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Review

The Private Sector Role as a Key Supporting Stakeholder towards Circular Economy in the Built Environment: A Scientometric and Content Analysis

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Abstract: The United Nations (UN) 2030 Agenda, borne from the most inclusive policy dialogue ever, emphasized partnerships built upon collaboration to achieve sustainable goals, as documented in SDG17. However, the building and construction sector has been experiencing sustainability issues, leading to several traditional government-led initiatives in the built environment. The private sector is critical to achieving the sustainable development goals (SDGs) and the 2030 Agenda by interacting with societies, governments, and other actors for a circular built environment. The circular economy (CE) is a paradigm that is becoming increasingly popular to drive the movement to sustainability, requiring the partnership of the private sector to be implemented successfully. However, the application of CE initiatives in the private sector engagement has received less attention. Recognizing the interaction of multiple parties' influence on the uptake of a CE, this study thus seeks to examine the participation of the private sector in the CE in the built environment using a mixed review approach (scientometric and content analysis). The findings reveal that the private sector faces barriers in terms of financial and economic, institutional and technological, and political and regulatory factors. This research also identified areas for greater private sector involvement in CE initiatives in the built environment, such as resource reduction, sharing, and the adaptive reuse of existing buildings.

Keywords: private sector; public–private partnership; circular economy; built environment; building and construction; sustainable development

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1. Introduction

The building and construction industry consumes 40% of total natural resources globally, generates 40% of worldwide waste, and emits 33% of global emissions [1], making it the world's greatest user of raw resources. It produces 50% of the world's steel and consumes about 3 billion tons of raw materials. The world's population is predicted to grow from two to five billion people by 2030, putting more strain on resource usage. This will add to the existing demand for housing and services [2].

Cities have remained hubs of activity in recent years, luring billions of new residents. By 2050, the global urban population is predicted to increase by 3 billion people [3]. Given that 60% of the area predicted to be urban by 2030 is yet to be created, one can envision the enormous demand that this will place on existing and future infrastructure. Incorporating CE principles across the sector has evident benefits. As a first step toward shifting to circularity in the built environment, this would entail changing how projects are designed, constructed, maintained, and recycled.

Since the Ellen MacArthur Foundation's CE study in 2012, scholars and practitioners have lauded the CE concept as the best strategy to prevent the consequences of the linear economy, as well as operational traction toward the overused term of sustainable development [4]. The advantages of a CE have been researched in previous research. For example,

McDonough and Braungart [5] expressed that when the CE is completely implemented, it will ensure that technical and biological elements are safely returned to the industrial system and environment. The CE concept also leads to the use of renewable energy in manufacturing systems [4] and the application of innovative business models that catalyze collaboration and technological innovation. Thus, several global cities demonstrate their devotion and intellectual capacity to develop the CE.

Some strategies, such as those used in Amsterdam, focusing on built environment solutions, such as creating CE buildings and commercial areas, exist. Amsterdam is speeding up its transformation to become one of the first CE cities in the world. Towards the Amsterdam Circular Economy and the City Circle are two examples of such initiatives [6], while other cities and localities, on the other hand, have launched specialized programs that employ CE ideas in a variety of ways. In Paris, the city approaches CE via a social and cohesive economy method emphasizing socioeconomic priorities, including sharing above profit, communal intelligence, and mobilizing local governments and individuals [7]. Peterborough, in the United Kingdom (UK), has announced that it wants to be the country's first circular city. Peterborough DNA, the organization driving the program, is based on concepts such as systems thinking, urban metabolism, and biomimicry. It takes a bottom-up, collaborative approach to build and maintain circular approaches, with local stakeholders playing a key role. It emphasizes municipal systems and networks, including water, electricity, resources, local skills, transportation, education, healthcare, neighborhoods, recreational activities, and other municipal services [8]. However, due to the vast size of the development and resources required, the public sector (government) is under pressure because of the ensuing tightening of state development budgets and the magnitude of global development difficulties. The focus has thus shifted to the private sector to increase finances and offer expertise and knowledge to address associated issues [9,10].

Several solutions to the building and construction industry's circularity and delivery difficulties have been top-down, government-driven actions. While such an approach has its merit, various approaches, including multi-stakeholder cooperation in circular networks to produce unique solutions, could be considered. The application of CE concepts to the built environment is still in its early stages of development [11]. As a result, in conformance with the United Nations' Sustainable Development Goal (SDG) 11 to make cities and human settlements inclusive, safe, resilient, and sustainable [12], public–private partnership (PPP) is currently a rapidly expanding form of collaboration that interconnects infrastructure gaps around crucial city services and utilities such as transportation, healthcare, and power supply [13]. Furthermore, the necessity of adopting multi-actor collaborations and stakeholders' involvement and participation is emphasized, as it is a stand-alone target, SDG 17 "partnerships for the goals," in the 2030 Agenda for Sustainable Development. This target 17;17, in particular, develops and promotes effective public–private collaborations [12].

Gatherings of international leaders, including local representatives, NGOs, and private industry actors, at the three major United Nations conferences on Sustainable Development have helped to frame these trends during the last few decades, such as in 1992 in Rio de Janeiro, 2002 in Johannesburg, and 2012 at the Rio + 20 conference. During these sessions, the private sector's growing position as a development actor was emphasized. For example, the Johannesburg Declaration stated that "the private sector, including both big and small firms, has a duty to contribute to the evolvement of sustainable and equitable communities and societies" [10,14]. Also emphasized in the Rio + 20 policy statement is that the private sector must contribute to the advancement of inclusive and sustainable communities and societies [10,14]. Therefore, research on private sector participation is warranted.

This paper is structured in sections. Section 1 presents the need for the study, an overview of the CE and the built environment, and the contribution of the current study given the existing body of knowledge. Section 2 presents the research methodology, including the scientometric and content analysis undertaken, involving the search strategy, paper screening, and analysis tools and methods. Section 3 provides the results of the comprehensive analysis of the countries, institutions, authors, journals, and papers in

this field and the content analysis. Recommendations and conclusions are presented in Sections 4 and 5, respectively.

1.1. Brief History of the CE and Built Environment

The CE advocates for a more resource-efficient model by decoupling economic growth from the consumption of resources, and it has its origins in the 1970s through the schools of thoughts of the industrial ecology [15], regenerative design [16], the performance economy [17], biomimicry [18], and cradle-to-cradle [19]. The Ellen MacArthur Foundation, a non-profit organization dedicated to encouraging the worldwide transition to a CE, has created awareness about the concept. The Foundation created the system or butterfly diagram (Figure 1) based on the idea that material fluxes can be separated into two interconnected loops, namely: the technical and biological material cycles. Composting and anaerobic digestion are examples of how reusable and plant-based elements are used, reproduced, and safely returned to the ecosystem within the biological cycle. The bioeconomy is a developing industry with the capacity to minimize raw material utilization and waste and develop higher-value goods for biological reuse in the long run. Manufactured items are a part of the technological cycle [20].

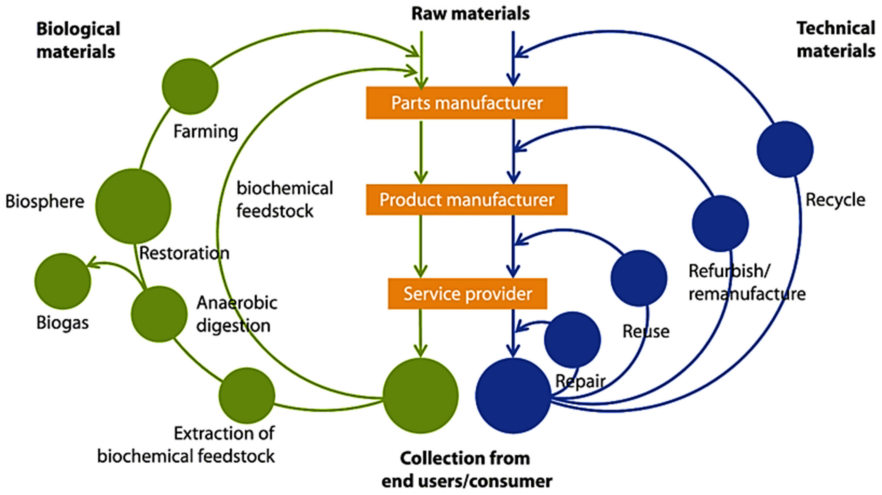

Figure 1. Circular economy butterfly diagram (adapted from EMF (2013) [20]).

The three principles of the CE model are as follows: (1) protect and develop natural capital by managing limited resources and optimizing renewables streams; (2) maximize resource yields by recirculating high-value products, elements, and resources in both biological and technical processes in all periods; and (3) improve system efficiency by identifying and eliminating adverse effects on the environment [20,21].

Multilateral environmental and development partnerships have changed through the years to emphasize private sector involvement in advancing development and environmental policy objectives. This increased interest in private market mechanisms appears to be based on a changing conception of the government's legitimate role and new organizational structures for attaining public policy goals and growing the practice in the face of stagnant public funds for multilateral development [22].

The CE would require an integrated approach that coordinates the efforts of all stakeholders in partnership with the business sector to be implemented successfully. According to Agenda 2030, the private sector is a critical stakeholder [23] and plays an important role in achieving the SDGs [24] as it is a key actor in economic development.

With the above in mind, this research tries to answer these key questions:

1. What is the state of research on public–private collaboration organized in terms of countries, institutions, authors, journals, and papers?

2. What is the role of the private sector in the CE for the built environment?
3. What are the challenges facing the private sector towards contributing to a CE in the building and construction industry?
4. What are the solutions and opportunities for enhanced private sector participation?

In this article, scientometric analysis is used to map cooperation networks, co-citation networks, and co-occurrence networks using the VOSviewer software version 1.6.16 created by Waltman and Van Eck, sourced from Leiden University, Netherlands. Information analysis is used to dig deeper into the content in order to find answers to the research questions. The advanced review paradigm of combined scientometric and content analysis provides a methodical but in-depth assessment. Relevant scholars and practitioners will benefit from the search approach presented for this study. The findings can assist researchers in identifying current research advancements and collaboration opportunities and in building further work in this vibrant field with the advancement of studies on circularity in the built environment.

1.2. Contribution of the Study

The study contributes to the continuing discourse on building sustainable and circular cities by focusing on the private sector as a key stakeholder in ensuring that the building and construction sector is on a sustainable path for a circular built environment.

Past studies by Benachio et al. and Antwi-Afari et al. [25,26] made efforts to document the review of the circularity transition in the construction industry; however, there was no precise information on the shift from a linear economy to a CE through collaboration. Pomponi and Moncaster [27] also examined the key roles of bottom-up and top-down initiatives and multidisciplinary research in making the shift to "circular buildings" easier, but the private sector's role as a major stakeholder was not included in the scope of research. Hossain et al. [28] reviewed the existing trends and challenges in the CE in the construction industry; however, the peculiarity of the influence of the public or private sector was not recognized. Similarly, Hart et al. [29], using a literature review, explored the barriers and drivers of the CE in the built environment, but the research did not identify the specific roles of the public and private sectors and their unique barriers. These reviews have improved the current understanding of the CE in the built environment, but some gaps in knowledge still exist relating to characterizing the stakeholder's role. As a result, it is expedient to address this important knowledge gap by investigating and gaining a deep understanding of the role of the private sector involvement in the CE in the built environment. In terms of roles, Fowler and Biekart [30] argued that the participation of multiple stakeholders is critical for enhancing the likelihood of effective implementation of sustainable development goals, of which the CE is a major component. Thus, the private sector has a major role in CE adoption. Through an online survey of relevant stakeholders, Leising et al. [31] investigated how to develop a conceptual framework that focuses on supply chain collaboration in circular buildings, and the findings demonstrated that developing circular value chains and evolving stakeholder collaboration are important for sustainable innovation. This, however, is restricted to the supply chain and does not apply to private sector involvement in such transactions.

This work is an attempt to address the research gaps and limitations identified in the literature. Using a mixed review methodology (scientometric and qualitative), it provides a distinct perspective on the state of the art of CE research in the built environment, with a focus on the involvement of the private sector.

This context presents both practical and theoretical implications and responsibilities for the private sector in realizing circularity potentials in accordance with SDG 11 on sustainable cities and communities as well as other interlinked goals. The practical implications suggest the need for adaptability in existing buildings in areas of building reuse. The theoretical implication is also highly resourceful, as it contributes to empirical knowledge on private sector engagement in areas of the CE in the built environment, thereby identifying the key role and barriers to their effective engagement. It further contributes to the

discourse on building sustainable development by promulgating the need for partnerships and inclusivity for sustainability in line with the UN 2030 Agenda.

The 2030 Agenda for Sustainable Development and its Goals; the Paris Agreement, which builds on the United Nations Framework Convention on Climate Change; and the Addis Ababa Action Agenda of the Third International Conference on financing for development call for increased private sector engagement. Additionally, other related multilateral frameworks under environmental agreements on ecosystems, climate change resources, and waste recovery also recognize and call for a stronger relationship with the private sector, including the implementation of more innovative methods [32] to promote private sector sustainability, revolution, and the leveraging of the private sector's technical know-how and resources. Finally, this study is a contribution to UN SDG 17 "Partnerships for the Goals".

2. Materials and Methods

2.1. Search Strategy

The search for literature on the private sector and PPP participation in the CE in the building and construction industry was conducted using Scopus. Compared to other databases, such as Web of Science, Science Direct, and Google Scholar, the Scopus database was chosen because it has a large range of academic articles with high accuracy and quick indexing operations [33]. A full advanced search was carried out using keywords obtained in the title/abstract/keyword field, and the results were limited to the English language. The time range was set to all years until the present to prevent the omission of any relevant papers. We used Scopus "Advanced search" function to build queries that included field tags, keywords, Boolean operators (OR, AND), and parentheses. The OR operator is used to link terms from the same set together, whereas the AND operator links phrases from separate sets together. The following is the detailed search strategy:

"private sector" OR PPP OR "PUBLIC-PRIVATE PARTNERSHIP" AND "CE" OR "Adaptive reuse" OR "SUSTAINABLE DEVELOPMENT" AND buildings OR construction AND (LIMIT-TO (OA, "all")) AND (LIMIT-TO (SUBJAREA, "SOCI") OR LIMIT-TO (SUBJAREA, "ENVI") OR LIMIT-TO (SUBJAREA, "ENER") OR LIMIT-TO (SUBJAREA, "BUSI") OR LIMIT-TO (SUBJAREA, "ENGI") OR LIMIT-TO (SUBJAREA, "EART") OR LIMIT-TO (SUBJAREA, "ARTS") OR LIMIT-TO (SUBJAREA, "MULT")) AND (LIMIT-TO (LANGUAGE, "English")). However, the search produced many irrelevant papers, which were further filtered.

2.2. Article Screening

To select suitable papers, we screened the titles and abstracts. Scopus initially retrieved 1467 publications as of February 2022. Further analysis was carried out to eliminate repetitions and other irrelevant papers that contained CE and PPP and associated terms in their abstracts, keywords, or titles but had no link to the research's context. Following this final screening, 67 relevant publications were acquired using the above manual selection process and employed in the scientometric study. Subsequently, the approach utilized by Kirchherr and van Santen [34] was used to select key papers for the content analysis phase of the study. As a result, the most cited articles from the document citation analysis were chosen. Then, based on the number of cited sources, the five most recent articles in the first five top journals were chosen. Finally, the snowball method was used to select 15 papers at random from the literature depending on their importance. After deleting duplicates and evaluating the acquired articles against pre-defined criteria, 23 articles were found to be suitable for further investigation and discussion.

2.3. Scientometric Analysis and Methods

Mulchenko [35] defined scientometrics as a quantitative examination of research on the progress of science. It is a method that entails assessing research impact, comprehending the citation process, and visualizing the knowledge structure and evolvement in a field

using a vast scientific dataset [36]. Scientometric approaches enable academics to identify systematic literature-related discoveries by linking literature themes that may be missed in manual review studies [37] by analyzing vast quantities of bibliometric data. CiteSpace [38], VOSviewer [39], and HistCite [40] are just a few of the scientometric mapping tools that are now available to academics. VOSviewer was used in this research to visualize the knowledge mapping. Figure 2 depicts an overview of the study framework.

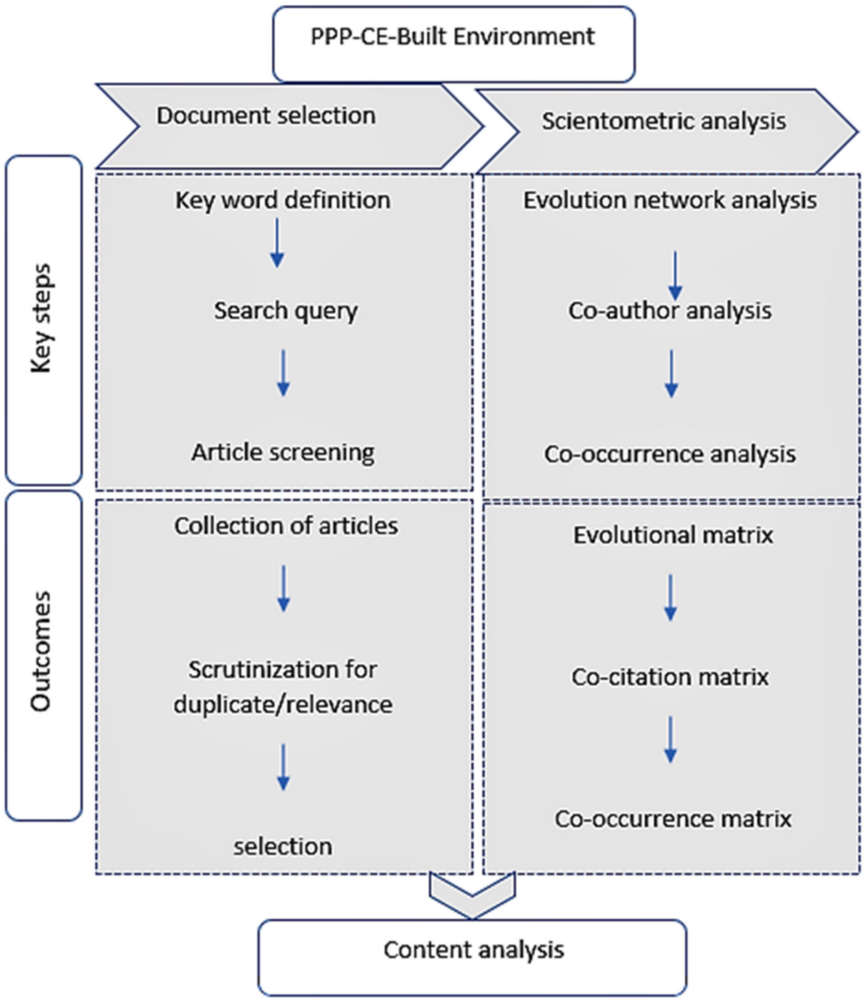

Figure 2. The framework of the study.

2.4. Knowledge Mapping

This study visualizes the knowledge map of the subject by countries, organizations, authors, and journals, in line with the theme of private sector partnership in CE. In this study, the following scientometric research approaches were used: (1) network analysis of evolution, which includes country, institution, and author cooperation networks; (2) co-author network analysis: a network of author co-citations that indicates the field's knowledge bases and patterns; and (3) co-occurrence network analysis: a keyword co-occurrence network that reflects the evolution of research topics and hotspots [39]. Additional information is presented as a result of the content analysis.

3. Results

The study answers research question 1 (RQ1) by exploring the state of research on public–private collaboration, organized in terms of countries, institutions, authors, journals, and papers, as presented in Section 3.1. Research questions 2 to 4 (RQ2–RQ4) are presented and discussed in Section 3.2.

3.1. State of Research on Public–Private Collaboration

The findings for RQ1 are presented in terms of countries, institutions, authors, journals, and papers. The annual publication output, co-authorship, country, and keyword networks are shown.

3.1.1. Annual Publication Output

Figure 3 depicts the distribution of 67 bibliographic records from 2002 through 2022. Since 2002, there has been a gradual increase in the number of publications. Since 2012, participation in the CE in the building and construction industry has received more attention, particularly following the Rio + 20 conference in 2012, which highlighted the private sector's growing role as a developmental stakeholder. From the retrieved data, 201 authors contributed to 67 papers and published in 84 journals, and according to the information gathered, 201 writers contributed to 67 papers that were published in 84 journals. The majority of the publications, however, were published in *Sustainability*, *Buildings*, and *Advances in Civil Engineering* (Figure 4).

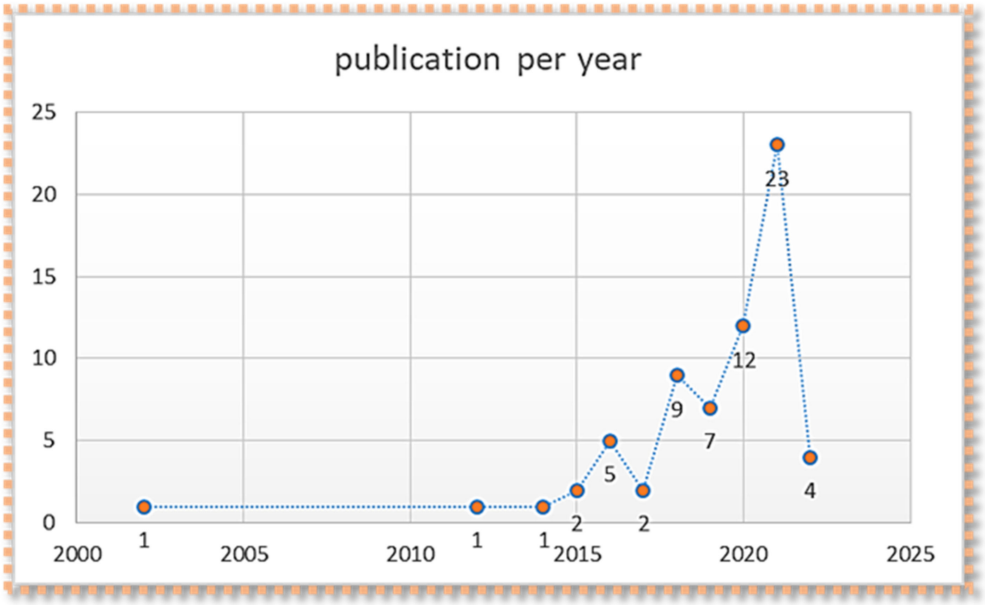

Figure 3. Annual scientific production.

The top 10 most productive authors by the number of citations are listed in Table 1, with Shen L. et al. [41], Bossink B.A.G. [42], Leigland J. [43], and Della Spina L. [44] among the first four. Table 2 also shows the most productive authors in terms of co-authorship.

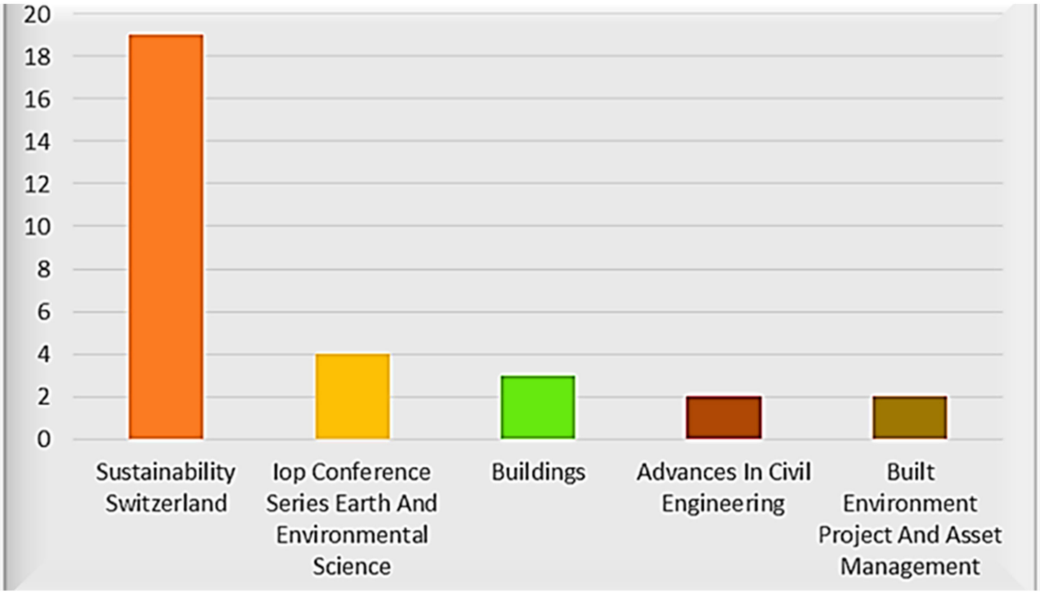

Figure 4. Output distribution by source.

Table 1. Most productive authors in PPP-related studies on CE in the built environment.

Authors	Title	Year	Cited by	Author Keywords
Shen, L., Tam, V.W.Y., Gan, L., Ye, K., Zhao, Z.	Improving sustainability performance for public-private-partnership (PPP) projects	2016	50	Contribution; Infrastructure project; Public and private sectors; Public-private-partnership; Sustainability performance
Bossink, B.A.G.	A Dutch public-private strategy for innovation in sustainable construction	2002	43	Innovation management; Strategic management; Sustainability policy; Sustainable construction
Leigland, J.	Public-private partnerships in developing countries: The emerging evidence-based critique	2018	31	public-private partnerships, private participation, development. government
Della Spina, L.	Adaptive sustainable reuse for cultural heritage: A multiple criteria decision aiding approach supporting urban development processes	2020	30	Adaptive reuse;multi-criteria decision-aid; Cultural heritage conservation; Strategic assessment
Berrone, P., Ricart, J.E., Duch, A.I., Bernardo, V., Salvador, J., Peña, J.P., Planas, M.R.	Easier: An evaluation model for public-private partnerships contributing to the sustainable development goals	2019	19	Assessment; Evaluation; Impact; Public-private partnership (PPP); Sustainability; Sustainable development; Sustainable development goals (SDG)
Eberhardt, L.C.M., Birkved, M., Birgisdottir, H.	Building design and construction strategies for a CE	2020	18	buildings; built environment; CE (CE); design strategies; environmental performance
Ma, L., Li, J., Jin, R., Ke, Y., Yuan, J.	A holistic review of public-private partnership literature published between 2008 and 2018	2019	17	public-private partnership; industries
Tan, Y., Shuai, C., Wang, T.	Critical success factors (CSFs) for the adaptive reuse of industrial buildings in Hong Kong	2018	17	Adaptive reuse; Critical success factor; Hong kong; Industrial buildings; Principal component analysis
Kamar, K.A.M., Hamid, Z.A.	Sustainable construction and green building: The case of Malaysia	2012	17	Green buildings; Malaysia; Sustainable construction

Table 2. Productive co-author collaboration.

Author Name	Number of Papers	Research Domain	Title of Paper	Major Contribution of the Paper
Nwachukwu, C. et al.	4	CE, reverse logistics, construction management	The critical success factors for stakeholder management in the restoration of built heritage assets in the UK	The study developed the key success factors (CSFs) for managing stakeholders to meet the goals of construction projects.
Crick, F. et al	3	Climate change, urban climate, and adaptation	Enabling private sector adaptation to climate change in sub-Saharan Africa	It provided crucial elements necessary for the business sector to assist society in adapting to and becoming more resilient to greenhouse gas emissions.
Kavishe, N. et al.	3	Stakeholder partnership bidding contracts, Bot transfer	Identifying project management practices and principles for Public-Private Partnerships in housing projects: The case of Tanzania	The importance of incorporating PM practices and concepts into the implementation of PPPs in Tanzanian housing projects was highlighted.
Udeaja, C. et al.	3	Facility management, information modeling	An investigation into the sustainability practices in PPP infrastructure projects: a case of Nigeria	It promoted the use of sustainability techniques in PPP infrastructure projects in Nigeria.
Atela, J. et al.	2	Urban climate, environmental protection	Private adaptation in semi-arid lands: A tailored approach to 'Leave no one behind'	It created consciousness for governments to develop partnerships to aid adaptation and climate resiliency development in the built environment.

3.1.2. Co-Authorship Analysis

With the advancement of information communication technology and increased academic interactions, research collaboration has grown. Analyzing the state of research and identifying notable authors requires identifying collaborative relationships among scholars. To describe the collaboration acts, a co-authorship network and a network of co-authors' nations were created. The first five co-authorship collaborations identified from the Scopus database are Nwachukwu, C.; Crick, F.; Kavishe, N.; Udeaja, C.; and Atela, N. Their key contributions are indicated in Table 2.

Since papers, journals, and institutions cannot directly engage with one another, the author is the subject of academic interaction and exchange. The examination of various sorts of co-occurrence associations is based on the co-authorship network. Figure 5 depicts a co-authorship network, in which each node represents an author, and the links reflect collaborative acts. There were 201 items, 55 clusters, and 399 links with a total link strength of 417 in the co-authorship network.

In Figure 5, there are multiple research communities, but no strong collaboration relationships have been developed between the researchers in the community. The strongest networks in the community were found amongst Chileshe, N.; Crick, F.; Udeaja; and Pintossi. These research groups' prominent authors were also recognized. A research community's central authors engage in more collaborative activities than other researchers. For instance, Chileshe, N. was the central author of a research community on a cluster that included Abubakar, U.O., Nwachuku, C., Terkaj, W., and Udeaja, C.; while Crick, F. was the central author of a research community consisting of Ganon, K.E. and Conway, D.

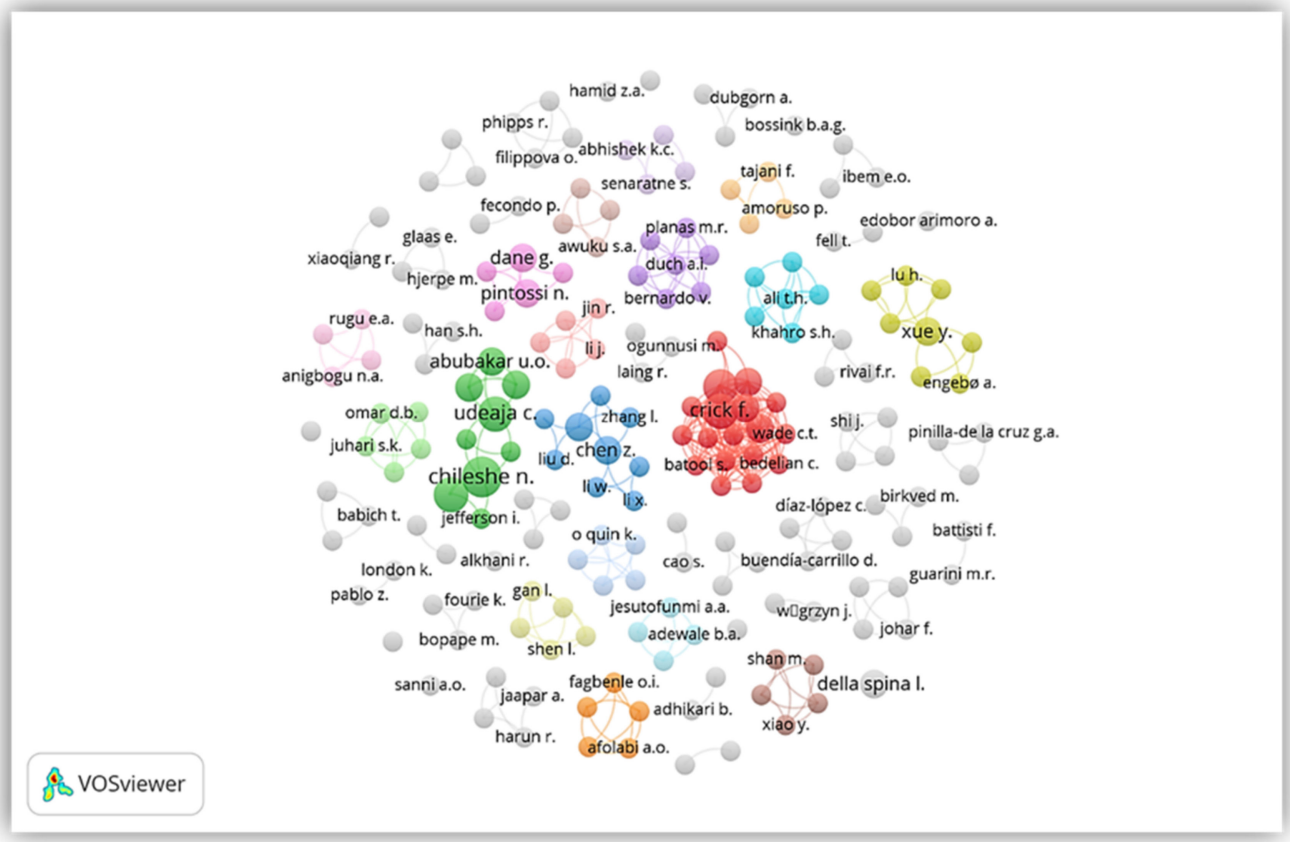

Figure 5. Co-authorship network.

3.1.3. A Network of Countries/Regions

Figure 6 depicts a network representing the regional distribution of articles about private sector partnerships in the built environment relevant to the CE. This network has 16 nodes and 26 linkages, as shown in Figure 5. As determined by retrieved articles on PPP and the CE, the main countries in the construction industry can be identified by network analysis. In Figure 6, the number of articles in the UK (13), China (10), Australia (9), Nigeria (8), and Italy (7) suggests that these countries have made major contributions to research in the building and construction industry on private sector partnerships for the CE. The UK made the most important contribution to the development of CE research in the building industry in terms of publications by country. Furthermore, in terms of international collaborations, Australian academics have extensive collaborations with researchers from other nations, including Malaysia, Tanzania, the UK, and Nigeria.

3.1.4. Keyword Co-Occurrence and Evolution Analysis

Keywords are succinct and accurate summaries of the topic of a research paper. Hot topics in the knowledge field can be recognized over a certain period using a keyword co-occurrence network. The development network can show how a study field has progressed over time. As illustrated in Figure 7, VOSviewer was used to create a network of co-occurring terms with 19 clusters and a 417 total link strength. The frequency of a word in the bibliometric record determines the sizes of nodes in this network. The top ten most commonly used keywords were "sustainable development", "public-private partnership", "private sector", "construction industry", and "adaptive management". As illustrated in Figure 7, the temporal overlay element was taken into account. The development of CE-based keywords commenced in 2020. These lines' colors indicate when a link was estab-

lished for the first time. Keywords include "adaptive reuse", "circular economy", "adaptive management", "stakeholder", "cultural heritage", and "public-private-partnership".

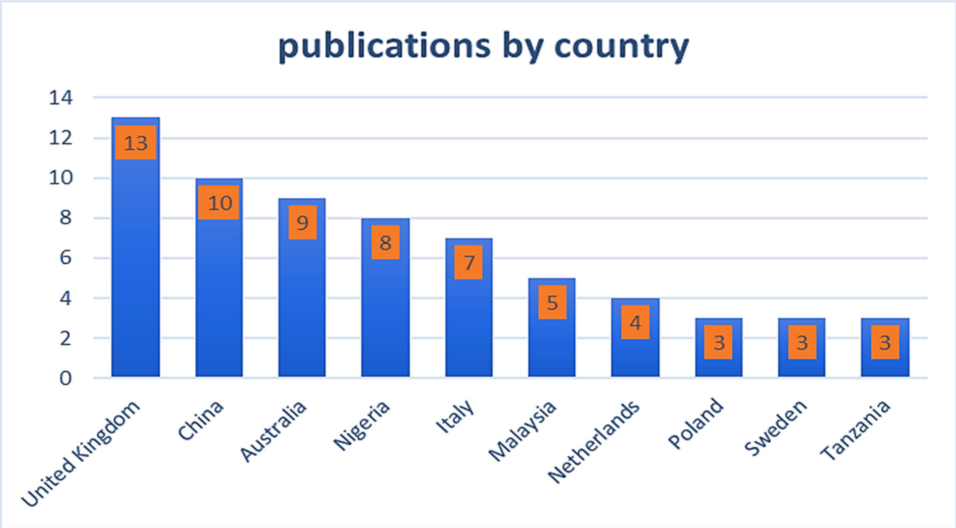

Figure 6. Number of publications by country/region.

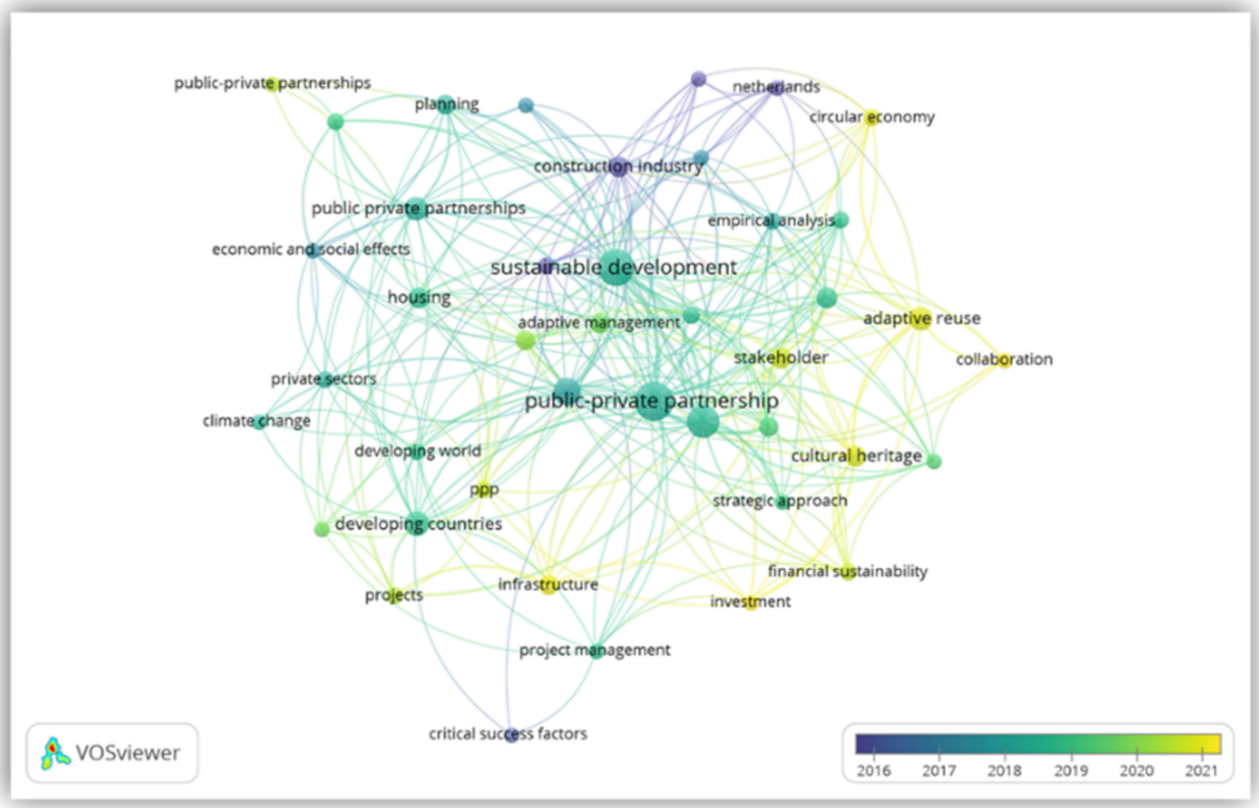

Figure 7. Temporal overlay of keywords.

3.2. Content Analysis and Discussion

3.2.1. The Role of the Private Sector in CE for the Built Environment

As some scholars have noted, the public sector has organizational and functional qualities that distinguish it from private enterprises [13,45]. Given that the study is concerned

with the private sector's role in the CE context, it is necessary to identify the characteristics of the public sector in these transactions to enrich the background. The public sector differs from the private sector in terms of its objectives; for example, rather than pursuing purely commercial profit goals, the public sector pursues many political and social purposes. They are primarily in charge of providing services, fostering resource redistribution, and/or developing policies [46]. The public sector is primarily service-oriented, as it provides services (non-material goods) rather than producing products (e.g., material goods) as industrial companies do [47].

The ability of the government to exert its influence to promote operational practices conducive to an enabling environment, as well as increasing private sector participation in the delivery process, is predicated on the ability of the government to foster an enabling environment. The public sector (government) duty is fundamental, and it must assure a balanced deployment of the tools at its disposal. These systems include regulation, procurement policy, human-resource strategies that are aligned with industrial growth priorities, direct assistance, which may include monetary assistance, and support from the government. The government alone can initiate and continue a constant assessment of the sector's procedures and structures with the help of an industry-coordinated statutory authority and other infrastructure-delivery bodies. The private sector can contribute to the simplicity and standardization of tender and contract documentation, as well as the wider dissemination of information and public adjudication processes [48,49].

Anderson [50] expands on the conventional role of the state by listing the seven essential duties of government that he argues are universally applicable, which include: establishing economic infrastructure; providing a variety of collective goods and services; resolving group conflicts; and ensuring that competition is preserved, natural resources are protected, individuals have minimal access to economic products and services, and the economy is stabilized. To this end, the World Bank [51] acknowledges that every government's mandate comprises five key tasks, including: (i) building a legal foundation; (ii) maintaining a non-disruptive policy environment, including macroeconomic stability; (iii) funding basic social services and infrastructure; (iv) safeguarding the vulnerable; and (v) safeguarding the environment.

3.2.2. The Context of Public–Private Partnership and Models

A PPP is a procurement strategy in which the public and private sectors join forces to offer a public service or facility, with both parties contributing their knowledge and resources to the project and sharing the risks [45]. Different jurisdictions' definitions of PPP may differ slightly depending on which portion of the agreement is prioritized. Our study's objectives are to examine how the CE is delivered in the built environment, focusing on the private sector's contribution.

Using a set of evaluated PPP interpretations, the most important characteristics of these partnerships are:

- It is the interaction, cooperation, and agreement between the government and the private partner;
- The interaction must be mutually beneficial (the private sector makes a profit, while the state solves socially important tasks);
- The project must be aimed at meeting the needs of society [52].

The following PPP models/contracts, whose characteristics are listed in Table 3, were synthesized based on the literature sources indicated. However, there is currently no single universal PPP model applicable to all countries and areas of application. Each society adjusts the right procedure to its own culture, financial climate, state priorities for the country's socioeconomic development, political atmosphere, and judicial framework [52].

Table 3. PPP models.

Partnership Models	Characteristics of the Model
BOT (Build–Operate–Transfer)	Contracts are created expressly for large-scale building or rehabilitation projects. The private investor is responsible for both investment and profit.
BBO (Buy–Build–Operate)	Transfer of public property to a private or quasi-public entity under the conditions of a contract that requires the property to be upgraded and run for a set time. During the length of the property transfer contract, the state exercises control.
DBFO (Design–Build–Finance–Operate)	Based on a long-term lease, the private sector develops, finances, constructs, and operates a new facility. After the lease term expires, the private sector hands the new building to the public sector.
ROT (Reconstruct–Operate–Transfer)	DBOT is a type that is similar to this one (Design–Build–Operate–Transfer). The distinction is that a private party assumes control of an existing facility and is responsible for its restoration.
BOOT (Build–Own–Operate–Transfer)	The private structure is granted permission to build at its own expense and operate the facility (as well as a charge for its use) for a set length of time, after which the state reclaims control.

Source: Retrieved based on the United Nations [53] and Tshombe, and Molokwane [54].

The government spends a lot of money on the built environment. The national government establishes policies that regulate public infrastructure services and provides substantial grant funding for housing and urban infrastructure. Municipalities must establish a wide range of connections, including the coordination of built environment activities to meet their infrastructure duties. The investment must be well coordinated and carefully timed to generate beneficial developmental results. Furthermore, due to a shortage of funds and access to cutting-edge technology, several governments in developing nations have invited the private sector to engage in funding infrastructure projects formerly monopolized by the state [13]. Whilst the public sector will retain a prominent role in infrastructure development, PPPs provide avenues for private sector involvement in the built environment.

3.2.3. A Paradigm Change from the Government as the Primary Actor (RQ2)

A change from linear to circular processes is a noteworthy finding from the content analysis. Multi-stakeholder collaboration in resilient networks that produce unique specialized solutions is required. Many approaches regarding housing problems are top-down, government-led measures. While such a strategy has merit, additional approaches using multi-stakeholder cooperation in resilient networks to offer unique specialized solutions should be considered. In order to address sustainability challenges in the building and construction sector, it is necessary to move beyond reliance on the government as a fundamental role and to prioritize multi-stakeholder engagement [11].

Multidimensional problems, such as those confronting the building and construction sector, are increasingly recognized as requiring the partnership of a broad array of stakeholders operating at various levels, often in network systems, ranging from local users to municipalities, regional and national organizations, and global organizations [11,13]. However, that does not imply that the government has a limited role to play; rather, the argument is that there is room for a variety of collaborative arrangements, whether government-led or not, that can lead to innovative housing solutions and that participatory contribution leading to a wider ecosystem of objectives is a critical component of success [27].

There has been a greater emphasis on private sector participation in urban development via PPPs. The intricacy of the built environment's rehabilitation in terms of scale, contextual factors, urban form, ownership, and regulatory systems necessitates organizational frameworks that bring together several stakeholders. The idea that both the public and private sectors can address the problem on their own has been emphasized [11,13,55].

The significance of clear regulatory frameworks for enabling the successful integration of PPPs, as well as an emphasis on the downsides, has been demonstrated in the literature. There is a need for a clear dedication from pertinent private entities to address and alle-

viate city development environmental repercussions. Impacts on the environment can be internalized into private sector manufacturing processes and development programs and, hence, into managerial obligations [13,22,56].

Without appropriate frameworks, neither public nor private sector investments can ensure the delivery of traits associated with long-term growth. It is critical to have well-integrated, forward-thinking planning methodologies in place, as well as supportive planning, collaboration, and legal frameworks. Focusing on sustainability approaches as a contribution to the SDGs in cities also demands collaboration practices in urban development and redevelopment, as well as highlighting the value of partnership, which includes local areas [57].

Including CE principles in current and emerging urban regeneration necessitates a comprehensive understanding of private sector involvement in various contexts, as well as the kind of inducement that can be useful while encouraging circularity. It also necessitates the establishment of inclusive and imaginative planning techniques based on a multi-scale examination of benefits and consequences in specific situations [55].

Recent studies have highlighted the importance of various approaches, such as the adaptive reuse of buildings (repurposing and retrofitting), in delivering sustainable and livable communities [58–60]. Thus, it is critical to emphasize the many prospects for urban regeneration via adaptive reuse for restoring cities and combating the decline in urban neighborhoods [44]. Not only will such a concept inspire sustainable and circular-linked communities, as Aigwi et al. [58] emphasized, but it will also encourage a shared vision that should be established cooperatively by local authorities and governments, investors, communities, and institutions.

Nature-based solutions (NBS) have recently received more attention in urban development and sustainability partnerships, as found in the literature. The United Nations Environment Program (UNEP) emphasizes that NBS can help to achieve the cost-effective decarbonization needed between 2020 and 2030 [61]. NBS is key for long-term sustainability, resulting in improved conservation efforts, energy security, and socioeconomic resiliency, among other things. Entities in the private industry must commit to NBS and use resources in cities in a far more sustainable way, as well as assist in the general use of renewables [62]. Environmental dangers, particularly pandemic threats, have recently attracted attention to the significance of a CE in the built environment, focusing on adaptation, resilience, and climatic issues all at the same time and urging collaboration [63,64]. Even though the above stresses that design for a CE in the built environment should change from just being the duty of the government sector to also include the private sector, it is important to remember that this can be difficult for private actors seeking more certainty and reliable investments.

As a result, more flexible and paradigm-shifting organizational and cooperation frameworks are required. Realizing the CE also necessitates consideration of planning, legislation, financial frameworks, and prospective partnerships, including private sector participation via more inventive frameworks [65].

3.2.4. The Private Sector's Role in Delivering CE in Building and Construction

Describing the private sector is critical to any understanding of existing practices and the function that the sector could play in the creation of a CE in the built environment, its commitment to the circularity aims, and its role in urban growth and sustainability. For example, the OECD's definition of the private sector covers "private firms, individuals, and non-profit organizations," whereas others restrict it to the business and corporate sector [66]. In practice, the word refers to private investors, that is, for-profit businesses and, indirectly, private organizations. The private sector stakeholders concentrate on their involvement in the built environment as an umbrella term including a range of different professions and organizations operating in diverse affiliations with one other, as well as with the government entity and the society. These are, as listed by Alkhani [67], provided below:

- Property owners, investors, and company owners. Individuals and corporations, private financial firms, investment companies, and government real estate firms all operate as private entities, blurring the boundaries between government and private.
- Construction companies and developers.
- Architects, builders, and engineers who work for the government or any other public or private business clients or individuals.
- Consulting firms (experts) assist public or commercial players in capacity building.
- Environmental managers who foster communication between local government as well as private firms or societies.

The private sector is an important player in both urban and economic growth, contributing significantly to national GDP and serving as the primary employer and generator of jobs. In the developing world, the private sector employs over 90% of the population (including formal and informal occupations), distributes important goods and services, and adds to tax income and the effective movement of capital [68,69].

Private sector stakeholders are known to play a role in urban management; they have an impact on whether cities evolve sustainably and inclusively, as well as on poverty alleviation [70,71]. To enable private sector participation in the CE and to integrate this participation with governments, participatory planning and decision-making procedures are required. Governments can enhance circularity by facilitating collaborative strategies that incorporate innovative techniques, materials, and concepts to stimulate the built environment and enable it to respond ingeniously [70].

The literature also recognizes the relevance of the private sector in achieving emissions reductions, usually through partnerships or collaborative strategies including all sectors, and highlighting the role of cities, government agencies, and society [72,73]. There is a rising need for the private sector's contribution to sustainability, implying that governments cannot manage the built environment alone and emphasizing the importance of private sector participation [62]. The private sector can assist in the development of a circular built environment. According to Arup [74] and Thelen et al. [75], the private sector should focus on the following measures to achieve scale in a collaborative effort.

Collaboration among peers: This is required to develop new technologies in a non-competitive environment. Companies should consider how partners can contribute to the solution from the start of each project or process. Sourcing circular building materials or exchanging water and energy between sites are examples of this. Thus, companies may achieve scale and encourage a distinct attitude by prioritizing circular thinking.

Co-create through the value stream: Co-creation will provide opportunities for businesses. Companies can collaborate with diverse stakeholders throughout the value chain to develop solutions that are relevant to the building's use and users (e.g., Design Thinking). Architects and developers could collaborate with demolition and recycling companies to produce cost-effective end-of-life design solutions.

Create a set of guidelines for circular materials: A unified circular materials standard should be developed to aid company collaboration. The nature, content, and dimensioning of materials and products all fall under the umbrella of standardization. It would be helpful for items to be built according to a common set of requirements to which all companies must adhere to allow companies to recycle materials used by other companies.

Investing in education and providing support: The internal understanding of CE ideas should be improved by businesses. The greater the number of employees who comprehend circularity, the greater the chance for growth. Non-financial assistance can be a good place to start when it comes to assisting internal and external stakeholders in establishing circular projects.

Certainly, from the foregoing measures, engaging the private market can assist in terms of capacity, as neither the state nor the federal government can mobilize the requisite resources or consensus to make successful initiatives that will lead to long-term sustainability. According to Macomber [76], the private sector has an unidentified potential to

participate in targeted investments that can enable cities to minimize the impact of these developments, filling the needs of urbanization and shortages of resources and energy.

Finally, private entities can be incentivized to mobilize their capacities by offering rewards. Henry [77] highlighted that if we can match explicit and meaningful rewards for voluntary action with robust mechanisms that deliver verifiable climate outcomes, the private sector will make a material contribution to closing the emissions gap.

3.2.5. Identifying the Barriers to Private Sector CE Investment and Creating an Enabling Environment

Research question 3—What are the challenges facing the private sector towards contributing to a CE in the building and construction industry?—is presented here. In the present age, it is becoming unfeasible for the public sector to supply infrastructure to match the demand of its citizens, hence the need for partnerships [55]. However, there are several barriers to private sector participation, as identified in the review, which are highlighted as follows.

There is a lack of appropriate financial assets to enable circular investment, as well as institutional and regulatory concerns, which constitute roadblocks to private sector involvement [78]. Ensuring that a partnership is best suited and more productive and efficient usually necessitates a lot of labor, time, and commitment in partnerships. The majority of collaborations and partnerships are hard to establish, maintain, and develop. Even at the scale of individual projects, they frequently incur high costs, which are much higher when pursuing more revolutionary changes across the built environment [79].

There is a lack of consistency among and within private sector stakeholders' actions. As a result, most private sector players will concentrate mainly on their primary business goals oriented to profit. Usually, these work against the sustainability programs being developed [79,80].

The status quo bias, or the ease of functioning in a known and trusted linear system versus the discomfort of operating in a new circular environment, is also a barrier [81]. Effective partnership growth needs a shift in the parties' mindsets and skillsets and institutional capabilities. It is a challenging task that must be undertaken to attain the scale and systemic impact required.

Bowen et al. [82] identified nine characteristic impediments linked to sustainable, private-sector-led growth in the built environment. These include impediments characterized as capital, technology, human resources, institutional and regulatory frameworks, market access, financial access, and competitive forces. However, low bureaucracy, simpler business registration procedures, labor regulation reforms, and systemic cooperation have been mentioned as key elements of an enabling environment [83,84].

Key barriers identified in the literature are grouped into financial and economic, institutional and technological, and political and regulatory categories, as presented in Table 4.

Table 4. Barriers to private sector participation in CE in the built environment.

Key Factors	Description	Sources
Financial and economic barriers	Lack of financial resources	[56,81]
	Lack of project feasibility and viability for the private sector	[84,85]
	Limited accessibility to sufficient resources (trained workforce and modernized apparatus) in the private sector	[79,81,84]
	Low level of desire in the private sector for rivalry in project duty owing to the absence of assistance from government establishments in projects	[79,86]

Table 4. *Cont.*

Key Factors	Description	Sources
Institutional and technological	Lack of consistency within and amid private sector players	[80,83]
	Lack of market drivers that generate more prospects for the private sector in CE	[81,83,87]
	Lack of technical skill in the private sector on CE innovative building projects	[87,88]
	Lack of systemic support among the public and private sectors	[89,90]
Political and regulatory	High-level political bureaucracy in project allocation	[13,22]
	Lack of legislative or regulatory drivers to promote private sector participation	[91–93]
	Lack of plans and incentive arrangements to attract the private sector in CE initiatives	[22,91,93,94]

3.2.6. Considering a Unique Intervention Toolset

This section deals with RQ4: *What are the solutions and opportunities for enhanced private sector participation?*

For a circular built environment, there is a need to broaden the existing toolset of interventions to examine unique and even specialized approaches for a CE in building and construction. Researchers cited specialized solutions that are often underestimated that the private sector can address to enable a circular built environment, such as the reuse of housing stock in the form of abandoned buildings [59,95]. These offer a lot of potential for the adaptive reuse or repurposing of existing structures for purposes other than those for which they were built [96], which can also be considered in line with Ellen MacArthur's circular framework for the built environment. Adaptive reuse has been implemented as an approach, for example, in Hong Kong, Los Angeles, New York, and a host of other cities [96,97]. It has been associated with ecological and social sustainability advantages. Entities in Australia have experimented with adaptive reuse by converting vacant homes into temporary apartments for a short time, sometimes while pending development approval. During the global pandemic, these were also employed to alleviate persistent homelessness and as an emergency response to housing requirements [98]. Public, residential, commercial, or industrial structures are examples of typical investments or projects that can be undertaken. End-of-life or abandoned or vacant residential buildings can be repurposed as residential buildings or for a completely different purpose, such as commercial [99]. To constitute as significantly contributing to the CE, a building retrofitting project must be circular by design and illustrate significant improvements in (material) resource utilization through CE approaches, not just energy performance or building resilience [20]. Typical characteristics of circular renovation projects include the circular design of a building, allowing easy disassembly, reuse, repair, and recycling via using building materials that are recyclable, reusable, or compostable [99].

Another alternative presented is the prefabricated design for adaptable mixed-use spaces. This is accomplished by deploying a low-voltage direct current (DC) energy network that can function independently of the main grid. This would let residents transmit the electricity that they produce back into the grid, increasing the system's resiliency. The design is not just low-energy and environmental, but it also offers a low-cost remedy to the housing crisis and affordability issues that many cities confront [74].

4. Recommendations for Private Sector Engagement

In light of the growing consensus on the private sector's increased significance in the circular built environment agenda, private sectors may make substantial contributions in the following key areas, among others, both on their own and through collaborative initiatives. First, the private sector can create and implement business models that provide value to sustainable solutions. Companies can create items that lower the amount of energy

used by buildings by avoiding waste, deconstruction, and bioclimatic designs. Firms can source a more significant proportion of their energy from renewable sources [100].

Secondly, to achieve system change, the private sector must integrate its business strategy across the value chain with environmental and public concerns in mind. For example, in the housing and construction industry, design and construction processes have a significant impact on the quantity of energy and materials consumed throughout operations [59].

Thirdly, collaboration and engagement with other organizations, both locally and globally, are greatly encouraged and recommended for a CE as a result of the findings in the literature, which revealed a lack of interaction and collaboration with businesses. As a result, more collaboration mechanisms, dialogue, and knowledge transfer among broad partners such as investors, universities, organizations, businesses, and communities are needed. This will allow for the co-creation of relevant and adapted circular strategies for the private sector in all of its areas of action and operation [101].

Finally, the private sector may invest in research and development to discover and support important enablers for a low-carbon or zero-waste building design future and develop novel technologies to improve circularity in the built environment. Businesses can also strive to increase the incorporation of reuse and deconstruction into the design and construction of buildings.

The public sector must also incorporate incentives to motivate private sector participation in the CE to enable the private sector to participate [14,91]. According to a World Bank report, legal and regulatory change is required to foster more sustainable economic growth and increase the impact of the private sector. There must be consistency in the objectives, and the public sector must be reliable enough to stimulate confidence among stakeholders in the economy [83]. There is a need to consider the fight against both corruption and bureaucracy at the governmental level. Implementing specialized policy instruments and initiatives is highly advised, rather than competing with the private sector; there is a need to support, coordinate, and cooperate with it [83,91]. More research is needed to create novel, participative, and useful methods for active private sector involvement and to address the hurdles that prevent them from implementing CE practices in the built environment.

5. Conclusions

This study conducted a scientometric and content analysis of the role of the private sector as a critical supporting stakeholder towards a CE in the built environment. It was conceptualized with the reflection that despite the scale and extent of PPPs, research and a practical understanding of how the CE notion has been implemented to promote it in the built environment via private sector participation are still lacking. The study set out to examine the state of research on public–private collaboration by first exploring the patterns of publications and then analyzing the research content. Therefore, from this bibliometric analysis and content synthesis of research on private sector engagement in a CE in the built environment, conclusions can be derived for both governmental and private building and construction actors and the built environment industry as a whole.

The main results of this study can be summarized as follows according to the study's objectives, starting with the first objective: *What is the state of research on public-private collaboration organized in terms of countries, institutions, authors, journals, and papers?* According to the findings, research on private sector participation in the CE is still in its infancy. Following the Rio + 20 conference in 2012 highlighting the private sector's expanding role as a developmental stakeholder, public–private engagement in the building and construction industry has received more attention. There are several research communities, but no strong collaborative linkages have been established among the community's scholars. In 2020, the development of CE-based keywords began to increase in the built environment following the Ellen McArthur concept.

Further, on the second objective—*What is the role of the private sector in CE for the built environment?*—the study identified the major roles that the private entities can adopt to

influence the CE in the built environment. These include focusing on the private actors putting circular thinking first, collaboration among peers to produce new technologies in a pre-competitive field, co-creation across the value chain, and providing support and investment in education.

Thirdly, the study answered the third objective on *the private sector's challenges in contributing to CE in the building and construction industry.* The study highlighted the barriers impeding the participation of the private sector in the CE in the building and construction industry. These were categorized into financial and economic, institutional and technological, and political barriers. Furthermore, the study revealed the need to eliminate bureaucracies. Incentivizing legal and regulatory change was among the factors identified to enable private sector participation in the CE in the built environment sector.

Lastly, on the fourth objective—*proposed solutions and opportunities for enhanced private sector participation*—the study emphasized practical areas documented by researchers for specialized solutions that the private sector may address to enable a circular built environment. For example, the reuse of housing stock in the form of abandoned structures, which developers typically overlook, has been associated with environmental and social sustainability advantages. Therefore, it is worth concluding that the private sector must align its business plan across the value chain with environmental and public concerns towards system transformation for a circular built environment.

This study is not without limitations. Although using scientometrics and content analysis allowed for a large sample of literature to be captured, using other methods such as interviews and questionnaires will further enrich the findings. Thus, this study is part of a broader doctoral research project being undertaken. Despite this limitation, the current study's findings will be of great value to PPP stakeholders involved in CE initiatives in the building and construction industry. Further studies will be conducted using primary research techniques to develop a framework for the participation of the private sector and integration of CE concepts in the built environment.

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