

SCIENTIFIC RESEARCH ON SUSTAINABLE CITIES AND COMMUNITIES IN THE LAST TWO DECADES: A BIBLIOMETRIC ANALYSIS

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Abstract

This bibliometric analysis aimed to assess the trends and impact of publications published between 2003 and 2023 in the area of sustainable cities and communities. This analysis uses the Scopus database and is reviewed using Microsoft Excel and VOS Viewer. This study uses 8129 documents which are then sorted into 3144 articles from 2003 to 2023, then the number of papers used for analysis is 1954. We recognized that the United Kingdom and the United States were the pioneers of early sustainable cities and communities research, whereas China and Spain have recently emerged as global engines of research in the field. Sustainable cities and communities research initially concentrated on urban development before shifting to smart cities. Initially, researchers looked into sustainable cities and communities (i.e., renewable energy and waste management) from a city planning standpoint. The most recent research phase, however, focuses on the social aspects of sustainable cities and communities, as defined by keywords such as community participation and governance approach. Furthermore, the introduction of sustainable development goals has accelerated the evolution of sustainable development goals research and has remained the most widely used technological advancement, aside from managing waste disposal and handling climate change. As the social aspects of sustainable cities and communities research have grown in importance, new methods have emerged.

Keywords: Bibliometric analysis, Communities, Scientific research, Sustainable cities, Sustainable development.

1. Introduction

Scientific research on sustainable cities and communities in the last two decades using bibliometric analysis is an alternate study for comprehending trend mapping in social science [1]. Sustainable cities and communities research could be the shortcomings and potential of hot issues concerning Sustainable Development Goals (SDGs no.11) [2-4]. Pursuing sustainable cities and communities has risen to the top of scientists' and policymakers' priority lists, and it has been emphasized in major global documents and national policies, including in Indonesia [5-8]. SDGs 11 practically begs for attempting to make cities and human settlements equitable, convenient, resilient, and sustainable as soon as possible [9]. This increased emphasis on cities and their role in achieving sustainability is not problematic because cities now house more than half of the world's population and account for roughly 70% of global carbon dioxide emissions [10-14].

Many attempts to improve data, evaluation techniques, evaluation methods, and measurement tools for the environment in urban planning and development are directly related to others' increased focus on sustainable city growth [15]. The substantiation of the process for a considerable number of studies published for more than 10 years in this research area. Several review papers have been published to synthesize the existing knowledge as the number of publications in this area continues to grow rapidly. These papers primarily focus on specific aspects of a sustainable city, such as indicator-based approaches to sustainability assessment, sustainable cities for promoting low-carbon city development, population and urbanization and its impact, and environmental sustainability of solutions [15].

Prior research indicated that no study addressed the concept of bibliometrics on sustainable cities and communities' concept as integrated research. Even though bibliometric studies in sustainable cities and communities and all of its areas of study have earlier been published [16-19], the hot trend concept of future studies related to sustainable cities and communities has not been discovered in the scholarly literature, which is a significant difference in the current article.

The primary objective of this article is to provide a broad overview of approximately two decades of existing studies on sustainable cities and communities using bibliometric analysis. As a result, this differs from the previous reviews. In other words, it supplements current review articles that primarily employ systematic review techniques to investigate specific trends of sustainable cities and communities. This study provides a systematic bibliometric review of sustainable cities and communities research from the sustainable development goals perspective to close this knowledge gap. The findings of this study can be used for a variety of purposes. They can be used by engaged vulnerable groups to truly understand available tools, methodologies, and approaches for the bibliometric analysis of sustainable cities and communities. They can inform interested researchers about keywords, articles, and tools that can serve as points of reference for a better understanding of the field to be explored further in the coming years.

2. Literature Review

Sustainable cities and communities are a contemporary concern that combines science, citizenship, technology, and engineering [20]. Sustainable cities and communities are related to sustainable technology. A sustainable city develops to meet the current generation's requirements without jeopardizing future generations' ability to fulfil their requirements [10]. There is an accelerated increase in the

number of individuals who migrate through and reside in cities. Trends and personal decisions have resulted in the development of buildings and facilities, as well as social, cultural, and environmental procedures that do not harm nature or the environment [15, 21].

A sustainable city, similar to smart city [22, 23], must be built through innovative energy consumption reduction, infrastructure building, waste, and nature management, public-private synergies, economic growth strategy, smart healthcare, and talented education and training. Then, transforming a city across sustainable technological innovation is a huge undertaking [21]. The innovation of the sustainable city of the future needs to be strategically organized, offer services, involve communities, and include well-connected entire systems. Sustainable cities and communities are related to science, technology, policy, engagement, and introduction [24]. Sustainable communities result in smart networks (electronic, wireless, and clean) of public and private organizations, such as energy producers, generators, transmission lines, and companies, who emphasize particular existing customers such as academic institutions, shopping centres, pedestrian streets, residences and pension communities, and office spaces. Figure 1 shows the agile sustainable communities including local distributed power systems [21, 25].

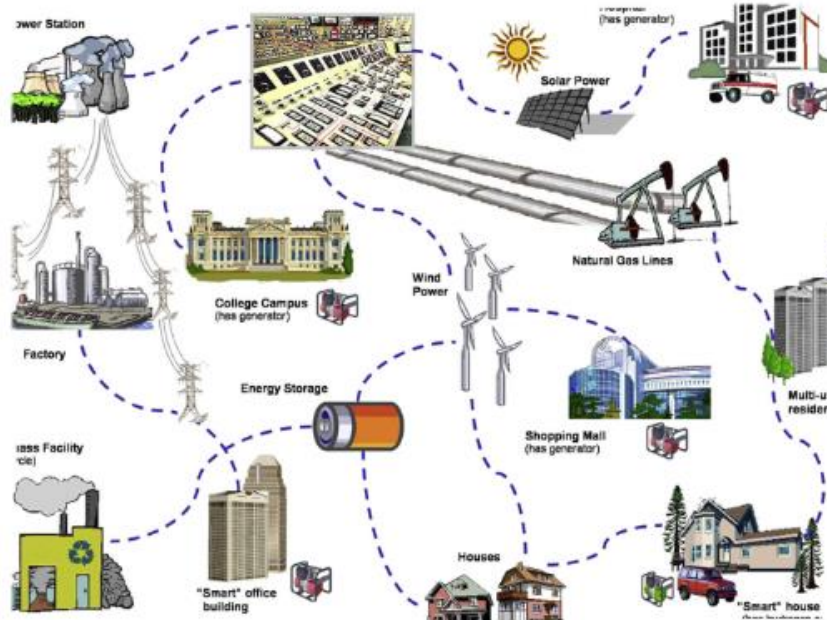


Fig. 1. Agile sustainable communities: Local distributed power systems [25].

Agile systems behave similarly to the internet. Some media organizations have referred to new energy infrastructure [25]. Communities within a geopolitical city, state, or region simply create their energy from town on-site renewable electricity resources including solar, water, waste, wind, geothermal, and biomass, among others. The standard sample of sustainable cities and communities is Hiroshima city including energy system [15]. It connects heat, power, and information networks, as well as a variety of decarbonizing inputs and integrated solid waste management (ISWM) [25]. ISWM refers to a shift away from otherwise desirable

waste management and disposal techniques (incineration and various forms of sanitary landfills) toward reducing waste, reuse, and recycling [26].

3. Research Methods

We used Scopus for trying to find and examine scientific quotations [27, 28] using all names of sustainable cities and communities. The filtered result has been 8,129 documents published until March 2023. We obtained 3,104 documents after combining keywords in the sustainable development goals, with the limitation between 2003 and 2023. There are ten types of published documents were considered to be investigated. Finally, the papers refined in this stage were manually filtered, and 2,000 articles were excluded based on the summary and title of the review documents. We divided the downloaded papers into ten periods to investigate the evolution and milestones of sustainable cities and communities research: 2003-2005, 2007, 2009, 2011, 2013, 2015, 2017, 2019, 2021, and 2023. We divided the countries into the ten major macro-regions. VOSviewer 1.6.18 and MS Excel version 2302 were used for the quantitative bibliometric analysis. Detailed information for the use of VOSviewer is explained in previous report [29]. Both software tools are used in SDGs research to analyse scientific literature and visualize keyword co-occurrence maps, co-citation, and co-author networks.

4. Results and Discussion

Table 1 depicts a country's total publication output. The US and the UK excel among the countries involved in sustainable cities and communities research, with incredibly high publication outputs (29.7% of total publication output combined). However, a significant difference between the US and the UK is the average publication year in the US (298) and the UK (282). This pattern suggests that sustainable cities and communities research has only recently gained traction in the US and given the disparity in the two countries' publication dynamism. China may soon be the world's leading innovator of Sustainable cities and communities research. Table 1 explains that the majority of European countries.

Table 1. Publication 2003-2013 (1st decade) and 2003-2013 (2nd decade).

Country	Number of Publication	Country	Number of Publication
UK	44	US	254
US	42	China	240
Australia	21	UK	224
Canada	15	Italy	131
Brazil	8	Australia	108
South Africa	8	Spain	95
Germany	7	Germany	83
Hongkong	6	Netherlands	81
Italy	6	Poland	72
Netherlands	6	Canada	67

A cluster analysis of keyword co-occurrence performed to gain insight by VOSviewer extracted 366 relevant keywords with at least 7 occurrences, which were then organized into 4 major clusters. The keywords in this cluster are from 18987 links. The number of keywords in Cluster #1 until #4 are 148, 110, 85, and 23, respectively. The majority of keywords of those is in Cluster #1. Figure 2 shows sustainable cities, and communities research, experiencing a shift in its main research topics ("sustainable development"). The research focus has gradually been

replaced by "urban development". The social aspects of sustainable cities and communities research have received as much attention as the stakeholder approach.

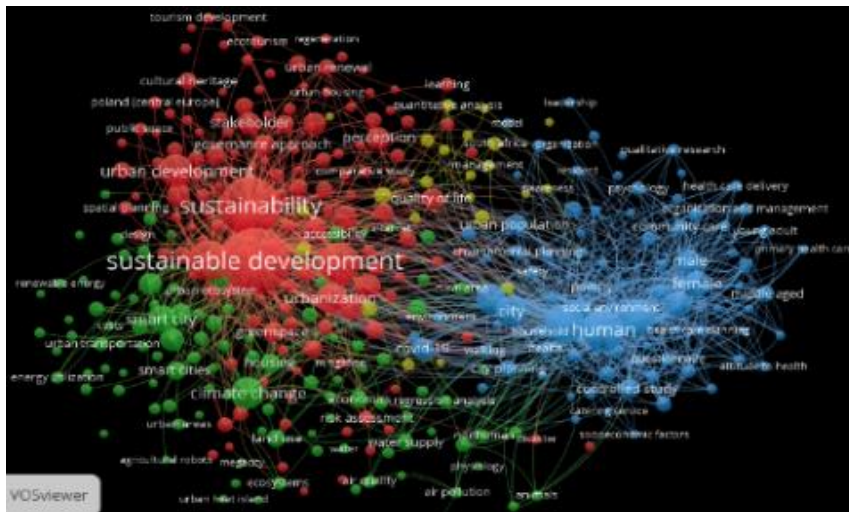


Fig. 2. Network visualization of sustainable cities and communities.

Table 2 depicts the keywords with the highest citation between 2003 and 2023. We divided keywords into 4 major evolution clusters. As a confirmation of the previous section's findings, the 1st keywords in Cluster #1 are related to "sustainable" and "sustainable development," which were the strongest keywords in the first cluster. The keywords in Cluster #2 fall into 2 categories, "sustainable cities" and "smart cities". The keywords in Cluster #3 fall into 2 categories. One of the keywords is related to humans ("urban population"), its effects ("socioeconomic factor"), and the possibility of reducing it through education means ("city planning," "public health," and "community care"). Another major topic in Cluster #4 is waste management ("Municipal solid waste, waste disposal, and sanitation").

The overlay visualization includes the newest keywords from sustainable cities and communities research (Fig. 3). Cluster #2 and #4 more likely relates to the newest trend of sustainable cities and communities than Cluster #1. Most recently sustainable cities and smart cities, and in combination with the global acceleration of waste management, the study of the relationship between sustainable cities and communities has gained widespread attention.

After reviewing the bibliometric data, modern sustainable cities and communities research began in the early 2003s in the United States and the United Kingdom with sustainable development of urban development. Since then, urban development research has remained an important topic within the field, such as sustainable cities and smart cities. As a result, sustainable cities and community participation research have gained traction in developing countries experiencing significant municipal solid waste in cities and in countries significantly impacted by urban growth. Research on waste management appears to be the primary driver of health care and governance approach research in general, it should be noted that in developing countries (such as Indonesia). We conclude from further investigation of the keyword occurrence trends of two decades of sustainable cities

and communities research that the dominance of urban development research has been challenged by research on sustainable cities and land communities located in urban areas. Finally, this study gives additional data for the use of bibliometric in giving research trend, as discussed in other reports [30-35].

Table 2. The most popular keyword in sustainable cities and communities research.

No.	Cluster #1	Cluster #2	Cluster #3	Cluster #4
1	SDGs	Sustainable cities	Human	Waste management
2	Sustainability	Smart cities	Urban population	Municipal solid waste
3	Urban development	Urban growth	Cities	Waste disposal
4	Urban area	Climate change	City planning	Community participation
5	Stakeholder	Urban transport	Public health	Informal settlement
6	Governance	Planning	Education	Developing world
7	Greenspace	Renewable energy Resource	Human experiment	Sanitation
8	Quality of life	Land use	Community care	SDGs
9	Local participation	Built environment	Socioeconomic factor	Social network

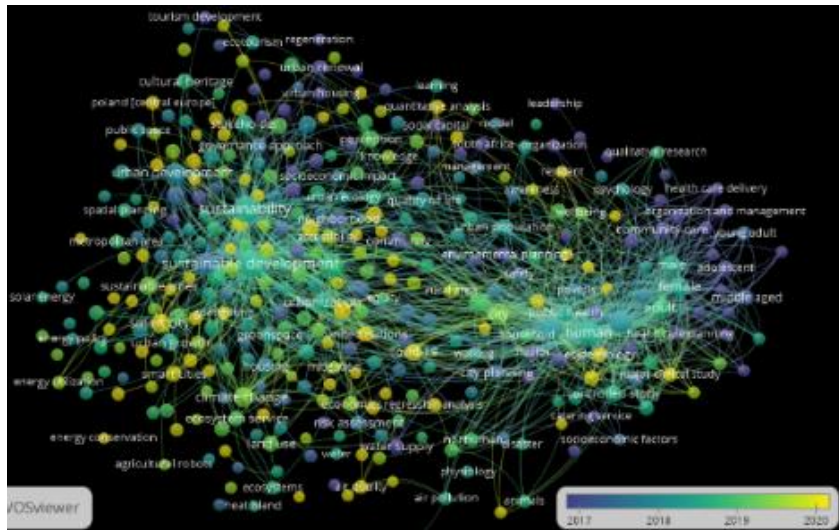


Fig. 3. Overlay visualization of sustainable cities and communities.

5. Conclusion

Cities all over the world have recognized that sustainable cities and communities (green space, city planning, or waste management) can be effective tools for making cities more sustainable and liveable. Over the last two decades, researchers' primary focus has gradually shifted from sustainable development goals to a social perspective of sustainable cities and communities research. As a result, to understand the effects of other factors, we should dig a little deeper, not just reviewing article titles, abstracts, and keywords, but viewing them holistically. Furthermore, because

the Scopus databases are biased toward the English language, we should consider using others (for example, the Scopus Index and WOS) that include more journals published in other languages. Overall, we have provided a thorough understanding of the trends and patterns that have defined two decades of research on urban development, city planning, renewable energy, and other waste management.

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