS

Building on the methodological framework outlined above, this section details the five priority research areas that will form the core of the proposed study. Each area addresses a critical aspect of CEO influence on decarbonization adoption and sustainable transformation.

#### 5.1 CEO Integration of Multiple Pressures in Decision-Making

This research area will investigate how CEOs navigate and prioritize competing pressures when making decisions about decarbonization investments. Drawing on findings from Lozova et al. (2023) indicating economic viability (72.2%) as the primary driver for hydrogen technology investment, this component will examine:

- How CEOs weigh short-term financial considerations against long-term sustainability benefits
- Methods CEOs employ to evaluate and respond to regulatory requirements while maintaining competitive advantage
- Approaches for balancing shareholder expectations for returns with broader stakeholder demands for environmental responsibility
- Mental models and decision frameworks CEOs use when evaluating novel technologies for decarbonization

- The influence of organizational context (size, industry position, financial health) on CEO decision-making regarding sustainability investments

This investigation will utilize decision-making simulations, critical incident interviews, and policy-capturing methodologies to reveal the actual decision processes employed by CEOs when considering decarbonization adoption.

### **5.2 Evaluation of Leadership Training Programs for Decarbonization**

This research area will address the notable knowledge gap identified in previous research, where CEOs and general managers demonstrated significantly lower familiarity with and confidence in decarbonization technologies compared to technical specialists (Lozova et al., 2024). This component will:

- Assess existing executive education programs focused on sustainability and clean energy technologies
- Identify key knowledge and competency requirements for executives leading decarbonization initiatives
- Evaluate the effectiveness of different learning approaches (experiential learning, peer networks, technical briefings) in building executive capability
- Investigate the role of mentoring and knowledge-sharing between technical experts and executives
- Develop and pilot test leadership development interventions specifically designed to build executive capability in decarbonization technologies

This area will employ program evaluations, pre-post assessments of executive knowledge and attitudes, and longitudinal tracking of organizational outcomes following leadership development interventions.

### **5.3 Impact of Board-Level Sustainability Mandates**

This research area will examine the influence of governance structures on CEO commitment to decarbonization strategies. Building on the finding that 65.6% of respondents support clear regulatory frameworks for industry investment certainty (Lozova et al., 2024), this component investigates how internal governance mechanisms affect CEO decision-making:

- The impact of board-level sustainability committees on organizational commitment to decarbonization adoption
- How sustainability-linked executive compensation affects CEO prioritization of decarbonization initiatives
- The influence of board composition and expertise on corporate environmental strategies
- Interactions between external regulatory pressures and internal governance mechanisms
- Best practices in board-level oversight of climate-related risks and opportunities

This investigation will utilize comparative case studies, analysis of board meeting minutes and governance documents, and interviews with board members and CEOs to understand governance influences on sustainable transformation.

### **5.4 Mechanisms for CEO-Driven Innovation**

This research area will investigate how CEOs can drive innovation that accelerates the adoption of low-carbon practices. Given the finding that 59.4% of survey respondents recommended business model co-development with industry experts (Lozova et al., 2024), this component will examine:

- Leadership practices that foster organizational innovation culture supportive of sustainability initiatives
- CEO approaches to managing the risks associated with adopting emerging technologies for decarbonization
- Strategies for securing resources and organizational commitment for sustainability innovation
- Methods for effective collaboration with external partners (research institutions, startups, industry consortia) to accelerate technology adoption
- Approaches for scaling successful pilot projects to organization-wide implementation

This area will employ innovation assessment tools, case studies of successful and unsuccessful innovation initiatives, and network analysis of collaborative relationships to identify effective leadership practices for driving sustainable innovation.

### **5.5 Corporate Leadership's Facilitation or Impediment of Transformation**

This research area will examine how leadership practices actively influence the pace and success of sustainable transformation efforts. Building on the observation that technical specialists showed high technology familiarity while non-technical roles exhibited variable understanding (Lozova et al., 2024), this component will investigate:

- Leadership behaviours that effectively bridge technical and business perspectives on sustainable technologies
- Communication strategies that build organization-wide understanding and commitment to decarbonization goals
- Change management approaches that overcome resistance to adoption of decarbonization technologies
- Leadership practices that embed sustainability considerations into organizational culture and decision processes
- The role of symbolic actions, personal modelling, and narrative in shaping organizational responses to sustainability challenges

This investigation will utilize organizational ethnographies, longitudinal case studies, and comparative analysis of leadership approaches across organizations with varying levels of success in sustainable transformation.

## **6. EXPECTED CONTRIBUTIONS AND IMPLICATIONS**

### **6.1 Theoretical Contributions**

The proposed research agenda is expected to make several significant theoretical contributions:

1. Integration of leadership and sustainability theories: By examining CEO influence on decarbonization adoption through multiple theoretical lenses, the research will advance understanding of how leadership theories apply specifically to sustainability contexts.
2. Development of a CEO sustainability leadership typology: The research aims to develop a typology of CEO approaches to sustainable transformation, identifying distinct patterns in how executives conceptualize and address decarbonization challenges.
3. Refinement of decision-making models: By investigating how CEOs evaluate novel technologies for decarbonization, the research will contribute to decision-making theories in contexts of high uncertainty and complex trade-offs.
4. Advancement of change management theory: The research will extend organizational change theories by examining their application to sustainability transitions, potentially identifying unique aspects of leading change for environmental purposes.

### **6.2 Practical Implications**

The research agenda is designed to yield actionable insights for multiple stakeholders:

1. For CEOs and executives: The research will provide frameworks, tools, and best practices for leading sustainable transformation, specifically addressing the challenges of green hydrogen adoption. These insights will help executives navigate competing pressures, build organizational capabilities, and implement effective change management strategies for decarbonization.
2. For boards and governance bodies: Findings will inform the development of effective governance mechanisms to support sustainability initiatives, including board structures, CEO evaluation criteria, and incentive systems aligned with decarbonization goals.
3. For leadership development professionals: The research will identify key competencies and effective approaches for developing executive capability in sustainability leadership, enabling the creation of targeted leadership development programs.
4. For policy makers: Insights regarding CEO decision-making will inform the development of policies and regulations that effectively incentivize and enable corporate adoption of green hydrogen technologies.

### 6.3 Policy Implications

Building on the recommendations from Lozova et al. (2024), this research will provide additional insights for policy development:

1. Targeted incentive structures: Understanding CEO decision processes will help in designing incentive structures that effectively address the specific concerns and priorities of corporate leaders.
2. Leadership development initiatives: Findings regarding effective leadership development approaches could inform government-supported executive education programs focused on building capability for the green hydrogen transition.
3. Governance requirements: Research on board-level sustainability mandates may provide evidence for potential governance requirements or guidelines regarding climate risk management and sustainability oversight.
4. Public-private collaboration models: Insights regarding CEO-driven innovation may inform the development of more effective models for public-private collaboration in advancing decarbonization technologies.

## 7. CONCLUSION

The transition to a sustainable, decarbonized built environment requires not only green hydrogen technological innovations and policy support but also effective leadership from the executives who ultimately make organizational investment and adoption decisions. Previous research by Lozova et al. (2024) highlighted a concerning disconnect between technical experts' confidence in green hydrogen technologies and the scepticism expressed by key decision-makers, particularly CEOs.

This paper has proposed a comprehensive research agenda focused on understanding and addressing this critical gap. By investigating how CEO decision-making behaviours and leadership models influence organizational adoption of green hydrogen technologies, the proposed research aims to provide actionable insights for accelerating sustainable transformation in the built environment.

The five priority research areas outlined - examining CEO integration of multiple pressures, evaluating leadership development approaches, investigating board-level sustainability mandates, assessing mechanisms for CEO-driven innovation, and exploring leadership's facilitation or impediment of transformation - together form a coherent framework for advancing knowledge in this crucial but underexplored domain.

Successfully implementing this research agenda will require collaborative efforts between academic researchers, industry partners, and policy makers. By building on the foundation laid by previous studies and addressing the specific challenges of executive-level decision-making, this research has the potential to significantly accelerate the adoption of green hydrogen technologies, contributing to the urgent global effort to combat climate change through sustainable transformation of the built environment.

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