buildings

MDPI

Review

The Early Case for Stabilization and Sustainability of Korean G-SEED Based on Collaborative Governance: A Theoretical Review

Myunghee Kim

Faculty of Smith College, Sahmyook University, 815 Hwarang-ro, Nowon-gu, Seoul 01795, Republic of Korea; kmh@syu.ac.kr

Abstract: This article aims to identify the significance of collaborative governance in the initial stage of the system for stabilization and sustainability through a case study of the introduction of the Green Standard for Energy and Environmental Design (G-SEED) certification system. To this end, the collaborative governance model was examined, and how the initial drivers and collaborative dynamics contributed to the stabilization and sustainability of the G-SEED certification system were investigated. Based on a theoretical literature review, a descriptive case study was conducted by applying the Integrated Framework of Collaborative Governance framework to address how multi-stakeholder collaboration works in G-SEED. The results of this study demonstrate that the drivers and collaborative dynamics in the early G-SEED contributed to a major revision of green building certification regulations and standards as outcomes of collaborative actions and to a continued increase in the number of certifications. This article argues that the stabilization and sustainability of the certification system depend on how multiple stakeholders collaborate and establish collaborative governance in the early stage of system introduction. It suggests that in the case of G-SEED, it is necessary to consider the implications derived from the results based on collaboration among sectors to achieve qualitative growth rather than quantitative expansion.

Keywords: energy-efficiency building; Green Standard for Energy and Environmental Design; sustainability; collaborative governance; innovative design

Citation: Kim, M. The Early Case for Stabilization and Sustainability of Korean G-SEED Based on Collaborative Governance: A Theoretical Review. *Buildings* **2023**, *13*, 2631. https://doi.org/10.3390/buildings13102631

Academic Editors: Youjin Jang, Jeehee Lee and Soowon Chang

Received: 29 August 2023
Revised: 9 October 2023
Accepted: 13 October 2023
Published: 18 October 2023

1. Introduction

Sustainability is a concept presented at the 1992 "Earth Summit" with the basic principle of "environmentally desirable and sustainable development". It refers to "development that meets the needs of the present without compromising the ability of future generations to meet their own needs" [1]. This concept can also be applied to improve energy efficiency in cities and buildings. As the global urbanization rate reached 57% in 2022, each country has been paying attention to the sustainability of cities and buildings and calling for innovation based on low energy consumption, high efficiency, and expansion of clean energy. In particular, innovative design has been emphasized in urban architecture [2].

American environmental scientist Amory Lovins argues that the "fifth fuel" is energy efficiency. After coal, oil, natural gas, and nuclear power, the energy efficiency concept appeared 30 years ago and now occupies the position of the fifth fuel. In other words, energy efficiency has the same value as fuel because it reduces the energy used to provide services such as heating, lighting, and transportation [3]. In this context, the Net Zero Energy Building (NZEB), which refers to a building characterized by no net energy consumption, is rapidly emerging as a new environmental paradigm worldwide. An NZEB is more precisely defined as a building in which the sum of the energy used annually is approximately equal to the sum of renewable energy produced on site [4–9].

While buildings up to the nineteenth century actively utilized the natural environment in a traditional manner, buildings in the twentieth century utilized various devices and

facilities; this resulted in a rapid increase in energy consumption and emission of large amounts of greenhouse gases. Passive houses, which appeared in the twenty-first century, are NZEBs that utilize natural energy and minimize energy loss. Korea prefers the ZEB (Zero Energy Building) to the NZEB, defining it as "a green building that minimizes the energy load required for buildings and minimizes energy consumption by utilizing renewable energy" [10]. Therefore, ZEB can reduce energy consumption to a minimum by using insulated windows made of eco-friendly materials and eco-friendly heating and cooling equipment and utilizing technologies such as solar chargers and waste heat recovery ventilators during construction. In addition, anyone can participate in the environmental movement to respond to climate change through ZEB.

Although the content differs depending on the context of each country, many countries have taken the lead in establishing zero-energy buildings—that is, green building standards, certification, and assessment systems—to reduce the impact of buildings on the environment and practice global environmental conservation. Assessment rating systems that began with individual building units in the early days are now expanding and diversifying into neighborhood, city, and national spatial planning [11]. The United States is operating Leadership in Energy and Environmental Design (LEED), which is widely known worldwide, and promoting the world's first Building Research Establishment Environmental Assessment Method (BREEAM), while Japan is introducing the Comprehensive Assessment System for Building Environmental Efficiency (CASBEE) [12,13]. Among these, LEED in the US is a green building certification system in which the U.S. Green Building Council (USGBC) assesses the design and practices of eco-friendly buildings in the United States and worldwide; it is used in more than 150 North American countries. In the UK, BREEAM originated from the Building Research Establishment (BRE) and is used in 93 countries worldwide to provide certification with the goal of improving buildings' environmental performance based on science [12].

Korea integrated the eco-friendly building certification system, which has been introduced only for public housing since 2002, into the Green Standard for Energy and Environmental Design (G-SEED) in 2013. Certification bodies entrusted by the government assess factors that affect the environment every year and certify buildings' environmental performance [14,15]. G-SEED was created according to the Green Building Construction Support Act, and the Korean government and provincial governors establish a green building basic plan every five years and reflect it in their projects every year. Meanwhile, in 2019, the Ministry of Land, Infrastructure, and Transport (MOLIT) announced a roadmap for obligatory zero-energy construction and a plan to spread it; until now, phased obligatory zero-energy construction has been promoted [16]. Alleviated building standards are applied to certified buildings, and local tax exemptions are provided to building owners.

Some studies have identified the following issues in G-SEED operation: (1) Most evaluation items and factors for G-SEED certification are the results of benchmarking from BREEAM and LEED. Some certification items do not take into account domestic policy situations. (2) Since the introduction of G-SEED, although the total number of certification cases in Korea has been increasing, the number of overseas certification cases is very low. In other words, unlike BREEAM or LEED, G-SEED is not being expanded into a global certification system. (3) In the case of foreign countries, continuous management is conducted starting from the initial certification during a building's life cycle; in Korea, however, the maintenance management and re-certification system for existing buildings is insufficient. (4) Even though domestic certification demand is increasing and evaluation items are standardized, the evaluation results of each certification body are different [17–21]. So why have these problems persisted? Could it be that the lack of collaboration between cross-sector actors has caused them? As such, problems that occur in the operation of the system can raise doubts about the initial governance system and collaboration between organizations. In this respect, research to identify the initial governance mechanism of G-SEED is necessary and can be considered meaningful as an important challenge.

Based on the background, this article focuses on the context and contents of the extensive revision of the G-SEED certification standards in the third year since its introduction. In particular, attention is paid to governance, which is a communication mechanism and relationship among stakeholders dealing with certification systems. Governance generally plays an important role in the successful execution of public services, and a governance approach can be an important tool in developing research. Collaborative governance, in which one or more public institutions engage stakeholders in the decision-making process for public policy or program implementation, can be considered a useful tool for analyzing current issues related to G-SEED [22–24]. Accordingly, this study addresses collaboration as a component of the government governance model consisting of collaboration between horizontal and vertical organizations and coordination of ideas and actions.

Many scholars have studied the framework of cross-sector collaboration in public management and have explored the concepts and theories of governmental collaboration processes and their influencing factors. For a country to evaluate the eco-friendliness of buildings and induce sustainable architecture, mutual collaboration among various actors, such as the government, market, and citizens, is essential, and close communication and vitalization of networks are required. In addition, public values must be created through participation and compromise in solving public problems, and governance, known as a form of social coordination, must operate as its enabling mechanism. In particular, collaborative governance is "a joint decision-making method for solving public policies and social problems through autonomous and horizontal interaction of various public and private actors, as well as a structure and process for creating public values". Until recently, it has been widely used as a research approach in the field of environmental policy [24–29].

As the number of G-SEED certifications has increased significantly over the past 10 years, it is assumed that the 2016 revision of certification standards had a substantial impact. Unfortunately, however, not many studies were conducted in the early stages of G-SEED's launch, and the research mainly included reports dealing with certification factors and certification evaluation methods by researchers belonging to G-SEED-operating organizations. In this respect, this study is different from previous ones in that it identifies the status of collaboration by the social sector and addresses problems that occur during the certification process.

This article, as a descriptive case study, aims to identify collaborative governance based on the context from the introduction of the G-SEED system in 2013 to the system revision in 2016, present the results according to the framework, and derive implications for the certification system's stabilization and sustainability. The findings are expected to guide Korea and other countries pursuing green building certification systems in a similar situation to implement better response methods in the future. The article is organized as follows. The Introduction presents the need for research and research agendas. The governance approach and framework components are explained in the Methods section. In the Results section, the collaborative governance structure and changes of stakeholders related to G-SEED in Korea are identified from the perspective of the Integrative Framework for Collaborative Governance (IFCG). In the conclusion, the results are summarized, and the research implications are presented along with recommendations for follow-up studies.

2. Methods

2.1. Governance Approach

Governance theories are applied to investigate G-SEED's overall operating system. Governance is mostly defined as a system of laws, rules, and judicial decisions through which the public sector delivers, directs, and sometimes regulates public goods and services through formal or informal relationships with organizations in the private sector. Thus, the concept of governance encompasses collaboration through the participation of non-profit organizations and private enterprises in the delivery and operation of public services. However, the concept of governance, the value to be pursued, and the mutual relationships among participants may be different depending on the perspective from which governance

is approached. The term "governance", which has the same etymology as "government", has developed along with various theories related to governance since the 1980s [30].

In particular, collaborative governance has recently attracted attention as a new paradigm for state administration, with the role of the government and expectations for national management methods evolving according to changes in times and environments. This concept refers to the government involving stakeholders in the decision-making process to solve common problems, and it emphasizes agreement and negotiation, so that conflicts among stakeholders can be alleviated, social costs reduced, and consensus reached in conflict situations. Collaborative governance, developed by Huxham (2003), embraces several governance concepts but utilizes a form of social coordination to go beyond participation and compromise, increase interdependence and accountability, and create new public values. Table 1 summarizes the conceptual definition of collaborative governance claimed by several researchers [24,31–34].

Table 1. Conceptual definition of collaborative governance.

Authors	Conceptual Definition of Collaborative Governance
Ansell and Gash (2008) [31]	A governing arrangement where one or more public agencies directly engage non-state stakeholders in a collective decision-making process that is formal, consensus-oriented, and deliberative and that aims to make or implement public policy or manage public programs or assets.
Bryson, Crosby and Stone (2006) [32]	The linking or sharing of information, resources, activities, and capabilities of organizations in two or more sectors to jointly achieve results that cannot be achieved by organizations in either sector.
Emerson, Nabachi and Balogh (2012) [24]	The processes and structures of public policy decision-making and management that engage people constructively across the boundaries of public agencies, levels of government, and/or the public, private, and civic spheres in order to carry out a public purpose that could not otherwise be accomplished.
Huxham (2003) [33]	Any form or term of governance in which an actor performs tasks in relation to actors in other organizations.
Lee (2010) [34]	Creating new public values through various types of interactions, transcending existing organizations and policies, through the optimal mixing and utilization of social mediation modes by various actors, such as the government and private sector.

As above, researchers have derived the following keywords from the concept of collaborative governance: actors, stakeholder linkage, mutual relations, collaboration, public policy decision making, structure, and process of public management, information, resources, the activity of participating organizations, connecting and sharing capabilities, creating public value. However, researchers have highlighted that for most organizations, collaboration with other organizations is not easy [25].

2.2. Theoretical Review on the Integrative Framework for Collaborative Governance

Based on the keywords of the collaborative governance definition derived above, this study theoretically reviews Emerson et al.'s (2012) IFCG—a theoretical framework that explains how collaboration among multiple stakeholders can ultimately have a beneficial impact on society. It is based on various theories such as organization theory, public administration theory, conflict management theory, and planning and environmental management theory [24].

According to this framework, system context, collaborative governance regime, drivers, collaborative dynamics, and collaborative actions are emphasized as conceptual components for evaluating governance systems. In Figure 1, the system context refers to the political, legal, and institutional environment or cultural context that affects the system of governance. A collaborative governance regime is described as "a system in which cross-sectoral collaboration represents the primary mode of action, decision-making, and activity" [35,36].

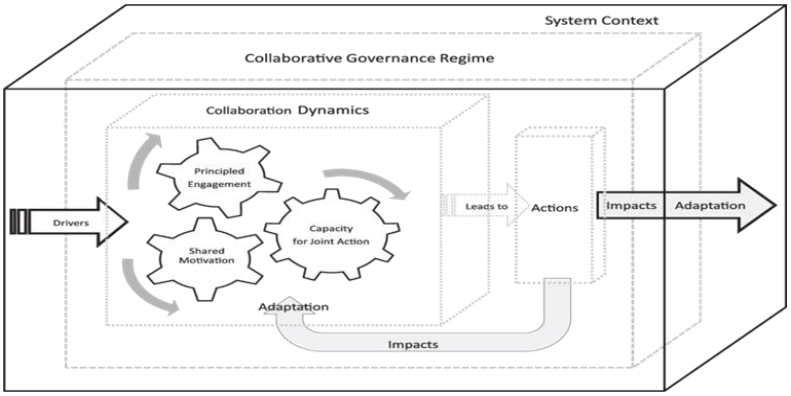

Figure 1. An integrative framework for collaborative governance. Source: Emerson et al. 2012 [24], p. 6.

It is a key feature of the IFCG as a process of overall governance, where collaboration by multiple parties is the dominant pattern of behavior and activity. Drivers such as leadership, consequential incentives, interdependence, and uncertainty are the driving force that activates and set the direction of a collaborative governance regime [24]. Collaborative dynamics, a key element of analysis, are here defined as "a change in the state of collaboration or cooperation among actors, that is, people who promote and lead collaboration" [37]. They have three key intertwined elements: principled engagement, shared motivation, and capacity for joint action, and if these elements do not work simultaneously, they cannot succeed.

Principled engagement, one of the three components of collaborative dynamics, refers to the collective agreement among participants formed by face-to-face conversations, meetings, and networks. Such engagements are formed by participants with different values and cultures and are also called "espoused principles". This research examines the structure and participation principles of G-SEED's enforcement/entrusted organizations that enable meetings, networks, and conversations among participants as a principled engagement property.

Shared motivation refers to mutual trust within the governance of participants. It appears as mutual trust, mutual understanding, internal legitimacy, and shared commitment. Mutual trust is an important factor in determining the success of collaborative governance because it reduces transaction costs and monitoring activities; here, mutual trust as a shared motivation property is examined through the process of certification shared among enforcement/entrusted organizations.

The capacity for joint action is a key attribute of collaborative governance processes among organizations. It consists of four elements: procedural and institutional arrangements, leadership, knowledge, and resources. This research reviews certification rules, certification factors, and stakeholders' actions.

Collaborative actions refer to the outcome and feedback of collaborative dynamics. They influence governance frameworks and appear as the arrangements of laws, policies, rules, knowledge, property, and human resources. In this study, collaborative actions are viewed as the result of inter-organizational collaboration centered on G-SEED from 2013 to 2016.

2.3. Methods

This article investigates the literature on domestic and overseas green building certification systems and conducts a descriptive case study to identify collaborative governance from the initiation of G-SEED in Korea to its revision using the IFCG. Unlike empirical research, a descriptive case study is a research method that focuses on "what is" and "what was", rather than on the "why" and "how"; such design does not manipulate any variable but rather observes and measures it.

Articles that applied IFCG as a methodology were interested in what characteristics of collaborative governance promote or hinder the system, and make specific efforts to reveal the dynamics of collaborative governance. Accordingly, this study also seeks to limit the analysis elements to "drivers, collaborative dynamics, and collaborative actions" based on IFCG to achieve the research purpose. Drivers examine leadership before and after system integration, new international norms, and the emergence of a new government. Collaborative dynamics investigates the participation principles and structured roles of institutions, shared motivation, and the joint action capacity of sector stakeholders. Collaborative actions explore the results of collaborative dynamics. Meanwhile, it seeks to present the increase in the number of certifications as evidence for the stabilization and sustainability of G-SEED.

The temporal scope of research to identify collaborative dynamics is also limited to the period from 2013, when the Korean Green Building Construction Support Act was executed, to the end of 2016, when it was amended. For the case review, documents related to green building systems published by domestic and international organizations, various statistics, and academic data with articles were collected and reviewed without a specific time period.

3. Results

3.1. Drivers

As greenhouse gas reduction due to global climate change has emerged as an important policy issue in each country, Korea has also faced uncertainty. The country has long paid attention to the significance of energy-efficient and eco-friendly buildings that can be used for more than 30 years once built. President Lee, who took office at the right time, was the first president in the world to enact the Framework Act on Low Carbon Green Growth in 2010 and announced a national strategy and five-year plan for green growth [38]. However, the actively pursued green growth policy faced a period of stagnation as the successor administration shifted the policy agenda in a different direction according to political objectives [39]. Instead, Park's administration sought to upgrade the eco-friendly building certification system, which had been in effect since 2002, to a high-level certification system run by advanced countries such as the United States, Britain, and Japan.

In June 2013, the Park administration launched a green building certification system that integrated the housing performance rating system into the eco-friendly building certification system that had been implemented since 2006. To strengthen the brand, the English name was set as G-SEED, and the system was supplemented by expanding the subject of mandatory public building certification and establishing a classification system for specialized fields. The G-SEED, similar to global certification systems such as LEED and BREEAM, began with the purpose of creating a foundation for entering the global market through technical collaboration and academic exchange. In fact, G-SEED has influenced the promotion of ZEB policy since 2017 [40]. Meanwhile, the Park government eventually presented a 37% reduction target compared to BAU (business as usual) by 2030 based on the 2015 Paris Climate Agreement and established and presented specific detailed action plans [41].

Since 2013, the green building certification system has been supervised by the green building division of the MOLIT, and green building certification rules and standards have been jointly managed by the MOLIT and the Ministry of Environment (MOE) [42]. In terms of certification service delivery, the MOLIT could designate an operating body and certification bodies, and certification tasks are to be delegated to these institutions by law.

3.2. Collaborative Dynamics

3.2.1. Principled Engagement and Structured Division of Roles among Operating Institutions

Collaborative dynamics is a key indicator to identify how operating organizations collaborate against these internal and external pressure factors. Principled engagement

can be evident in the composition of the operating institutions guaranteed by the relevant legislation.

G-SEED was launched by integrating the eco-friendly building certification system targeting apartment houses, which had been in operation since 2002, and the housing performance rating certification system. The rules for green building certification and a joint decree by the MOLIT and the MOE specified the types of buildings subject to certification, certification criteria and procedures, certification validity period, fees, and certification body designation standards. The MOLIT designated an operating body and certification bodies to effectively operate the green building certification system and delegated the certification task. The Korea Institute of Civil Engineering and Building Technology (hereinafter KICT) serves as the only operating body and specifically performs tasks such as management of certification bodies, operation of certification systems, review of certification assessment results, training of green building designers, and green building certification education. When the system began operating, 11 institutions were established as certification bodies: Korea Land and Housing Corporation; Korea Institute of Energy Research; Korea Institute of Education and Environment; Crebiz Certification Authority; Korea Facilities Safety Corporation; Korea Appraisal Board; Korea Environment Corporation; Korea Environmental Industry & Technology Institute; Korea Productivity Center Quality Assurance; Korea Green Building Council; and Korean Society for Environmental Architecture. The certification body designation was valid for 5 years and could be renewed through joint consultations between the MOLIT and MOE and deliberation by the certification steering committee. In accordance with the rules for green building certification, the operating body reports the green building certification performances to the MOLIT and the MOE every month. The certification bodies also submit the green building certification status data to the operating body every month, which are used as certification performance management data [43,44].

In Figure 2, G-SEED's operating system shows the tasks, roles, and communication patterns of organizations participating in the certification system.

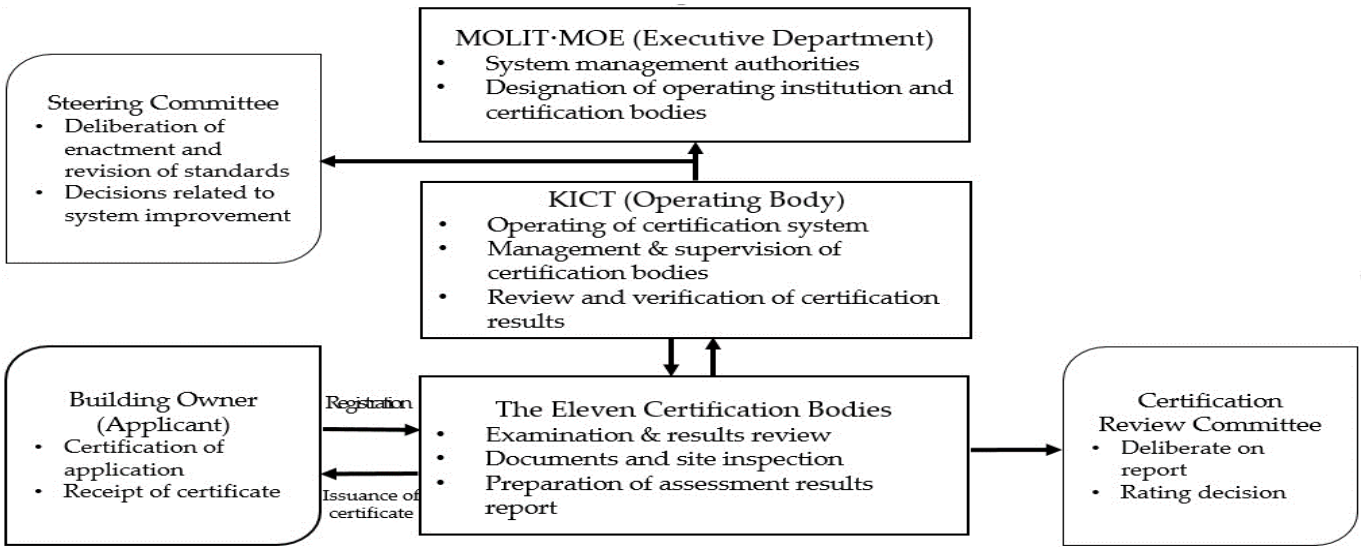

Figure 2. G-SEED operating system.

The MOLIT and MOE entrust the management and institutional improvement of each certification body to the Korea Institute of Civil Engineering and Building Technology, which is an operating body, and this is agreed upon by law [40]. In other words, each operating institution is able to collaborate structurally by performing the roles and responsibilities assigned vertically and horizontally according to participation following the principles established by law.

3.2.2. Shared Motivation Based on Sharing Information System for All Stakeholders

G-SEED is the only system that comprehensively assesses buildings' eco-friendliness and has made certification acquisition compulsory for public buildings and provided incentives to buildings that have obtained certification. During the initial period, all operating organizations, regardless of their legal status or roles, seemed to have a common belief that the G-SEED system would prompt the construction of resource-saving and naturalistic buildings. Then, it seemed that efforts were being made by the relevant organizations to prepare additional certification procedures and standards for greenhouse gas emissions and energy reduction by evaluating buildings' environmental performance from the beginning of the system's introduction to its design and disposal [17,43–45].

Evidence for shared motivation during the period is as follows. (1) Related organizations notified regulations and standards on the website of each accountable organization to promote the spread of green buildings and participate in expanding the mandatory acquisition standards for public buildings. (2) The operating institution opened and operated an official website as an information system for G-SEED, mainly providing content, such as the current status of certification achievements of certification bodies, green building casebooks, green building-related events, and green building-related news. The main targets were users such as certification applicants, certification body judges, and central government agencies, and the goal was to improve user convenience and the utilization of information. (3) Every certification body operated a separate website and web page named "Green Building Certification" on their own platform, explaining certification standards and procedures in detail; for example, the standard for public buildings with a total floor area of 10,000 m^2 or more was expanded to buildings with a total floor area of 3000 m^2 or more. The target of application was also expanded to detached houses, multi-residential houses, cultural and assembly facilities, sales facilities, transportation facilities, medical facilities, education and research facilities, business facilities, and accommodation facilities. In addition, public work facilities were required to acquire an excellent grade (Grade 2 Green) or higher, and the specialized field classification system was reestablished from the existing nine to seven items, as shown in Table 2 [44,46].

Table 2. The seven categories of the classification system.

1	Land use and transportation
2	Energy and pollution
3	Materials and resources
4	Water management
5	Maintenance
6	Ecological environment
7	Indoor environment quality

In Figure 3, certification proceeded in two stages: preliminary certification and final certification. When the necessary documents were submitted for preliminary certification in the design stage, a certificate was issued after the examination; this corresponded to the use approval stage, and based on the preliminary certificate, the final certificate could be issued only after going through the actual construction site transaction statement, site photo, test report, and examination by the certification body [44].

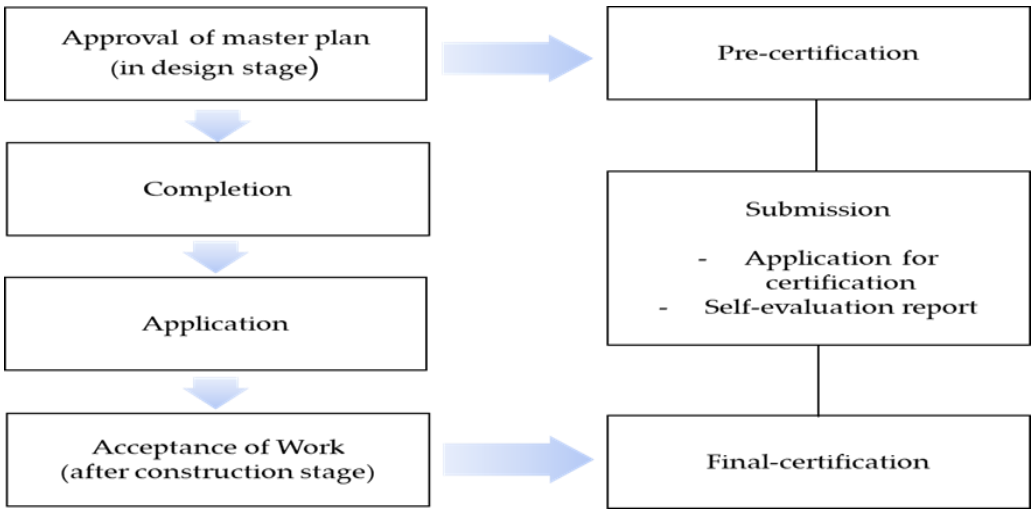

Figure 3. Certification procedure.

3.2.3. Capacity for Joint Action by the Operating Institutions, Technical Experts, and Citizen Applicants

Before and after the introduction of G-SEED, research institutes and researchers focused on the fact that the certification systems of the UK, US, and Japan, among other countries, are widely used as certification standards overseas, and attempted to actively reflect them in the domestic certification system. KICT, leading a system operation with a government-funded research institute as its leadership, formed a technical committee and started discussions to supplement the shortcomings of G-SEED in 2012.

In Table 3, the KICT technical committee comprised 90 industry, academia, and research experts, and since the regular subcommittee was held in 2012, it has played a role in establishing green building certification standards and reviewing revision proposals. The committee, which included architecture and environment-related associations, academic societies, and industry experts, reviewed and proposed directions for upgrading and revising G-SEED. In addition, certification standards were drafted through workshops and forums, and they had to go through deliberation by the Green Building Certification Steering Committee [47]. Among the G-SEED stakeholders, the group that demonstrated the best capacity for joint actions was the technical committee members commissioned by the KICT. In general, the technical committee is characterized as a temporary organization that is disbanded when a specific goal is accomplished and recomposed with new members if necessary. The members, as experienced experts in the field, worked relentlessly to complete the revision of the green building certification regulation and certification standards with their own expertise, and their area of expertise was divided into four: sustainable space, living environment, resource management, and green planning [44,45].

Table 3. Joint actions of technical committee.

Date	Name of Meeting	Description
August 2012–March 2013	Subcommittee of technical committee	Establishment of standards such as review of evaluation items and establishment of supplements
29 March 2013	Green architecture forum	Preparation of apartment housing review plan
30 April 2013	Expert committee plenary meeting	Development of non-residential amendments
21 August 2013	Technical committee chairperson and vice chairperson workshop	Review and collect opinions on the entire non-residential amendment bill with the Green Architecture TF Team of the Korea Institute of Registered Architects

Table 3. *Cont.*

Date	Name of Meeting	Description
17 December 2013	Green architecture forum	Preparation of non-residential review
30 September 2014	Technical committee chairperson and vice chairperson breakfast meeting	Review of multi-unit housing and non-residential amendments
18–19 March 2014	Amendments review workshop (first)	Discussion on how to assign points and set weights
15–16 April 2014	Amendments review workshop (second)	Discussion of revision to existing buildings
November–December 2014	Technical committee	Preparation of draft commentary on revision
18–19 December 2014	Joint workshop with certification system-related organizations	Full review by area of revision
June–July 2015	Workshop for revision	Full review of details for each area of the revision
August 2015	Subcommittee for revision review	Full review of details for each area of the revision

Source: MOLIT; MOE; KICT. 2015 G-SEED annual report.

Meanwhile, the KICT has built and operated a question-and-answer (Q&A) system in the official information system (https://www.gbc.re.kr/app/cop/qna/list.do) (accessed on 3 June 2023) to induce a fair certification evaluation among citizen applicants and judges of certification institutions. This can be seen as an example of practicing joint collaborative governance through close citizen participation among certification organizations to reduce the inconvenience of certification examiners and citizens as certification applicants due to the interpretation of different assessment standards among certification bodies. The Q&A system is divided into three stages. Level 1 is an inquiry of simple content and refers to an inquiry at a level at which the certification body can make its own judgment. In this case, it makes its own judgment and notifies the applicant of the answer to the inquiry; it collects the contents of the inquiry and the answers every month and reports them to the operating body.

Level 2 corresponds to a level of inquiry that is difficult for the certification body to answer on its own, and this body prepares a review opinion and delivers it to the operating body. According to the reply from the operating body, the certification body responds to the inquiry applicant by official e-mail. Level 3 refers to internal inquiries that are difficult for the auditors and judges of the certification body to decide. When the review opinion is sent to the operating institution, the operating institution forwards the answer to the certification body. The operating institution sends and shares the questions and answers collected from the certification bodies on a monthly basis so that all can be familiar with them [44].

3.3. Collaborative Actions

From its inception, G-SEED faced a series of challenges, such as the need to add changed global standards (LCA) as certification items, global greenhouse gas reduction, request for revision of certification standards, and adjustment of difficulty according to technological development. In addition, under the collaborative governance regime, problems arose consecutively, such as negligent management and supervision by the operating institution, the absence of creative design evaluation items, and the level of certification evaluation centered on specific buildings [17,40,45,47].

After all, collaborative actions as a result of collaborative dynamics led to a drastic revision of G-SEED in 2016, as confirmed by the public notices of the MOLIT (No. 2016-541) and MOE (No. 2016-110). This revision was as follows: (1) It expanded from new construction-oriented certification to existing building certification and reformed the use classification system. (2) Some of the certification examination standards items were deleted and newly established. (3) The innovative design field was newly introduced into the existing classification system in Table 2, which was then reorganized from seven items to eight specialized items. In the innovative design field, an additional 10 points can

be added to the basic score (100 points). (4) Green building experts (G-SEED Integrated Designer) who had completed relevant training at the KICT or KIRA (Korea Institute of Registered Architects) participated in the design process from the initial stage, so that integrated design could be achieved [44,47].

The significance of introducing the innovative design field was to further expand this area by giving additional points to the case where the builder or building owner introduced innovative technology related to green architecture, utilized green building experts, and adopted an innovative design. Table 4 shows a compositional system in the innovative design field. This design field has already been adopted by LEED and BREEAM and is the same as G-SEED in that additional points are given to the basic score. However, unlike the two global systems, G-SEED is different in that it is limited to buildings applying for best or excellent ratings.

Table 4. Compositional system of innovative design.

Category	Innovative Design Certification Items	Green Building Experts	Innovative Green Building Planning and Design
Assessment criteria	Detailed assessment criteria for each item (existing/new assessment items)	Confirmation of participation in design by green building experts	Eco-friendly design, integrated design, innovative planning and design
Points	Points for each item (1–5 points)	One point	Up to three points
Assessment methods	Review of submitted materials	Review of submitted materials	Review of submitted materials
Assessor	Certification bodies	Certification bodies	Council
Note	Assessment items by field		Evaluation of buildings applying for best/excellent ratings

Source: Cho, D. W. 2016 [47].

The Collaborative Dynamics have also resulted in a significant expansion of the number of certifications in between. Table 5 shows that the cumulative number of building certifications in 2013 was 3926, and in 2016, the number was 7968—nearly twice that of 2013. Moreover, the number of preliminary certifications has more than doubled [48].

Table 5. G-SEED certification status from 2010–2016.

Category		2010	2011	2012	2013	2014	2015	2016
Certified buildings	Final certification	278	218	179	244	351	510	567
	Pre-certification	352	282	390	483	683	859	1072
	Cumulative total	2130	2630	3199	3926	4960	6329	7968

Source: Lee et al., 2018 [48].

4. Discussion

Since the revision of the regulations in 2016, G-SEED has achieved stabilization of the governance system and sustainable growth, and I provide evidence that the number of certifications has continued to increase until 2022 in Table 6. The cumulative number of certifications in 2017 was 9733, but more than doubled to 20,926 in 2022. However, it has continued to increase and is unfortunately decreasing slightly due to COVID-19 from 2021. This appears to be a temporary phenomenon and is expected to soon return to a sharp rise as infectious diseases decline. From Table 5, it is clear that the cumulative certification growth rate in 2016 compared to 2013 was 49%, while in Table 6, the growth rate in 2020 compared to 2017 was 60%. However, what is noteworthy is that, unlike final certification, the number of preliminary certification cases continued to increase regardless of COVID-19. This may be evidence to prove that the direction of system operation is still limited to quantitative increase.

Table 6. G-SEED certification status since 2017.

Category		2017	2018	2019	2020	2021	2022
Certified buildings	Final certification	752	855	973	1036	945	856
	Pre-certification	1013	1145	1196	1287	1436	1457
	Cumulative total	9733	11,733	13,902	16,225	18,608	20,926

Source: G-SEED. Available online: http://www.gseed.or.kr/greenCertiDetailPage.do?rnum=3&bbsCnt=554&bbsId=1186 (accessed on 15 June 2023).

According to the above evidence, it is confirmed that the increase in the number of initial certifications after the introduction of G-SEED continued even after the regulation revision and that the collaborative governance of the operating institutions and stakeholders played a pivotal role in stabilizing the certification system.

5. Conclusions

Based on the IFCG-based analysis, from 2013 to 2016, G-SEED seemed to have established a collaborative governance system and to have overcome certification system-related trials and errors through principled engagement, mutual trust, and capacity for joint action among system stakeholders. As a result, G-SEED was able to enter the stabilization and sustainability phase due to the revision of certification regulations and standards. The results of this case analysis revealed the importance of establishing a solid collaborative governance system in the early stages of the system.

To summarize Table 7, under this collaborative governance system, the legacy of the existing eco-friendly building certification system, the enactment of Green Building Construction Support Act, the inauguration of a new government, and international agreements on greenhouse gas reduction are drivers that affect collaborative dynamics. Vertically, a well-organized executive system among the ministries in charge—operating body and certification bodies—and horizontally, institutional devices for certification-related joint collaboration between certification bodies, external technical experts, and citizen applicants were created.

The property of collaborative dynamics included the principled engagement of stakeholders specified in the law, the opening of G-SEED-related websites and information disclosure by operating organizations based on mutual trust, the acceptance of a new global agenda, the activation of technical committees, various types of meetings, and the construction of a Q&A system within the information system. As shown above, these drivers and collaboration dynamics were clearly identified as contributing to the successful outcomes and collaborative actions in 2016: a major revision of green building certification regulations and standards and a significant increase in the number of certified cases. The theoretical analysis results so far represented how the government and entrusted organizations, technical experts, and citizens of applicants mutually collaborated and what collaborative governance as a policy environment was needed for a certification system such as G-SEED to stabilize and continuously grow from the early stage of its introduction. In addition, it was confirmed that the problems arising in the process of operating the system could be resolved under a collaborative governance system.

In particular, introducing an innovative design field and green building experts with enhanced capabilities to receive advice on new assessment items seems to have had a great impact on sustainability and secured G-SEED's stabilized expertise. In this respect, I argue that the determining factor that created the certification standards and assessment criteria of the 2016 revised G-SEED was the vertical and horizontal collaborative governance system among operating institutions. Accordingly, the implications derived from the theoretical analysis results are as follows. (1) One operating body, the KICT, may have helped strengthen expertise in the field of green building certification; however, it was insufficient to manage the eleven certification institutions. Therefore, in order to further strengthen its role in the future, it seems necessary to secure independence such as LEED,

BREEAM, etc. [49,50]. (2) Since the importance of the technical committee was revealed in the process of revamping the certification system, there is a need to broadly consider converting it to a permanent organization rather than a temporary committee in the future. (3) By adding the innovative design field to the evaluation field, we have created an opportunity to take it one step further as a global certification system. Meanwhile, the current evaluation items only target the highest or excellent-grade buildings, so in-depth discussions in terms of system expandability are likely to be necessary in the future.

Table 7. The summary of research results based on IFCG.

Drivers	Collaborative Dynamics		Collaborative Actions
- Legacy of existing eco-friendly building certification rules - Launch of G-SEED by the new government and new law - Implementation of G-SEED governance system Interdependence - Uncertainties of goals for greenhouse gas reduction in accordance with international agreements	Principled engagement	- Joint ministry in charge: MOLIT, MOE - One operating body: KICT - Eleven certification bodies	- Drastic revision of rules for the green building certification and certification standards in 2016 - Significant increase in certification performances
	Shared motivation	- Building clear mutual trust among members for the G-SEED project - Open an official website for information and mutual understanding led by operating body - Post and share certification-related information on related websites among respective certification bodies	
	Capacity for joint action	- Formation of consensus among stakeholders on the addition of the LCA agenda - Activation of technical committees led by KICT - Holding various joint meetings such as annual workshops, forums, and seminars and presenting alternatives - Establishment of a Q&A system in the official information system	

In conclusion, rather than quantitatively expanding the number of G-SEED certifications, I argue for the need to establish a long-term vision and strategy taking into account the implications derived from the collaborative governance between sectors so far in order to substantially improve the quality of energy efficiency in buildings. This article has inherent limitations as a descriptive study. In particular, it was not easy to conduct in-depth research because not many articles applied a governance theoretical approach related to G-SEED. Nevertheless, it is hoped that this article will serve as a trigger for more research studies dealing with the sustainable growth of G-SEED to be published and referenced. In the near future, follow-up studies quantitatively analyzing why and how collaboration is taking place for stakeholders participating in the governance system of G-SEED will be needed.

Funding: This paper was supported by the Sahmyook University Research Fund in 2021.

Data Availability Statement: Not applicable.

Conflicts of Interest: The author declares no conflict of interest.

References

1. Sustainable Development Commission. What Is Sustainable Development? Available online: https://www.sd-commission.org.uk/pages/what-is-sustainable-development.html (accessed on 22 June 2023).
2. Statista. Share of Urban Population Worldwide in 2022, by Continent. Available online: https://www.statista.com/statistics/270860/urbanization-by-continent/ (accessed on 11 April 2023).
3. Doshi, T.K. Energy Efficiency: The Fifth Fuel or Fool's Gold? *The Strait Times*, 1 April 2017.
4. Jaysawal, R.K.; Chakraborty, S.; Elangovan, D.; Padmanaban, S. Concept of net zero energy buildings (NZEB): A literature review. *Clean. Eng. Technol.* **2022**, *11*, 100582. [CrossRef]
5. Yoon, G.; Niwa, H.; Ukai, M.; Onishi, G. Current situation and actions for ZEB in Japan. *REHAVA J.* **2018**, 32–37.
6. AbuGrain, M.; Alibaba, H. Optimizing existing multi-storey building designs towards net-zero energy. *Sustainability* **2017**, *9*, 399. [CrossRef]
7. Ballarini, I.; De Luca, G.; Paragamyan, A.; Pellegrino, A.; Corrado, V. Transformation of an office building into a nearly zero energy building (nZEB): Implications for thermal and visual comfort and energy performance. *Energies* **2019**, *12*, 895. [CrossRef]
8. Carpino, C.; Loukou, E.; Heiselberg, P.; Arcuri, N. Energy performance gap of a nearly Zero Energy Building (nZEB) in Denmark: The influence of occupancy modelling. *Build. Res. Inf.* **2020**, *48*, 899–921. [CrossRef]
9. Moran, P.; O'Connell, J.; Goggins, J. Sustainable energy efficiency retrofits as residential buildings move towards nearly zero energy building (NZEB) standards. *Energy Build.* **2020**, *211*, 109816. [CrossRef]
10. Korea Institute of Civil Engineering and Building Technology. *2019 G-SEED Annual Report*; KICT: Goyang, Republic of Korea, 2019.
11. Cohen, M. A systematic review of urban sustainability assessment literature. *Sustainability* **2017**, *9*, 2048. [CrossRef]
12. Stephanie, V. Green Building Standards and Certification Systems: Whole Building Design Guide. Available online: https://www.wbdg.org (accessed on 9 April 2023).
13. Yun, Y.S.; Cho, D.W. An analysis of green building certification for developing G-SEED global. *J. Korean Inst. Archit.-Sustain. Environ. Build. Syst.* **2020**, *14*, 744–755.
14. Kim, Y.W.; Yu, K.H. Study on the certification policy of zero-energy buildings in Korea. *Sustainability* **2020**, *12*, 5172. [CrossRef]
15. Yun, Y.; Cho, C.; Chae, C. Analysis of green building certification system for developing G-SEED. *Future Cities Env.* **2018**, *4*, 1–9. [CrossRef]
16. Ministry of Land, Infrastructure and Transport (MOLIT). *Zero Energy Building Spread Dissemination Plan*; MOLIT: Sejong, Republic of Korea, 2019.
17. Jang, H.S.; Lee, S.H. A study on problems of the G-SEED process and their improvements: Focusing on case studies of office buildings. *Korea Inst. Ecol. Archit. Environ.* **2014**, *14*, 91–99.
18. Yun, Y.S.; Jang, D.H. Analysis of Certification Results and Items of G-SEED Multi-residential Buildings. *J. Korean Sol. Energy Soc.* **2022**, *42*, 115–125. [CrossRef]
19. Kim, E.B.; Yoo, D.U. A qualitative study on the sustainability assessment tools to apply on Korean green neighborhood design. *Urban Des.* **2021**, *22*, 171–181. [CrossRef]
20. Lee, Y.J.; Lee, K.H. An analysis of the improvement measures of the certification system through G-SEED research trend analysis: In case of maintenance and re-maintenance. *J. Reg. Assoc. Archit. Inst. Korea* **2021**, *23*, 1–9.
21. Kim, H.K.; Chae, C.; Cho, D. Development of an assessment method for energy performance of residential buildings using G-SEED in South Korea. *J. Asian Archit. Build. Eng.* **2022**, *21*, 133–144. [CrossRef]
22. Moynihan, D.P.; La, R.M. *Leveraging Collaborative Networks in Infrequent Emergency Situations*; IBM Center for the Business of Government: Washington, DC, USA, 2005.
23. Provan, K.G.; Milward, H.B. Do networks really work? A framework for evaluating public-sector organizational networks. *Public Adm. Rev.* **2001**, *61*, 414–423. [CrossRef]
24. Emerson, K.; Nabatchi, T.; Balogh, S. An Integrative Framework for Collaborative Governance. *J. Public Adm. Res. Theory* **2012**, *22*, 1–29. [CrossRef]
25. Bryson, J.M.; Crosby, B.C.; Stone, M.M. Designing and implementing cross-sector collaborations: Needed and challenging. *Public Adm. Rev.* **2015**, *75*, 647–663. [CrossRef]
26. Agranoff, R.; McGuire, M. Multi-network management: Collaboration and the hollow state in local economic policy. *J. Public Adm. Res. Theory* **1998**, *8*, 67–91. [CrossRef]
27. Farazamand, A. Learning from the Katrina crisis: A global and international perspective with implications for future crisis management. *Public Adm. Rev.* **2007**, *67*, 149–159. [CrossRef]
28. Daley, D. Interdisciplinary problems and agency boundaries: Exploring effective cross-agency collaboration. *J. Public Adm. Res. Theory* **2009**, *19*, 477–493. [CrossRef]
29. Lee, G. Exploring good governance with an integrative framework for collaborative governance: A case study. *Korea Rev. Org. Stud.* **2020**, *17*, 149–172.

30. Goldsmith, S.; Eggers, W.D. *Governing by Network: The New Shape of Public Sector*; Brookings Institution Press: Washington, DC, USA, 2005.
31. Ansell, C.; Gash, A. Collaborative governance in theory and practice. *J. Public Adm. Res. Theory* **2008**, *18*, 543–571. [CrossRef]
32. Bryson, J.; Crosby, B.; Stone, M. The design and implementation of cross-sector collaborations: Propositions from the literature. *Public Adm. Rev.* **2006**, *66*, 44–55. [CrossRef]
33. Huxham, C. Theorizing collaboration practice. *Public Manag. Rev.* **2003**, *5*, 401–423. [CrossRef]
34. Lee, M.S. Collaborative governance and publicness. *Mod. Soc. Public Adm.* **2010**, *20*, 23–53.
35. Williamson, O.E. *The Mechanisms of Governance*; Oxford University Press: New York, NY, USA, 1996.
36. Lynn, I.E.; Heinrich, C.J.; Hill, C.J. *Improving Governance: A New Logic for Empirical Research*; Georgetown University Press: Washington, DC, USA, 2001.
37. van de Ven, A.H.; Poole, M.S. Explaining development and change in organizations. *Acad. Manag. Rev.* **1995**, *20*, 510–540. [CrossRef]
38. Green Growth Korea. Available online: http://17greengrowth.pa.go.kr/?page_id=42450 (accessed on 6 June 2023).
39. Son, J.Y.; Lee, J.J.; Kim, S.J. Policy Network Analysis of Green Growth Policy in Korea. *J. Korea Technol. Innov. Soc.* **2015**, *18*, 516–538.
40. Kim, Y.S. *Current Green Building Certification System and the Future Tasks*; National Assembly Research Service Korea: Seoul, Republic of Korea, 2018; p. 1498. Available online: https://www.nars.go.kr/eng/report/view.do?categoryId=&cmsCode=CM0136&searchType=ALL&searchKeyword=Green%20Building&brdSeq=23793 (accessed on 6 June 2023).
41. Choi, H.J. Not Good Enough: South Korea's 2030 Carbon Mitigation Target and the INDC. The Asan Institute of Policy Studies, Issue Briefs. 2015. Available online: http://en.asaninst.org/contents/not-good-enough-south-koreas-2030-carbon-mitigation-target-and-the-indc-2/ (accessed on 4 May 2023).
42. Rules for Green Building Certification. Available online: http://www.yeslaw.com/lims/front/page/fulltext.html?pAct=view&pPromulgationNo=167908 (accessed on 3 May 2023).
43. Yun, Y.S.; Ryu, S.H. A study on the improvement of G-SEED through analysis of the previous studies. *J. Korea Inst. Ecol. Archit. Environ.* **2013**, *13*, 31–42.
44. Ministry of Land, Infrastructure and Transport (MOLIT); Ministry of Environment (MOE); Korea Institute of Civil Engineering and Building Technology. *2015 G-SEED Annual Report*; MOLIT: Sejong, Republic of Korea, 2015.
45. Cho, D.W. Trends and future development of G-SEED. *Korea J. Air-Cond. Refrig. Eng.* **2013**, *42*, 18–26.
46. G-SEED. Available online: http://www.gseed.or.kr/siteMain.do (accessed on 2 May 2023).
47. Cho, D.W. *Green Building Certification Standards*; Korea Institute of Civil Engineering and Building Technology (KICT): Goyang, Republic of Korea, 2016.
48. Lee, E.; Cho, Y.; Kim, S. *The Performance and Development Strategy of the Green Building Plan in Korea*; Auri Research Brief; Architecture and Urban Research Institute: Sejong, Republic of Korea, 2018.
49. LEED. Available online: https://www.usgbc.org/leed (accessed on 21 April 2023).
50. Building Research Establishment (BRE). BREEAM Certificates and Countries. 2020. Available online: https://www.breeam.com (accessed on 22 April 2023).