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Mapping Sustainable Cities and Communities (SDG 11) Research: A Bibliometric Review †

Dilip Kumar [1,*], Abhinav Kumar Shandilya [2] and Sachin George Varghese [1]

[1] Welcomgroup Graduate School of Hotel Administration, Manipal Academy of Higher Education, Manipal 576104, Karnataka, India; sachinyahoo@gmail.com
[2] Department of Hotel Management and Catering Technology, Birla Institute of Technology, Mesra, Ranchi 835215, Jharkhand, India; sabhinavkumar@bitmesra.ac.in
* Correspondence: k.dilip@manipal.edu
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Abstract: Sustainability is a prime concern in the present scenario, and to achieve the United Nations 2030 agenda, every country is putting in its best effort. Sustainable Development Goal (SDG) 11 explains Sustainable Cities and Communities' concern for society. Rapid urbanisation and accommodating the masses, which started shifting from rural to urban society, brought the construction of cities in full swing. This study reviewed the publication and citation trends, sources, trending topics, thematic evolution and thematic map (niche, motor, basic and emerging or declining themes) through metadata extracted from the Scopus database using the Biblioshiny (R-tool) version 4.2.3 open-access software tool. After applying the inclusion and exclusion criteria, only 537 metadata appeared sufficient for the final analysis. This research answered various research questions, an eye-opening lesson in the present scenario, where every country is marching towards achieving the SDG 2030 agenda. Major publications appeared after the launch of the SDG 2030 agenda, i.e., in 2015. Citations also increased after 2016 and reached their peak in 2021 with 1808 citations. Sustainable development goals and sustainability appeared as the most trending topics, whereas, recently, some topics have also emerged which can play a significant role in achieving the SDG 2030 agenda. Various themes such as sustainable development goals, remote sensing, machine learning and Ethiopia have emerged recently that need to be focused on by future researchers to understand this growing concern better, along with the policy development and strict practice approach. More focus is required on the emerging themes, which can be helpful to progress towards SDG 11. More research, and mega-cities with a sustainability approach, can be a milestone in attaining the SDG 11 target.

Keywords: SDG 11; sustainable cities and communities; sustainability; bibliometric; Biblioshiny

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1. Introduction

Each stakeholder is an inseparable ingredient to accomplish the Sustainable Development Goals (SDGs) target [1]. Global SDG-related policies are assessed under the SDG 2030 agenda and UN-Habitat (new urban agenda), which not only assesses cities and community scale, keeping long-term developmental objectives in mind, but also provides quality life to the urban people as the world gradually shifts towards cities. Sustainability issues can only be adequately addressed by touching on the cities' sustainability, as it contributes 85% of the global Gross Domestic Product (GDP) and generates 75% of greenhouse gas (GHG) emissions [2]. Although there are various challenges regarding achieving the SDG 2030 agenda due to the vast and rapid urban shifting (three-quarters of the global population), Sustainable Cities and Communities (SDG 11) is the most daunting task. Making cities sustainable means creating opportunities for business and jobs for people and providing safe, affordable and resilient societies by investing in the green economy through participatory and inclusive support from every stakeholder.

In 1950, only 30% of the world's population were residing in urban areas, but due to rapid urbanisation since the second half of the 20th century, the urban population is expected to reach 70% of the world's total population by 2050; hence, urban planning approaches are needed to help communities sustainably grow in their ecosystem [3]. SDG-11 aimed to provide safe and reasonable transport facilities, reduce urban extension, and involve more the urban authority, simultaneously retaining cultural heritage, enhancing urban flexibility and contributing to climate change-resolving issues [4]. Despite various urban environmental monitoring, [5] found it inadequate to assess the SDG 11 progress due to a lack of targets, benchmarks and apparent assessment of stake considerations.

Cities' environmental traces are becoming uncontrollable due to higher energy consumption (60–80%), carbon emissions (70%) and resource consumption (75%), which constitute circa 3% of the land surface. Concepts like "heritage and conservation" and "disaster risk resilience" can play a crucial role in designing sustainable cities by keeping budgetary planning in mind and achieving SDG 11's goals [6]. The adoption of SDGs prepared a global platform focusing more precisely on attaining global sustainable and comprehensive growth. Government initiatives and planning authorities can play a major role in urban development, and botanical gardens can contribute significantly to understanding the significance of flora and fauna in urban development [3]. Decisions and policymakers closely monitor the quality of efforts to measure effective action and initiatives to make the cities and communities more sustainable [7].

There is a significant increase in the literature on the global concern of SDG 11 and its significance on society. Despite abundant empirical and scientific research on this global concern, few systematic literature reviews (overview) [8–12] are available. None of them have used a bibliometric tool such as Biblioshiny (R-tool) [13] to review this area except [8], who used PRISMA for the overview of public–private partnership (PPP) model for the development of a futuristic sustainable city where resident participation and involvement was found as a mandatory strategy tool. The authors in [8] only used "Sweden" OR "Nordic" OR "Denmark" OR "Norway" OR "Finland" OR "Iceland" countries for their study; they did not consider the entire world.

This study aimed to review the published literature on SDG 11 using the Biblioshiny open-access software used by [14,15] using the Scopus database. This study proposes the following research questions:

RQ1—What are the publication citation trends in SDG11?
RQ2—Which sources mainly contributed to the publication journey?
RQ3—How is the publication of SDG 11 geographically distributed?
RQ4—What are the trending topics in the publication journey?
RQ5—How do keywords evolved thematically?
RQ6—What are the different themes in the field of SDG 11?

2. Materials and Methods/Methodology

Bibliometric analysis helps to organise published literature findings (quantitative and qualitative) of the relevant field through a transparent, systematic and reproducible review based on various statistical measurements [16,17]. The dynamism of the research field and its structure can be extracted by measuring authors' collaboration through science mapping [18,19]. This study used the guidelines recommended by [20] regarding performance retrospection of a research field, choosing the techniques of study, data collection, running of data and analysis of findings. This study applied a three-stage approach, which includes—(a) data extraction, (b) data analysis using Biblioshiny, and (c) analysis interpretation and discussion.

2.1. Databases and Keywords Used

Data extraction was done by applying a (TITLE-ABS-KEY(sustainable AND cities AND communities OR sustainable AND development AND goals 11 OR sdg 11) AND (EXCLUDE (DOCTYPE,"bk") OR EXCLUDE (DOCTYPE,"ch") OR EXCLUDE (DOC-

TYPE,"ed") OR EXCLUDE (DOCTYPE,"no") OR EXCLUDE (DOCTYPE,"sh")) AND (EXCLUDE (LANGUAGE,"Italian") OR EXCLUDE (LANGUAGE,"Spanish") OR EXCLUDE (LANGUAGE,"Chinese") OR EXCLUDE (LANGUAGE,"Russian") OR EXCLUDE (LANGUAGE,"Hungarian") OR EXCLUDE (LANGUAGE,"Greek") OR EXCLUDE (LANGUAGE,"French") OR EXCLUDE (LANGUAGE,"Croatian") OR EXCLUDE (LANGUAGE,"Portuguese") OR EXCLUDE (LANGUAGE,"Persian") OR EXCLUDE (LANGUAGE,"Korean") OR EXCLUDE (LANGUAGE,"Japanese") OR EXCLUDE (LANGUAGE,"Turkish")) AND (EXCLUDE (SRCTYPE,"k"))) keywords using one of the most reliable Scopus databases on 18th July 2023. According to [21], the Scopus database is considered one of the most widely used databases for bibliometric studies.

2.2. Inclusion and Exclusion Criteria

Articles that appeared since inception (1998) and were published in English were considered for final analysis. Initially, when articles searched related to (TITLE-ABS-KEY (sustainable AND cities AND communities OR sustainable AND development AND goals 11 OR SDG 11) on the Scopus database, 598 articles appeared, but when it was limited to articles, conference papers, review papers, journal and conference proceeding only 537 articles appeared. No duplicate or missing author information was found on the extracted data when checked with the MS Excel filter criterion. The same criteria of metadata extraction were used by [22] and considered appropriate since they genuinely represent the scholarly work.

2.3. Selection of Analytical Tools

Bibliometric analysis techniques exhibit (1) Performance analysis and (2) Science mapping categories. Research constituents' relationships are measured through science mapping analysis [23]. Science mapping highlights the structural and intellectual interaction among the research domain [20]. Performance analysis and science mapping are performed on 537 metadata extracted from the Scopus database and analysed using the Biblioshiny interface (R-studio) version 4.2.3.

2.4. Descriptive Study

The United Nations launched 17 agenda of SDG in 2015 and targeted to achieve the same by 2030. Upward publication trends in the field of SDG 11 have depicted that countries are putting in their best effort to achieve the same. A total of 537 publications (403—articles, 90—conference papers, 44—reviews) on SDG 11 from 1998 until 18th July 2023 were used for the final analysis in the present study extracted from 258 sources. The article's annual growth rate is 20.03%, the document average age is 2.24, and the average citations per document is 13.44.

2.5. Evolution of Publication and Citation on SDG 11

The first article on SDG11 was published in 1998 (25 years ago) by [24] and has received only four citations to date, and the next article was published nine years later. Between 1998 and 2015 (17 years), only seven documents (1.29%) were published, which received 355 citations and remained in the nascent stage until 2015. Publication trends grew drastically after 2015, especially after launching the SDG 2030 agenda, presented in Figure 1. In the next five years, publications grew to 191 (28%) and 4492 citations due to people's awareness and the United Nations' (UN) inexhaustive efforts. A drastic increase was seen in the next $2^{1/2}$ years, with 339 publications and 2372 citations. Publication growth depicts that researchers are putting their efforts into bringing the global concern of SDG 11 and their probable solutions to achieve the SDG 2030 agenda.

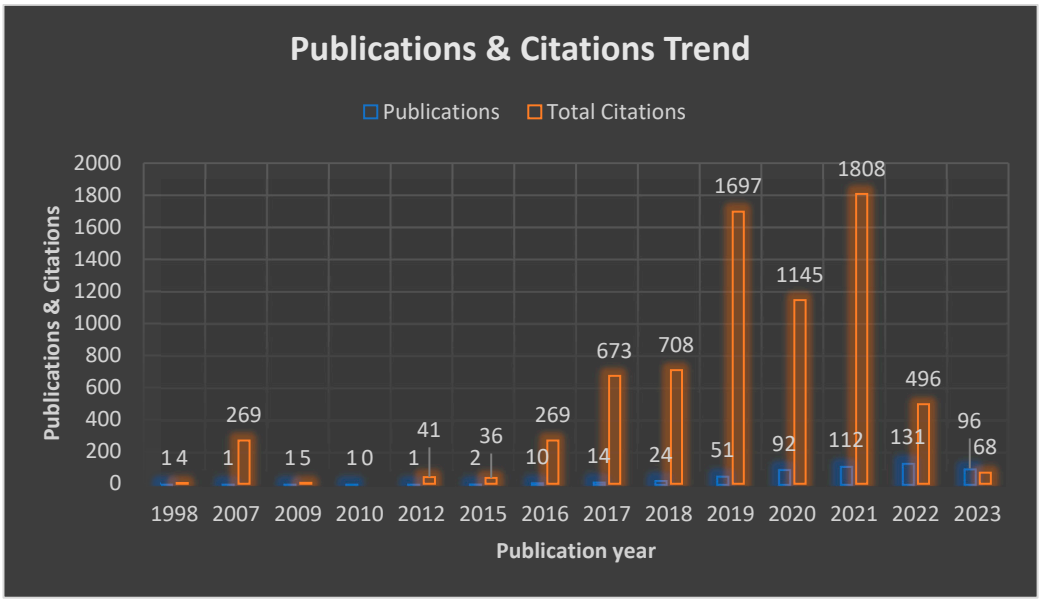

Figure 1. Publication and Citations trend of SDG 11.

2.6. Top Publication Sources on SDG 11

The publications in the most impactful sources are exhibited in Table 1; a total of 537 articles were published in 258 sources. These top 5 journals published 200 (37.24%) out of 537 articles, whereas 158 articles were published in the top 5 journals such as "*Sustainability (Switzerland)*", "*IOP Conference Series: Earth and Environmental Science*", "*Remote Sensing*, *International Journal of Environmental Research*", "*Public Health*" and "*Journal of Cleaner Production*" and contributed 29.42% of the published work. These journals published articles related to SDGs.

Table 1. Top 10 most impactful sources (Source: Scopus database) (PY_start—Publication starting year, CR—Citations received, NP—Number of publications).

Rank	Sources	PY_Start	H-Index	CR (2019–2022)	NP	Zone
1	*"Sustainability (Switzerland)"*	2009	136	145,304	83	Zone 1
2	*"IOP Conference Series: Earth and Environmental Science"*	2010	41	29,342	29	Zone 1
3	*"Remote Sensing"*	2009	168	72,276	21	Zone 1
4	*"International Journal of Environmental Research and Public Health"*	2004	167	130,872	13	Zone 1
5	*"Journal of Cleaner Production"*	1993	268	177,782	12	Zone 1

This concern has been addressed in 258 sources, but the maximum number of articles, i.e., 83 (15.45% articles) published in "*Sustainability (Switzerland)*" published by MDPI, started publishing in 2009. Since 2019, the publication journey has taken an upward growth, marked in purple colour line, and the maximum contribution came in the last three and half years, as shown in Table 1. "*IOP Conference Series: Earth and Environmental Science*" started its publication journey in 2010 and published 29 articles on SDGs. "*Remote Sensing*" journal ranked third and published 21 articles; in contrast, it started its publication journey in 2009. Each of the five articles is categorised in Zone 1.

2.7. Trending Topics

Since 2015, various trending topics can be seen in Figure 2. The most trending topic was Sustainable development, which had 286 frequencies highly appearing in 2021, followed by Sustainable development goals, which had 146 frequencies highly appearing in 2022. The United Nations is the third most trending topic in the present area of research, with 79 frequencies and highly appearing in 2022. Some more trending words like climate change, planning and China emerged in the study. These emerging trends suggest that SDG, sustainable development and the United Nations have been studied widely and rigorously, especially after the launch of the SDG 2030 agenda.

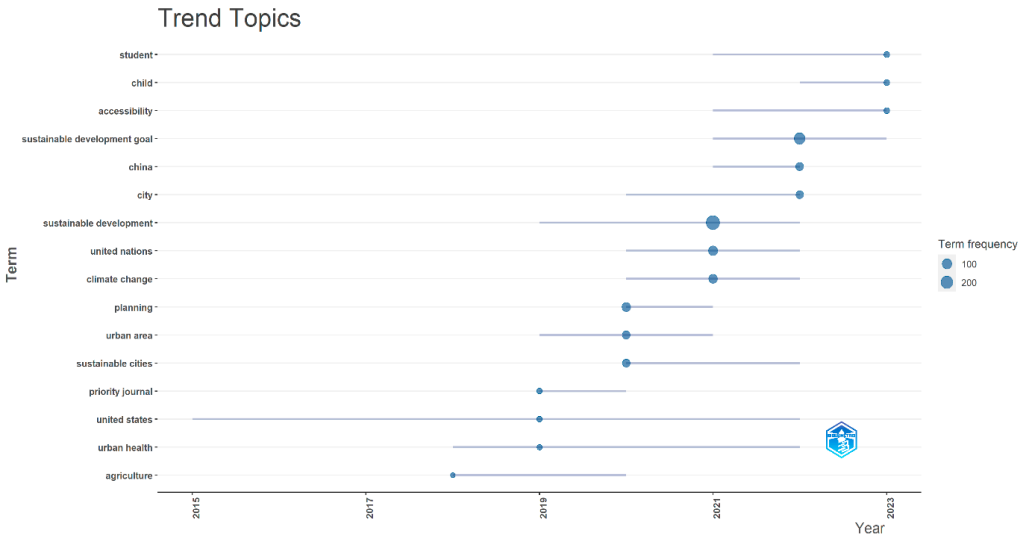

Figure 2. Trending words in the SDG 11 publications.

2.8. Thematic Evolution of Keywords since 1998

Thematic evolution of keywords since 1998 is presented in Figure 3. From 1998 to 2020 keywords, nine keywords (air quality, global health, climate change, sustainable development, case studies, human settlement, planning, and carbon) appeared. Air quality was found as the maximum occurred keyword, followed by case studies and sustainable development. During 2021, eight keywords appeared: planning, risk assessment, local government, sustainable development, health risks, human, smart city and demand analysis. The planning keyword has a maximum appearance collaborated with the keywords (case studies, human settlement, and planning) that appeared in the previous theme (1998–2020). Risk assessment and local government are the second and third most frequently appeared keywords in this theme. The third theme that appeared in 2022 has seven keywords. Sustainable cities has the highest occurrence, followed by observations and SDG, which closely collaborates with the keywords of the theme of 2021. This study used the Scopus publication until 18 July 2023; however, the last theme (2023) presented the seven keywords. Articles, SDG and Ethiopia are the keywords that appear the most.

2.9. Thematic Map

The thematic map represents the various themes developed on a centrality and density basis. Figure 4 illustrates the four themes over time: Niche, Motor, Basic, and Emerging or Declining. The theme on the top left quadrant depicts Niche, which visualises the theme having a high impact and less visibility. Human, City and Article themes can potentially gain the attention of researchers and academicians but cannot find an impact on the researchers. The top right quadrant represents the motor theme; keywords that appeared here (China, environmental impact, and quality of life) have high visibility and high impact. This theme is overstudied, and there are few chances for further exploration; therefore, researchers and academicians are now paying less attention to these areas. The

bottom right quadrant represented a basic theme presenting a cluster containing sustainable development, sustainable goals, and the United Nations. This theme has high visibility but low impact. Keywords that appeared here have the potential but could not achieve the desired outcome. The last emerging or declining theme appeared in the bottom left quadrant. The cluster formed here contains keywords such as planning, sustainable cities and urban growth with low visibility and low impact. These keywords have huge potential, and more attention is required in these areas to contribute towards achieving the SDG 11 target.

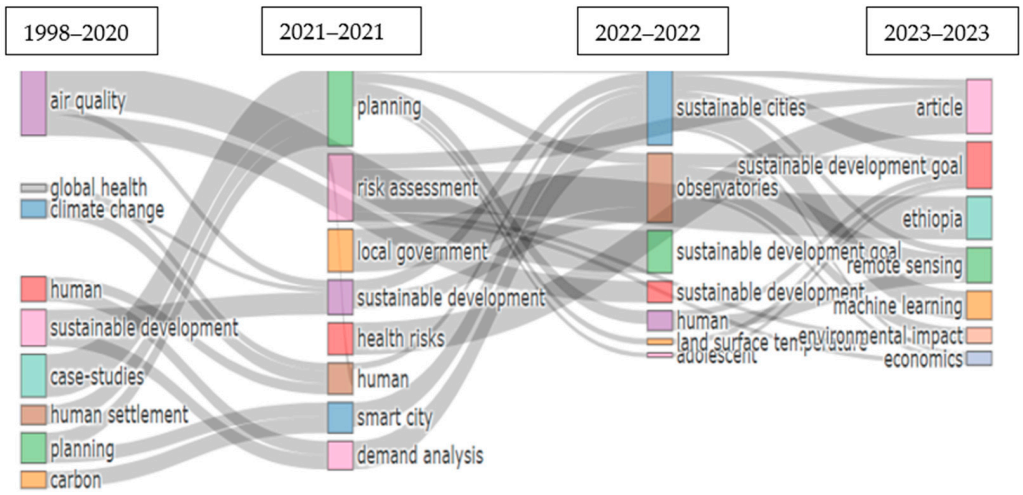

Figure 3. Thematic evolution of keywords (1998–2023).

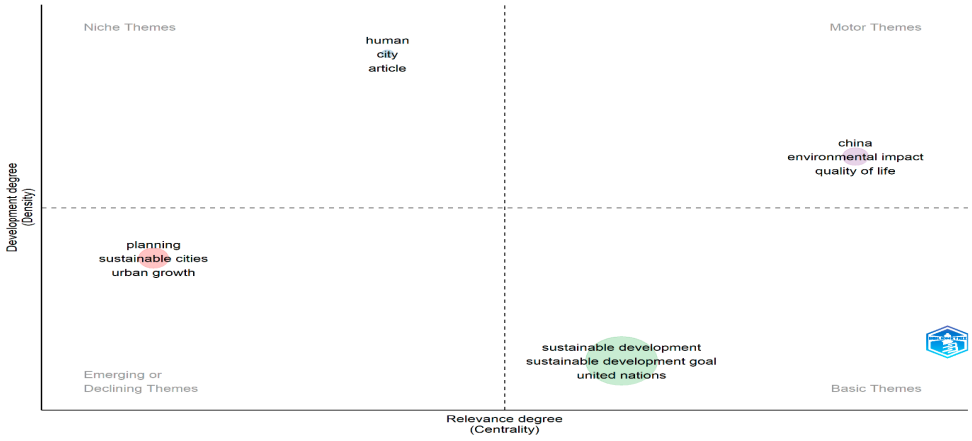

Figure 4. Thematic map based on density and centrality.

3. Conclusions

SDG 2030 is a matter of concern for every nation, and the United Nations has targeted to achieve all 17 goals by 2030. SDG 11, which deals with sustainable cities and communities, is a growing concern in the present scenario, as mass migration has started from rural to urban areas, and to accommodate those masses, a huge amount of construction is required; simultaneously, environmental conservation also needs to be prioritised. Upward publication trends in SDG 11 were found, which suggest its importance and societal concern, especially after launching the SDG 2030 agenda. In the recent past (last two years), an unprecedented growth of publications and citations from various authors and countries was seen. The top 10 journals contributed more than 200 articles, which shows that these journals mainly considered SDG work and tried to contribute as much as possible towards achieving the SDG 2030 agenda. "*Sustainability (Switzerland)*" appeared as the top-ranked

journal with 87 publications in the last 14 years, followed by "*IOP Conference Series: Earth and Environmental Science*" with 29 publications in the last 13 years.

While analysing the trending topics, "Sustainable development" highly appeared in 2021, followed by "Sustainable development goals", which appeared in 2022, and the "United Nations" is the third most trending topic in the present research area. Four different themes have evolved since 1998. "Air quality" appeared as the dominating theme from 1998 to 2020. "Planning", "Sustainable Cities" and "Article, SDG and Ethiopia" themes appeared as the dominating themes in 2021, 2022 and 2023. The thematic map classified the keywords into four quartiles (niche, motor, basic, and emerging or declining theme). Emerging or declining theme represents the keywords that have less impact and visibility in the study and can potentially become a topic of concern for future researchers, such as planning, sustainable cities and urban growth. Therefore, these areas require more attention from every stakeholder (researchers, policymakers, government and industry).

4. Implications, Limitations and Further Recommendations

In the first quarter of the 21st century, construction and development gained the attention of the mega-cities development race, resulting in uncontrolled environmental traces, higher energy consumption, carbon emissions and resource consumption. To counter the environmental traces, the United Nations came up with the proposal of the 17 sustainable development goals agenda, and various countries have constantly taken efforts and initiatives to achieve those targets. Sustainable urbanisation and green economy concepts emerged after the emergence of the SDG 2030 agenda. The combined efforts of policymakers, government and the public are needed to achieve the SDG 11 target. More contributions from developing countries and authors are required, and strict policy implementation while developing sustainable cities and communities is required to reach this goal. The findings of the study (publication trends, trending topics, dominating themes and keywords quartiles) add content to the existing literature.

The present study used Biblioshiny (R-tool) open-access software tools. The dataset was extracted from the Scopus database. Abstract, author, document type, journal, language, publication year, title and total citation data appeared to be of excellent quality, generating an excellent output that can easily be generalised in the present context. However, the metadata have some limitations such as keywords and corresponding data that appeared of moderate quality; therefore, an analysis could not be performed.

Future researchers should concentrate more on the emerging or declining theme, and more focus is required on the highly cited publications and new areas that can be generated from them. Future researchers should also target collaborating with countries like China and Ukraine for their future work, and the most prolific journals can be targeted for the same.

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