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Navigating Tensions in Green Building Certification: The Impact of Leadership and Collaboration in Temporary Multi-Organizations

Jorge Vareda Gomes [1,*], Vasco Barata [1] and Mário Romão [2]

[1] ECEO, Universidade Lusófona Lisboa, 1700-097 Lisbon, Portugal; vascobarata1995@gmail.com
[2] ADVANCE/CSG/ISEG—Instituto Superior de Economia e Gestão, 1200-781 Lisbon, Portugal; mario.romao@iseg.ulisboa.pt
* Correspondence: jorge.gomes@phd.iseg.ulisboa.pt

Abstract: The building sector has emerged as a crucial driver of innovation in the transition towards sustainability, gaining increased recognition at multiple levels of society. This shift is not occurring in isolation; it is being accelerated by mounting pressures from both governmental bodies and non-governmental organizations. These external forces are pushing the building industry to adopt more sustainable practices, leading to significant changes not only within individual organizations but also on a broader macroeconomic scale. Policies, regulations, and market demands are converging to create a landscape where sustainability is no longer optional but imperative. Considering these developments, this study set out to investigate the impact of Green Building Certificates (GBCs) on innovation processes within the construction industry. The research specifically focused on how GBCs influence both the technological advancements introduced in building projects and the collaborative dynamics among the various stakeholders involved. By employing a multiple case study approach, the study was able to capture real-world examples and offer a comparative analysis against established academic frameworks. One of the standout findings was the pivotal role played by the green project champion; a leadership figure whose influence extends across all stages of project development. This role is not merely administrative; it is strategic, as the green project champion helps to navigate the complexities of sustainable practices, fostering collaboration among architects, engineers, developers, and consultants. Their leadership is instrumental in ensuring that sustainability goals are integrated into the project's objectives, while also managing the tensions that arise between the various actors involved. This study highlights the importance of effective leadership and collaboration in driving the successful implementation of GBCs, emphasizing the green project champion's role as a key facilitator of innovation in the sustainable building sector.

Keywords: green building certificates; collaboration; building; innovation; sustainable development

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1. Introduction

Recent reports have highlighted the increasing severity of climate change and emphasized the critical role of human activity in accelerating these shifts. The 2023 Synthesis Report by the Intergovernmental Panel on Climate Change (IPCC) underscores that without urgent action to reduce greenhouse gas emissions, global temperatures are on track to exceed 1.5 °C above pre-industrial levels. This increase will exacerbate extreme weather events, particularly in vulnerable regions, leading to widespread environmental and socio-economic disruptions. The report stresses that cutting fossil fuel use, alongside investment in renewable energy and nature-based solutions, is essential for mitigating the worst effects of climate change (IPCC, 2023) [1].

Beyond environmental concerns, growing market competitiveness driven by globalization has heightened the urgency for change. Organizations are now compelled to introduce

diverse innovations to gain a competitive edge, meet sustainable development goals, and satisfy the needs of both customers and employees [2,3].

The building sector is no exception, and today, it stands alongside other essential sectors in the long journey toward sustainable transition. Over recent decades, international efforts have focused on improving building practices to reduce their negative environmental impacts [4]. This evolution has sparked discussions on topics ranging from environmental impact and recycling to the concept of green buildings and building certificates, which quantify implemented measures. Building performance has emerged as a key concern for professionals in the sector [5]. It is widely recognized that the building industry is a significant contributor to environmental degradation, not only due to its overuse of natural resources during construction and maintenance but also through direct and indirect pollution [5,6].

Given the growing importance of sustainable practices, Green Building Certificates (GBCs) like LEED and BREEAM have emerged as essential tools for improving building performance. These certifications provide measurable criteria for energy efficiency, water conservation, and reduced environmental impact, helping the industry transition toward greener practices. The comparative study discussed in this article highlights how GBCs not only promote innovation but also enhance collaboration among stakeholders in the building sector. This emphasizes the vital role GBCs play in driving the industry towards more sustainable and efficient outcomes [1].

Recognizing the growing importance of these issues, this article presents the results of a comparative study that enhances our understanding of how Green Building Certificates (GBCs) influence innovation and collaboration processes within the building sector.

2. Literature Review

2.1. Sustainable Development

According to the Brundtland Commission (p. 15) [7], sustainable development is defined as "development that meets the needs of the present without compromising the ability of future generations to meet their own needs". This concept has been widely adopted not only in academic discourse but also in political and corporate spheres [8]. Over time, various interpretations have emerged [9], but the core distinction of sustainable development lies in its emphasis on preserving resources for future generations, setting it apart from traditional environmental policies.

The overarching goal of sustainable development is long-term stability, encompassing both environmental and economic dimensions. Achieving this requires addressing the interconnected concerns of the economy, environment, and society, collectively known as the Triple Bottom Line [9]. In an organizational context, sustainable development involves continuous efforts to balance environmental and social concerns with economic objectives, minimizing harm while enhancing benefits to society and the environment [10].

The building sector is closely tied to environmental concerns due to its extensive use of natural resources, its role in pollution, and its impact on ecosystems. As a result, the sector plays a pivotal role in addressing environmental challenges and implementing mitigation strategies [11]. The shift toward more sustainable practices is driven by legal obligations and growing public awareness of the environmental impact of construction [12].

A study by Janjua et al. [13] talks about sustainable buildings' performance, manufactured using recycled materials and byproducts from industries. Also, it was concluded that for park buildings, a sustainable building design with reduced energy demand and high thermal efficiency with use of recycled/byproduct materials is the main requirement [14].

Sustainable building is viewed as a pathway for the sector to contribute to sustainable development by protecting the environment, conserving natural resources, and improving quality of life [6,11]. It seeks to incorporate the principles of sustainable development—economic, social, and environmental—throughout all phases of a project, from design to construction and maintenance, aligning with the pillars of the Triple Bottom Line [15]. However, Berardi [16] notes that current approaches to sustainable building often

place disproportionate emphasis on the environmental dimension, with energy consumption becoming the primary focus.

Green buildings are beneficial when it comes to energy consumption and emissions; low maintenance and operation costs; boosting health and productivity [17]. Green buildings are the fundamental platform of sustainable development [18], one such concept that has been introduced to reduce these environmental burdens of buildings over their life cycle. Green buildings have higher commercial value compared to traditional buildings, due to the perceived low carbon emissions, energy savings, and maximized economic benefits throughout the life cycle [19,20].

Despite widespread agreement on the importance of sustainable development in the building sector, the motivations of various stakeholders in adopting these practices remain unclear [21]. Some authors have explored these perspectives and linked them to the use of Green Building Certificates (GBCs), examining their impact on collaboration, innovation, and project planning.

Reed [22] highlights the need to engage with ecological systems in design, moving beyond simply minimizing environmental harm. He proposes three levels of learning:

Level I—Greening (efficiency),
Level II—Alignment with sustainability (effectiveness),
Level III—A broader understanding, addressing reconciliation and regeneration at the macro level, questioning the project's purpose.

These levels are further divided into five evolving stages: (1) conventional practices, (2) green buildings, (3) sustainable buildings, (4) sustainable designs, and (5) restorative, reconciling, and regenerative designs.

2.1.1. Green Building Certificates (GBCs)

The first Green Building Certificates (GBCs) emerged in the early 1990s [23], driven by the need to align building practices with more sustainable methods [24]. These certificates introduced frameworks for measuring and monitoring not only the environmental performance of construction processes but also that of the buildings themselves [25].

In the building sector, environmental certifications aim to recognize and add value to buildings that contribute to a sustainable future [4]. They also raise awareness among stakeholders and users, becoming a powerful tool to demonstrate commitment to sustainable development [5].

Chronologically, the BREEAM (Building Research Establishment Environmental Assessment Methodology) certificate was the first, introduced in Great Britain in the 1990s. In the following decades, numerous building certificates were developed worldwide, originating from different countries and international institutions [26], such as LEED in the USA, CASBEE in Japan, NABERS in Australia, HQE in France, DGNB in Germany, and SBTool in multiple countries.

Herazo and Lizarralde [21] note that early certifications primarily focused on "Green Buildings". However, as experience grew, these certifications expanded to include sociocultural, economic, and technical aspects, moving toward the broader concept of "Sustainable Buildings".

Regardless of the GBC used, obtaining certification often involves additional costs, which must be considered. Nonetheless, experts argue that the long-term benefits of certification typically outweigh the short-term expenses [21].

In addition to GBCs, organizations like the International Organization for Standardization (ISO), the European Committee for Standardization (ECS), the International Code Council (ICC), and more recently, the European Commission (EC) have worked to establish minimum environmental and sustainability standards for the construction sector [26].

Despite the wide variety of GBCs, they all share a common goal. Among them, LEED (Leadership in Energy and Environmental Design) stands out as the most widely used and recognized certification globally, and it will be the focus of further discussion.

2.1.2. Leadership in Energy and Environment Design Certification (LEED)

Leadership in Energy and Environmental Design (LEED) is a globally recognized green building certification program developed by the U.S. Green Building Council (USGBC) (https://proptechos.com/leed-certificate/, accessed on 4 September 2024). LEED certification is an internationally recognized, voluntary program that helps design, build, and certify green buildings. It is based on a system of prerequisites and credits, which evaluates a building or group of buildings according to strategies aimed at improving performance in areas such as energy and water efficiency, CO_2 emissions reduction, indoor environmental quality, and resource utilization [27,28].

In its early versions, LEED used a simpler approach where points were awarded across categories based on an external assessment of the building. With the introduction of LEED 2009, a new weighted system was implemented, assigning points according to the project's potential to reduce environmental impact [29]. LEED v4 built upon this framework by introducing impact categories and a digital tool that allows for visualizing strategy combinations, performing statistical analyses, and improving overall system accuracy [30]. The latest version, LEED v4.1, further raises the standards, positioning itself as a leading management system for sustainable building projects globally.

LEED v4.1 operates across six key credit categories: location and transportation, sustainable sites, water efficiency, energy and atmosphere, materials and resources, and indoor environmental quality. Each category includes mandatory prerequisites and optional credits, with projects needing to document both to earn a minimum of 40 points out of 100 for certification. The higher the points, the more prestigious the certification level. This flexible credit system allows for adaptation to different project needs, with credits weighted based on their contribution to the certification's overall goals in six impact categories [30]. The LEED certification offers several benefits:

- Helps investors meet environmental, social, and governance (ESG) goals by providing a globally recognized green building framework to measure and manage real estate performance.
- Provides a competitive advantage, as over half of the companies that pursue LEED certification view sustainability as a financial asset and market differentiator.
- Increases occupancy, as LEED-certified buildings typically enjoy higher occupancy rates despite rental premiums averaging around 20%.
- Enhances the health and well-being of occupants.
- Reduces operating costs through energy and resource savings.

Between 2015 and 2018, LEED-certified buildings reportedly saved around USD 1.2 billion in energy costs, USD 149.5 million in water consumption, USD 715.3 million in maintenance, and USD 54.2 million in waste management.

2.1.3. LEED Certification in Portugal

In Portugal, as in many other parts of the world, LEED certification is one of the most widely used. The official USGBC website maintains an up-to-date database of projects that are registered, under development, or have already obtained certification. As of today, 136,048 projects are listed across 169 countries, with 49 of these located in Portugal. Although the number of nationally certified projects remains relatively small, particularly with LEED, the growing demand for environmental certifications in new building projects is becoming an increasing reality. Additionally, many ongoing projects have not yet been registered in the international database, suggesting that the actual number of LEED-certified projects in Portugal may be slightly higher than the current figure.

2.1.4. Green Project Champion

As demand for sustainability certifications increases, projects aiming to incorporate measures aligned with sustainable development often require a project manager responsible for coordinating and integrating all stakeholders involved [21]. In the literature, this role is commonly referred to as the "Green Project Champion". This individual or group,

representing various stakeholders, plays a key role in influencing and mobilizing different parties during decision-making processes [31], overcoming cooperation barriers, and fostering innovative ideas [32]. A Green Project Champion must exhibit strong leadership, a willingness to take risks, and a high degree of innovation [33]. They are leaders who are influential in driving change [34], and their approaches range from political action to grassroots movements [35]. When the role is shared by multiple people, they are typically referred to as a "Green Team", with the most experienced member assuming the leadership position [36].

According to Bossink [37], these managers of sustainable and innovative building projects are leaders in knowledge management, as they take the lead in addressing challenges related to the implementation process and achieving certification.

Being a champion does not require a formal leadership position. Champions drive transitional change by strengthening relationships, establishing a collective commitment to action [38], building coalitions, and mobilizing and convincing existing networks to participate [39]. Establishing a collective commitment to action requires skills in influencing others and using various communication and persuasion strategies [40].

2.2. Innovation

2.2.1. Sustainability-Oriented Innovation (SOI)

The Oslo Manual [41] defines innovation as the implementation of a new or significantly improved product (good or service), process, marketing method, or organizational method in business practices, workplace organization, or external relations. Over the past few decades, innovation has been one of the key drivers of sustainable development [42]. However, according to Dias [43], the relationship between innovation and sustainability can be complex, and insufficient analysis may lead to misunderstandings about the concept of Sustainability-Oriented Innovation (SOI). According to Roome [44] and Martínez-Conesa et al. [45], when firms aim to contribute to sustainability development, they must create both a sustainability-oriented practice and innovation. Sustainability-oriented innovation (SOI) is the capability of an organization to contribute to sustainable development while simultaneously delivering economic, social, and environmental benefits—the so-called triple bottom line [46].

Adams et al. [47] argue that SOI at the organizational level requires intentional changes to a company's philosophy and values, leading to alterations in products, processes, or practices to create social and environmental value alongside economic returns. Similarly, Klewitz and Hansen [48] describe SOI as the integration of economic, social, and ecological considerations into the design of new products, processes, and organizational structures. According to a recent Mckinsey [49] survey, sustainability is an important priority for CEOs that aim to strategically impact social and environmental issues.

In the context of sustainability, eco-innovations have emerged as a primary focus. These innovations can take the form of processes, organizational structures, products, or technologies [41,50]. Process eco-innovations, for example, aim to enhance eco-efficiency in the production of goods and services [51], while organizational eco-innovations involve restructuring company interactions and management approaches [52]. Product and technology eco-innovations, on the other hand, focus on improving or developing new products that are more environmentally friendly, durable, or energy-efficient, or that introduce entirely new sustainable technologies [46].

As the concept of sustainability expanded to include a social dimension, a more holistic approach to business sustainability through innovation emerged. Numerous terms and frameworks have since been developed to support the integration of sustainability into business practices [48,53]. The concept of SOI builds on these earlier stages, reflecting the evolution of sustainability in organizations, supported by the deliberate management of economic, social, and environmental factors in a unified direction [47,48].

2.2.2. Innovation and Collaboration in the Building Sector

Over the past two decades, there has been increasing research and discussion surrounding innovation in the building sector. Innovation is an important means of sustainable development [54]. The implementation of new technology can realize improvements in resource efficiency, which can significantly reduce the impact on the environment. Toole et al. [55] define innovation in this context as the introduction of a significant improvement in a process, product, or system that is new to the organization, potentially altering individual perspectives and resulting in competitive advantages, enhanced value for customers, or benefits for stakeholders.

Successful innovations not only create value for a broad range of stakeholders, including investors and suppliers, but they also unfold through a series of decisions made in an environment of uncertainty [15].

2.2.3. Innovation and Collaboration Analysis Tool in the Building Sector

Toole et al. [55] developed a Maturity Assessment Model (MAM) to help organizations identify key weaknesses and areas for improvement in their innovation capabilities across eight critical areas of influence. Building on this, Bossink [56] introduced the Inter-Organizational Innovation Model (IOIM), focusing on how organizations collaborate to enhance and implement innovations in sustainable building. This theoretical model consists of eight stages of interorganizational innovation and 22 interaction patterns.

Herazo and Lizarralde [21] built on the models by Toole et al. [55] and Bossink [56] to create an analytical tool that can be applied at various levels of strategic and tactical management within an organization, including internal management and temporary multi-organization collaborations. Their study also identified four key tensions that arise when applying Green Building Certificates (GBCs) within temporary multi-organizations, which result from the clash between various "push-and-pull" factors, such as (1) bottom–up versus top–down processes [57], (2) short-term versus long-term efficiency [58], (3) individual versus collective approaches [59], and (4) competition versus collaboration [60].

These tensions require balancing opposing concepts to find optimal solutions. The four tensions are as follows:

- Strategic vs. Tactical: Balancing strategic planning with tactical execution is crucial. While most decisions are made strategically in a project's early stages, tactical leadership and motivation during implementation are essential for success.
- Collaborative vs. Competitive: Organizations must collaborate to address the complexity and fragmentation of the building sector. However, economic pressures and technological advancements drive increased competition.
- Participatory vs. Effective: The tension between inclusive decision-making and efficiency involves various stakeholders in the construction process. Sustainable building tools help actors share experiences to guide decision-making towards sustainability.
- Individual vs. Collective: While the building sector often leans towards individualism, cooperation and teamwork are necessary, especially when sustainability is a focus in project decision-making.

The way these tensions are managed can significantly impact organizational performance and project outcomes. Herazo and Lizarralde [21] identified several factors that, when applied to GBCs, influence innovation and collaboration within the building sector.

3. Materials and Methods

This study aimed to compare the innovation processes in the Portuguese building sector related to the application of Green Building Certifications (GBCs) with the study conducted by Herazo and Lizarralde [21]. The objective was to identify key convergences and divergences, thereby assessing the maturity of major stakeholders in the construction process regarding innovation and collaboration for sustainable development.

A qualitative methodology was employed, utilizing a multiple case study approach to examine the influence of GBCs on innovation within the construction sector. To ensure

comparability with the Herazo and Lizarralde [21] study, a similar conceptual model was applied. This involved selecting projects based on the same criteria, using similar interview questions, and interviewing individuals in equivalent hierarchical positions. The data collection and observation methods mirrored those described by Herazo and Lizarralde [21]. The case studies selected met the following criteria:

1. Projects applying LEED certification.
2. Projects developed by large and complex organizations, whether private, public, or mixed capital.
3. Projects promoted by clients/owners for their own business activities.
4. Projects significantly engaged with sustainable development.
5. Projects either ongoing or completed within the last three years to facilitate access to relevant information and interviews.

Ten interviews were conducted, featuring eight open-ended questions that focused on the green certification processes outlined by Herazo and Lizarralde [21] and the eight key areas of the model developed by Toole et al. [55] (see Table 1).

Table 1. Summary the case study respondents.

Case Study	Client	Contractor	Architect/LEED Consultant	Project Manager/Inspection
A	1	2	1	2
B	1	1	1	1

During the data collection phase, the aim was to delve into the organizational aspects related to green certification processes.

To supplement the interview data, additional information was gathered from various sources, including project documentation, site visits, photographs, project drawings, meeting attendance, and meeting minutes (see Table 2).

Table 2. Documentary information collected.

Case Study	Case Study A	Case Study B
Document		×
Owner's strategic plans		×
Owner's annual reports	×	×
Official website information	×	
Work meetings	×	×
Press documents	×	×
Photographs		×

Table 3 lists the eight questions posed to each interviewee to gather comprehensive information and identify the intra-organizational relationships impacting the innovation processes in each case study [21].

After collecting and transcribing the data, they were processed to analyze both the primary areas of innovation outlined by Toole et al. [55] and the prevalent innovative practices at the inter-organizational level as suggested by Bossink [56]. This analysis aimed to produce results comparable to those of Herazo and Lizarralde [21], allowing for a comparative evaluation based on the four identified tensions.

Table 3. Questions (adapted from Herazo and Lizarralde [21] and Toole et al. [55]).

Key Area	Question
Organizational Processes	How have Sustainable Development strategies been implemented at both the organizational and project decision-making levels?
Resource allocation	Was there a dedicated budget or team specifically assigned for obtaining certification?
Risk Perspective	Did the customer perceive green certification as risky?
Culture	Was the organizational environment receptive to new ideas, processes, and feedback, both internal and external, with a long-term view?
Customer Focus	How did the design teams (project and consultancy) address and prioritize customer needs?
Learning	How was knowledge transferred between projects?
Collaboration	What mechanisms were employed for communication, coordination, and collaboration with internal and external stakeholders?
Leadership	Was a Green Project Champion appointed?

4. Discussion

4.1. General Characteristics of Case Studies

Regarding Case Study A (see Table 4), the current owners acquired land along with an existing project and a finalized Green Building Certification (GBC). After reviewing the project, they opted to change the certification system and upgrade from a BREEAM GOOD certification to a LEED GOLD certification. These modifications required substantial structural changes at the design level.

Table 4. Summary table of the case studies presented.

Characteristics	Case Study A	Case Study B
Client	Private	Private
Use	Multifunctional installations for any type of rent	Offices for the company's own use
Building area	About 6500 m^2	About 5500 m^2
Project budget	Approximately 60 million	Approximately 40 million
Certification	LEED GOLD	LEED GOLD
Completion estimates	2023	2022
Key green building strategies	Rainwater recovery systems, flow reducers, photovoltaic panels, facades with improved shading levels, parking for bicycles, electric vehicles	Rainwater recovery systems, photovoltaic panels, parking for bicycles, electric vehicles
Type of funds and investment	Private investment fund	Private company

Case Study B (see Table 4) involves a prominent Portuguese company planning to construct an office building for its headquarters. This case is particularly noteworthy because it represents the company's fourth building project to receive LEED certification, reflecting a high level of decision-making maturity and expertise in certification processes.

4.2. Comparison with Theoretical Models

The collected data were confronted with the theoretical models of Toole et al. [55] and Bosink [56]. Table 5 presents the relationship between the eight key areas of Toole et al.'s [55] model and the certification process.

Table 5. Summary of key areas by case study [55].

Key Areas	Case Study A	Case Study B
Organizational Processes	Transfer of expectations related to sustainable development fundamentally from top to bottom (top–down)	Top–down transfer of sustainable development-related expectations and needs
Allocation of resources	Budget and specific human resources to obtain certification; more horizontal structure	Budget and specific human resources to obtain certification; more hierarchical structure
Perspective of Risk	Certifications are seen as an opportunity to enhance the value of the building to be constructed; viewed as a contractual obligation	Certifications are not seen as a risk, but as a tool to help financial savings; viewed as a contractual obligation
Culture	Most of the stakeholders are receptive to the principles of sustainable development, which improve the project	All stakeholders are receptive to the principles of sustainable development, which improve the project
Customer Focus	Support from external consultants to carry out the project and obtain LEED certification	Support from external consultants to carry out the project and obtain LEED certification
Learning	Little evidence of formal learning, but commitment by all stakeholders to familiarize themselves with issues related to certification	Clear definition and clarification of communication strategies on certification but with little clear evidence of formal learning
Collaboration	Collaboration between consultants and architects for strategic integration of the sustainable development premises in the initial phases of the project. Collaboration between project inspection/management and contractor to define project execution tactics	Collaboration between consultants and architects for strategic integration of the sustainable development premises in the initial phases of the project. Collaboration between LEED consultants and contractor to define project execution tactics
Leadership	A more strategic and tactical Green Project Champion	A more strategic and tactical Green Project Champion

4.2.1. Organizational Process

In the organizational processes analyzed in both case studies, expectations related to sustainable development (SD) are conveyed hierarchically, in a top–down approach. In other words, within the temporary multi-organizations involved, SD-related issues originate with project owners, who set strategic guidelines. These guidelines are then progressively and systematically disseminated through the various stages of the project, involving all organizations participating in the construction process. The incorporation of sustainability concerns, therefore, demands increased coordination in decision-making processes, especially at the project design stage, as this is where the project's primary guiding principles are defined [55]. These strategic decisions are grounded in a clear vision held by the project owners regarding the future of construction, where increased innovation, linked to the use of LEED certification, is seen as an added value not only in construction processes but also in the final product. This approach offers benefits across multiple domains, particularly in the economic, social, and environmental spheres. In relation to Case Study A, the increase in sustainability introduced by the certification results in financial added value and enhances the profitability of the asset intended for commercialization. In Case Study B, this financial added value is viewed from a different

perspective. Here, the increase in sustainability introduced by the certification is seen as a tool for financial savings.

4.2.2. Resource Allocation

In terms of resource allocation, both case studies feature individuals within the temporary multi-organizations specifically designated to handle matters related to obtaining LEED certification, along with a dedicated budget for this purpose. This allocation of resources spans all project phases and is primarily focused within the LEED consultancy office (hereafter referred to as the "LEED consultant"), whose main responsibilities include the following:

- Providing comprehensive oversight of the project and addressing any LEED certification-related questions that arise throughout its duration;
- Establishing the primary strategic guidelines to align the project with LEED certification requirements;
- Assisting the architectural team in integrating these guidelines into the project design in the most cost-effective and feasible manner;
- Supporting project supervision and contractors in understanding the project details and defining optimal strategies and execution plans; and
- Managing all bureaucratic aspects associated with achieving the desired certification level.

During the project's execution phase, other participants (such as supervisors and contractors) also need to allocate specific resources to LEED-related issues, and at this point, certain differences emerge between the case studies.

In Case Study A, there is a greater allocation of resources, and the organizational structure created to coordinate certification-related matters is more horizontally distributed compared to Case Study B. In Case Study B, the resource allocation is more limited, and the structure is more vertically organized, with clearly defined hierarchical levels.

4.2.3. Risk Perspective

When analyzing the third key area defined by Toole et al. [55] for each of our case studies, it is clear that this aspect represents one of the greatest points of convergence between them. Although the first key area highlighted some differences in the project owners' motivations for incorporating LEED certification, the risk perspectives associated with its use are, generally, quite similar.

This similarity is largely due to the fact that neither project owner is new to LEED certification. For the owner in Case Study A, this is their second project, while for the owner in Case Study B, it is their fourth. This familiarity among decision-makers creates room to consider adding complementary certifications, such as WELL certification. WELL, which focuses on building use, assures property owners that future occupants will manage and utilize the spaces in alignment with the initial sustainability principles established through LEED.

From a more technical and tactical standpoint—specifically, from the perspectives of supervision and contractors—LEED certification introduces a higher level of bureaucracy (e.g., in the procurement and validation processes of materials used in construction) and requires a strong understanding of certification-related matters. The inclusion of LEED certification in the construction process was seen from two perspectives: on one hand, as a contractual requirement that must be met, and on the other, as a learning opportunity for those who had not previously worked with this certification system.

4.2.4. Culture

Culturally, there are some clear differences between the two temporary multi-organizations studied. However, there are also several guiding principles that are shared by both.

A key factor for successfully integrating certification into the construction process is openness to new ideas and processes. Effective coordination between different companies

and between various departments within the same company also plays a crucial role. Lastly, the presence of external feedback to drive improvement and guide the process to successful completion is of great importance [55].

Regarding project owners, project managers, supervisors, and LEED consultants in both case studies, all are generally aligned with these points. The main difference, however, is observed among contractors, where the greatest challenge lies in balancing immediate efficiency with adaptability to innovative and more sustainable processes. Before delving into these differences, it is important to clarify that both contractors comply fully with all national and international laws and standards regarding quality, safety, and environmental practices. However, even without prior experience working with LEED certification, the contractor in Case Study B shows a slight advantage in adaptability to the certification requirements compared to the contractor in Case Study A.

This small advantage for the contractor in Case Study B can be attributed to a series of practices promoted across its various work sites. These initiatives focus not only on compliance but also on the systematic adoption and internalization of social and environmental standards by all employees.

4.2.5. Customer Focus

Customer focus is another area of strong alignment between the two case studies analyzed. Both projects engaged external consulting firms to support the entire process of implementing and achieving LEED certification. Another commonality is the longstanding relationship between these consulting firms and the respective project owners; in both cases, they had previously collaborated on similar projects. This prior working relationship proved crucial in helping the consultants understand the client's needs and incorporate guidelines best suited to each project's specific requirements.

Another important factor for customer satisfaction is the selection of the organizations responsible for executing the project. In both cases, nationally renowned organizations with extensive infrastructure and experience in large-scale projects were chosen. These companies are highly motivated to be at the forefront of industry practices, which provides a sense of security when it comes to innovation. Such organizations are generally better equipped to tackle new challenges and more readily adapt to evolving paradigms.

4.2.6. Learning

The key area related to learning is one of the most challenging to study within our temporary multi-organizations for several reasons. First, there is the urgency to change certain common practices in the sector, followed by the limited or nonexistent experience of most participants in the construction process with certification systems (CCV). These factors highlight the lack of an intrinsic knowledge management system within the organizations that could facilitate learning and familiarization with these topics, outside of practical experience and/or when confronted with a contractual requirement or something equivalent.

What exists currently, as the interviews clearly indicated, is a strong desire to learn and adopt best practices from those participants encountering CCV for the first time (contractors and supervisors), and, on the other hand, a willingness to teach and share knowledge from those more familiar with CCV (client and LEED consultant). Since projects applying CCV are still relatively rare, learning occurs slowly and without significant impact on the broader industry landscape. Organizations that need to work with CCV often rely on consulting firms to address immediate questions without fully understanding the depth or underlying reasons behind specific decisions.

In both case studies presented, some key points about learning can be identified. In both cases, there is no clear evidence of formal learning. However, the way the process unfolds is notably different. In Case Study A, there is a clear commitment from all participants to familiarize themselves with certification-related issues. In Case Study B, the

definition and clarification of communication strategies regarding the certification proved to be a positive factor throughout the process.

4.2.7. Collaboration

Collaboration enables different organizations to work together towards a common goal throughout the various phases of the project. Initially, it is crucial between the project owner, the different consulting firms, and the architects to define the best possible design within the guidelines imposed by the certification. At a more advanced stage, it becomes essential between the project management team, the LEED consultant, and the contractor to establish the execution tactics. In parallel, the collaboration between the project owner and all participants, at every phase of the project, is always necessary to address the various issues that arise during the process.

The main difference in collaboration between the case studies was related to the participants involved during the execution phase of the project. In Case Study A, collaboration primarily occurred between the contractor and the project management/supervision teams. In Case Study B, however, this collaboration took place directly between the contractor and the LEED consultant, through the use of "LEED pivots".

4.2.8. Leadership

The key area of leadership can be considered the transversal point across all other key areas. It is through effective leadership, exemplified by the role of the "Green Project Champion" in CCV projects, that bridges are created, and entropy between all stakeholders is reduced. This leadership also fosters a more holistic view of the entire process, integrating individual actions toward a common goal.

This role is typically assigned to one person or a group of individuals responsible for overseeing the process at all stages and ensuring that the certification is successfully completed. As with the other key areas, there are both similarities and differences between the two case studies in terms of leadership.

In both cases, it is clear that the role of the "Green Project Champion" is filled by a group of people, either from the same or different organizations, who share strategic and/or tactical responsibilities. This core group is supported by individuals known as "Green members", who assist throughout the process. Another common point is the externalization of strategic decisions supporting the certification, meaning the LEED consultant defines the certification guidelines.

In Case Study A, there is a clear distinction between a more strategic "Green Project Champion" (the LEED consultant) and a more tactical one (the project management/supervision team). In Case Study B, the "Green Project Champion" role is filled by a team of individuals with a strong blend of both strategic and tactical responsibilities, in conjunction with the LEED consultant. The main difference lies in the individuals within the temporary multi-organization involved in defining the more tactical decisions. While in Case Study B the LEED consultant also assists in defining the best tactical procedures, in Case Study A, this responsibility falls to the project management/supervision team.

Table 6 outlines the stages of innovation and the patterns of inter-organizational interaction observed in each case study [56]. While all eight stages of innovation were identified, none of the twenty-two interaction patterns were detected in either case.

By taking a more detailed look at Table 6, it becomes evident how the participants in the temporary multi-organizations interact with each other while managing the different innovative processes throughout the project. Similar to what is identified in the literature, the two case studies used also do not strictly follow the linear sequence presented in the theoretical model developed by ref. [37].

Table 6. Stages of inter-organizational innovation [56].

Innovation Stages	Case Study A	Case Study B
Autonomous innovation	Autonomous innovation Innovation portfolio	Autonomous innovation Innovation portfolio
Networking	Choose to innovate or are forced to innovate. Prefer to work with known partners. Perceive an influential position in the innovative network	Choose to innovate or are forced to innovate. Prefer to work with known partners. Perceive an influential position in the innovative network
Exploration (Execution)	Determine what experience is needed	Determine what experience is needed. Develop a cooperative portfolio
Training	Enter contracts	Enter contracts
Organization	Establish a joint organization Establish control bodies Develop an architectural project	Establish control bodies Develop an architectural project
Planning	Allocate experiences Facilitate cooperation and communication	Allocate experiences Facilitate cooperation and communication
Co-innovation	Coordinate the realization of innovation	Coordinate the realization of innovation
Dismantling	Dismantle the joint organization	Dismantle the joint organization

4.2.9. Autonomous Innovation

- In both cases, innovation occurs autonomously, as the decision to implement a certification system (CCV) is voluntarily made by the project owners based on a set of strategic decisions.
- Both manage their innovation portfolios by deciding, in collaboration with the LEED consultants, the certification level they aim to achieve. From there, they define the main guidelines and strategies to follow in order to achieve their goals.

4.2.10. Networking

- In both case studies, participants choose or are compelled to innovate. Once the project owner decides to implement a certification like this in their project, all participants in the construction process must comply with it, which forces innovation in numerous situations.
- Both prefer to work with familiar partners, particularly in the early stages of the project, to facilitate the definition of guidelines that best suit the project and ensure their effective inclusion. In the case studies, the preferred partners were clearly the architectural firms and LEED consultants.
- Both recognize their influential position within the innovative network, as there is widespread awareness among all parties, not only due to the limited number of projects with similar certifications at the national level, but also because the inclusion of such certifications in these types of projects will serve as a differentiating factor in the medium term.

4.2.11. Exploration

- In both case studies, the decision-makers determine the necessary experience to carry out each phase of the project, with particular emphasis on the project definition stages, which are crucial for the subsequent phases. Any changes at this stage tend to incur significant costs.
- In Case Study B, there is also the development of a cooperative portfolio between the LEED consultant and the project owner, due to their history of collaborative work on similar projects. This allowed the incorporation of ideas from previous projects, improving their development and fostering a much more stable and established cooperation.

4.2.12. Training

- There are no clearly identified moments of organizational interaction aimed at conducting formal training. What is identifiable in both case studies is that training takes place in a more informal manner through the sharing of information provided by the LEED consultants who offer consultancy to the respective projects.

4.2.13. Organization

- In Case Study A, a joint organization is established. Although all key participants are directly contracted by the project owner, the outsourcing of project management/supervision to the owner leads to the creation of an organization between the owner and the project management team, aimed at managing all innovations within the construction process. In Case Study B, as project management is internalized within the project owner's team, this type of organizational structure is not as clearly defined.
- Both cases create a control body that all participants respect, headed by the LEED consultant, who evaluates and validates the certification process.
- Both projects present the guidelines that must be followed during the construction phase to successfully achieve the desired certification. The project also defines the main green sustainability characteristics to be implemented in terms of building materials, energy, water, and other aspects.

4.2.14. Planning

- Both allocate experience by subcontracting the entire consultancy and supervision process for obtaining certification to an external and specialized organization in the field.
- Both facilitate cooperation and communication, reducing the complexity of the communication network and decreasing entropy by ensuring that the different participants communicate directly with each other.

4.2.15. Co-Innovation

- Both case studies coordinate the implementation of innovations through the CCVs, using a point-based system to assess the expected level of sustainability for each project.

4.2.16. Dismantling

- In both case studies, the temporary multi-organizations formed will be dismantled once the projects are completed, and the process will restart for the next project.

4.3. Assessment of Tensions Influencing Innovation and Collaboration

A detailed analysis of the testimonies reveals the presence of three out of the four previously mentioned tensions. It is important to note that, although these tensions were identified, they generally appeared to be less pronounced compared to those observed in prior studies.

4.3.1. Strategic/Tactical Tensions

In both cases, two common factors are identified. Firstly, there is a strong commitment from the project owners, primarily from a strategic standpoint to the core principles of sustainable development. Secondly, most strategic and tactical decisions are concentrated in the initial design phase.

In terms of collaboration, Case Study A reveals some communication and information transfer issues between the contractor and the LEED consultant. These issues are somewhat mitigated by a more horizontal organizational structure and the active involvement of project management in operational aspects. Despite this, some tension arises, particularly from the contractor's side, rather than from the LEED consultant.

Conversely, Case Study B benefits from a well-defined hierarchical structure that facilitates highly effective collaboration among all parties involved. The LEED consultant

plays a key role, providing a thorough explanation of the project environment at the outset and remaining readily accessible to address any issues during the construction and execution phases.

4.3.2. Collaborative/Competitive Tensions

In none of the interviews conducted for the two case studies were collaborative/competitive tensions observed. Several factors contribute to this absence of tension.

Firstly, the organizations involved in the temporary multi-organizations for both case studies, while operating within the same industry, are not direct competitors. This reduces the potential for competitive friction.

Secondly, a limited understanding of Green Building Certification (GBC) issues among many tactical actors may have contributed to the lack of identified tensions. This knowledge gap might have prevented these actors from recognizing or addressing competitive aspects.

The data indicate that, although collaboration is present across both case studies, the nature of this collaboration varies. Issues such as dissatisfaction with the working methods or the level of expertise of the LEED consultants are among the main disruptive factors noted.

Additionally, the generally positive relationships among the organizations involved may have influenced the lack of observed tensions. For large-scale projects involving multiple organizations, there is often an inherent collaborative tendency driven by a shared goal of success and contractual obligations. This collaborative spirit was evident in all interviews.

4.3.3. Participatory/Effective Tensions

The participatory/effective tensions were observed in a much subtler manner than typically described in the literature. This diminished visibility can be attributed to the challenge of interviewing future building users. Tensions between participatory decision-making processes and short-term efficiency often arise between decision-makers and users, and these are less evident without input from the latter.

In Case Study A, no community participatory programs were implemented. However, the emphasis on incorporating innovations required for certification highlights an effort to provide future tenants with tools that enhance talent retention.

In Case Study B, although participatory engagement with employees was not explicitly examined, some insights were gathered from the owner's interview. It was noted that the owner values employee well-being and has acted on feedback through initiatives such as satisfaction surveys. Recommendations from these surveys led to improvements in existing buildings, including the addition of a gym, better facilities, and the replacement of less healthy vending machine options with healthier alternatives.

4.3.4. Individual/Collective Tensions

Individual/collective tensions become particularly pronounced when integrating innovative processes like obtaining a Green Building Certification (GBC) into the traditionally mechanized construction sector. Herazo and Lizarralde [21] suggest that in organizations with a more collectivist culture, such tensions are less apparent during project execution and certification. Instead, these tensions are more visible in the interactions between operational members, or "green members", and the green project champion.

In Case Study A, there are two distinct types of green project champions. A specialized work team is established, with specific roles allocated within the organizational process. The LEED consultant acts as a key liaison, translating certification guidelines into actionable steps and overseeing their implementation. Meanwhile, the project management/inspection office provides tactical support, assisting green members with material selection and ensuring the timely execution of certification requirements. This approach addresses potential delays and supports a smoother process.

In Case Study B, a company was hired from the outset to serve as the green project champion. This firm's early involvement allowed for the pre-definition of sustainability guidelines, which were then integrated into the project by the architects. The consultancy firm, thus, played a dominant role in guiding decision-making throughout the project's phases, addressing operational queries and ensuring alignment with sustainability objectives.

From this analysis, it is clear that the role of the green project champion is crucial in mitigating tensions between individualistic and collective perspectives within temporary multi-organizations. Additionally, an evaluation of these tensions should consider the individual risks perceived by each actor. The data reveal a consensus among both strategic and operational actors, who generally view the use of GBCs as low-risk, despite some differing opinions.

5. Conclusions

In alignment with the study by Herazo and Lizarralde [21], the results of this analysis were compared with the theoretical models proposed by Toole et al. [55] and Bossink [56]. This comparison aimed to identify both the convergences and divergences between these theoretical frameworks and the practical scenarios observed in the case studies, with a specific focus on the tensions faced by temporary multi-organizations during the implementation of Green Building Certification (GBC).

The analysis provided valuable insights into the theoretical models and identified three of the four tensions described in the literature. The collaborative/competitive tension was not evident in the case studies, likely due to the relatively low maturity level of sustainable development practices in the national building sector.

A key finding consistent with the existing literature is the crucial role of leadership in integrating innovative processes. The green project champion, as a new role within temporary multi-organizations, significantly enhances understanding of these processes and fosters consensus among stakeholders.

The study also highlights that tensions in inter-organizational relationships align with the stages of inter-organizational innovation outlined in Bossink's model [56]. These tensions are often driven by stakeholder pressure to adopt sustainable development principles. In the case studies, this pressure predominantly came from project owners and was formalized through contractual obligations, which were enforced by the LEED consultants.

Developers in the case studies were instrumental in navigating these inter-organizational phases to reduce tensions between strategic and tactical aspects. While the LEED consultants primarily managed technical responsibilities, they also served as green project champions, making key decisions that aligned with the project's objectives.

A significant observation not evident in the case studies but noted in the literature is the varied perception of risk associated with GBC implementation. The additional workload for tactical actors was generally seen as a learning opportunity rather than a deterrent.

In line with Herazo and Lizarralde [21], the analysis revealed that certification imposition by project owners requires stakeholders to adapt, though these adaptations are not always imsmediately recognized due to inexperience.

In conclusion, the study underscores the growing importance of the green project champion role, often held by consulting firms, in successfully implementing GBCs. Effective collaboration among all actors in temporary multi-organizations is essential for achieving successful outcomes in these projects.

6. Limitations and Future Work

One final limitation to acknowledge is the limited number of available case studies. The scarcity of projects meeting the selection criteria and the challenges in directly contacting stakeholders were significant factors. Consequently, the conclusions drawn cannot be broadly generalized to the entire national building sector. Instead, this study serves as an

indicative examination of the influence of Green Building Certification (GBC) on innovation and collaboration within construction projects, highlighting key points and main impacts.

For future research, it is recommended to replicate this study over a span of five to ten years with a larger sample of projects. This would help assess the evolution of trends related to GBC and explore whether the constraints, tensions, benefits, and opportunities differ across various certifications or emerging programs, whether governmental or private.

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References

1. IPCC. *AR6 Synthesis Report: Climate Change 2023*; Intergovernmental Panel on Climate Change: Geneva, Switzerland, 2023.
2. Atkinson, R.D. *Competitiveness, Innovation and Productivity: Clearing up the Confusion*; The Information Technology & Innovation Foundation: Washington, DC, USA, 2013; pp. 1–7.
3. Porter, M.E. *The Competitive Advantage of Nations*; Harvard Business Review: Brighton, MA, USA, 1990. [CrossRef]
4. Cole, R.J. Building environmental assessment methods: Redefining intentions and roles. *Build. Res. Inf.* **2005**, *35*, 455–467. [CrossRef]
5. Ding, G.K.C. Sustainable construction-The role of environmental assessment tools. *J. Environ. Manag.* **2008**, *86*, 451–464. [CrossRef] [PubMed]
6. Amado, M.P.; Lucas, V.; Ribeiro, M. Sustainable Construction: Value of Certification. In Proceedings of the ACSEE—International Conference on Advances in Civil, Structural and Environmental Engineering, Institute of Research Engineers and Doctors, Zurich, Switzerland, 13 October 2013; pp. 180–187.
7. Commission Brundtland. *Our Common Future*; Oxford University Press: Oxford, UK, 1987; p. 15. [CrossRef]
8. Redclift, M. Sustainable Development (1987–2005): An Oxymoron Comes of Age. *Sustain. Dev.* **2005**, *13*, 212–227. [CrossRef]
9. Emas, R. Brief for GSDR 2015 The Concept of Sustainable Development: Definition and Defining Principles. 2015. Available online: https://asset-pdf.scinapse.io/prod/2184349672/2184349672.pdf (accessed on 4 September 2024).
10. Dyllick, T.; Hockerts, K. Beyond the business case for corporate sustainability. *Bus. Strategy Environ.* **2002**, *11*, 130–141. [CrossRef]
11. Ding, G.K.C. Developing a multicriteria approach for the measurement of sustainable performance. *Build. Res. Inf.* **2005**, *33*, 3–16. [CrossRef]
12. Robichaud, L.B.; Anantatmula, V.S. Greening Project Management Practices for Sustainable Construction. *J. Manag. Eng.* **2011**, *27*, 48–57. [CrossRef]
13. Janjua, S.Y.; Sarker, P.K.; Biswas, W.K. Sustainability implications of service life on residential buildings–An application of life cycle sustainability assessment framework. *Environ. Sustain. Indic.* **2021**, *10*, 100109. [CrossRef]
14. Bhochhibhoya, S.; Pizzol, M.; Marinello, F.; Cavalli, R. Sustainability performance of hotel buildings in the Himalayan region. *J. Clean. Prod.* **2020**, *250*, 119538. [CrossRef]
15. Tan, Y.; Shen, L.; Yao, H. Sustainable construction practice and contractors competitiveness: A preliminary study. *Habitat Int.* **2011**, *35*, 225–230. [CrossRef]
16. Berardi, U. Sustainability Assessment in the Construction Sector: Rating Systems and Rated Building. *Sustain. Dev.* **2012**, *20*, 411–424. [CrossRef]
17. Meena, C.S.; Kumar, A.; Jain, S.; Rehman, A.U.; Mishra, S.; Sharma, N.K.; Bajaj, M.; Shafiq, M.; Eldin, E.T. Innovation in Green Building Sector for Sustainable Future. *Energies* **2022**, *15*, 6631. [CrossRef]
18. Liu, T.; Chen, L.; Yang, M.; Sandanayake, M.; Miao, P.; Shi, Y.; Yap, P.-S. Sustainability Considerations of Green Buildings: A Detailed Overview on Current Advancements and Future Considerations. *Sustainability* **2022**, *14*, 14393. [CrossRef]
19. Alwisy, A.; BuHamdan, S.; Gül, M. Evidence-based ranking of green building design factors according to leading energy modelling tools. *Sustain. Cities Soc.* **2019**, *47*, 101491. [CrossRef]
20. Sun, C.; Li, Z.; Li, X. Research on Green Building Incremental Cost Optimization. *IOP Conf. Ser. Earth Environ. Sci.* **2019**, *267*, 052040.
21. Herazo, B.; Lizarralde, G. The influence of green building certifications in collaboration and innovation processes. *Constr. Manag. Econ.* **2015**, *33*, 279–298. [CrossRef]
22. Reed, B. Shifting from 'sustainability' to regeneration. *Build. Res. Inf.* **2007**, *35*, 674–680. [CrossRef]

23. Pérez-Lombard, L.; Ortiz, J.; González, R.; Maestre, I.R. A review of benchmarking, rating and labelling concepts within the framework of building energy certification schemes. *Energy Build.* **2009**, *41*, 272–278. [CrossRef]
24. Bragança, L. Princípios de Desenho e Metodologias de Avaliação da Sustentabilidade das Construções. 2005. Available online: http://repositorium.sdum.uminho.pt/handle/1822/4943 (accessed on 4 September 2024).
25. Ofori-Boadu, A.; Owusu-Manu, D.G.; Edwards, D.; Holt, G. Exploration of management practices for LEED projects: Lessons from successful green building contractors. *Struct. Surv.* **2012**, *30*, 145–162. [CrossRef]
26. Mateus, R.; Bragança, L. Sustainability assessment and rating of buildings: Developing the methodology SBToolPT-H. *Build. Environ.* **2011**, *46*, 1962–1971. [CrossRef]
27. Dobiás, J.; Macek, D. Leadership in Energy and Environmental Design (LEED) and its impact on building operational expenditures. *Procedia Eng.* **2014**, *85*, 132–139. [CrossRef]
28. Sebastien, H.; Heike, A.; Nishil, B.; Arpad, H. Leadership in Energy and Environmental Design (LEED)—A critical evaluation by LCA and recommendations for improvement. *Int. J. Life Cycle Assess.* **2007**, *12*, 25. [CrossRef]
29. USGBC. Leed and the International Green Construction Code. 2018. Available online: https://www.usgbc.org/about/programs/green-codes (accessed on 4 September 2024).
30. Owens, B.; Macken, C.; Rohloff, A.; Roseberg, H. *LEED v4—Impact Category and Point Allocation Process*; USGBC, Ed.; LEED: Washington, DC, USA, 2013; pp. 1–16.
31. Gattiker, T.F.; Carter, C.R. Understanding project champions ability to gain intra-organizational commitment for environmental projects. *J. Oper. Manag.* **2010**, *28*, 72–85. [CrossRef]
32. Hartmann, A. Overcoming resistance to innovation: The integration champion in construction. In *Clients Driving Innovation*; Brandon, P.S., Lu, S.-L., Eds.; Blackwell: Oxford, UK; Malden, MA, USA, 2008; pp. 157–166.
33. Howell, J.M.; Higgins, C.A. Champions of technological innovation. *Adm. Sci. Q.* **1990**, *35*, 317–341. [CrossRef]
34. Bayraktar, M.E.; Owens, C.R. LEED Implementation Guide for Construction Practitioners. *J. Archit. Eng.* **2010**, *16*, 85–93. [CrossRef]
35. Mould, S.; Fryirs, K.; Lovett, S.; Howitt, R. Supporting champions in rive management. *WIREs Water* **2020**, *7*, e1445. [CrossRef]
36. Tenali, S.; McManus, P. Climate change acknowledgment to promote sustainable development: A critical discourse analysis of local action plans in coastal Florida. *Sustain. Dev.* **2022**, *30*, 1072–1085. [CrossRef]
37. Bossink, B.A. Leadership for sustainable innovation. *Int. J. Technol. Manag. Sustain. Dev.* **2007**, *6*, 135–149. [CrossRef] [PubMed]
38. Lindsay, J.; Rogers, B.C.; Church, E.; Gunn, A.; Hammer, K.; Dean, A.J.; Fielding, K. The role of community champions in long-term sustainable urban water planning. *Water* **2019**, *11*, 476. [CrossRef]
39. Teicher, M.H. How organized credibility enables climate action: The U.S. climate security coalition as a credibility machine. *J. Environ. Policy Plan.* **2022**, *24*, 261–276. [CrossRef]
40. Rochell, K.; Xie, L.; Fisher, R.; Griffin, K. Contextual factors for transnational municipal network's local environmental action: A study of ICLEI Africa's LAB Wetlands SA Programme. *Local Environ.* **2022**, *28*, 882–899. [CrossRef]
41. OECD. The Measurement of Scientific, Technological and Innovation Activities. In *Oslo Manual 2018: Guidelines for Collecting, Reporting and Using Data on Innovation*, 4th ed.; OECD Publishing: Luxembourg; Eurostat: Paris, France, 2018.
42. Schaltegger, S.; Wagner, M. Sustainable entrepreneurship and sustainability innovation: Categories and interactions. *Bus. Strategy Environ.* **2011**, *20*, 222–237. [CrossRef]
43. Dias, A.S. Inovação Orientada para a Sustentabilidade: Uma análise ao caso da Corticeira Amorim. Master's Thesis, Departamento de Economia, Gestão, Engenharia Industrial e Turismo, Universidade de Aveiro, Aveiro, Portugal, 2018.
44. Roome, N. Business strategy, R&D management and environmental imperatives. *RD Manag.* **1994**, *24*, 065–082.
45. Martínez-Conesa, I.; Soto-Acosta, P.; Palacios-Manzano, M. Corporate social responsibility and its effect on innovation and firm performance: An empirical research in SMEs. *J. Clean. Prod.* **2017**, *142*, 2374–2383. [CrossRef]
46. Hart, S.; Milstein, M. Creating sustainable value. *Acad. Manag. Exec.* **2003**, *17*, 56–69. [CrossRef]
47. Adams, R.; Jeanrenaud, S.; Bessant, J.; Denyer, D.; Overy, P. Sustainability-oriented Innovation: A Systematic Review. *Int. J. Manag. Rev.* **2016**, *18*, 180–205. [CrossRef]
48. Klewitz, J.; Hansen, E.G. Sustainability-oriented innovation of SMEs: A systematic review. *J. Clean. Prod.* **2014**, *65*, 57–75. [CrossRef]
49. McKinsey & Company. Survey on Sustainability Priorities for CEOs. 2021. Available online: https://www.mckinsey.com/capabilities/sustainability/our-insights (accessed on 4 September 2024).
50. Beise, M.; Rennings, K. Lead markets and regulation: A framework for analyzing the international diffusion of environmental innovations. *Ecol. Econ.* **2005**, *52*, 5–17. [CrossRef]
51. Huber, J. Technological environmental innovations (TEIs) in a chain-analytical and life-cycle-analytical perspective. *J. Clean. Prod.* **2008**, *16*, 1980–1986. [CrossRef]
52. Hansen, E.G.; Grosse-Dunker, F.; Reichwald, R. Sustainability innovation cube—A framework to evaluate sustainability-oriented innovations. *Int. J. Innov. Manag.* **2009**, *13*, 683–713. [CrossRef]
53. Rennings, K.; Ziegler, A.; Ankele, K.; Hoffmann, E. The influence of different characteristics of the EU environmental management and auditing scheme on technical environmental innovations and economic performance. *Ecol. Econ.* **2006**, *57*, 45–59. [CrossRef]
54. Ebolor, A.; Agarwal, N.; Brem, A. Sustainable development in the construction industry: The role of frugal innovation. *J. Clean. Prod.* **2022**, *380*, 134922. [CrossRef]

55. Toole, T.M.; Hallowell, M.; Chinowsky, P. A tool for enhancing innovation in construction organizations. *Eng. Proj. Organ. J.* **2013**, *3*, 32–50. [CrossRef]
56. Bossink, B.A. The interorganizational innovation processes of sustainable building: A Dutch case of joint building innovation in sustainability. *Build. Environ.* **2007**, *42*, 4086–4092. [CrossRef]
57. Fraser, E.D.G.; Dougill, A.J.; Mabee, W.E.; Reed, M.; McAlpine, P. Bottom up and top down: Analysis of participatory processes for sustainability indicator identification as a pathway to community empowerment and sustainable environmental management. *J. Environ. Manag.* **2006**, *78*, 114–127. [CrossRef]
58. Eriksson, P.E.; Olander, S.; Szentes, H.; Widén, K. Managing short-term efficiency and long-term development through industrialized construction. *Constr. Manag. Econ.* **2014**, *32*, 97–108. [CrossRef]
59. Fellows, R.; Liu, A.M.M. Use and misuse of the concept of culture. *Constr. Manag. Econ.* **2013**, *31*, 401–422. [CrossRef]
60. Brandenburger, A.; Nalebuff, B. *Co-Opetition: 1. A Revolutionary Mindset That Combines Competition and Co-Operation. 2. The Game Theory Strategy That's Changing the Game of Business*, Pbk. ed.; Currency Doubleday: New York, NY, USA; Toronto, ON, Canada, 1998.