

## URBAN PLANNING AND SUSTAINABILITY: A BIBLIOMETRIC REVIEW OF GREEN AREAS AND RESILIENCE IN CITIES

### PLANEJAMENTO URBANO E SUSTENTABILIDADE: UMA REVISÃO BIBLIOMÉTRICA SOBRE ÁREAS VERDES E RESILIÊNCIA NAS CIDADES

Article received on: 1/5/2026

Article accepted on: 4/6/2026

**Raghda Najim Abed\***

\*Aliraqia University, Baghdad, Iraq

Orcid: <https://orcid.org/0009-0001-1280-2196>

[raghda.n.abd@aliraqia.edu.iq](mailto:raghda.n.abd@aliraqia.edu.iq)

The authors declare that there is no conflict of interest

#### Abstract

The urban population is expected to account for 60% of the total global population by 2030. As well as the cities are among the world's largest contributors to carbon emissions and resources consumption. Statistics show that cities are responsible for approximately 70% of global carbon emissions and consume over 60% of the world's resources. In this study, a bibliometric analysis is conducted using Web of Science (WoS) database to filter the publications and VOSviewer to visualise the data. The publications analysed according to the research areas under different headings. These headings include the titles, study subjects, document types and sources, publications number of countries and organisations, authors and co-authorship analysis, keyword analysis, and a focus on the top 10 most cited publications between 2010 and August 2024. used to analyse these publications. The findings outline the novel approach to resilient urban areas and green spaces in the context of urban planning and sustainability, as well as the potential in the sector. It is anticipated that this research will aid in the development of more theoretical and practical efforts to be used in this sector, as well as aid researchers and policymakers in understanding the consequences of policies for resilient and sustainable cities.

**Keywords:** Urban Planning. Sustainability. Green Area. Resilience. Bibliometrics.

#### Resumo

*Estima-se que a população urbana represente 60% da população global total até 2030. Além disso, as cidades estão entre os maiores responsáveis pelas emissões de carbono e pelo consumo de recursos no mundo. As estatísticas mostram que as cidades são responsáveis por aproximadamente 70% das emissões globais de carbono e consomem mais de 60% dos recursos mundiais. Neste estudo, é realizada uma análise bibliométrica utilizando a base de dados Web of Science (WoS) para filtrar as publicações e o VOSviewer para visualizar os dados. As publicações foram analisadas de acordo com as áreas de pesquisa sob diferentes rubricas. Essas rubricas incluem títulos, temas de estudo, tipos de documentos e fontes, número de países e organizações de origem das publicações, análise de autores e coautoria, análise de palavras-chave e um foco nas 10 publicações mais citadas entre 2010 e agosto de 2024. Os resultados delineiam uma abordagem inovadora para áreas urbanas resilientes e espaços verdes no contexto do planejamento urbano e da sustentabilidade, bem como o potencial do setor. Prevê-se que esta pesquisa contribua para o desenvolvimento de esforços mais teóricos e práticos a serem utilizados neste setor, além de auxiliar pesquisadores e formuladores de políticas na compreensão das consequências das políticas para cidades resilientes e sustentáveis.*

**Palavras-chave:** Planejamento Urbano. Sustentabilidade. Área Verde. Resiliência. Bibliometria.



## 1 INTRODUCTION

Cities usually represents the economic, political, and scientific centres of their regions. Urban populations now account for more than half of the world's total population. The urban population is expected to account for 60% of the total global population by 2030. It is predicted that the proportion of the urban population to the total global population will rise to 60% in 2030 (The 2019 Revision of World Population Prospects, 2019). Nevertheless, these cities are among the world's largest contributors to carbon emissions and resources consumption. Statistics show that cities are responsible for approximately 70% of global carbon emissions and consume over 60% of the world's resources. As a result, cities have a significant impact on global sustainability (Wiedmann et al., 2020; Biello, 2018)

### 1.1 Urban planning

Urban planning is known as the practice of creating and controlling land use to influence the physical landscape of cities, towns, and regions. Sustainable planning aims are balanced with the demands of infrastructure, population expansion, and community well-being. The field has changed throughout the years to take into account factors like social justice, climate resilience, and sustainable development (Oliveira, 2016). Human activities linked to urbanisation have significant impacts on the natural environment. The natural environment is greatly affected by human activities associated with urbanisation. The percentage of people residing in urban areas will rise from 50% in 2014 to 66% in 2050, according to United Nations (2014). Urban planning represents the process of interaction between the government and society which seeks to clarify public policies and how they are implemented in the area in relation to national, regional, and local goals in order to support administration for increased societal development and well-being (Pepe et al, 2021; Germán, 2020).

However, because cities are the most resource-efficient way of living and have a smaller environmental effect per area, well-planned cities are essential to the solution of sustainable urban planning (EEA, 2024; Bento et al, 2018; Kayakutlu et al, 2017). As a result, contemporary urban planning must take into account socioeconomic and

environmental factors linked to population densification in a holistic and symbiotic manner (Ruiz et al 2015; Teller, 2014), enabling the creation of a territory model that supports strategic decision-making based on sustainability and is transferable to other urban ecosystems (Raum et al, 2018; Márquez et al, 2015).

## 1.2 Sustainability

Sustainability in urban planning refers to the development that satisfies the demands of the present without compromising the ability of future generations to satisfy their own needs (United Nations Brundtland Commission, 1987). Worldwide, a large number of nations are implementing sustainable practices. The emergence of new sustainable cities is evidence of this. This new frontier in city design may be attributed to worries about the environment, a resurgence of interest in the development of human capital, and healthy living standards (Aquilani et al., 2018, Szopik-Depczyńska et al., 2018). However, a few key components need to be present for a city to be deemed sustainable. When coupled with knowledgeable and cooperative residents, these components—sustainable education, renewable energy, energy efficiency, sustainable transportation, sustainable structures, waste management, etc.—may result in the benefits of sustainability (Sadiq et al., 2019).

Sustainable planning is based on an understanding of urban ecological systems and environmental management, with the goal of improving the quality of life for its beneficiaries (Mejía et al, 2020). The ecological footprint is used as a tool to analyse lifestyles and consumption, but the results of this analysis do not ensure that the interested organization will make decisions that are effective in the direction of sustainability (Brouwer et al, 2018; Pandit et al, 2017; Li et al, 2017). Furthermore, the concept is refined based on the standards that align with the principles of physical well-being, which ensures safety and comfort, habitability from an environmental perspective, and social welfare, which aims to create a sense of appropriation and belonging and universal access to urban services (Igarza et al, 2019).

### 1.3 Urban green areas

Urban green spaces, which include parks and urban forests, are vital elements of resilient and sustainable urban environments because they enhance sustainability, liveability, and environmental quality (Lee et al, 2015; Haq, 2011). These green areas offer a variety of advantages at the local and national levels, while also enhancing the visual appeal and recreational value of urban surroundings. They improve the general quality of life in cities by having a favourable influence on urban planning frameworks, social, economic, and ecological systems. Green spaces solve many of the major issues that metropolitan regions confront, including social inclusion, public health, sustainability, and urban revitalisation (Addas, 2023; Lee et al, 2015).

Several scholarly investigations have emphasised the manifold aspects of urban green spaces (UGSs), highlighting their contributions to planning, social, economic, and ecological goals. Because UGSs may absorb dangerous pollutants and regulate local temperatures, they mitigate the urban heat island effect and greatly contribute to biodiversity and climate management. Urban forests' trees serve as natural air filters, and parks and street trees cut down on traffic-related noise pollution. Furthermore, UGSs support psychological, emotional, and cognitive health, which lowers stress, promotes mental wellness, and improves memory and focus. In addition to promoting physical activity, enhancing health, and lowering the risk of chronic illnesses and death, these areas offer leisure options (Wang et al, 2022; Aram et al, 2019; Hedblom et al, 2019; Yu et al, 2018; Yang et al, 2016; Cicea et al, 2011; Bowler et al, 2010).

During the COVID-19 lockdowns, when access to green areas proved crucial for preserving human health and well-being, the need of UGSs became even more clear. Cities all across the world have taken action to expand the quantity and accessibility of these places in recognition of their significance. Consequently, there has been a significant increase in interest in UGS research, with academics not only emphasizing the detrimental effects of a lack of green space but also providing insightful advice on how to create effective UGS networks for planners and politicians. The significance of these places on a worldwide scale is highlighted by researchers looking through hundreds of papers from previous decades, highlighting the necessity of preserving and expanding

green spaces in urban settings (Marconi et al, 2022; Maury-Mora et al, 2022; Venter et al, 2022; Farkas et al, 2022; Martins et al, 2022).

#### **1.4 Resilience**

The ability of a city to endure and recover from various disruptions, including natural disasters, social challenges and economic crises. Recently, urban planners have increasingly prioritised the development of resilient infrastructure, the promotion of adaptive governance, and the reinforcement of social cohesion to help cities manage and adapt to these challenges (Meerow et al., 2016; Shao et al., 2015). With the concept of resilient cities gaining prominence, there has been growing interest in the practical aspects of spatial planning, which encompasses urban design methods, land use optimisation, and landscape design strategies (Li et al., 2020).

Research on resilient cities has garnered significant attention from both academia and society, resulting in a growing body of theoretical and practical studies. The importance of urban resilience was formally recognized in 2015 when the United Nations Sustainable Development Goals (UN-SDGs) identified enhancing urban resilience as a key global priority. As global urbanization accelerates, the construction of resilient cities has become a critical issue for sustainable development (Gao, 2019).

Despite these advancements, the field of resilient city research faces new challenges and evolving requirements. One of the primary challenges is how to effectively integrate resilient city concepts into the broader framework of territorial spatial planning. This integration is essential for developing comprehensive strategies that address the growing risks posed by climate change, economic shifts, and social stressors. The recent research on resilient cities primarily focuses on understanding system characteristics, developing evaluation indicator systems, and formulating policies to enhance resilience (Liang, 2021; Figueiredo et al, 2018).

Studies have demonstrated that urban resilience is closely linked to spatial planning, particularly in the context of climate uncertainty. Effective spatial planning policies play a crucial role in building cities that can adapt to and recover from disruptions (Lu et al, 2013). Moving forward, it is essential to explore how these policies can be

further optimised and aligned with the principles of resilient urban development to ensure cities are equipped to face future challenges.

Therefore, this paper will use a bibliometric analysis approach by screening more than 70,000 publications in the field of green areas and resilience in cities research, followed by a comprehensive analysis and visualisation of the literature published in the core database of Web of Science during the period of 2010-2024 by using VOSviewer. More specifically, the research has sought to answer the following research questions: Q1/ What are the trends in the development of literature about green areas and resilience in cities and urban planning perspective? Q2/ How have the journals, authors, research countries and institutions focusing on green areas and resilience in cities perspective changed? Q3/ What are the research focused themes in this field and how have they developed?

This article is organised into the following sections: the section “Materials and Methods” which outlines the research methodology and visualisation tools employed in the study, the section of “Results” presents a detailed analysis of publications, highlighting emerging trends in the intersection of green areas and resilience in cities. And the “conclusion” section to modify the possible recommendations and future directions in this field.

## **2 RESEARCH MATERIALS AND METHODS**

A more trustworthy and impartial evaluation of the literature is offered by bibliometrics (Sheng et al., 2022). Bibliometrics involves the analysis of literature through mathematical or statistical techniques, providing a means to measure and assess scientific output using various methods and extracting objective data. With the growing number of scientific and technical journals, as well as diverse research fields, the importance of bibliometric methods has increased, making it easier to track research trends within disciplines (Chandrashekarai et al, 2010). As a result, bibliometric analysis studies are crucial for analysing the scientific endeavours of scholars, organisations/affiliations, regions, and regions in order to identify research trends.

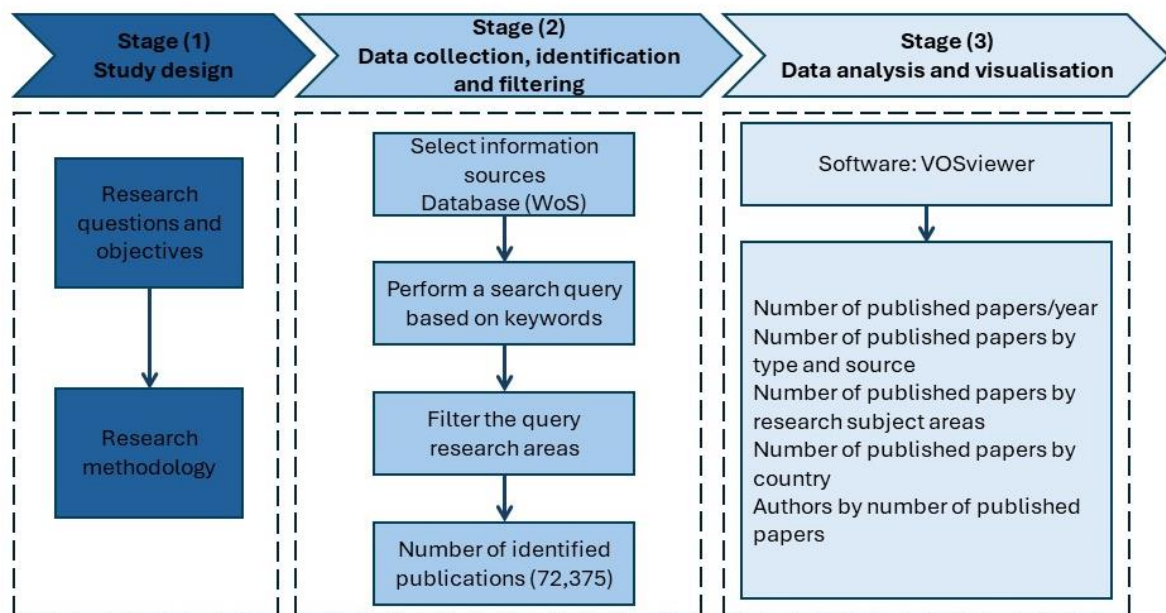
The Web of Science database (WoS) from Clarivate Analytics is the database of choice for this study because of its innovative search queries and high-quality data. One

of the best platforms in the world for accessing a wide range of studies, analytical data, and scientific citations is Web of Science (Li and Song, 2022; Xie et al., 2020; Chavarro et al., 2018).

## 2.1 Data collection approach (database, keywords, and inclusion criteria)

**Figure 1**

*Research framework of bibliometric analysis.*



Note: WoS core collection was last updated in August 2024

As a necessary and important step to know the screening process framework before starting the comprehensive bibliometric analysis. Thus, the figure (1) summarised the research approach by determining the steps map.

The next stage is to run a search query based on keywords after identifying the database, and these chosen keywords are then filtered for the research areas. 72,375 publications were then displayed by the filtered search. The titles, study subjects, document types and sources, publications number of countries and organisations, authors and co-authorship analysis, keyword analysis, and a focus on the top 10 most cited publications between 2010 and August 2024 are all used to analyse these publications.

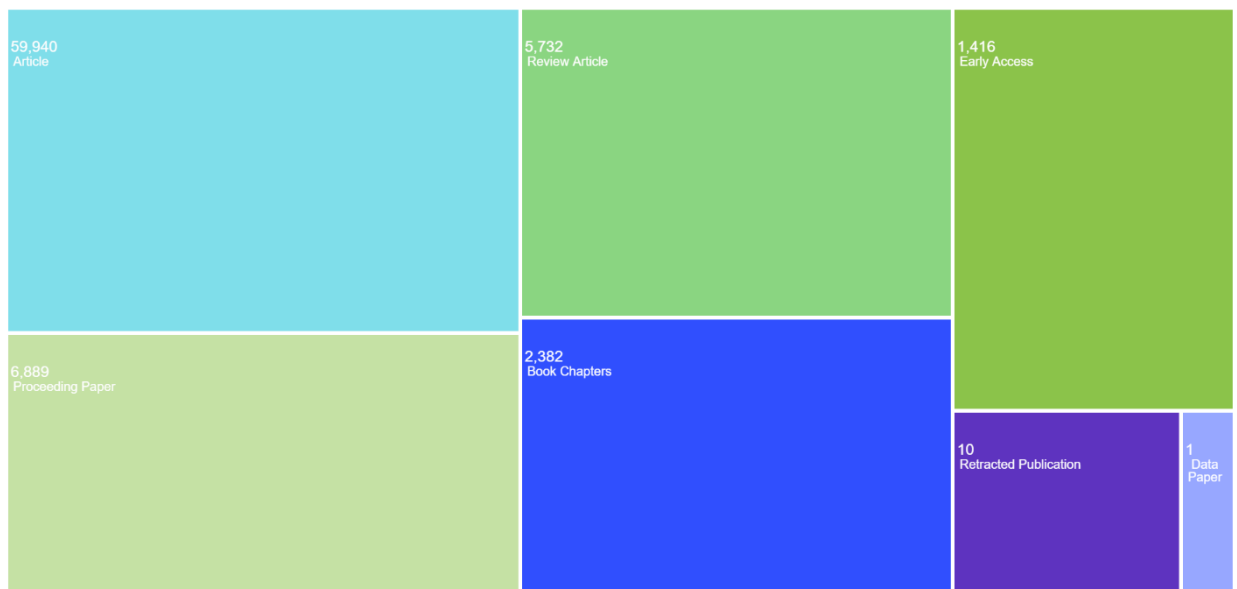
To visualise the network analysis, programmes such as VOSviewer, SankeyMATIC, Citespace, and others can be utilised.

In this study, maps and charts are generated utilising network data, employing labels, links, and circles to illustrate the relationships among the data. The clusters in VOSviewer are distinguished by varied colours.

### 3 RESULTS AND DISCUSSION

#### Figure 2

##### *Publication's types*



In this study, the Web of Science database is used to define and analyse the publications. The interrogation was conducted on 1<sup>st</sup> of August 2024. The WoS core collection's "Title/Abstract/Keywords" headers were searched for the search query of English documents which mostly (59,934 articles, 6,887 proceeding papers and 5,732 review articles), figure (2). A query strategy based on keywords was determined as: ("green area\*" or "urban planning" or "sustainability" or "resilience"). These keywords are use under the research areas of science technology other topics, environmental science ecology, engineering, construction building technology, urban studies, public administration and architecture are filtered.

### 3.1 Annual publication and citation numbers

Table (1) shows the numbers of publication and citation for each year. According to the findings, with a total of 9649 publications, 2023 had the most publications between 2010 and 2024 and followed by 2022 with 9333 publications. After 2016, publications have grown at the quickest rate. Scientific impact of a publication in all times is defined as citation (Guo et al., 2019; Agarwal et al., 2016). The quantity of citations in publications has consistently risen to the present day. Since the year 2024 had not concluded at the time this research was conducted, it is anticipated that the number of research studies will exceed this rate by the end of the year.

**Table 1**

*The annual number of publications from 2010 to August 2024*

% of 72.375	Record Count	Publication Years
9.688	7012	2024
13.332	9649	2023
12.895	9333	2022
12.645	9152	2021
10.527	7619	2020
8.799	6368	2019
7.956	5758	2018
5.712	4134	2017
4.865	3521	2016
3.146	2277	2015
2.368	1714	2014
2.021	1463	2013
1.447	1047	2012
1.304	944	2011
1.337	968	2010

### 3.2 Research áreas

Research areas are chosen as science technology other topics, environmental science ecology, engineering, construction building technology, urban studies, public administration, and architecture for the publications that are found using the keywords green area/s, urban planning, sustainability, and resilience. The overlap of the designated study topics led to the identification of three additional research areas. These three research areas—geography, materials science, and energy fuels— and others are listed in

figure 3. In total, there are there are 49,330 publications in science technology other topics, 49,230 publications in environmental science ecology, 23,114 publications in engineering, 12,065 publications in construction building technology, 10,886 publications in urban studies, 5,987 publications in public administration, 3,747 publications in architecture, 3,340 publications in energy fuels, 3,031 publications in geography, and 2,783 publications in materials science.

### Figure 3

*The most 10 research areas of the publications*



### 3.3 Publication titles

Articles, conference papers, and review articles made up the majority of the publications mentioned before. Table 2 states that, based on the publishing numbers, the most of these titles are academic journals, with the exception of *Procedia Engineering*, which is a collection of proceedings from conferences. Among all journals, the one with the most publications (24,565) is *Sustainability*. Publication titles are represented as follows: *Journal of Cleaner Production* (8979 publications), *Environment Development and Sustainability* (1666 publications), *Sustainable Cities and Society* (1455 publications), *Construction and Building Materials* (1176 publications), *Cities* (1017

publications), Buildings (1013 publications), ACS Sustainable Chemistry Engineering (892 publications), Sustainability Science (829 publications) and Sustainable Production and Consumption (818 publications). The other 10 publication titles are shown in table below.

**Table 2**

*The most 20 publication contributions during 2010-2024*

Publication Titles' Count	Publication Titles
24565	Sustainability
8979	Journal of Cleaner Production
1666	Environment Development and Sustainability
1455	Sustainable Cities and Society
1176	Construction and Building Materials
1017	Cities
1013	Buildings
892	ACS Sustainable Chemistry Engineering
829	Sustainability Science
818	Sustainable Production and Consumption
698	Journal of Building Engineering
644	Landscape and Urban Planning
595	Urban Forestry Urban Greening
566	Energy and Buildings
552	Building And Environment
506	Current Opinion in Environmental Sustainability
498	Procedia Engineering
440	Clean Technologies and Environmental Policy
432	Local Environment
386	Habitat International

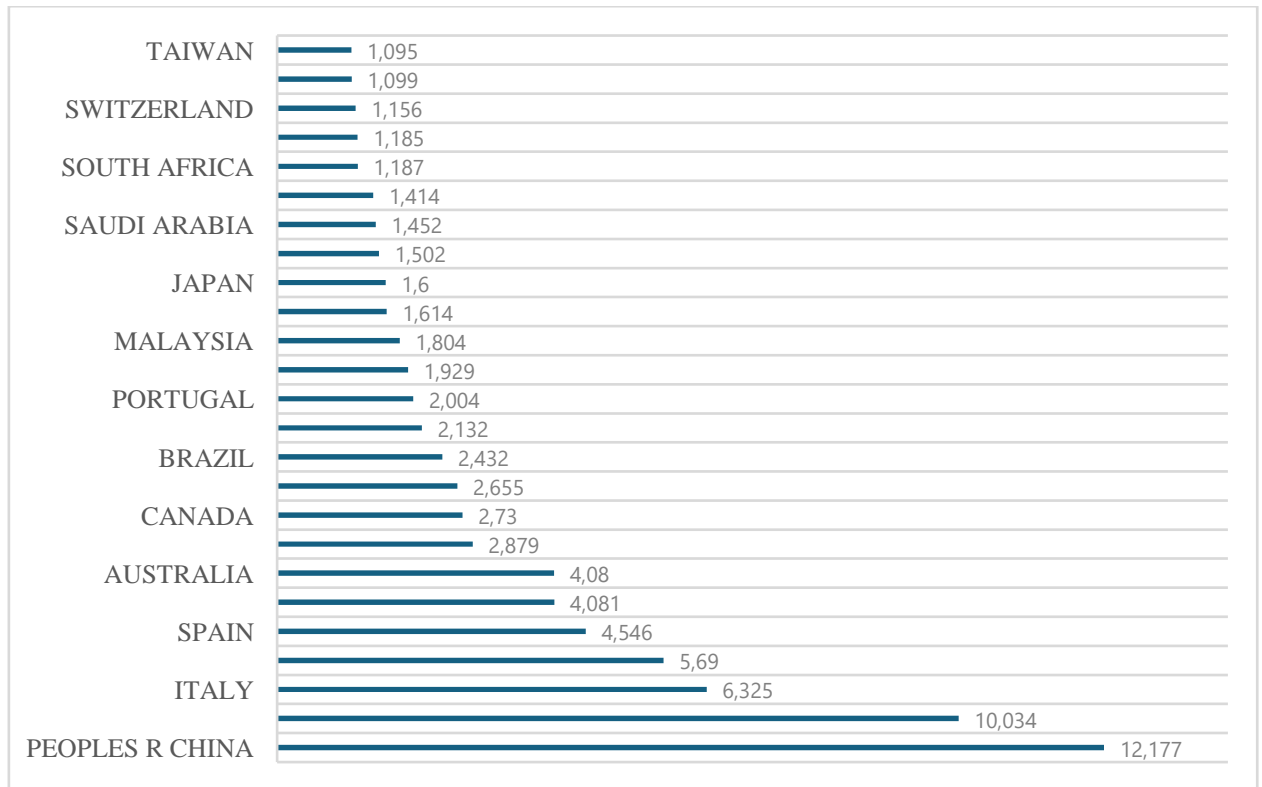
### 3.4 Publication numbers of countries

This research looks at the distribution of 72,375 articles based on the countries in which they were published. According to Figure 4, China has the highest number of publications (12,177 publications). The second is USA (10,034 publications) and third is Italy (6,325 publications). After Italy, there are another countries such as UK (5,690 publications), Spain (4,546 publications), Germany (4,081 publications), Australia (4,080 publications), India (2,879 publications), Canada (2,730 publications), the Netherlands (2,655 publications), Brazil (2,432 publications), Sweden (2,132 publications), Portugal (2,004 publications), South Korea (1,929 publications), Malaysia (1,804 publications), France (1,614 publications), Japan (1,600 publications), Poland (1,502 publications),

Saudi Arabia (1,452 publications), Iran(1,414 publications), South Africa (1,187 publications), Turkey (1,185 publications), Switzerland (1,156 publications), Finland (1,099 publications), and Taiwan (1,095 publications).

#### Figure 4

*The annual number of publications for 25 productive countries*



### 3.5 Most relevant authors and affiliations

The presented data in Table (3) shows the affiliations and corresponding research contributions in green areas and resilience in cities and urban planning. The Hong Kong Polytechnic University Faculty of Construction and Environment in China emerges as the leading affiliation with a substantial contribution of 379 publications, highlighting its outstanding role in advancing research in this field. University College London Bartlett Faculty of The Built Environment follows with 240 publications, underlining the significant research outputs from this organisation. The Polytechnic of Milan School of Architecture, Urban Planning, and Construction Engineering, together with The Hong

Kong Polytechnic University Department of Building and Real Estate, demonstrate significant contributions with 234 and 230 publications, respectively. The global character of research is seen in the representation of many nations among the leading contributors, including Singapore, the Netherlands, Portugal, Italy, and Sweden. This international collaboration is particularly evident with institutions like National University of Singapore College of Design and Engineering, Utrecht University Faculty of Geosciences, Instituto Superior Tecnico, University of Naples Federico II Polytechnic and Applied Sciences School and Stockholm Resilience Centre making substantial contributions.

The table includes columns that identify the 20 top writers based on their publication count and nationality during the specified years. Liu Y. (China) is the first author with 200 publications. After Liu, the authors came as follows for those who published more than 120 documents: Zhang Y. (China) 194, Wang Y. (China) 181, Li Y. (China) 162, Zhang L. (China) 129, Kim J. (South Korea) 127 and Li J. (China) 123 documents. While between 100-119 publications are published by Lee J. (South Korea) with 118; Zhang J. (China) with 112; Kim S. (South Korea), Wang J. (China) and Wang L. (China) with 111; Chen Y. (China) with 110; and Liu J. (China) with 104 publications. In addition, the authors with less than 99 publications are as follows: Zhang H., Wang H., Wang XY., Li H. (China), Leal W. (UK), and Kumar A. (India) with 98, 90, 90, 83, 83, 83 respectively.

**Table 3**

*The most contributed authors and affiliations with their countries*

Countries	Record count	Authors	Countries	Record count	Affiliations
China	200	Liu Y	China	379	The Hong Kong Polytechnic University Faculty of Construction and Environment
China	194	Zhang Y	UK	240	University College London Bartlett Faculty of The Built Environment
China	181	Wang Y	Italy	234	Polytechnic of Milan School of Architecture Urban Planning Construction Engineering
China	162	Li Y	China	230	The Hong Kong Polytechnic University Department of Building and Real Estate
China	129	Zhang L	Singapore	224	National University of Singapore College of Design and Engineering
South Korea	127	Kim J	Netherlands	204	Utrecht University Faculty of Geosciences
China	123	Li J	Portugal	196	Instituto Superior Técnico - Universidade de Lisboa

South Korea	118	Lee J	Italy	194	University of Naples Federico II Polytechnic and Applied Sciences School
China	112	Zhang J	Sweden	193	Stockholm Resilience Centre
South Korea	111	Kim S	Portugal	169	University of Minho School of Engineering
China	111	Wang J	Australia	165	University of New South Wales School of Built Environment
China	111	Wang L	USA	164	Arizona State University Julie Ann Wrigley Global Futures Laboratory
China	110	Chen Y	USA	161	Arizona State University Global Institute of Sustainability and Innovation
China	104	Liu J	Australia	157	The University of Melbourne Faculty of Architecture Building and Planning
China	98	Zhang H	Netherlands	157	Utrecht University Department of Innovation Environmental and Energy Sciences
China	90	Wang H	Sweden	153	KTH Royal Institute of Technology School of Architecture and The Built Environment
China	90	Wang XY	UK	152	University of Cambridge School of Technology
China	83	Li H	USA	150	Arizona State University School of Sustainability
UK	82	Leal W	Australia	149	RMIT University College of Design and Social Context
India	81	Kumar A	China	147	Beijing Normal University School of Environment

### 3.6 Collaborative network analysis

Network analysis made use of VOSviewer, a software that lets users create maps of the scientific literature based on information such as co-authorship, co-citation, and bibliographic coupling. These maps were based on bibliometric networks.

#### 3.6.1 Co-countries/ regions and institutions network analysis

Collaborations and connections between various countries and areas, as determined by scientific publications, have been shown in this analysis. The programme was utilised with its default settings, which establish a minimum threshold of five papers and a minimum of one reference per country. These thresholds are a potent sign of a country's willingness to work together with other countries. Out of 183 countries, 137 have reached the thresholds, and these countries are divided into 8 groups. It is important to note that the linkages and the total link strength quantify the intricate web of connections that characterises international interactions and highlight more important international collaboration.



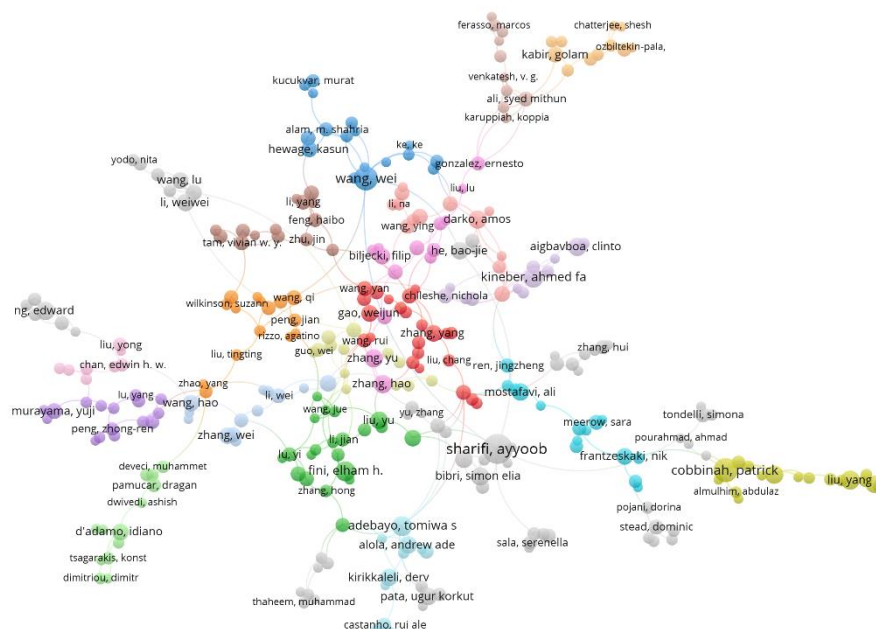


### 3.6.2 Co-authorship visualisation analysis

The authors and their collaboration networks can be identified via VOSviewer. A co-authorship visualisation created for authors from 2010 to 2024 is examined in Figure (7). Out of the 111,921 authors, 1000 meet the requirements (5 minimum number of publications and 5 minimum number of citations). There are some authors in the network who are not related to one another. There are 96 items in the greatest group of connected items. The primary author with the greatest total link strength is Leal Filho, W. Furthermore, among the authors who cooperated the most between 2013 and 2024 are Sharifi A. and Salvia A. It is important to draw attention to the contributions made by research in various clusters, since this demonstrates the presence of author collaboration networks. Leal Filho, W., for example, is noted to have contributed to 36 papers, 86 linkages, 9 distinct groups, and the creation of a connecting node. As well as Mcphearson, T. is connected to 6 groups through 21 documents and 41 links with different authors. At the same time, Sharifi, A. contributed to 7 groups, 60 links through 57 documents.

**Figure 7**

*Co-authorship network and author collaborations*



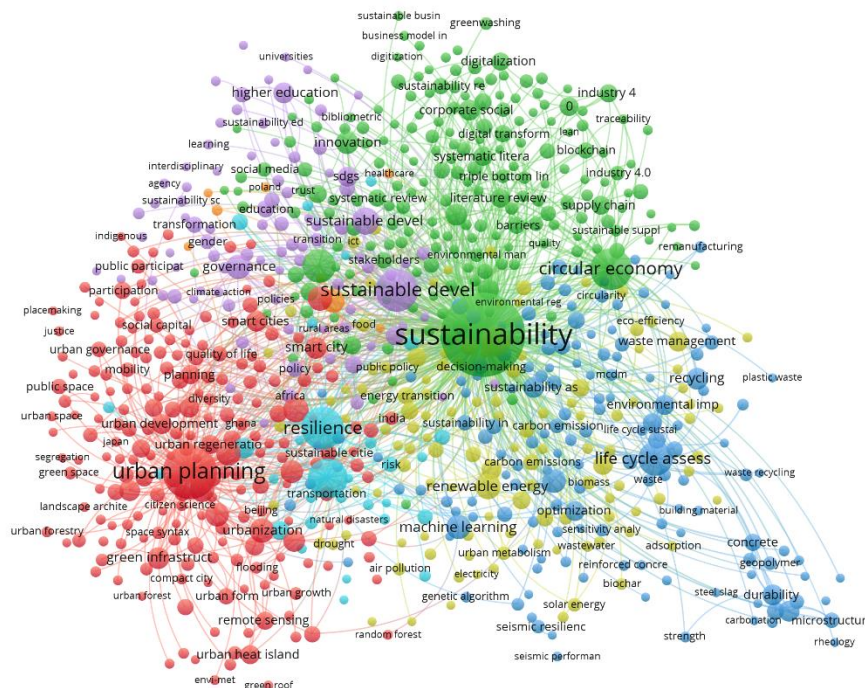
### *3.6.3 Author keywords co-occurrence and frequency analysis*

Keyword co-occurrence analysis in VOSviewer is very helpful for comprehending the study area's thematic landscape (Oladinrin et al., 2022). It displays the connections between the keywords that authors have supplied in scholarly works from 2010 to August 2024. The clusters of the articles were created using the keywords co-occurrence analysis in this study, which employed a threshold of 25 keyword occurrences. Only 800 out of 79,228 keywords were considered for visualisation.

In the co-keywords network figure (8), the larger circle shows a keyword has been chosen more frequently in publications. Therefore, keywords such as sustainability, urban planning, sustainable development resilience and circular economy have the most occurrences, 7453, 2407, 1331, 1303, and 1243, respectively. The distance between the two keywords indicated the extent of strength and thematic similarity. Furthermore, it is evident that similar subjects within these publications are grouped in circles of the same colour. Furthermore, VOSviewer identified seven interdisciplinary clusters: three with a high number of items (red, green, and blue) containing no fewer than 150 items, two with a medium number of items (yellow and purple) ranging from 100 to 149, and two with a small number of items (turquoise and orange) containing fewer than 30 items, with the clusters being closely interconnected.

**Figure 8**

*Network visualisation according to keywords co-occurrences*



Based on the keywords and analysing clusters' circles (figure 8), labels could be assigned to the seven clusters. The large red cluster (208 items) could be named “urban planning and sustainability” because it contains keywords such as urban planning, urban sustainability, urban heat island, land use, smart cities, urban development, wellbeing, etc. In the green cluster (198 items), keywords like sustainability, circular economy, covid-19, supply chain, digital transformation, etc., focused on “economic sustainability”. In the blue cluster (118 items), keywords such as lifecycle assessment, sustainability assessment, recycling, and optimisation are associated with “environmental impact on urbanisation”. Then, the keywords in the yellow cluster (151 items), such as renewable energy, carbon emissions, and carbon footprint, concentrated on “energy efficiency in urban planning”. The fifth cluster in purple (102 items) included keywords related to “sustainable development goals” such as sustainable development, governance, transition, etc. Another cluster in Turquoise (30 items) comprised keywords like climate change, resilience, adaption, risk assessment, etc., which are more concerned with “climate change effect”. The last cluster, orange (9 items) gathered keywords like environment, healthcare, society, etc.

To clarify more, the table below lists the top 10 co-occurrence keywords with links, total link strength, average published years, and cluster numbers (in Figure 10a).

**Table 4**

*The top 10 co-occurrence keywords*

Avg. pub. year	Total link strength	Links	Cluster colour	Occurrences	Keywords	Ranking
2022	12883	747	Green	7453	Sustainability	1 <sup>st</sup>
2019	3978	537	Red	2407	Urban planning	2 <sup>nd</sup>
2021	2410	608	Purple	1331	Sustainable development	3 <sup>rd</sup>
2021	2705	536	Turquoise	1303	Resilience	4 <sup>th</sup>
2022	2674	490	Green	1243	Circular economy	5 <sup>th</sup>
2021	2375	515	Turquoise	1081	Climate change	6 <sup>th</sup>
2022	1373	321	Blue	775	Life cycle assessment	7 <sup>th</sup>
2022	1398	410	Green	721	Covid-19	8 <sup>th</sup>
2022	926	359	Yellow	537	Environmental sustainability	9 <sup>th</sup>
2022	840	325	Purple	416	Sustainable development goals	10 <sup>th</sup>

### 3.6.4 Content analysis of the selected articles

A crucial component of bibliometric analysis, content analysis helps in examining the qualitative elements of the published literature and offers a more thorough grasp of the topic. As a result, as Table (5) illustrates, the top 10 referenced papers in this area include reviews that were published in a variety of journals between 2014 and 2019. These articles undergo careful analysis in order to provide background knowledge and subject descriptions.

To improve process efficiency and guarantee accurate and insightful evaluation of the content analysis, the ten papers are categorised. The assessment criteria for the substance of the research are based on the citation number ranking of the publications, as shown in table (7), and relate to the field's progress in relation to the research purpose, the utilised methods, the outcomes, and conclusions.

**Table 5**

*The top ten cited publications during 2010-2024*

Research Type	Source Title	Publication Year	Authors	Research Title	Times Cited
Review	Journal of Cleaner Production	2017	(Geissdoerfer, et al)	The Circular Economy A new sustainability paradigm?	3211

Review	Journal of Cleaner Production	2016	(Ghisellini, et al)	A review on circular economy: the expected transition to a balanced interplay of environmental and economic systems	2826
Article	Landscape and Urban Planning	2014	(Wolch, et al)	Urban green space, public health, and environmental justice: The challenge of making cities 'just green enough'	2384
Review	Journal of Cleaner Production	2014	(Bocken, et al)	A literature and practice review to develop sustainable business model archetypes	1884
Article	Journal of Urban Technology	2015	(Albino, et al)	Smart Cities: Definitions, Dimensions, Performance, and Initiatives	1540
Article	Current Opinion in Environmental Sustainability	2015	(Díaz, et al)	The IPBES Conceptual Framework - connecting nature and people	1506
Review	Landscape and Urban Planning	2016	(Meerow, et al)	Defining urban resilience: A review	1323
Article	Cities	2014	(Neirotti, et al)	Current trends in Smart City initiatives: Some stylised facts	1244
Article	Sustainability Science	2019	(Purvis, et al)	Three pillars of sustainability: in search of conceptual origins	1166
Article	Cities	2017	(Ahvenniemi, et al)	What are the differences between sustainable and smart cities?	679

**Table 6**

*The top ten cited publications with content analysis*

Conclusions	Outcomes	Methods	Purpose	Research Title
-suggests that that further research is required in order to completely comprehend the consequences of these interactions. -create more comprehensive strategies for sustainability and Circular Economy activities.	-how these ideas interact, and overlap is made easier by this classification, which also summarises the key distinctions and similarities between sustainability and the circular economy.	-literature review -bibliometric analysis -snowballing techniques	-finds eight distinct categories of connections between sustainability and the circular economy.	<b>The Circular Economy A new sustainability paradigm?</b>
-the adoption of CE, which has the potential to improve the present unsustainable production and consumption practices, necessitates cooperation across every sector of society, explicit laws, and financial incentives.	-with many implementation strategies used across the world, CE has its origins in ecological economics and industrial ecology. It is still in its early stages and is mostly focused on recycling, with some achievement	-extensive literature review	-examines the literature on the Circular Economy (CE) over the last 20 years to learn about its origins, principles, advantages, disadvantages, and global application at different scales.	<b>A review on circular economy: the expected transition to a balanced interplay of environmental and economic systems</b>

	in waste management.			
-urban green space policies ought to strive for a balance between social equality and ecological advantages, meaning that they should be "just green enough" to prevent gentrification and displacement.	-rich populations benefit disproportionately from green space, and although attempts have been made to expand green space in underprivileged regions, they have the potential to cause gentrification and displacement.	-Anglo-American literature	-focuses on the environmental justice issue associated with the unequal distribution of green spaces by reviewing the literature on urban green space and comparing greening initiatives in US and Chinese cities.	<b>Urban green space, public health, and environmental justice: The challenge of making cities 'just green enough'</b>
-by creating a common language via SBM archetypes, businesses may implement sustainable business models more quickly, integrating sustainability into their core competencies and gaining a competitive edge..	-eight sustainable business model concepts, such as optimising material efficiency, generating value from waste, and switching to renewables, were found via study to enhance corporate sustainability.	-literature and business practices	-goes beyond conventional eco-efficiency and corporate social responsibility programmes to investigate how sustainable business models (SBMs) might spur company innovation for long-term social and environmental sustainability.	<b>A literature and practice review to develop sustainable business model archetypes</b>
-to assess the performance of smart cities and direct the creation of efforts to increase urban smartness worldwide, a precise and uniform definition of smart cities is required.	-highlights the need for a common definition of a "smart city" and lists the several attributes, performance indicators, and metrics that set smart cities apart from conventional ones.	-in-depth literature review	-define the term "smart city" precisely and to pinpoint the essential characteristics and measurements of urban smartness by examining pertinent academic and official documentation.	<b>Smart Cities: Definitions, Dimensions, Performance, and Initiatives</b>
-the framework is a useful tool for IPBES as well as the larger academic and policy groups who are interested in biodiversity and ecosystem services because of its multidisciplinary character and participatory approach.	-the IPBES Conceptual Framework is a framework for synthesizing information at various scales and topics, emphasizing the integration of numerous viewpoints on the interaction	-describes how the framework was developed via an open, collaborative approach that included knowledge from indigenous knowledge systems and a range of scientific fields.	-outlines the IPBES Conceptual Framework, which is intended to facilitate cooperation across various knowledge systems and stakeholders while establishing connections between nature and people by	<b>The IPBES Conceptual Framework - connecting nature and people</b>

	between humans and nature.		organising and directing IPBES operations.	
-suggests a more flexible and inclusive definition of urban resilience, pointing out that context-specific answers to the questions "resilience for whom and to what?" are necessary for its implementation in order to direct future research and cooperation.	-reveals six fundamental tensions in defining urban resilience, such as system equilibrium, adaptation, and timescale -highlights the lack of conceptual clarity in existing definitions.	-literature review and bibliometric analysis	-in order to overcome differences in the academic literature, the essay proposes a new definition and identifies important conceptual difficulties in the idea of urban resilience.	<b>Defining urban resilience: A review</b>
-focuses on the most pertinent domains for implementation and provides advice for politicians and city administrators to customize Smart City initiatives depending on local realities.	-finds that local context elements have a major role in influencing the emergence of Smart Cities, with economic development, population density, urban layout, and geography all having a significant impact.	-develops a taxonomy of SC domains and carries out empirical research to look at how geographic, urban, demographic, and economic aspects affect SC planning.	-aims to give a thorough overview of Smart City (SC) projects by examining worldwide trends in SC deployment and creating a taxonomy of application domains.	<b>Current trends in Smart City initiatives: Some stylised facts</b>
-reflecting different historical schools of thought, the three pillars' lack of a strong theoretical basis makes it difficult to operationalise sustainability in a rigorous way.	-without a single point of origin or conceptually precise explanation, the three-pillar model progressively evolved from criticisms of the current economic situation and attempts to balance economic expansion with social and ecological concerns.	-In order to determine how the three pillars were developed and conceptualized, it examines past sustainability literature.	-examines the theoretical underpinnings and historical development of the social, economic, and environmental three-pillar model of sustainability.	<b>Three pillars of sustainability: in search of conceptual origins</b>
-to close this gap, the phrase "smart sustainable cities" is advised, and impact metrics that measure contributions to social, economic, and environmental sustainability should be	-urban sustainability frameworks place greater emphasis on environmental indicators than do smart city frameworks, which highlights a	-it looks at 16 city evaluation frameworks, including 8 frameworks for smart cities and 8 frameworks for urban sustainability,	-seeks to evaluate and examine the distinctions between the frameworks for smart cities and sustainable cities.	<b>What are the differences between sustainable and smart cities?</b>

incorporated into smart city frameworks as they develop.	disparity between the two. Smart city frameworks prioritise technology and social/economic issues.	and classifies 958 indicators into 12 sectors and 3 effect categories.		
--	--	--	--	--

#### 4 CONCLUSIONS

In this research, a bibliometric analysis is conducted using Web of Science database with the keywords of English document (“green area\*” or “urban planning” or “sustainability” or “resilience”). Keywords are filtered for the research areas of science technology other topics, environmental science ecology, engineering, construction building technology, urban studies, public administration and architecture, and 72,375 publications were found. The titles, study subjects, document types and sources, publications number of countries and organisations, authors and co-authorship analysis, keyword analysis, and a focus on the top 10 most cited publications between 2010 and August 2024 are all used to analyse these publications. From 2010 to 2024, most of the publications were published in 2023. Year 2022 comes in the second place. The period in which the number of publications increased the fastest is between 2018 and 2023. Thus, the first objective of the research has been achieved.

Objective 2: More than 24,565 analysed publications were published in the Sustainability journal because this journal's scope aligns with research interests. Publication titles are represented as follows for more than 1,000 documents: Journal of Cleaner Production, Environment Development and Sustainability, Sustainable Cities and Society, Construction and Building Materials, Cities, Buildings, and less than 900 documents such as, ACS Sustainable Chemistry Engineering, Sustainability Science and Sustainable Production and Consumption. The most productive countries/ regions in publications on the researched subject were China, the USA and Italy. At the same time, the leading contributed affiliations in the field of green areas and resilience in cities are The Hong Kong Polytechnic University Faculty of Construction and Environment (China), University College London Bartlett Faculty of The Built Environment (UK) and Polytechnic of Milan School of Architecture Urban Planning Construction Engineering

(Italy). China, the United States, and the United Kingdom are the top three countries that cooperate based on overall link strength, documents, and citations, according to the collaborative network analysis, co-countries/regions, and institutions study. The network analysis conducted by the institution places the Chinese Academy of Sciences (China) at the highest point of the cooperation network.

Objective 3: according to keyword analysis, keywords such as sustainability, urban planning, sustainable development, resilience, circular economy, climate change, life cycle assessment, covid-19, environmental sustainability, sustainable development goals have the most occurrences. Based on the content analysis, the interaction between sustainability and the circular economy (CE) reveals key distinctions and overlaps, emphasising the need for further research to fully understand their implications. CE, rooted in ecological economics and industrial ecology, focuses on recycling and waste management, requiring cross-sector cooperation, legal frameworks, and financial incentives to transform unsustainable production and consumption. Urban green space policies, while promoting ecological benefits, must balance social equality to avoid gentrification. Sustainable business models, driven by material efficiency and waste valorisation, offer companies competitive advantages when integrated into core operations. Smart cities, distinct from conventional ones by their focus on technology and urban efficiency, require a clear, unified definition to guide global urban development. The IPBES Conceptual Framework and evolving definitions of urban resilience highlight the importance of integrating diverse perspectives to address urban challenges. Bridging the gap between urban sustainability and smart city frameworks can lead to "smart sustainable cities," incorporating metrics that support social, economic, and environmental goals. Lastly, the three-pillar sustainability model, despite its historical evolution, faces challenges due to its lack of theoretical rigor, complicating its practical application.

Additionally, it is suggested that additional research be undertaken to examine the impact of a wider range of publications in this area of study using academic databases other than WoS, such as Scopus, and in languages other than English.

## REFERENCES

- Abdullah, A. The importance of urban green spaces in the development of smart cities. *Frontiers in Environmental Science*, 11, 2023. <https://doi.org/10.3389/fenvs.2023.1206372>
- Agarwal, A.; Durairajanayagam, D.; Tatagari, S.; Esteves, S. C.; Harlev, A.; Henkel, R.; Roychoudhury, S.; Homa, S.; Puchalt, N. G.; Ramasamy, R.; Majzoub, A.; Ly, K. D.; Tvrdá, E.; Assidi, M.; Kesari, K.; Sharma, R.; Banihani, S.; Ko, E.; Abu-Elmagd, M.; Gosalvez, J.; Bashiri, A. Bibliometrics: tracking research impact by selecting the appropriate metrics. *Asian Journal of Andrology*, 18(2), 296–309, 2016. <https://doi.org/10.4103/1008-682X.171582>
- Ahmed, S.; Baloch, A. A. B.; Khan, S. A.; Sezer, N.; Mahmoud, S.; Jama, M.; Abdelaal, A. Towards modern sustainable cities: review of sustainability principles and trends. *Journal of Cleaner Production*, 227, 972–1001, 2019. <https://doi.org/10.1016/j.jclepro.2019.04.106>
- Albino, V.; Berardi, U.; Dangelico, R. M. Smart cities: definitions, dimensions, performance, and initiatives. *Journal of Urban Technology*, 22(1), 3–21, 2015. <https://doi.org/10.1080/10630732.2014.942092>
- Aquilani, B.; Silvestri, C.; Ioppolo, G.; Ruggieri, A. The challenging transition to bio-economies: towards a new framework integrating corporate sustainability and value co-creation. *Journal of Cleaner Production*, 172, 4001–4009, 2018
- Aram, F.; Higuera García, E.; Solgi, E.; Mansournia, S. Urban green space cooling effect in cities. *Heliyon*, 5(4), e01339, 2019
- Bento, S. C.; de Melo Conti, D.; Baptista, R. M.; Ghobril, C. N. As novas diretrizes e a importância do planejamento urbano para o desenvolvimento de cidades sustentáveis. *Revista de Gestão Ambiental e Sustentabilidade*, 7, 469–488, 2018
- Biello, D. Gigalopolises: urban land area may triple by 2030. *Scientific American*, 18, 2018
- Bocken, N. M. P.; Short, S. W.; Rana, P.; Evans, S. A literature and practice review to develop sustainable business model archetypes. *Journal of Cleaner Production*, 65, 42–56, 2014
- Bowler, D. E.; Buyung-Ali, L.; Knight, T. M.; Pullin, A. S. Urban greening to cool towns and cities: a systematic review of the empirical evidence. *Landscape and Urban Planning*, 97(3), 147–155, 2010
- Brouwer, M. T.; van Velzen, E. U. T.; Augustinus, A.; Soethoudt, H.; De Meester, S.; Ragaert, K. Predictive model for the Dutch post-consumer plastic packaging recycling system and implications for the circular economy. *Waste Management*, 71, 62–85, 2018

- Chandrashekarai, M.; Mulla, K. R.; Harinarayana, N. S. Bibliometric analysis of literature published in Emerald publications on digital libraries. *International Journal of Library Science*, 1, 20–29, 2010
- Chavarro, D.; Ràfols, I.; Tang, P. To what extent is inclusion in the web of science an indicator of journal quality? *Research Evaluation*, 27(2), 106–118, 2018
- Cicea, C.; Pîrlogea, C. Green spaces and public health in urban areas. *Theoretical and Empirical Research in Urban Management*, 6(2), 83–92, 2011
- Díaz, S. et al. The IPBES conceptual framework — connecting nature and people. *Current Opinion in Environmental Sustainability*, 14, 1–16, 2015. <https://doi.org/10.1016/j.cosust.2014.11.002>
- European Environment Agency. Urban adaptation in Europe: what works? Implementing climate action in European cities, 2024. <https://www.eea.europa.eu/publications/urban-adaptation-in-europe-what-works>
- Farkas, J. Z.; Kovács, Z.; Csomós, G. The availability of green spaces for different socio-economic groups in cities: a case study of Budapest, Hungary. *Journal of Maps*, 18, 97–105, 2022
- Germán, A. Planeación y desarrollo. 1st ed. Madrid: Alfaomega, 2020
- Guo, Y. M.; Huang, Z. L.; Guo, J.; Li, H.; Guo, X. R.; Nkeli, M. J. Bibliometric analysis on smart cities research. *Sustainability*, 11(13), 3606, 2019
- Hannele, A.; Aapo, H.; Isabel, P.; Miimu, A. What are the differences between sustainable and smart cities? *Cities*, 60, 234–245, 2017
- Hedblom, M.; Gunnarsson, B.; Irvani, B.; Knez, I.; Schaefer, M.; Thorsson, P.; Lundström, J. N. Reduction of physiological stress by urban green space in a multisensory virtual experiment. *Scientific Reports*, 9(1), 10113, 2019
- Kayakutlu, G.; Daim, T.; Kunt, M.; Altay, A.; Suharto, Y. Scenarios for regional waste management. *Renewable and Sustainable Energy Reviews*, 74, 1323–1335, 2017
- Lee, A. C.; Jordan, H. C.; Horsley, J. Value of urban green spaces in promoting healthy living and wellbeing: prospects for planning. *Risk Management and Healthcare Policy*, 8, 131–137, 2015
- Li, F.; Liu, H.; Huisingh, D.; Wang, Y.; Wang, R. Shifting to healthier cities with improved urban ecological infrastructure. *Journal of Cleaner Production*, 163, S1–S11, 2017
- Li, J.; Song, W. Food security review based on bibliometrics from 1991 to 2021. *Foods*, 11(23), 3915, 2022

- Liang, Z. Assessment of the construction of a climate resilient city. *International Journal of Environmental Research and Public Health*, 18(4), 2082, 2021
- Marconi, P. L.; Perelman, P. E.; Salgado, V. G. Green in times of COVID-19: urban green space relevance during the COVID-19 pandemic in Buenos Aires City. *Urban Ecosystems*, 25(3), 941–953, 2022
- Márquez, J. M. M.; López, A. L. Ciudades sostenibles: análisis y posibles estrategias. *Urbanismo Organización Territorio Clave Multidisciplinar*, 17, 59–68, 2015
- Martin, G.; Paulo, S.; Nancy, M. P. B.; Erik, J. H. The circular economy – a new sustainability paradigm? *Journal of Cleaner Production*, 143, 757–768, 2017
- Martins, B. Where to construct new urban green spaces. *Urban Forestry & Urban Greening*, 72, 127571, 2022
- Maury-Mora, M.; Gómez-Villarino, M. T.; Varela-Martínez, C. Urban green spaces and stress during COVID-19 lockdown. *Urban Forestry & Urban Greening*, 69, 127492, 2022
- Mejía, R. C.; Camacho, C. J. Lineamientos para la inserción de restricciones ambientales en el ordenamiento territorial. In: *I Jornada de Investigación*, 2020
- Oladinrin, O. T.; Arif, M.; Rana, M. Q.; Gyoh, L. Interrelations between construction ethics and innovation. *Construction Innovation*, 23(3), 505–523, 2022
- Oliveira, V. Urban morphology: an introduction to the study of the physical form of cities, 2016
- Pandit, A. et al. Infrastructure ecology: an evolving paradigm for sustainable urban development. *Journal of Cleaner Production*, 163, S19–S27, 2017
- Paolo, N.; Alberto, D.; Anna Corinna, C.; Giulio, M.; Francesco, S. Current trends in smart city initiatives. *Cities*, 38, 25–36, 2014
- Patrizia, G.; Catia, C.; Sergio, U. A review on circular economy. *Journal of Cleaner Production*, 114, 11–32, 2016
- Pepe, P.; Jimmy, O.; Maarten van R.; Ana, M. An urban planning sustainability framework. *Sustainable Cities and Society*, 66, 102677, 2021
- Purvis, B.; Mao, Y.; Robinson, D. Three pillars of sustainability. *Sustainability Science*, 14, 681–695, 2019
- Raum, S.; Hand, K. L.; Hall, C.; Edwards, D. M.; O'Brien, L.; Doick, K. J. Achieving impact from ecosystem assessment and valuation of urban greenspace. *Landscape and Urban Planning*, 190, 103590, 2019

- Ruiz, P. A. C.; Torné, J. M. L. Repensando la ciudad. *Nodo Arquitectura Ciudad Medio Ambiente*, 10, 73–83, 2015
- Sara, M.; Joshua, P. N.; Melissa, S. Defining urban resilience: a review. *Landscape and Urban Planning*, 147, 38–49, 2016
- Sheng, S.; Song, W.; Lian, H.; Ning, L. Review of urban land management based on bibliometrics. *Land*, 11(11), 1968, 2022
- Szopik-Depczyńska, K.; Cheba, K.; Bąk, I.; Stajniak, M.; Simboli, A.; Ioppolo, G. The study of relationship in a hierarchical structure of EU sustainable development indicators. *Ecological Indicators*, 90, 120–131, 2018
- Teller, J. Regulating urban densification: what factors should be used? *Buildings and Cities*, 2, 302–317, 2021
- United Nations. The 2019 revision of world population prospects. New York, 2019
- Venter, Z. S.; Barton, D. N.; Gundersen, V.; Figari, H.; Nowell, M. Urban nature in a time of crisis. *Environmental Research Letters*, 15(10), 104075, 2020
- Wang, C.; Ren, Z.; Dong, Y.; Zhang, P.; Guo, Y.; Wang, W.; Bao, G. Efficient cooling of cities at global scale using urban green space. *Urban Forestry & Urban Greening*, 74, 127635, 2022
- Wiedmann, T.; Chen, G.; Owen, A.; Lenzen, M.; Doust, M.; Barrett, J.; Steele, K. Three-scope carbon emission inventories of global cities. *Journal of Industrial Ecology*, 25, 735–750, 2020
- Xie, H.; Zhang, Y.; Wu, Z.; Lv, T. A bibliometric analysis on land degradation. *Land*, 9(1), 28, 2020
- Yang, P.; Xiao, Z. N.; Ye, M. S. Cooling effect of urban parks and their relationship with urban heat islands. *Atmospheric and Oceanographic Sciences Library*, 9(4), 298–305, 2016
- Yu, Z.; Xu, S.; Zhang, Y.; Jørgensen, G.; Vejre, H. Strong contributions of local background climate to the cooling effect of urban green vegetation. *Scientific Reports*, 8(1), 6798, 2018