A Decade of Publications on Smart Cities: A Bibliometric Perspective

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ABSTRACT

This study presents a comprehensive bibliometric analysis of scholarly publications on smart cities with the aim of examining the intellectual structure, thematic evolution, and collaborative patterns within this rapidly expanding research domain. Despite the growing volume of smart cities literature, existing studies often remain fragmented, making it difficult to obtain a systematic understanding of dominant research themes, methodological orientations, and global knowledge production trends. To address this gap, this study employed a structured bibliometric methodology based on data retrieved through advanced searching in the Scopus database, resulting in a final dataset of 718 relevant publications. Descriptive statistics and preliminary trend analyses were conducted using the Scopus analyser to examine publication growth, subject area distribution, and citation patterns. OpenRefine was subsequently utilised to clean, standardise, and harmonise bibliographic records, ensuring consistency in author names, keywords, and institutional affiliations. VOSviewer was then applied to visualise co-occurrence networks of author keywords and co-authorship collaboration patterns, enabling the identification of major research clusters and international collaboration structures. The findings reveal that smart cities research is anchored around core themes such as sustainability, urban development, governance, and information and communication technologies, with emerging emphasis on artificial intelligence, internet of things, and data driven decision making. The numerical results further indicate strong international collaboration led by countries in Europe, North America, and Asia Pacific. Overall, this study contributes to the body of knowledge by providing a structured and integrative overview of smart cities research, offering valuable insights for scholars, policymakers, and practitioners seeking to understand research trends, identify gaps, and inform future research directions.

Keywords: Smart Cities, Bibliometric Analysis, Urban Governance, Sustainability, Information and Communication Technology

INTRODUCTION

The rapid urbanisation and exponential population growth have posed significant challenges to cities worldwide, including environmental degradation, resource scarcity, and infrastructure strain. In response, the concept of smart cities has emerged as a promising solution to these urban challenges. Smart cities leverage advanced technologies such as the Internet of Things (IoT), big data, and artificial intelligence (AI) to create interconnected, efficient, and sustainable urban environments (Babay & Erragcha, 2023; Bakir et al., 2024; Razmjoo et al., 2021). This study aims to explore the background, problem statement, the necessity of this research, and key concepts from the literature on smart cities.

The primary problem driving the development of smart cities is the increasing pressure on urban infrastructure and resources due to rapid urbanization. Traditional urban management approaches are often inadequate to cope with the complexities of modern cities, leading to issues such as traffic congestion, pollution, and inefficient resource utilization(Ozdamli & Nawaila, 2024; Tymoshenko et al., 2025) . Smart cities aim to address these problems by integrating advanced technologies into urban systems, enabling real-time data collection, analysis, and decision-making (Rjab & Mellouli, 2021; Visvizi & Lytras, 2019) . However, the implementation of smart city initiatives is not without challenges. Key barriers include data security and privacy concerns, interoperability

issues, and the need for substantial investments in infrastructure and technology (Al Shidhani, 2019; Braun et al., 2018).

The need to carry out this study is underscored by the potential benefits that smart cities offer in terms of sustainability, efficiency, and quality of life. By harnessing the power of ICT and IoT, smart cities can significantly reduce energy consumption, optimize transportation systems, and enhance public services (Musa et al., 2022; Osipov et al., 2018). Moreover, smart cities can contribute to achieving the United Nations' Sustainable Development Goals (SDGs), particularly SDG 11, which focuses on making cities inclusive, safe, resilient, and sustainable (Papadopoulou, 2021). Understanding the complexities and potential of smart cities is crucial for policymakers, urban planners, and researchers to develop effective strategies for future urban development.

The literature on smart cities highlights several key concepts and technologies that are central to their development. These include the use of IoT for real-time monitoring and control of urban systems, big data analytics for informed decision-making, and ICT for enhancing connectivity and communication (Barhoumi et al., 2025; Hatem, 2023). Smart cities also rely on renewable energy sources, smart grids, and energy-efficient buildings to promote sustainability (Lara et al., 2021; Lekkerkerk, 2016). Additionally, the integration of AI and machine learning technologies enables predictive analytics and automation, further enhancing the efficiency of urban operations (Li et al., 2022; Wang et al., 2016). However, the successful implementation of these technologies requires addressing challenges related to data security, privacy, and interoperability (Khavarian-Garmsir & Sharifi, 2022; Omambia, 2020).

Despite the promising potential of smart cities, several challenges must be addressed to realize their full benefits. Data security and privacy are major concerns, as the extensive use of sensors and connected devices increases the risk of cyberattacks and data breaches (Jebbar et al., 2024; Mozuriunaite, 2018). Ensuring the interoperability of different technologies and systems is also critical to avoid fragmentation and inefficiencies (László, 2016; Zhou et al., 2020). Furthermore, the high costs associated with developing and maintaining smart city infrastructure can be a significant barrier, particularly for developing countries (Al-Marri et al., 2025; Telang et al., 2021). Addressing these challenges requires a collaborative approach involving public-private partnerships, robust policy frameworks, and continuous investment in research and development (Long, 2020; Mishchenko et al., 2018).

Accordingly, smart cities represent a visionary approach to urban development, leveraging advanced technologies to create more efficient, sustainable, and liveable urban environments. While the concept holds great promise, its successful implementation requires addressing significant challenges related to data security, interoperability, and infrastructure investment. This study underscores the importance of understanding the complexities and potential of smart cities to develop effective strategies for future urban development. By exploring the key concepts, challenges, and opportunities associated with smart cities, this research aims to contribute to the ongoing discourse on sustainable urbanization and provide valuable insights for policymakers, urban planners, and researchers.
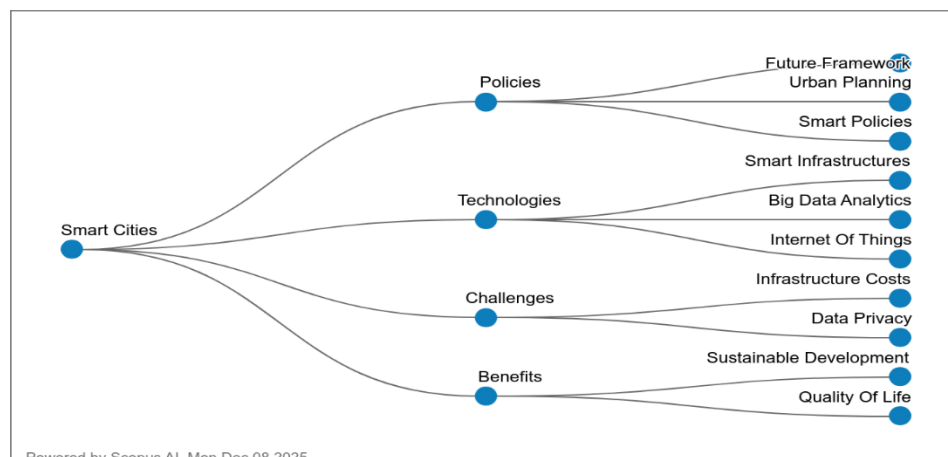

Figure 1. Key concepts generated on smart cities

Figure 1 presents a concept map generated by Scopus AI that organises the topic of smart cities into four principal conceptual clusters, namely policies, technologies, challenges and benefits. These clusters are further expanded into a total of twelve detailed sub-concepts. The map shows a deductive flow from the overarching idea of smart cities on the left towards increasingly specific thematic elements on the right. The policies cluster highlights future frameworks, urban planning and smart policy development, indicating that governance remains a foundational pillar in smart city discourse. The technologies cluster comprises smart infrastructures, big data analytics and the Internet of Things, illustrating the centrality of digital systems in enabling urban intelligence. The challenges cluster emphasises infrastructure costs and data privacy, reflecting persistent constraints that influence implementation and public acceptance. Finally, the benefits cluster outlines sustainable development and quality of life as key outcomes sought through smart city initiatives. Overall, the concept map synthesises the field into a coherent structure, demonstrating that research on smart cities is anchored in policy direction, driven by technological innovation, affected by operational challenges and ultimately geared towards societal and environmental improvements.

RESEARCH QUESTIONS

This study investigates the following five research questions:

RQ1: What are the research trends of smart cities according to the year of publication?

RQ2: What are the top 10 cited articles of smart cities?

RQ3: Which are the top 10 countries on smart cities based on number of publication?

RQ4: What are the popular keywords related to smart cities?

RQ5: What are co-authorship by countries' collaboration of smart cities?

METHODOLOGY

Bibliometrics entails the systematic collection, organisation and evaluation of bibliographic records derived from scientific (Alves et al., 2021; Assyakur & Rosa, 2022; Verbeek et al., 2002). In addition to fundamental descriptive indicators, such as identifying source journals, publication years and influential authors (Wu & Wu, 2017), bibliometric inquiry encompasses advanced analytical procedures including document co-citation analysis. A rigorous literature review demands an iterative and methodical process of keyword selection, database searching and critical examination of retrieved materials, thereby facilitating the construction of a comprehensive bibliography and the generation of robust findings (Fahimnia et al., 2015).Guided by this methodological stance, the present study prioritised high-impact publications, given their capacity to illuminate core theoretical foundations within the field. To ensure precision and reliability of data, SCOPUS was employed as the principal data source (Al-Khoury et al., 2022; di Stefano et al., 2010; Khiste & Paithankar, 2017). Furthermore, to preserve scholarly rigour, only peer-reviewed journal articles were included, while books and lecture notes were intentionally omitted (Gu et al., 2019). Using Elsevier's Scopus, recognised for its extensive coverage, publications from 2015 to December 2025 were systematically retrieved for subsequent analysis.

Data search strategy

The search strategy for this study was designed to ensure a rigorous, transparent and replicable process for identifying high-quality research publications on smart cities. Using the Scopus database as the primary source, an advanced search query was constructed to retrieve literature that is both thematically relevant and methodologically robust. The search string applied was TITLE ("smart cities"), which restricts the dataset to articles that explicitly feature the term in their titles, thereby increasing the likelihood that the retrieved studies directly address the conceptual and empirical dimensions of smart cities. To refine the dataset further, several filters were included. First, the publication period was limited to works published between 2015 and 2025 (PUBYEAR > 2014 AND PUBYEAR < 2026), a time frame selected to capture the most recent and impactful decade of research aligned with the rapid expansion of smart city initiatives worldwide. Second, the keyword

filter LIMIT-TO (EXACTKEYWORD, "Smart Cities") was applied to ensure thematic precision by selecting publications explicitly indexed under the smart cities domain. Third, the dataset was narrowed to peer-reviewed journal articles only through LIMIT-TO (DOCTYPE, "ar"), thereby excluding conference papers, reviews, book chapters and other non-article formats that may not undergo comparable levels of scholarly scrutiny. Fourth, the search was limited to the Social Sciences subject area (LIMIT-TO (SUBJAREA, "SOCI")), recognising that smart cities research frequently intersects with governance, planning, socio-technical systems and urban management. Finally, the filter LIMIT-TO (LANGUAGE, "English") ensured consistency in interpretation and facilitated broader international comparability. These combined parameters initially yielded a total of 7721 documents, reflecting the extensive and multidisciplinary nature of smart city scholarship over the past decade.

Following the initial retrieval, a systematic data cleaning and exclusion process was undertaken to enhance accuracy, remove irrelevant or duplicate items and establish a dataset suitable for bibliometric analysis. This exclusion phase involved several iterative steps, including the screening of abstracts and titles to verify relevance, the removal of papers that did not substantively address smart cities despite containing the term in their titles, and the elimination of incomplete records or articles misclassified under the selected subject area. Additional scrutiny was applied to ensure that only empirical and conceptual contributions that directly engage with smart city frameworks, technologies, policies or societal implications were retained. Publications that merely referenced smart cities tangentially, or used the term metaphorically or in contexts unrelated to urban innovation, were excluded. Through this rigorous refinement process, the initial dataset of 7721 documents was reduced to a final corpus of 718 peer-reviewed journal articles. This substantial reduction highlights the importance of systematic filtering in mitigating noise and ensuring that only high-quality, thematically focused scholarship is incorporated into the bibliometric analysis. The final dataset offers a robust and credible foundation for mapping research trends, identifying influential authors and institutions, uncovering conceptual clusters and examining the evolution of the field. By adopting such a precise and methodical approach, the study ensures that its findings reliably reflect the intellectual structure and research dynamics of smart cities across the designated 2015 to 2025 period.

Table 1. The search string

Source	Search string
Scopus	TITLE ("smart cities") AND PUBYEAR > 2014 AND PUBYEAR < 2026 AND (LIMIT-TO (EXACTKEYWORD , "Smart Cities")) AND (LIMIT-TO (DOCTYPE , "ar")) AND (LIMIT-TO (SUBJAREA , "SOCI")) AND (LIMIT-TO (LANGUAGE , "English")) Access date: December 2025

Table 2. The selection criterion of searching

Criterion	Inclusion	Exclusion
Language	English	Non-English
Timeline	2015 – 2025	< 2015 > 2025

Data analysis

VOSviewer, developed by Nees Jan van Eck and Ludo Waltman at Leiden University in the Netherlands (van Eck & Waltman, 2010, 2017), is a widely acknowledged bibliometric software designed to support the visualisation and analysis of scientific literature. Distinguished by its intuitive and interactive interface, the software enables the construction of advanced network visualisations, clustering structures and density maps, thereby facilitating the identification of intellectual patterns and conceptual linkages within complex research landscapes. Its extensive capabilities include the mapping of co-authorship, co-citation and keyword co-occurrence networks, offering comprehensive insights into the dynamics of scholarly communication. Continuous enhancements to its algorithms and functionalities further strengthen its analytical robustness, ensuring that both emerging and experienced researchers can effectively engage with large-scale bibliometric datasets. With its capacity to compute diverse metrics, customise visual representations and integrate seamlessly with multiple bibliographic databases, VOSviewer has become a critical instrument for knowledge mapping and research assessment.

A key strength of VOSviewer lies in its ability to distil intricate bibliometric data into visually coherent and analytically meaningful maps, enabling the detection of thematic clusters, co-occurrence structures and citation linkages that might otherwise remain obscured. Unlike many traditional bibliometric tools, VOSviewer combines methodological rigour with accessibility, which broadens its relevance across disciplinary fields. Its adaptability, particularly in relation to network visualisation and density mapping, ensures precise and transparent representation of evolving research domains. Ongoing developments have firmly positioned VOSviewer at the forefront of bibliometric analytics, with flexible and customisable features that provide scholars with both methodological depth and interpretive clarity.

In the present study, bibliometric datasets covering publication year, title, author name, journal, citation count and keywords were exported in PlainText format from the Scopus database for the period 2015 to December 2025. These datasets were subsequently processed using VOSviewer version 1.6.20, which enabled the application of clustering and mapping techniques to generate comprehensive knowledge structures. Methodologically, VOSviewer offers an alternative to Multidimensional Scaling (MDS) by positioning items in low-dimensional spaces such that spatial proximity reflects their degree of relatedness (van Eck & Waltman, 2010). Although sharing conceptual parallels with MDS ((Appio et al., 2014), VOSviewer departs from it through the application of a more refined normalisation method for co-occurrence data, namely the association strength (ASij), computed as (Van Eck & Waltman, 2007):

$$AS_{ij} = \frac{C_{ij}}{w_i w_j}$$

where Cij represents the observed co-occurrence of items i and j, while wi and wj denote their respective occurrence frequencies. This metric reflects the ratio between observed co-occurrences and those expected under statistical independence (Van Eck & Waltman, 2007). Through this methodological refinement, VOSviewer enhances the accuracy and interpretive power of bibliometric mapping, establishing it as a superior tool for revealing latent structures within scholarly domains.

FINDINGS AND DISCUSSION

This section deliberates on each of the five research questions of the study.

Research Question 1: What are the research trends of smart cities according to the year of publication?

The publication trend on smart cities between 2015 and 2025 demonstrates a gradual but fluctuating growth in scholarly attention as shown in **Figure 2**.
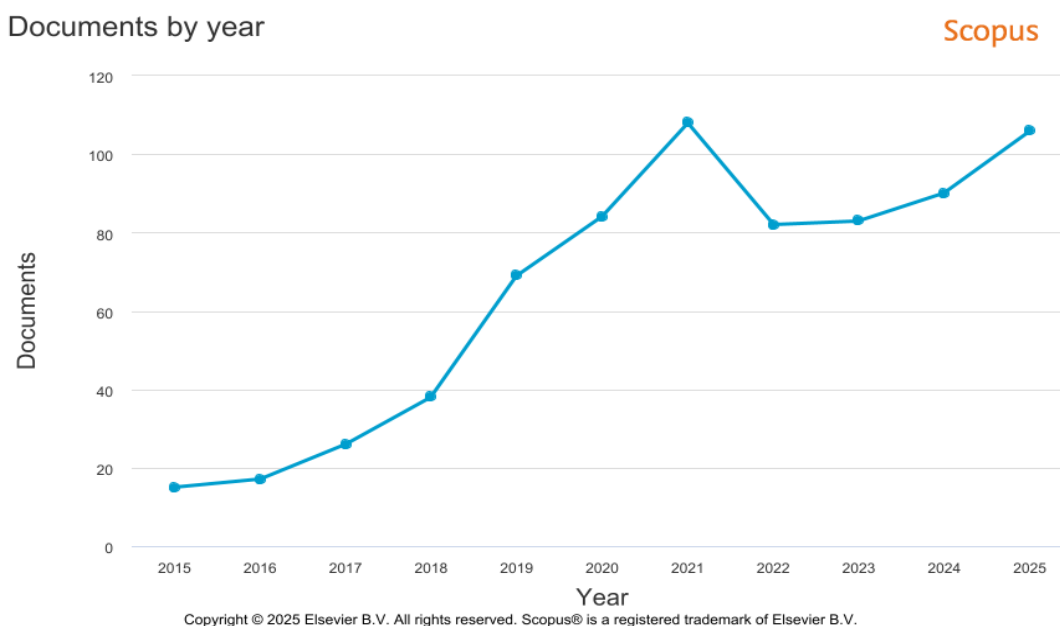
Figure 2. Publication trend by year of publication

The publication trend on smart cities from 2015 to 2025 demonstrates a clear and sustained growth trajectory, indicating the rising academic and policy relevance of the topic. The period from 2015 to 2018 shows a gradual increase, moving from fewer than 20 publications to almost 40. This early phase reflects the initial consolidation of smart city research as governments and urban planners worldwide began adopting digital technologies for urban management. A marked surge is observed from 2019 to 2021, where publications rose sharply, reaching a peak of over 110 articles in 2021. This escalation corresponds with global interest in data-driven urban governance, the expansion of Internet of Things applications, and increasing investments in smart infrastructure. The COVID-19 pandemic further accelerated scholarly attention, as cities relied heavily on digital systems for mobility control, public health monitoring and service delivery, prompting intensified academic inquiry into urban resilience, digital surveillance and technological governance.

Following the 2021 peak, the dataset shows a temporary decline in 2022, where publications fell to around 82. This moderation may indicate a post-pandemic adjustment period, during which research funding and institutional priorities shifted as countries transitioned into recovery phases. Nevertheless, the trend rebounds in subsequent years, with publications steadily increasing between 2023 and 2025, ultimately surpassing 105 documents in 2025. This renewed upward trajectory suggests that smart city research continues to expand, driven by advancements in artificial intelligence, sensor networks, urban analytics and sustainability-oriented urban policy. The persistent growth also reflects global commitments to digital transformation and the alignment of smart city initiatives with the Sustainable Development Goals, particularly those related to sustainable urbanisation. Overall, the pattern underscores the maturing and multidisciplinary nature of the smart cities field, indicating sustained scholarly engagement and expanding research frontiers.

Research Question 2: What are the top 10 cited articles of smart cities?

Produced below in Table 3 is the list of top 10 cited articles on the topic of smart cities.

Table 3: Top 10 cited articles

Authors	Title	Year	Source title	Citation count
Allam, Z.; Dhunny, Z.A.	On big data, artificial intelligence and smart cities	2019	Cities	890
Shelton, T.; Zook, M.; Wiig, A.	The 'actually existing smart city'	2015	Cambridge Journal of Regions, Economy and Society	681
Ahad, M.A.; Paiva, S.; Tripathi, G.; Feroz, N.	Enabling technologies and sustainable smart cities	2020	Sustainable Cities and Society	506
Allam, Z.; Sharifi, A.; Bibri, S.E.; Jones, D.S.; Krogstie, J.	The Metaverse as a Virtual Form of Smart Cities: Opportunities and Challenges for Environmental, Economic, and Social Sustainability in Urban Futures	2022	Smart Cities	505
Javed, A.R.; Shahzad, F.; Rehman, S.U.; Zikria, Y.B.; Razzak, I.; Jalil, Z.; Xu, G.	Future smart cities requirements, emerging technologies, applications, challenges, and future aspects	2022	Cities	493
Dembski, F.; Woessner, U.; Letzgus, M.; Ruddat, M.; Yamu, C.	Urban digital twins for smart cities and citizens: The case study of herrenberg, germany	2020	Sustainability (Switzerland)	481
Syed, A.S.; Sierra-Sosa, D.; Kumar, A.; Elmaghraby, A.	Iot in smart cities: A survey of technologies, practices and challenges	2021	Smart Cities	451
White, G.; Zink, A.; Codecà, L.; Clarke, S.	A digital twin smart city for citizen feedback	2021	Cities	440
Kaïka, M.	'Don't call me resilient again!': the New Urban Agenda as immunology … or … what happens when communities refuse	2017	Environment and Urbanization	428

	to be vaccinated with 'smart cities' and indicators			
Cardullo, P.; Kitchin, R.	Smart urbanism and smart citizenship: The neoliberal logic of 'citizen-focused' smart cities in Europe	2019	Environment and Planning C: Politics and Space	383

The citation pattern of the top ten most cited publications on smart cities reflects both the intellectual maturation of the field and the centrality of certain thematic domains within urban technology research. The most cited article, Allam & Dhunny (2019), which focuses on big data, artificial intelligence and smart cities, has accrued 890 citations, indicating strong scholarly interest in the technological foundations that underpin smart city development. Similarly, foundational conceptual works such as Shelton et al. (2015) with 681 citations, continue to exert significant influence because they critically interrogate the socio-political dimensions of the "actually existing smart city", offering perspectives that remain highly relevant as urban digitalisation expands. High citation counts for Ahad et al. (2020) and Dembski et al. (2020) reflect the growing research emphasis on enabling technologies, sustainability and the application of digital twins, which are increasingly recognised as essential components of contemporary urban systems. These papers successfully bridge theory, technology and practice, making them valuable across interdisciplinary domains and contributing to their high visibility in academic discourse.

Recent publications such as Allam et al. (2022), Javed et al. (2022) and Syed et al. (2021) have also accumulated substantial citations within a relatively short period, indicating rapid uptake of emerging topics including the metaverse, advanced requirements for future smart cities and the expanding role of the Internet of Things. Their strong citation performance can be attributed to the acceleration of digital transformation during and after the COVID-19 pandemic, when scholars sought new frameworks and technological solutions for resilient and adaptive urban systems. Papers by Kaïka (2017) and Cardullo & Kitchin (2019) remain influential because they critically examine governance, citizenship and the political economy of smart urbanism, highlighting tensions related to inclusivity, data governance and neoliberal urban policies. Their ongoing relevance demonstrates that despite technological advancements, debates surrounding ethical, political and societal implications remain central to the smart cities discourse. Overall, the citation trends suggest that highly cited works succeed either by introducing foundational conceptual critiques or by addressing emerging technological frontiers that rapidly reshape urban development practices.

Research Question 3: Which are the top 10 countries on smart cities based on number of publication?

The following **Figure 3** reveals the top 10 countries based on number of publication in the area of smart cities.
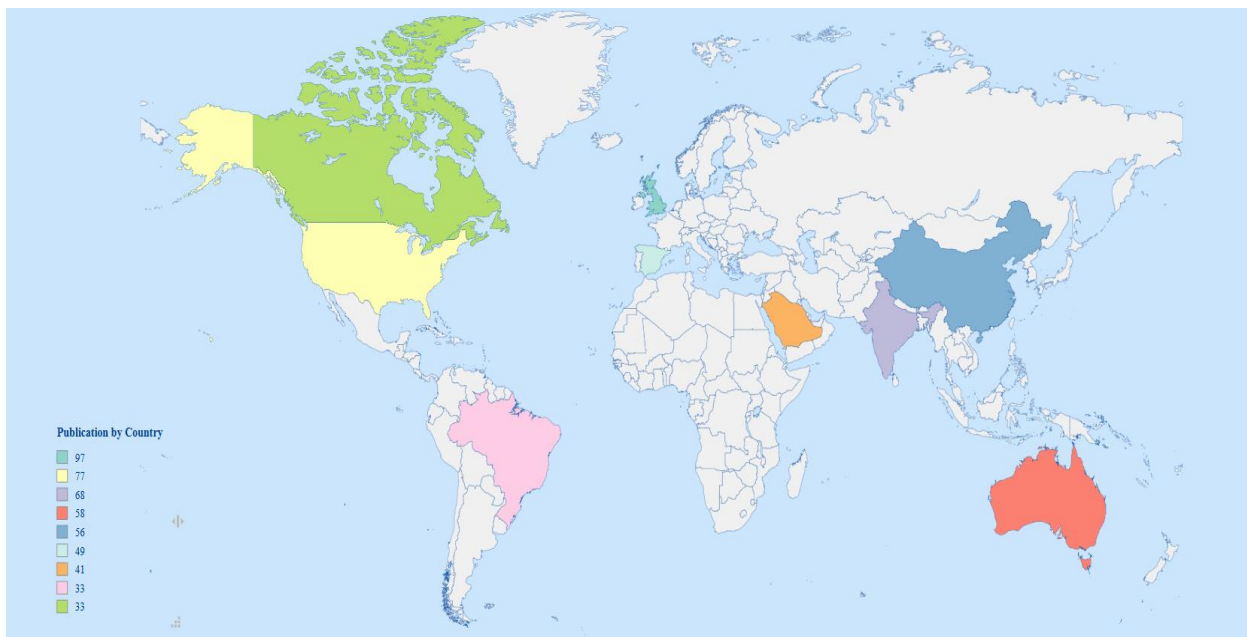

Figure 3. Top 10 countries based on number of publications

The publication distribution across the top ten countries reflects both the maturity of research ecosystems and the strategic national priorities associated with smart cities as shown in **Figure 3**. The United Kingdom leads the list with 97 publications, supported by its strong urban innovation agenda, active government–university collaboration and long-standing emphasis on digital governance and sustainable urban planning. The United States follows closely with 77 publications, driven by its advanced technological infrastructure, robust funding mechanisms and significant contributions from interdisciplinary fields such as computer science, urban studies and public policy. India, with 68 publications, demonstrates rapid growth due to its nationwide Smart Cities Mission, which has stimulated academic interest in urban digital transformation, infrastructure modernisation and service delivery reforms. Australia's contribution of 58 publications reflects its focus on resilient urban systems, smart governance and sustainable city-region development, while China's 56 publications align with its large-scale investments in digital infrastructure, urban analytics and technology-enabled public services as part of its broader smart urbanisation agenda.

European contributions from Spain (49) and Italy (45) are consistent with the region's strong policy orientation toward sustainable urban development, digital innovation and citizen-centric governance under the European Union's Smart Cities and Communities framework. Saudi Arabia's 41 publications can be attributed to national transformation initiatives, particularly Vision 2030, which prioritises digitalisation, smart governance and large-scale smart city projects such as NEOM. Brazil and Canada, each with 33 publications, also show sustained research interest aligned with their respective urban development priorities. Brazil's contributions often focus on challenges related to urban inequality, mobility and sustainability, whereas Canada's research landscape is shaped by its emphasis on smart infrastructure, inclusive urban innovation and climate-resilient city development. Collectively, these patterns indicate that countries with strong policy mandates, technological capacity and strategic national priorities tend to dominate scholarly outputs in the smart cities domain.

Research Question 4: What are the popular keywords related to smart cities?

The following **Figure 4** highlights the main keywords used by the authors related to the study of smart cities.
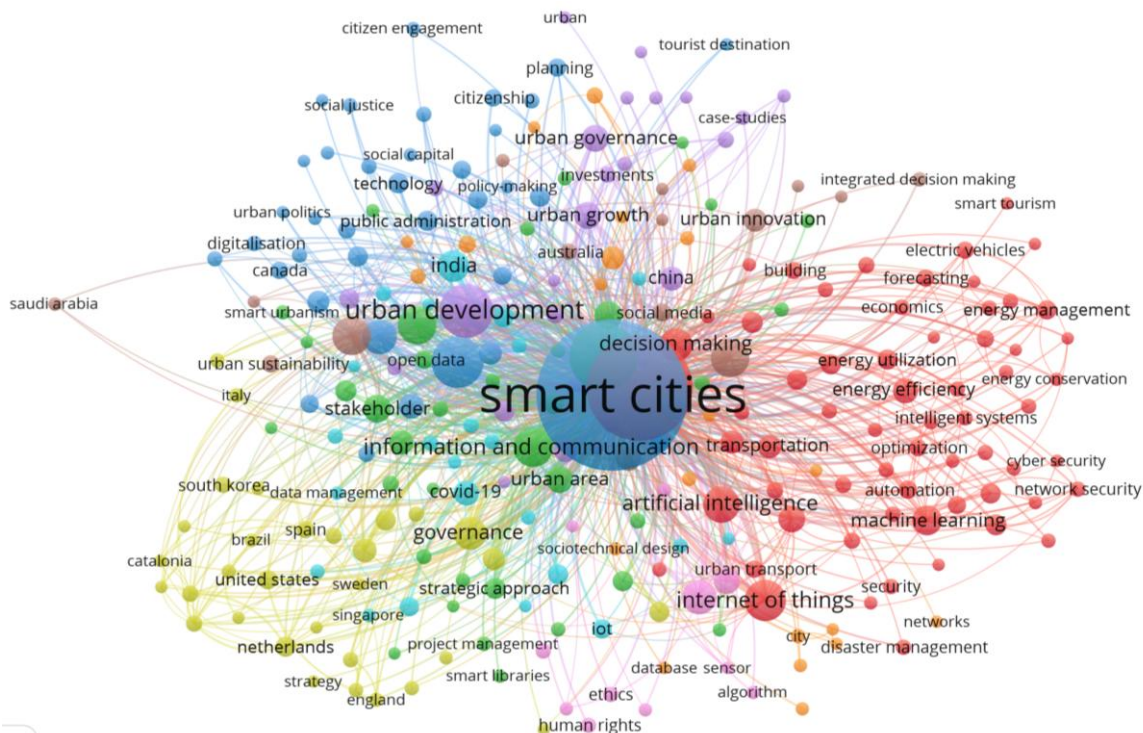

Figure 4 Network visualisation map of keywords' co-occurrence

Co-occurrence analysis of author keywords using VOSviewer is a bibliometric technique designed to identify and visualise the conceptual structure of a research field by examining how frequently keywords appear together within the same documents. The underlying assumption is that keywords which co-occur more often are thematically or conceptually related. VOSviewer translates these relationships into a network where nodes

represent keywords, node size reflects frequency of occurrence, and links indicate co-occurrence strength, measured through total link strength. This approach enables researchers to detect dominant research themes, emerging topics, and the interconnections between technological, social, and policy-oriented discourses. In the context of smart cities research, such analysis is particularly suitable because the field is inherently interdisciplinary, combining urban studies, information and communication technologies, governance, sustainability, and socioeconomic dimensions within a single analytical framework.

The network map was generated using a full counting method, whereby each keyword occurrence was counted equally, ensuring that frequently used concepts exert proportional influence on the network structure. From a total of 3,456 extracted keywords as shown in **Figure 4**, a minimum occurrence threshold of five resulted in 265 keywords being included, while a minimum cluster size of five produced nine distinct clusters. The findings show that "smart cities" (718, 3407) and "smart city" (356, 2607) dominate the knowledge structure, confirming their role as central anchoring concepts. These are strongly connected with sustainability related themes such as "sustainability" (148, 1015), "urban development" (94, 774), and "urban planning" (86, 647), alongside technological drivers including "internet of things" (55, 327), "artificial intelligence" (44, 271), "machine learning" (29, 227), and "big data" (39, 227). Governance and decision related keywords such as "decision making" (34, 295), "governance approach" (38, 357), and "governance" (35, 235) further indicate a strong policy and institutional orientation. Collectively, these patterns contribute to the body of knowledge by demonstrating that smart cities research has evolved into an integrated domain where technological innovation is closely intertwined with sustainability goals, urban governance, and quality of life considerations, rather than being treated as a purely technical or infrastructure driven agenda

Research Question 5: What are co-authorship by countries' collaboration on smart cities?

Produced below is **Figure 5**, depicting the network visualisation mapping of the authors' co-authorship collaboration by country.
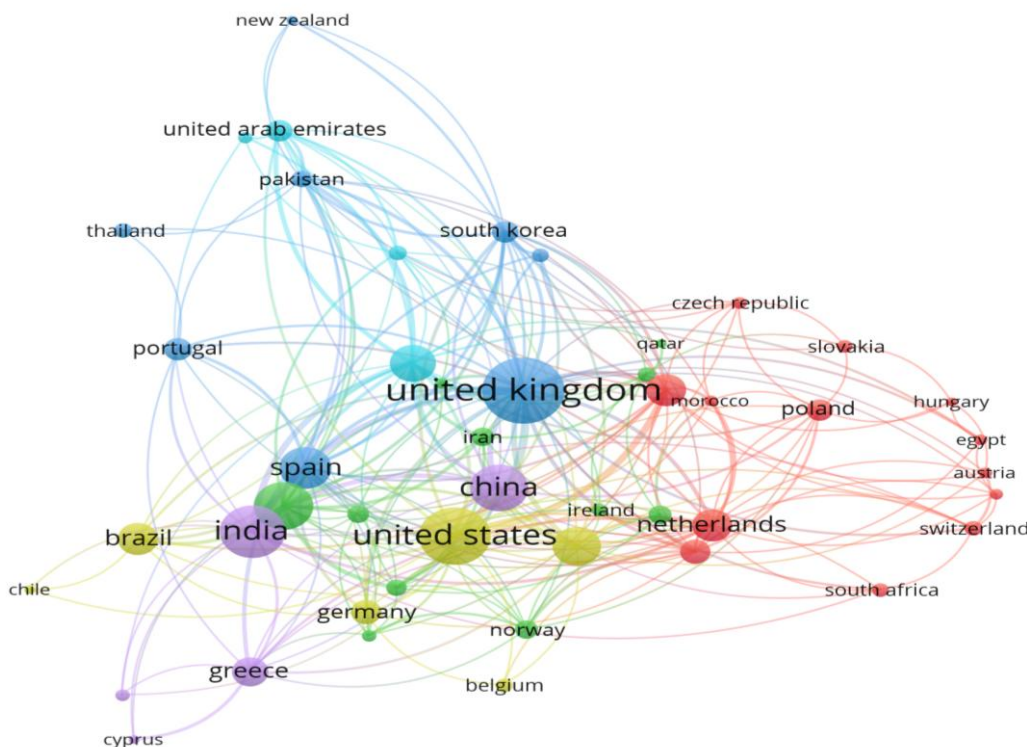

Figure 5. Network visualisation map of authors' collaboration by country

The co-authorship by country collaboration analysis based on VOSviewer examines patterns of international research collaboration by aggregating author affiliations at the country level and analysing how frequently countries co-appear within the same publications. Each country is represented as a node, while links between nodes indicate collaborative relationships, with total link strength reflecting the intensity and frequency of co-

authored outputs between countries. This approach allows the identification of leading contributor countries, collaborative hubs, and regional or transnational research networks within a given field. By visualising these relationships, VOSviewer provides insight into how knowledge production is distributed globally and how scholarly influence is shaped through cross border collaboration rather than isolated national efforts.

In generating the map, a full counting method was applied, meaning that each country listed in a publication received equal credit for that document. From a total of 86 identified countries as shown in **Figure 5**, a minimum threshold of five documents resulted in 48 countries being included in the analysis. A minimum cluster size of five countries produced six collaboration clusters, indicating distinct but interconnected international research groupings. The findings show that the United Kingdom emerges as a central collaboration hub with 97 documents, 4,569 citations, and the highest total link strength of 98, followed by the United States with 78 documents and a total link strength of 57, and Saudi Arabia with 41 documents and a link strength of 60. Other influential contributors include India with 68 documents and a link strength of 50, Australia with 59 documents and high citation impact, and China with 58 documents and a link strength of 37. These patterns contribute to the body of knowledge by demonstrating that research in this field is driven by strong international collaboration, particularly among countries in Europe, North America, the Middle East, and Asia Pacific, highlighting the globalised nature of knowledge production and the importance of cross regional partnerships in advancing research impact and visibility.

CONCLUSION

This study set out to systematically examine the evolution, structure, and collaborative landscape of smart cities research through a comprehensive bibliometric analysis. The primary purpose was to identify publication trends, influential contributions, dominant thematic areas, and international collaboration patterns that have shaped the field over the past decade. By addressing questions related to research growth, highly cited works, leading contributing countries, prominent keywords, and co-authorship networks, the analysis provides an integrated overview of how smart cities scholarship has developed and diversified over time.

The findings indicate a sustained and accelerating growth in smart cities research, particularly after 2019, reflecting increasing academic and policy interest in technology enabled urban development. The thematic analysis reveals that the field is anchored around core concepts such as sustainability, urban development, governance, and information and communication technology, with growing emphasis on artificial intelligence, internet of things, big data, and data driven decision making. Keyword co-occurrence patterns demonstrate that technological innovation is closely interconnected with policy, governance, and quality of life considerations, highlighting the socio technical nature of smart cities research. The co-authorship analysis further shows that knowledge production is highly internationalised, with strong collaborative networks led by countries in Europe, North America, the Middle East, and Asia Pacific. These patterns suggest that smart cities research is shaped by both global policy agendas and cross border knowledge exchange.

In terms of contribution, this bibliometric study offers a structured synthesis of a fragmented and multidisciplinary body of literature, clarifying its intellectual foundations and emerging directions. The findings have practical implications for researchers and policymakers by identifying mature themes as well as under explored areas that warrant further investigation, particularly in relation to governance capacity, inclusiveness, and implementation challenges in diverse urban contexts. Nevertheless, the study is limited by its reliance on a single database, a focus on English language journal articles, and the exclusion of conference proceedings and grey literature. Future research could expand the scope by incorporating multiple databases, comparative regional analyses, and longitudinal thematic tracking. Overall, this research demonstrates the value of bibliometric analysis as a rigorous tool for understanding the development and complexity of smart cities scholarship, and it provides a solid foundation for advancing future research in this evolving field.

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