

Nexus between Urban Circular Economies and Sustainable Development Goals: A Systematic Literature Review

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Abstract: Since the definition and publication of the 2030 Agenda in 2015, addressing Sustainable Development Goals (SDGs) has been pivotal in guiding carbon neutrality and sustainable solutions in urban development. Despite the passage of nine years, tangible successes in achieving the SDGs have been limited, underscoring the critical need for innovative approaches to fostering energy performance and reducing carbon emissions. This study advocates for adopting circular economy principles as a strategic pathway to mitigate environmental, social, and economic challenges and promote sustainable, net-zero-energy solutions. Through a systematic literature review spanning multiple databases, this research underscores the synergy between urban circular economies (UCEs) and the SDGs, with a particular focus on sustainable solutions, resource use circularity in construction, and renewable energy integration. By setting stringent eligibility criteria, this review captures a wide array of perspectives, providing a comprehensive analysis that bridges the gap between urban sustainability, renewable energy adoption, and climate change mitigation efforts. The analysis of 23 selected papers reveals a substantial linkage between UCE practices and the advancement of SDGs, highlighting the pivotal roles of responsible consumption, resource efficiency, and regenerative practices in achieving co-benefits through policy and regulatory frameworks towards carbon neutrality. The findings recommend implementing a holistic approach that integrates urban sustainability with circular economy principles, offering a structured insight into the potential of UCEs in fostering a sustainable transition in line with the 2030 Agenda for Sustainable Development.

Keywords: urban circular economy; Sustainable Development Goals (SDGs); sustainable development; urban development



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1. Introduction

Sustainable development is the target of various global projects and initiatives. One of the most notable implementations is the adoption of the Sustainable Development Goals (SDGs) by the United Nations in 2015 [1]. The SDGs are a universal call to action to end poverty, protect the planet, and ensure peace and prosperity for all by 2030 [1]. These goals encompass a wide range of social, economic, and environmental challenges and promote sustainable, net-zero-energy solutions, highlighting the interconnected nature of these issues and the need to balance social, economic, and environmental sustainability [2].

In parallel, urban circular economies (UCEs) represent a transformative approach to urban development and design that focuses on creating sustainable and self-sufficient communities [3]. This innovative model focuses on minimising waste, maximising resource efficiency, reducing carbon emissions, and challenging the traditional linear model of production and consumption [3]. Within the domain of circular economy research, several key areas deserve particular attention: the integration of sustainable development into industrial and urban environments, management of product lifecycles to minimise waste,

eco-production practices, and optimisation of logistics within closed-loop systems [3]. In this regard, data collected through this system forms a foundation for circularity, enabling tracking of the origin of a product, the production methods, and energy consumption. This information can empower firms, municipalities, and nation-states to implement resource renewal and utilisation with enhanced efficiency [3]. Furthermore, unlike the multifaceted and often abstract concept of sustainable development, circular economies aim to regulate ecological–economic systems. These systems are characterised by diverse interactions between the environment and economic activity [3]. By implementing circular economy principles at the neighbourhood and city level, UCE aims to create economically prosperous cities and regions that embody inclusivity and sustainability [4].

This paper comprehensively examines how UCE supports and contributes towards achieving sustainable development and identifies synergies between UCE principles/practices and SDG achievement. It addresses multiple social, economic, and environmental challenges outlined in SDGs and explores how UCE initiatives can contribute effectively toward poverty eradication, decarbonisation, and sustainable urban development [5]. Additionally, the research assesses potential impact at local and global levels, determining contribution capacity regarding crucial targets such as effective allocation of resources to promote economic growth, renewable energy integration, and minimise waste and use them efficiently. Based on the findings, recommendations are provided to improve integration into urban development strategies and support the SDGs. These recommendations aim to bridge existing gaps between current policies, fostering more outstanding support of UCE to the SDGs within broader sustainable development previous work [5]. The benefits of the UCE and SDGs association shall be highlighted, encouraging collective efforts towards a more sustainable and inclusive future [3]. By comprehensively examining and demonstrating the link between UCE and SDGs, this study aims to contribute to a deeper understanding of their interconnectedness.

Finally, this study concludes that adopting innovative approaches, like UCEs, can help the implementation of the SDGs. It highlights the immense potential of integrating these two concepts to create more inclusive societies while safeguarding our environment [6]. Ultimately, striving towards sustainability requires all governments, businesses, civil society organisations, and individuals alike to embrace new approaches like urban circular economies. Collaboration between governments, businesses, civil society organisations, and other stakeholders is crucial in promoting the successful integration of UCE principles and SDGs [6].

To achieve this aim, the study has conducted a thorough and rigorous systematic literature review (SLR) using a comprehensive methodology that includes qualitative research, bibliometric analysis, and descriptive qualitative research. This method involved a comprehensive qualitative analysis with descriptive and thematic data exploration, providing a deep understanding of the current knowledge landscape and highlighting the importance of this study in the scientific community. Through qualitative research and bibliometric analysis, urban sustainability assessment has been examined over the past nine years. Additionally, UCE approaches integrated across different SDGs are explored to enhance sustainability in urban environments and identify research gaps for future investigation. By synthesising existing studies in a scholarly and academically sound manner, it sought to address the research question: “How can the principles of UCEs help the implementation of the SDGs towards sustainable urban development?”.

2. Methodology

A comprehensive and rigorous methodology, which includes qualitative research, bibliometric analysis, and descriptive qualitative research, has been applied to this study. Qualitative research provides in-depth insights into real-world problems [7]. At the same time, the bibliometric analysis measures publications and citations, reflecting productivity in quantifiable terms and the influence and quality of scientific production [8]. This offers a thorough examination of research on urban circular economies spanning the last nine years.

The study explores the various UCE approaches integrated across different SDGs to enhance sustainability in urban environments through meticulous and thematic data analysis. The examination of UCE implementations reveals their impact on advancing the SDGs. Moreover, this approach facilitates the identification of research gaps and contributes to the setting of future research directions.

The study followed the PRISMA methodology to ensure accuracy and thoroughness in data collection, processing, and analysis (see Supplementary Materials). As shown in Figure 1, the SLR was guided by insights from management and organisation studies. It is important to note that the study does not aim to provide an exhaustive compilation of all relevant literature. Rather, it carefully selected search terms, databases, and exclusionary criteria to define its scope with precision. Acknowledging the limitations of this study is crucial, as they may have impacted the comprehensiveness and generalizability of the review. Methodological factors, including the selection of databases and exclusion criteria, could have limited the analysis's scope. Additionally, the scarcity of prior research on the subject may have hindered the availability and quality of data. Furthermore, accessing or obtaining specific information may have presented challenges, contributing to the study's limitations. These factors were taken into account when interpreting the results and proposing future directions for research.

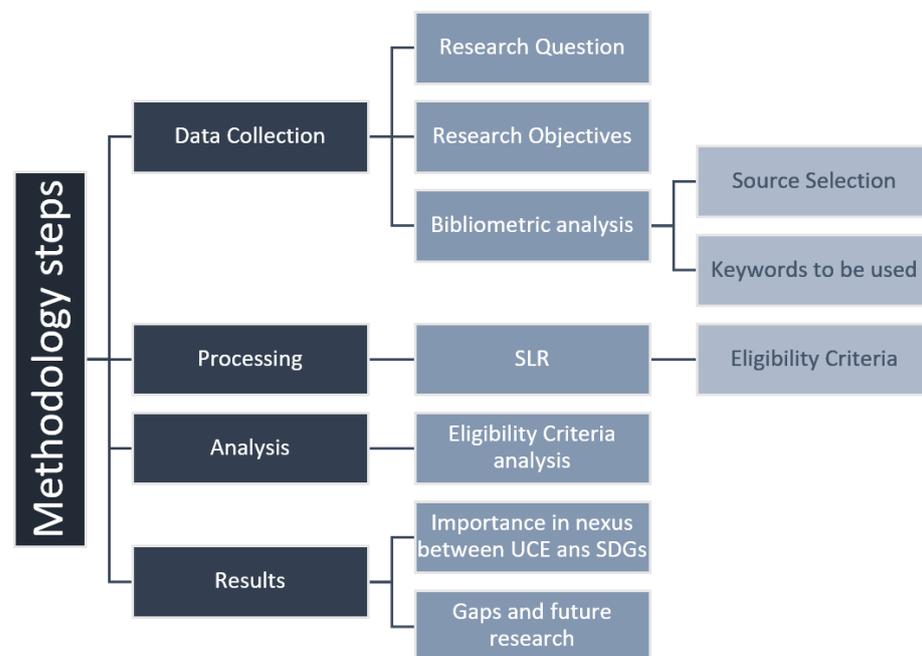


Figure 1. Methodology steps.

2.1. Data Collection

This study aims to provide a comprehensive overview of academic studies on the relationship between UCEs and SDGs and suggest possible future research directions. Therefore, the review addresses the following research question: “How can the principles of UCEs help the implementation of the SDGs towards sustainable urban development?”.

In the initial phase of this study, a thorough bibliometric investigation was conducted to identify and select relevant keywords that will be subsequently employed in this SLR [9]. This methodology allowed us to map and analyse the extensive existing literature, highlighting key trends and approaches within the scope of this study [9]. Using bibliometric techniques provided a robust foundation for identifying the most relevant terms, ensuring that the systematic review effectively focused on crucial areas to understand and address issues associated with the subject matter.

Bibliometric Analysis

A bibliometric analysis was then conducted using the VOSviewer 1.6.20 software. VOSviewer is instrumental in unravelling key insights from the literature. It is a specialised program for visualising and analysing bibliometric networks [10]. In the context of this review, the software facilitated the identification of influential keywords and their relationships within the studied domain. The bibliometric analysis involves a quantitative examination of publications, and VOSviewer aids in creating visual representations of networks, such as co-occurrence of keywords, co-authorship, and citation networks.

The bibliometric investigation included eight keywords: “urban circular economy”, “Sustainable Development Goals (SDGs)”, “Urban Development”, “Circular Economy”, “Circular Cities”, “Urban Circular Development”, “Urban sustainable development”, and “Urban economy”. The databases selected for this review were Scopus and Web of Science. This preliminary search yielded a total of 43,789 articles on the topic from 2015 to 2024 with open access (see Table 1). Subsequently, VOSviewer was employed to conduct a bibliometric analysis, providing a comprehensive overview of the field’s most frequently used and significant keywords.

Table 1. Processing of bibliometric search in the scientific literature (review date: 23 January 2024).

Keywords	Articles
“Sustainable Development Goals”	14,009
“Urban Development”	9413
“Urban circular economy”	16
“Circular Economy”	10,148
“Circular cities”	332
“Urban circular development”	3
“Urban sustainable development”	1193
“Urban economy”	8675

Figure 2 shows the first bibliometric analysis results, based on a minimum number of occurrences 100 times per word in 42,378 keywords. The analysis carried out using the VOSviewer program allowed the following four keywords to be used in the SLR: “circular economy”, “urban development”, “sustainable development”, and “sustainable development goals (SDGs)”. The selection of these four keywords that will be used in the SLR in this article was based on the results of the initial search. Although terms such as “sustainability” emerged as important clusters, they were not included as keywords due to their broad conceptualisation. This study aimed for a more specific keyword selection to ensure a focused search for the relevant literature.

Figure 3 outlines the interconnections between these four keywords: “circular economy”, “urban development”, “sustainable development”, and “sustainable development goals (SDGs)”. The circular economy seeks to maximise resource efficiency and promote reuse and recycling, closely related to sustainable development [3]. On the other hand, sustainable urban development aims to promote economic, social, environmental, and net-zero-energy solutions [3]. The sustainable development goals are a global agenda encompassing various areas and guide achieving sustainable development in all dimensions [5].

Including these terms allows a complete and more accurate picture of the current knowledge of the circular economy and sustainable urban development. Consequently, using these four keywords as the main criteria for this SLR is expected to collect valuable information that will contribute to scientific progress in this area. Furthermore, this will help establish solid theoretical research to critically examine the various studies found during the research process.

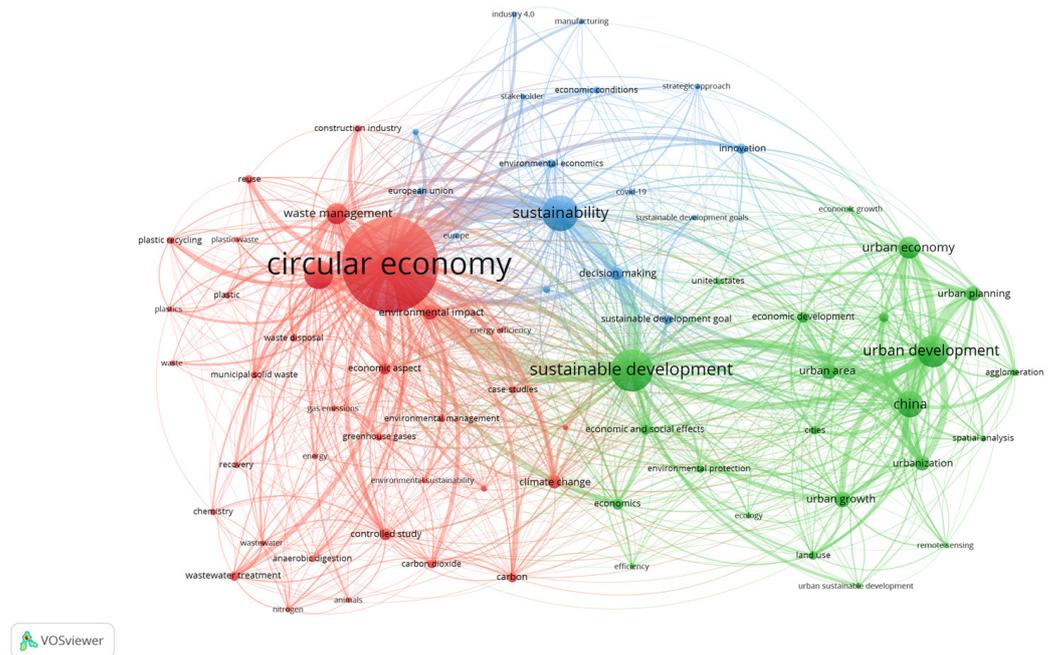


Figure 2. Keywords from bibliometric analysis (Source: VOSviewer—Visualising scientific landscapes).



Figure 3. Selected keywords (Source: VOSviewer—Visualising scientific landscapes).

Figure 4 shows the countries that have more publications in this bibliometric search. Countries that stand out in research and development on the urban circular economy include but are not limited to, China, the United Kingdom, Italy, Germany, and Brazil. Italy, China, and Brazil are countries that have made notable contributions to research and development in the field of urban circular economy.

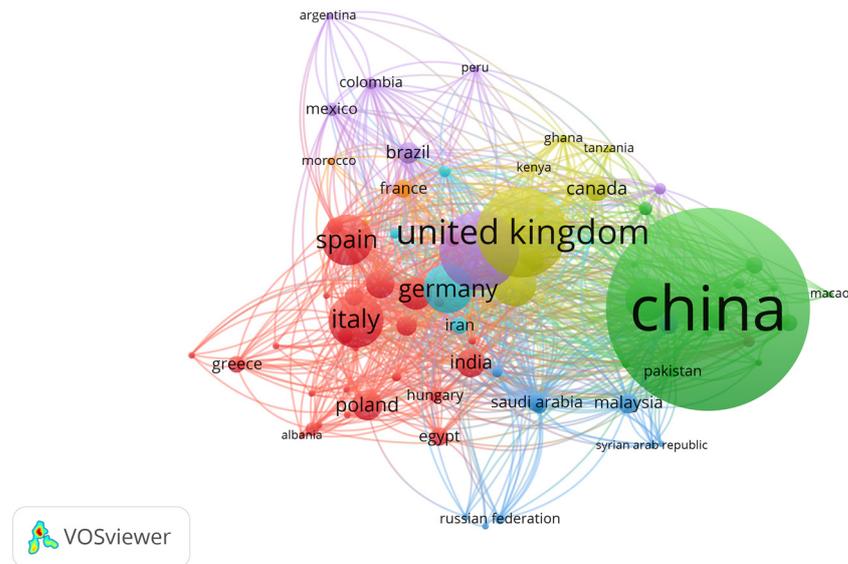


Figure 4. Countries most contributing to the bibliometric analysis (Source: VOSviewer—Visualising scientific landscapes).

Italy has acknowledged the importance of a circular economy in advancing sustainable urbanisation that fosters the harmonious development of social, economic, and ecological domains [11]. The country’s adoption of circular practices is geared towards achieving resource optimisation, waste minimisation, and establishing circular value chains that safeguard the environment and enable sustainable development [12]. Germany has earned a reputation for placing great importance on sustainable living and economic sustainability [13]. The nation has been steadfastly committed to effecting a paradigm shift in consumption patterns, while simultaneously focusing on the development of sustainable infrastructure and urban spaces [13]. This persistent effort is driven by a commitment to reduce greenhouse gas emissions, support the use of renewable energy sources, and foster a cleaner environment [13]. China has been actively promoting a circular economy as an alternative approach to resource management, aiming to maximise the utility of resources through renewable energy integration and minimum waste [14]. The UK has actively participated in research and development initiatives related to decarbonisation and urban circular economies [15]. In particular, studies in the UK context have looked at the drivers of sustainable business expansion in different regions and the development of industrial symbiosis in eco-industrial parks [15]. One such study highlights the specific contributions of the UK in advancing knowledge and practices related to net-zero-energy solutions and the urban circular economy. Brazil has also shown interest in the urban circular economy and has been monitoring and evaluating the sustainability progress of many of its cities towards achieving the SDGs [2].

The research and development efforts of these countries in the urban circular economy are in line with the global trend of urbanisation, as a substantial portion of the world’s population is projected to reside in cities by 2050. These countries have robustly committed to promoting the urban circular economy, investing in SDG projects, and developing related initiatives. As a result, they have made significant progress in advancing sustainable decarbonisation and urban development within their respective nations.

2.2. Processing the Sources of Information

The sources of information were the academic databases Web of Science and Scopus of Elsevier. The only filter applied was “type of documents”, choosing articles and reviews. The following three combinations of keywords were used as search terms: “Urban Development” + “Sustainable Development”, “Sustainable Development Goals (SDGs)” + “Urban Development”, and “Circular Economy” + “Urban Development”.

A requirement for conducting the SLR is a concise description of the criteria for including and excluding articles. The criteria adopted to include an article are articles within the defined time frame, English language, and full-text availability, resulting in a selection of 23 scientific articles, as shown in Table 2 and Figure 5.

Table 2. Selection criteria for the systematic review.

Criteria	Inclusion	Exclusion
Publication Type	Articles, review	Other publications (e.g., Book series, proceedings, trade journal)
Language	English	Other language
Period	2015–2024	Other years
Access	Open Access	Other access

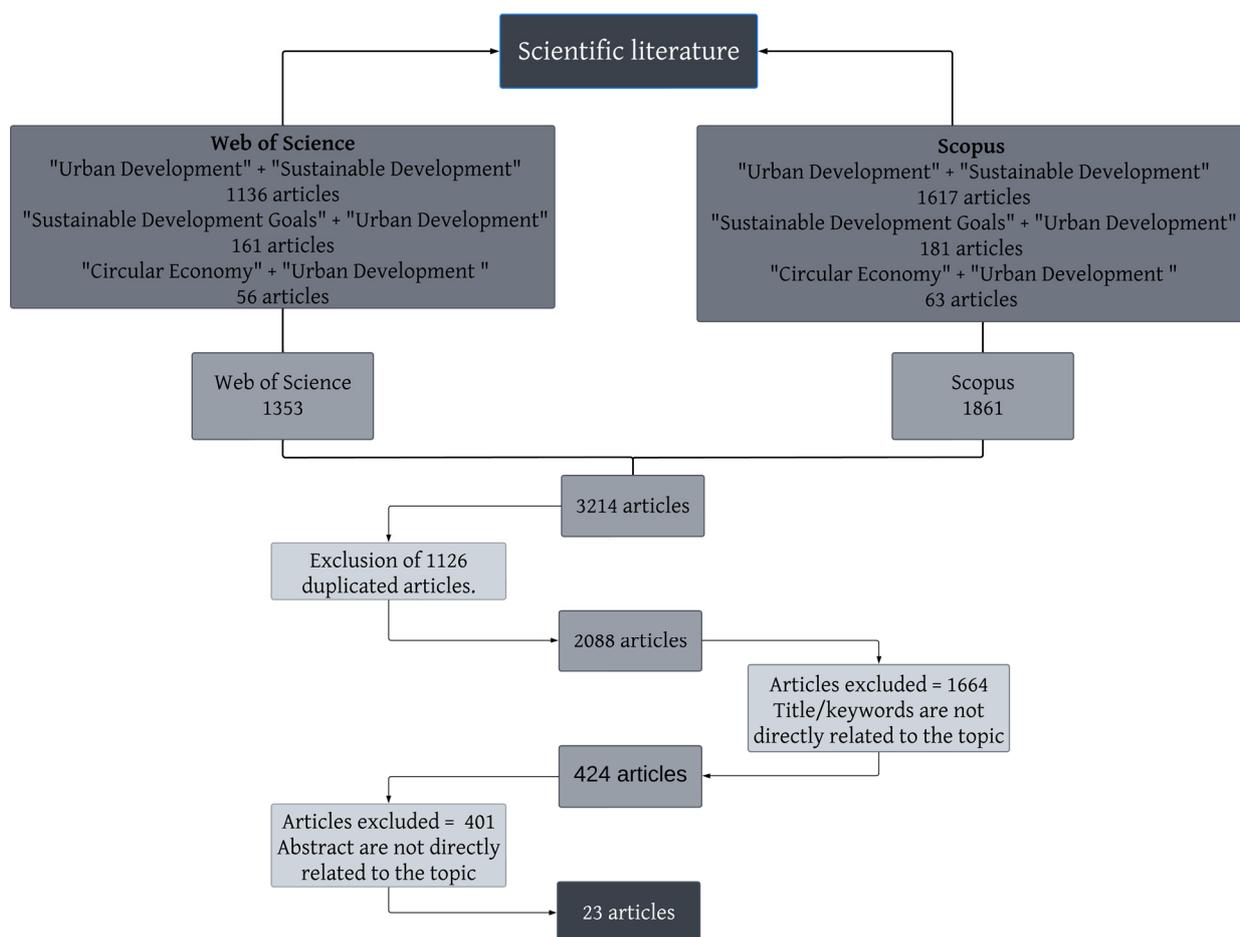


Figure 5. Processing of systematic literature review.

2.3. Criteria of Analysis

A total of 10 analysis criteria were selected for the general mapping of the literature. As shown in Table 3, the requirements include the article title, year, database, journal, number of article citations, access, keywords, abstract, research aim, and thematic axis. The criteria supplied valuable insights for pinpointing research topics and selecting the most pertinent articles on the central theme of this study. The perspectives and context of the studies within the selected articles were identified after a thorough reading and analysis. It categorised them based on the thematic axis of each article. Based on the number of times in the review articles and the authors' perception of the importance of implementing

UCE in the SDGs, the most relevant gaps are described in Section 3, first table, for future research directions.

Table 3. Criteria of analysis for the systematic review.

Criteria of Analysis
Article title
Year
Database
Journal
Number of article citations
Open access
Keywords
Abstract
Research aim
Thematic axis

2.4. Descriptive Analysis

After the criteria of analysis (see Table 3) were established and after the SLR processing (see Figure 5), 23 articles were selected. These articles are spread from 2015 to 2023 (see Figure 6). The articles published between 2015 and 2023 showcase the increasing emphasis on sustainable development and decarbonisation in urban areas. Research on urban environments has grown substantially during this period, driven by a heightened awareness of the critical challenges of cities worldwide [16]. These challenges include climate change, pollution, increased carbon emissions, and inadequate access to essential services, and they have gained significant attention from society. Consequently, there is now a shared sense of urgency to explore and implement sustainable urban solutions that promote net-zero-energy and reduce carbon emissions, with the ultimate goal of creating more sustainable and resilient urban environments. The proliferation of articles during this period reflects the growing recognition of the need for sustainable practices and technologies in urban settings and the shift in global focus towards the SDGs relevant to urban environments [3].

NUMBER OF SELECTED ARTICLES PER YEAR

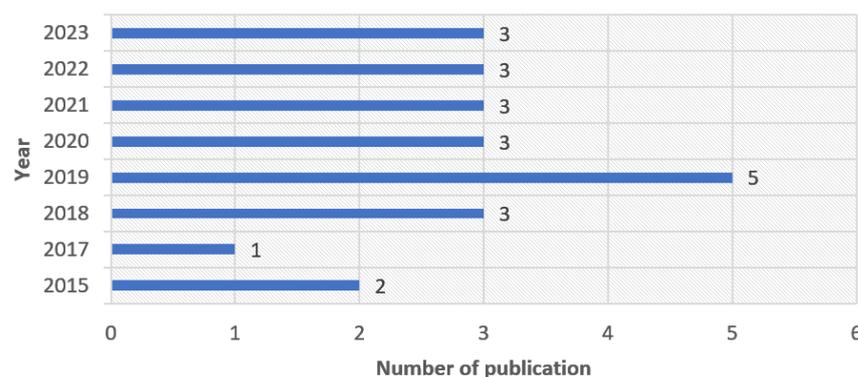


Figure 6. Number of selected articles per year.

The numbers of cited articles are listed in Table 4. Martin et al. [17], the authors of the most cited article, explore perspectives and practices to achieve a sustainable city. Then, Krellenberg et al. [2] and Terama et al. [6] exemplify the connection between UCEs and SDGs through several case studies, which helped to see the importance of the topic more clearly. Figure 7 shows the geographical distribution of the studies analysed according to the author's countries. Europe accounted for 65% of the authors involved in the 23 researched

articles, followed by Asia with 28%. South America had 6% and Oceania had 1%. Table 5 provides data on the number of citations, the year of publication, and the citations per article and author, and Table 6 outlines the participation of these authors in the selected articles. This information provides insight into the strength of research and development in Europe and Asia. In particular, the United Kingdom is the predominant country in Europe that contributes to this research landscape, with a significant presence of 10 authors actively engaged in this field. The UK's development of urban sustainability can be attributed to its robust academic community; sustainable, net-zero-energy solutions; well-established research institutions; and proactive approach to addressing sustainability challenges [18]. China closely follows this, with eight authors dedicated to advancing research on the same topic. China's prominence underlines its strategic focus on sustainable urban development, which is in line with its rapid urbanisation and environmental concerns. Moreover, China's notable contributions may reflect its proactive policies, significant investment in research and innovation, and the sheer scale of its urban challenges [14].

Table 4. Publications number of citations.

Authors	Article Title	Year	Total Citations
[17]	Smart and sustainable? Five tensions in the visions and practices of the smart-sustainable city in Europe and North America	2018	205
[19]	Strategic principles for smart city development: A multiple case study analysis of European best practices	2019	182
[20]	Rethinking sustainable Urban development: towards an Integrated Planning and development process	2015	180
[21]	Smart cities: an effective urban development and management model?	2015	113
[22]	How to contextualise SDG 11? Looking at Indicators for Sustainable Urban Development in Germany	2018	70
[23]	Sustainability indicators: A tool to generate learning and adaptation in sustainable urban development	2017	68
[24]	Moving Towards the Circular Economy/City Model: Which Tools for Operationalising This Model?	2019	54
[25]	Company disclosures concerning the resilience of cities from the Sustainable Development Goals (SDGs) perspective	2020	42
[26]	Sustainable and integrated urban planning and governance in metropolitan and medium-sized cities	2020	38
[2]	Urban sustainability strategies guided by the SDGs-A Tale of four cities	2019	38
[27]	Modelling Accessibility to Urban Green Areas Using Open Earth Observations Data: A Novel Approach to Support the Urban SDG in Four European Cities	2021	21
[28]	Sustainability of urban development with population decline in different policy scenarios: A case study of Northeast China	2019	19
[29]	Stimulating Implementation of Sustainable Development Goals and Conservation Action: Predicting Future Land Use/Cover Change in Virunga National Park, Congo	2020	16
[30]	Urban sustainability and natural hazards management; designs using simulations	2021	9
[31]	Does Circular Economy Contribute to Smart Cities' Sustainable Development?	2022	8
[6]	Urban Sustainability and the SDGs: A Nordic Perspective and Opportunity for Integration	2019	8
[32]	Urban sustainability performance measurement of a small Brazilian city	2021	6
[14]	Urban sustainability indicators re-visited: lessons from property-led urban development in China	2018	4
[33]	Continuous Long Time Series Monitoring of Urban Construction Land in Supporting the SDG 11.3.1—A Case Study of Nanning, Guangxi, China	2023	3
[34]	Circular Economy for Cities and Sustainable Development: The Case of the Portuguese City of Leiria	2022	2
[35]	A comparative work for spatially explicit urban growth modelling for monitoring urban land-use efficiency and sustainable urban development (SDG 11.3.1): A study on Kolkata metropolitan area, India	2022	2
[36]	Localising SDGs: The case of city planning in Malmö	2023	0
[37]	Sustainable Cities and Communities from Malaysian Local Authorities Perspectives	2023	0

GEOGRAPHIC DISTRIBUTION OF SELECTED ARTICLES

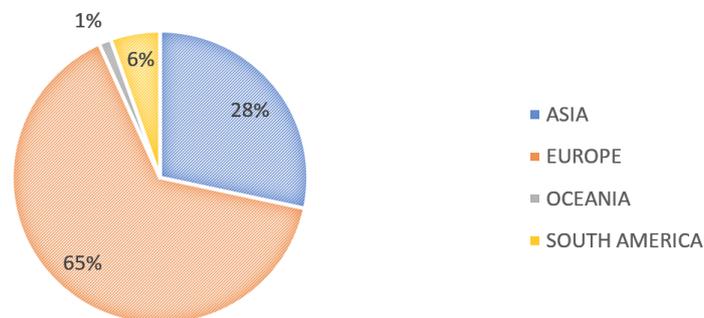


Figure 7. Geographic distribution of selected articles.

Table 5. Geographic distribution of authors.

Authors	Year	Authors Numbers	Country	Continent
Acuti D.; Bellucci M.; Manetti G. [25]	2020	1	UK	Europe
		2	Italy	
Antunes J.C.C.; Eugénio T.; Branco M.C. [34]	2022	3	Portugal	Europe
Azudin A.; Endut W.A.; Mohd Noor N.R.A.; Jusop M.; Long Y. [37]	2023	5	Malaysia	Asia
Caldatto F.C.; Bortoluzzi S.C.; de Lima E.P.; Gouvea da Costa S.E. [32]	2021	4	Brazil	South America
Christensen, M.; Arsanjani, J.J. [29]	2020	2	Denmark	Europe
Dincă G.; Milan A.-A.; Andronic M.L.; Pasztori A.-M.; Dincă D. [31]	2022	5	Romania	Europe
Fernández P.; Ceacero-Moreno M. [30]	2021	2	Spain	Europe
Girard, L.F.; Nocca, F. [24]	2019	2	Italy	Europe
Giuliani, G.; Petri, E.; Interwies, E.; Vysna, V.; Guigoz, Y.; Ray, N.; Dickie, I. [27]	2021	3	Switzerland	Europe
		2	Luxembourg	
		1	Germany	
Koch F.; Krellenberg K. [22]	2018	2	Germany	Europe
Krellenberg K.; Bergsträßer H.; Bykova D.; Kress N.; Tyndall K. [2]	2019	5	Germany	Europe
Ling, Z.Y.; Jiang, W.G.; Lu, Y.; Ling, Y.R.; Zhang, Z.; Liao, C.M. [33]	2023	6	China	Asia
Martin, C.J.; Evans, J.; Karvonen, A. [17]	2018	2	UK	Europe
		1	Sweden	
Medeiros E.; van der Zwet A. [26]	2020	1	Portugal	Europe
		1	UK	
Mithun S.; Sahana M.; Chattopadhyay S.; Chatterjee S.; Islam J.; Costache R. [35]	2022	6	India	Asia
Mora L.; Deakin M.; Reid A. [19]	2019	3	UK	Europe
Pupphachai U.; Zuidema C. [23]	2017	2	Netherlands	Europe
Terama, E.; Peltomaa, J.; Mattinen-Yuryev, M.; Nissinen, A. [6]	2019	4	Finland	Europe
Xu Y.; Keivani R.; Cao A.J. [14]	2018	1	China	Asia
		2	UK	Europe
Yang Z. [28]	2019	1	China	Asia
Yigitcanlar T.; Teriman S. [20]	2015	2	Iran	Asia
Yigitcanlar, T [21]	2015	1	Australia	Oceania
Zinkernagel R.; Neij L. [36]	2023	2	Sweden	Europe

Table 6. Classification of the selected articles according to the aspects of the urban circular economy.

Urban Circular Economy Aspect	Authors
1. Furnishing theoretical studies, strategies, and practical tools for implementing Circular Economy Models.	[14,17,19,21,23,24,26,30,31]
2. Integrating Circular Economy principles into Urban development to promote sustainable resource management, reduce waste, and enhance energy efficiency.	[6,19–22,26,27,31,32,34,37]
3. Concrete Examples, Strategies, and Practical SDGs in Sustainable Urban Development.	[25,28,29,33–36]

3. Results and Discussion

The objectives of the reviewed articles focused on analysing the relationships between UCEs and SDGs. By examining the interplay between UCEs and the different SDGs, the review sought to identify areas of alignment, potential synergies, and trade-offs. This comprehensive approach provides valuable insights into the potential impact of UCEs on sustainable urban development and its implications for achieving the SDGs. Table 6 presents the three main UCE aspects identified in the articles and the classification of the articles under these topics. The classification criteria were carefully selected to thoroughly analyse the correlation between UCEs and SDGs in sustainable urban development.

The reviewed articles provide comprehensive coverage of various aspects, highlighting the multifaceted relationship between UCEs and SDGs in the context of sustainable urban development. The UCE aspects emphasise the theoretical foundations, practical applications, and integration of CE principles, and they expose strategies and practical applications of SDGs in the context of sustainable urban development. This offers a real-world illustration of the intersection between UCEs and SDGs.

Table 7 summarises the current research areas in the field of urban circular economy. The main groups of UCE aspects identified in Table 6 comprised the three thematic axes. This analysis comprehensively addresses the main topics that have been the subject of studies and the gaps identified in the literature. These gaps not only represent knowledge gaps but also emerge as crucial opportunities for future research, which can play a fundamental role in advancing the integration of the circular economy in urban development and promoting more sustainable practices in the urban environment.

Table 7. Current themes, main gaps, and future research directions.

Urban Circular Economy Aspect	Thematic Axis	Main Gaps in Topics	Future Research	Reference
1	Circular Economy Models and Tools	<p>Insufficient practical tools for implementing circular economy models in urban development.</p> <p>Lack of universally applicable theoretical works for circular economy integration in diverse urban settings.</p> <p>Limited exploration of strategies that bridge theoretical works with practical implementation.</p>	<p>Develop user-friendly tools and guidelines for CE adoption in cities.</p> <p>Propose adaptable theoretical research for CE integration.</p> <p>Investigate effective strategies for translating theoretical research into practical actions.</p>	[14,17,19,21,23,24,26,30,31]

Table 7. Cont.

Urban Circular Economy Aspect	Thematic Axis	Main Gaps in Topics	Future Research	Reference
2	Circular Economy Integration in Urban Development to Promote Sustainability	Limited focus on specific circular economy strategies designed for urban contexts.	Examine the implementation of innovative circular economy models tailored to diverse urban environments, investigating their scalability across varying scales and assessing their holistic impact on overall urban sustainability.	[6,19–22,26,27,31,32,34,37]
		There is a need for comprehensive works addressing resource management, waste reduction, and energy efficiency.		
3	Concrete Examples of SDGs in Sustainable Urban Development	Lack of in-depth exploration of the interconnectedness between the circular Economy and urban sustainability.	Explore diverse case studies highlighting the successful implementation of SDGs in urban contexts. Develop works that support SDGs with various urban development contexts and goals. Investigate practical challenges and success factors in implementing SDGs in urban settings.	[25,28,29,33–36]
		Incomplete exploration of tangible instances showcasing the integration of SDGs in urban sustainability practices.		
		There is a need for more comprehensive works and studies that link SDGs to specific urban development strategies.		
		Limited discussion on the practical implementation of SDGs, including challenges and successes.		

The current research areas in urban development reflect a noteworthy emphasis on integrating circular economy principles. These principles can potentially contribute significantly towards achieving the SDGs (see Table 8). The future research possibilities in this field are vast and varied, ranging from designing new circular economy models suitable for diverse urban environments to analysing their comprehensive influence on urban sustainability. These research opportunities provide work for advancing the comprehension and practical implementation of a circular economy in urban development.

Based on the comprehensive results, it was possible to identify a strong correlation between the impact of UCEs and progress towards achieving the following SDGs: SDG 7: Affordable and Clean Energy [38]; SDG 9: Industry, Innovation, and Infrastructure [39]; SDG 11: Sustainable Cities and Communities [40]; SDG 12: Responsible Consumption and Production [41]; SDG 13: Climate Action [42]; and SDG 15: Life on Land [43]. This nexus between the impact of UCEs in SDGs is outlined in Table 8. They are closely associated with urban challenges such as housing, infrastructure, environmental impact, and energy consumption. Focusing on these SDGs can help cities become more inclusive, safe, resilient, and sustainable [6]. The cross-cutting nature of urban issues and their impact on various other SDGs highlight the need for integrated approaches to urban development. Given the rapid urbanisation and associated threats to the environment, climate, and social equity, focusing on urban areas to achieve the SDGs is imperative [5].

Furthermore, adopting UCE principles and practices can lead to numerous benefits at both local and global levels. At the local level, the implementation of UCE initiatives can make a substantial impact towards eradicating poverty. Initiatives aimed at facilitating the transition of human infrastructure, promoting digital transformation, cultivating human capital development, leveraging the waste sector, and encouraging sustainable industries can all contribute to job creation and economic growth [44]. Human infrastructure transi-

tion involves equipping individuals with the skills needed to adapt to the changing labour market through training and education programs. Leveraging the waste sector creates employment opportunities in waste management and recycling, as people become more aware of sustainability and waste reduction [44]. Promoting sustainable industries, such as renewable energies, energy efficiency, sustainable agriculture, and environmental conservation, generate job opportunities that align with the growing demand for sustainable products and services. By supporting economic growth and sustainable development, these initiatives can have a positive impact on local communities [44]. It can also foster sustainable urban development by reducing waste generation, improving resource efficiency, integrating renewable energy, and enhancing residents' overall quality of life [45]. On a global scale, embracing UCE principles supports SDGs such as SDG 7: Affordable and Clean Energy [38]; SDG 9: Industry, Innovation, and Infrastructure [39]; SDG 11: Sustainable Cities and Communities [40]; SDG 12: Responsible Consumption and Production [41]; SDG 13: Climate Action [42]; and SDG 15: Life on Land [43]. Minimising waste production and maximising resource utilisation through circular economy models can reduce carbon emissions substantially [6]. This helps mitigate climate change and contributes to achieving environmental goals outlined in the SDGs. Collaboration among various stakeholders is crucial to successfully integrating UCE principles into urban development strategies supported by the SDGs [4]. Governments must work with businesses, civil society organisations, academia, and citizens [16]. Only by coming together and working collectively can we effectively tackle social inequalities and ensure that our planet's resources are conserved for generations to come [45].

Table 8. Impact UCE in SDGs.

SDGs	The Impact of UCE on SDGs	Examples of Urban Circular Practices
SDG 7: Affordable and Clean Energy [38]	The urban circular economy plays a crucial role in advancing the objectives of SDG 7 by encouraging the adoption of renewable energy sources and energy-efficient practices within urban areas. Embracing circular practices can help cities reduce their dependence on non-renewable energy sources, contributing to the transition towards affordable and clean energy. This shift mitigates the environmental impact of urban energy consumption and strengthens energy security and resilience within urban settings, aligning with the broader goals of SDG 7.	Circular Urban Metabolism Framework: This framework underscores the difficulty of enacting successful waste management protocols to achieve sustainability, particularly in densely populated urban areas where the majority of global waste is produced. It underscores the necessity for a comprehensive, multilevel, and enduring strategy that transcends local remedies and linear tactics. The approach acknowledges the far-reaching implications of waste management that extend beyond city limits and advocates for circularity by integrating waste reduction, reuse, recycling, and appropriate disposal methods, thereby advancing SDG 7 [46].
SDG 9: Industry, Innovation, and Infrastructure [39]	Circular principles, such as resource efficiency, waste reduction, and sustainable production, are key drivers of innovation in urban infrastructure and industrial practices. By embracing circular approaches, cities can foster the development of sustainable urban infrastructure, advanced manufacturing processes, and innovative technologies, thereby promoting industry, innovation, and infrastructure in line with the objectives of SDG 9.	Sustainable Consumption and Production (SCP) Hotspots Analysis Tool: The SCP Hotspots Analysis Tool, created by UNEP, offers comprehensive information on countries' environmental and socio-economic progress for the past 25 years. This powerful tool enables countries to efficiently pinpoint and examine hotspots at both the national and sectoral levels, supporting circular economy principles and advancing the objectives of SDG 9 [47].

Table 8. Cont.

SDGs	The Impact of UCE on SDGs	Examples of Urban Circular Practices
SDG 11: Sustainable Cities and Communities [40]	By reducing waste, improving resource efficiency, and encouraging sustainable consumption, circular practices address critical urban challenges, including housing, infrastructure, and environmental impact. By integrating circular practices, cities can create inclusive, safe, and resilient urban environments for their residents.	Circular Urban Metabolism Framework: The framework emphasises the importance of taking a multidimensional, multiscale, and long-term approach that goes beyond local solutions and linear strategies. By incorporating waste reduction, reuse, recycling, and proper disposal practices, circularity can play a significant role in developing sustainable cities and communities, aligning with SDG 11 [46].
SDG 12: Responsible Consumption and Production [41]	The urban circular economy encourages responsible consumption and production practices in urban areas, which is in line with the objectives of SDG 12. By adopting circular principles, cities can significantly reduce waste generation, promote sustainable consumption habits, and improve overall resource efficiency. This change minimises the environmental impact of urban consumption.	Waste Management and Recycling: The adoption of circular economy practices, such as waste reduction, reuse, repair, remanufacturing, and recycling. With the aid of innovative technologies and business models, the circular economy effectively curbs the production and consumption of environmentally harmful products, resulting in enhanced resource efficiency and reduced strain on our natural surroundings [48].
SDG 13: Climate Action [42]	The urban circular economy plays a vital role in tackling the climate change challenges that cities face. By advocating for circular practices, cities can lower their carbon footprint, reduce waste generation, and optimise resource usage, thereby reducing the impact of urbanisation on climate change. Circular methods aid in reducing greenhouse gas emissions, preserving natural resources, and supporting climate-resilient urban growth, all while furthering the larger climate action agenda in SDG 13.	Reduction of Urban Resource Consumption: Efforts to transform cities into regenerative and adaptive urban ecosystems with closed resource loops and minimal waste would significantly reduce their ecological impact. Circular measures such as repurposing heat from buildings, anaerobic digestion of organic waste, and green infrastructure would all contribute towards curbing urban resource consumption and aligning with climate action goals [49].
SDG 15: Life on Land [43]	The urban circular economy is a key factor in advancing sustainable land use and promoting biodiversity in urban areas. Cities that implement circular practices can lessen their environmental impact, prevent land degradation, and safeguard natural habitats. This is supported by SDG 15, which focuses on the preservation and restoration of terrestrial ecosystems. By utilising circular approaches to regenerate natural systems, cities can create more vibrant urban green spaces, improve biodiversity, and protect critical ecosystems within and outside city limits.	Health Impact Assessments (HIAs) in Urban Planning: Health Impact Assessments (HIAs) are highly effective tools that facilitate the implementation of Health in All Policies (HiAP), by seamlessly integrating health recommendations into urban policies. The Barcelona Institute for Global Health has successfully conducted HIAs in over 20 cities spanning low to high-income countries [50].

After conducting a thorough analysis, as presented in Table 8, it is clear that UCEs play a significant role in driving social, economic, and environmental impacts towards achieving the SDGs. The interdependence of these contributions highlights the transformative potential of UCEs in promoting sustainable urban development, enhancing resilience, addressing critical environmental challenges, and promoting responsible consumption and production.

The primary objective of this extensive examination was to recognise the specific contributions of UCEs to individual SDGs while also identifying the interrelatedness and collective benefits of these factors. A thorough evaluation of UCEs' economic, environmental, and social implications provides valuable work for developing impactful policies and strategies that support sustainable urban development and the broader objectives of SDGs (see Table 9). The key elements of the UCE reflect a holistic approach to sustainability, encompassing environmental, economic, and social aspects and promoting sustainable,

net-zero-energy solutions [51]. These principles encourage responsible resource management, emphasising renewable resources, decarbonisation, extended product lifecycles, and circularity [51].

Table 9. Contributions of UCEs to various SDGs.

Urban Circular Economy Key Elements [51]	Triple Bottom Line Category	SDG 7 [38]	SDG 9 [39]	SDG 11 [40]	SDG 12 [41]	SDG 13 [42]	SDG 15 [43]
Prioritise renewable resources	Environmental and Economic	x		x	x	x	x
Extend the lifetime of products.	Environmental	x		x	x	x	
Reduce	Environmental	x		x	x	x	x
Reuse	Environmental	x		x	x	x	x
Recycle	Environmental	x		x	x	x	x
Circularity	Environmental and Economic	x		x	x	x	x
Industrial symbiosis	Economic		x		x	x	
Circular business model	Economic		x				
Team up to create joint value	Economic and social		x		x	x	
Design for the future	Economic, social, and environmental	x	x	x	x	x	
Application of digital technology	Economic and Environmental	x	x	x			
Knowledge creation	Economic, social, and environmental	x	x	x			
Education and pro-environmental behaviour	Environmental and social	x		x	x	x	

These key elements work collaboratively, particularly in their joint value creation, highlighting the interconnectedness required to implement the circular economy successfully [51]. This collaborative approach aligns with the broader goal of sustainable development, emphasising the importance of partnerships. In addition, integrating digital technologies and knowledge creation illustrates the role of innovation in advancing the circular economy and supporting the global agenda for industry and infrastructure development.

4. Conclusions

After conducting a thorough analysis, 43,789 articles containing the selected keywords for this SLR were screened. From this analysis, 23 articles were deemed the most relevant for this study. Upon analysing these 23 articles within the scope of UCEs and SDGs, the fundamental contributions to achieve clear answers to the research question “How can the principles of UCEs help the implementation of the SDGs towards sustainable urban development?” were identified. Focusing on 23 relevant studies within the UCE and SDG domains offered substantial insights into the impact of UCEs on SDGs towards sustainable urban development.

Through a comprehensive analysis of the UCEs’ influence on the SDGs, this study has uncovered significant findings and implications. It has also shed light on the key elements

of UCEs and their collaborative efforts towards promoting sustainable practices across environmental, economic, and social spheres. Ultimately, this systematic literature review emphasises the critical role that the UCE plays in advancing certain SDGs and highlights the need for continued research in this area. The urban circular economy plays a significant role in driving progress across several SDGs:

- SDG 7 encourages the adoption of renewable energy sources and energy-efficient practices within urban areas, contributes to the transition towards affordable and clean energy, and mitigates the environmental impact of urban energy consumption.
- The role of the urban circular economy in promoting sustainable infrastructure and innovation within urban areas aligns perfectly with the goals of SDG 9, driving resource efficiency, waste reduction, and sustainable production, thereby promoting industry, innovation, and infrastructure.
- Implementing circular economy principles in urban areas is crucial in advancing SDG 11 by promoting sustainable urban development and resilience; addressing critical urban challenges; and creating inclusive, safe, and resilient urban environments for residents.
- The urban circular economy plays a crucial role in encouraging responsible consumption and production practices in urban areas, significantly reducing waste generation, promoting sustainable consumption habits, and improving overall resource efficiency in line with the objectives of SDG 12.
- The urban circular economy plays a vital role in tackling cities' climate change challenges. It lowers their carbon footprint, reduces waste generation, and optimises resource usage, thereby reducing urbanisation's impact on climate change in alignment with the goals of SDG 13.
- The urban circular economy is a key factor in advancing sustainable land use and promoting biodiversity in urban areas, lessening environmental impact, preventing land degradation, and safeguarding natural habitats, supporting the preservation and restoration of terrestrial ecosystems outlined in SDG 15.

The integration of UCEs and SDGs is crucial for long-term sustainable city development, offering holistic solutions that address critical social, economic, and environmental dimensions. Despite the challenges in implementation, such as the need for coordinated multi-stakeholder efforts and strategic policymaking, the study underscores the necessity of integrated approaches to balance the diverse goals within SDGs and urban circular economy studies.

Factors like vulnerability, responsibility, and education are recognised as influential in shaping urban sustainability governance, emphasising inclusivity in waste management and plastic reduction initiatives for equitable and sustainable urban development. Challenges in achieving full material closure highlight the need for scenario planning considering future demand trajectories in urban areas. Quantitative research on the impact of the sharing economy and interdisciplinary collaboration is suggested to strengthen recommendations for UCEs and SDGs.

It's important to note that this research is not exhaustive and is intended to spark new discussions and ideas in the field. Moving forward, it's recommended that further works delve deeper into the thematic axes and the potential impact of the UCE on seven SDGs. At the same time, this study does have limitations, such as focusing on academic research in the construction industry and relying on keyword searches to select articles. The criteria for article selection were transparent. However, it's worth acknowledging that there may have been some researcher bias in the selection process. Additionally, this study only includes articles published in English, so there may be valuable research and practical results in other languages that were not considered.

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