# Smart City in Indonesia: Review Studies and Lessons for Sumatra

**Raihan Gunawan**[1]
[1]*SMART Indonesia*

Smart city is a concept that has gained increasing attention in Indonesia in recent years. This study uses bibliometric analysis to explore the development and trends of smart city research in Indonesia from 469 articles. The results show that the number of publications on smart city in Indonesia has increased significantly in recent years. Employing various bibliometric techniques, the study's results reveal key insights into the dynamics of Smart City research in Indonesia. The most prominent keywords reflect the multidisciplinary nature of the topic and its relevance to urban development, technology, governance, and environmental concerns. This study also found that in Sumatra, the development of Smart Cities is still in its early stages, but has the potential to improve the quality of life for citizens and address urban challenges. By comprehensively mapping the intellectual landscape of Smart City research in Indonesia, this research contributes to a better understanding of the key themes, trends, and collaborative networks shaping the discourse in this important domain.

**Keywords: Smart City; Bibliometric; Sumatra**

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*Correspondence:
Raihan Gunawan
raihangunawan365@gmail.com

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# INTRODUCTION

In the era of globalization and rapid development of information technology, the concept of "Smart City" has become a major focus in addressing the challenges of urbanization and the increasingly complex growth of cities. Smart city is a concept of a future city that uses information and communication technology (ICT) to improve efficiency, effectiveness, and the quality of life of citizens. This concept upholds the vision of creating a technologically oriented urban environment to improve the quality of life of citizens and public services (Afrianto & Tamnge, 2015; Effendi et al., 2016). The implementation of the Smart City concept is particularly relevant given that Indonesia, as a developing country with a large population, faces a variety of urban problems that require innovative solutions.

In Indonesia, the concept of smart city was first introduced in the early 2010s. The Indonesian government has issued various policies and programs to support the development of smart city in Indonesia, such as Presidential Regulation Number 97 of 2014 on the National Policy and Strategy for the Development of Smart City and Minister of Communication and Information Regulation Number 5 of 2019 on the Administration of Smart City. The Indonesian government targets to have 100 smart cities in Indonesia by 2025. To achieve this target, the government has worked with various stakeholders, including local governments, the private sector, and the community (Achmad et al., 2018; Hasmawaty et al., 2022; Hayati et al., 2020; Rachmawati, 2019).

This study focuses on a bibliometric analysis of the literature that discusses the development and trends of Smart City in Indonesia. In this context, bibliometrics is used as an analytical method that provides in-depth insights into the scientific development and literature related to the topic. This study was conducted by analyzing various data, such as the number of publications, authors, journals, and keywords. Bibliometrics can provide an overview of the development of research on the topic of Smart City in Indonesia. It can also be used to identify new research opportunities. By looking at the development of the literature, this study aims to identify trends, research focus, collaboration between researchers, and analyze the development of the concept and application of Smart City in the academic arena.

The development of digital, communication, and sensor technologies has had a significant impact on the Smart City concept around the world, including in Indonesia. The application of technology in urban development encompasses various aspects such as infrastructure management, data collection, accessibility of public services, and public participation in decision-making. Therefore, a bibliometric analysis of the development of the Smart City concept in Indonesia is important in providing a comprehensive view of the efforts to achieve the goals of smart and sustainable urban development.

This bibliometric study is expected to provide in-depth insights into the scientific development of Smart City in Indonesia. The results of this analysis are expected to make a significant contribution to academics, researchers, practitioners, and other stakeholders in understanding the development, focus, and direction of the Smart City concept in Indonesia. With a better understanding of the literature and development trends, it is hoped that the implementation of the Smart City concept in Indonesia can be more optimal in achieving the goals of urban sustainability.

# METHOD

Bibliometric mapping is a research topic in the bibliometric field (Borner et al., 2003). Two bibliometric aspects that can be distinguished are constructing the bibliometric map and the graphical representation of the map. In the bibliometric literature, the greatest concern has been with the construction of bibliometric maps. Research on the effect of differences on size similarity (Ahlgren et al., 2003), and they were tested by different mapping techniques (Boyack et al., 2005).

The graphical representation of the bibliometric received less attention. However, some researchers seriously study problems related to graphic representation (Chen, 2003). Most of the articles published in the bibliometric literature rely on simple graphical representations provided by computer programs. This study uses publication data in the form of papers sourced from various scientific journals and other sources with the theme of research on the application of Smart City in Indonesia. From the search results obtained 469 published articles.

Research with the bibliometric method on the issue of Smart City in Indonesia in general have been done by (Effendi et al., 2016; Afrianto & Tamnge, 2015; Larasati et al., 2018; Mahesa et al., 2018; Achmad et al., 2018; Rachmawati, 2019; Suartika & Cuthbert, 2020; Hayati et al., 2020; Kurniawan et al., 2020), for example,

recently Hasmawaty et al., (2022) present a case study on public services of South Sumatra government programs in order to develop a green smart city concept by combining smart city and green IT concepts which aim to align and incorporate green IT components, including pollution prevention, product stewardship, and clean technology into conceptual variants, essential elements, and strategic principles.

# RESULT AND DICUSSION

**Table 1:** Average Citation per Year

| Year | N | Mean TC per Article | Mean TC per Year | Citable Years |
|---|---|---|---|---|
| 2000 | 1 | 1 | 0.0434782608695652 | 23 |
| 2001 | 0 | 0 | 0 | 0 |
| 2002 | 0 | 0 | 0 | 0 |
| 2003 | 0 | 0 | 0 | 0 |
| 2004 | 0 | 0 | 0 | 0 |
| 2005 | 0 | 0 | 0 | 0 |
| 2006 | 0 | 0 | 0 | 0 |
| 2007 | 1 | 0 | 0 | 16 |
| 2008 | 0 | 0 | 0 | 0 |
| 2009 | 0 | 0 | 0 | 0 |
| 2010 | 0 | 0 | 0 | 0 |
| 2011 | 1 | 0 | 0 | 12 |
| 2012 | 1 | 1 | 0.0909090909090909 | 11 |
| 2013 | 4 | 12.25 | 1.225 | 10 |
| 2014 | 2 | 7 | 0.777777777777778 | 9 |
| 2015 | 8 | 12.5 | 1.5625 | 8 |
| 2016 | 12 | 16.3333333333333 | 2.33333333333333 | 7 |
| 2017 | 22 | 5.31818181818182 | 0.886363636363636 | 6 |
| 2018 | 46 | 5.89130434782609 | 1.17826086956522 | 5 |
| 2019 | 100 | 6.17 | 1.5425 | 4 |
| 2020 | 63 | 7.57142857142857 | 2.52380952380952 | 3 |
| 2021 | 85 | 3.01176470588235 | 1.50588235294118 | 2 |
| 2022 | 80 | 0.85 | 0.85 | 1 |
| 2023 | 43 | 0.906976744186046 | - | 0 |
| **Total** | **469** | | | |

The table above shows the number of citations from the average per article and per year in a paper on the theme of Smart city in Indonesia. This research examines documents on this theme which were published in a period of 23 years or from 2000 to 2023. Based on the table, it can be seen that the most published papers on Smart city in Indonesia themes were published in 2019 with a total of 100 documents. However, the data is still temporary because 2023 has not been completed and it is still possible to add more. The collection of papers studied in this study is limited to 21 August 2023.

Then, the highest average total citation for each article was in 2020 with an average of 2.52 citations per year. Meanwhile, the highest average total citations per article were in 2016, with an average score of 16.33. The results of this study indicate that there is a variation in the average total citation per year and per article on the topic of smart city in Indonesia from 2000 to 2023. From 2000 to 2011, the average total citation was

relatively low, with only one significant increase in 2000. The average total citation per year and per article began to increase significantly in 2012, with fluctuating trends thereafter, but generally increasing overall.

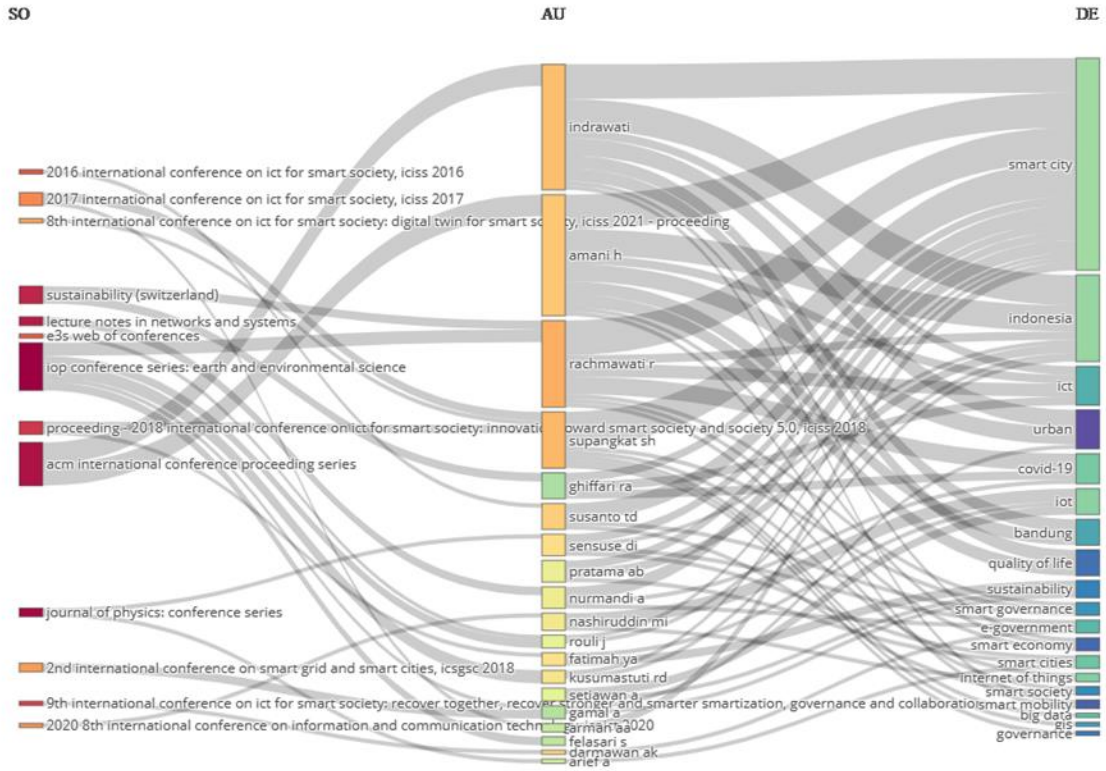


Figure 1: Three Fields Plot

The Three Fields Plot above is an illustration of 3 elements consisting of a list of journal names, a list of authors and a list of topics used. These three elements are plotted with a gray plot that shows their relationship with each other, starting from the name of the journal, then each journal shows the author, and each author is shown on the topic they use in their paper on the theme of Smart city in Indonesia. The size of each rectangle in the list of names shows the quantity of paper associated with that element.

The first element, namely the journal. There are 13 journals indexed in the Three Fields Plot that publish papers on the theme of Smart city in Indonesia, but the top journal that publishes the most papers on this theme is the IOP conferece series: earth and environmental science. which is described in a rectangle and connected by several authors, namely Rachmawati R, Rouli J, Kusumastuti, Gamal A, Felasari S.

The second element in the middle is the author's name. Several writers whose publication journals are recognized will be associated with the previous element. However, some others are not indexed so that they do not have any connection with any of the journals listed. In addition, each of these authors will also be associated with frequently used keyword topics on the right. There are top 19 authors listed in this plot. The size of the rectangle shows the quantity of the number of papers written by each author. In this plot, Indrawati and Amani H occupy the widest rectangle which shows that he wrote the most on Smart city in Indonesia themes.

The third element is the keyword topic that appears the most in the paper which is the object of research. Each topic is associated with an author who uses the topic a lot. There are 19 keyword topics listed and the keyword that appears the most frequently is 'Smart city', as indicated by the size of the light green rectangle that dominates the rest of the rectangle. It also appears that this Smart city topic is used by almost all registered authors, this data is in accordance with the theme of this study, namely discussing scientific papers related to Smart city. Apart from Smart city, this plot also shows several other keywords that are widely used, such as 'Indonesia, ICT, and Urban'.

**Table 2:** Most Cited Article

| Citation | Title | Year | Y/C |
|---|---|---|---|
| 225 | Industry 4.0 based sustainable circular economy approach for smart waste management system to achieve sustainable development goals: A case study of Indonesia | 2020 | 56.25 |
| 217 | Climate Change, Human Impacts, and Coastal Ecosystems in the Anthropocene | 2019 | 43.40 |
| 52 | Multi-stakeholder co-creation Analysis in Smart city Management: An Experience from Bandung, Indonesia | 2015 | 5.77 |
| 51 | A dynamic decision support system based on geographical information and mobile social networks: A model for tsunami risk mitigation in Padang, Indonesia | 2016 | 6.37 |
| 48 | Identifying the Components and Interrelationships of Smart Cities in Indonesia: Supporting Policymaking via Fuzzy Cognitive Systems | 2019 | 9.60 |
| 48 | Smart city dashboard for integrating various data of sensor networks | 2013 | 4.36 |
| 41 | Smart City Indicators: A Systematic Literature Review (SCOPUS) | 2016 | 5.12 |
| 38 | Effect of work motivation and job satisfaction on employee performance: Mediating role of employee engagement | 2021 | 12.67 |
| 36 | Forest fire detection system reliability test using wireless sensor network and OpenMTC communication platform | 2015 | 4.00 |
| 35 | Work from Home and the Use of ICT during the COVID-19 Pandemic in Indonesia and Its Impact on Cities in the Future | 2021 | 11.67 |
| 35 | Defining smart city, smart region, smart village, and technopolis as an innovative concept in indonesia's urban and regional development themes to reach sustainability | 2018 | 5.83 |
| 35 | A survey based approach to estimating the benefits of energy efficiency improvements in street lighting systems in Indonesia | 2016 | 4.37 |

The first top article in the order of articles with the most citations, namely 225 citations, is occupied by a paper with the title Industry 4.0 based sustainable circular economy approach for smart waste management system to achieve sustainable development goals: A case study of Indonesia written by Fatimah et al., (2020). The article with the second highest number of citations is the article with the title 'Climate Change, Human Impacts, and Coastal Ecosystems in the Anthropocene' with 38 citations written by He & Silliman, (2019).

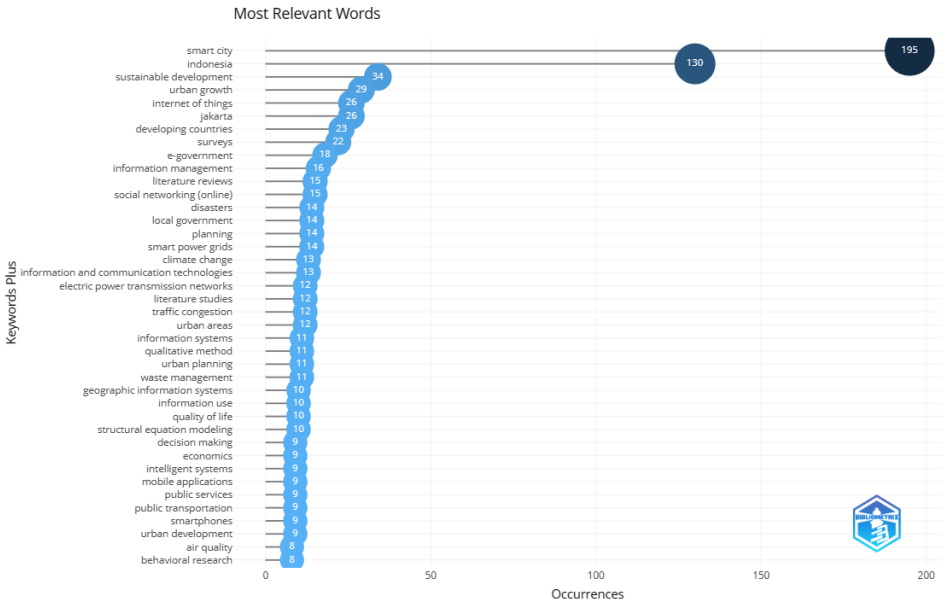


Figure 2: Most Relevant Words

This study also counts the relevant words used in the collection of documents that are the object of the study, there are several words with the number of occurrences between 0 and more than 100 times and the top 40 words are listed as well as a blue table diagram showing the comparison of the number of occurrences of each. Each word usage and its relevance to the Smart city in Indonesia theme.

The top word with the highest number of occurrences and most relevant to the theme of this study is 'Smart city' with a total usage of more than 150 times and is most relevant as shown by a dark blue line diagram. In the next sequence are the words "Indonesia" with an occurrence quantity of more than 100 times, but less than 150. Then, some of the highest words with an occurrence quantity below 50 are sustainable development, urban growth, internet of things, and Jakarta.

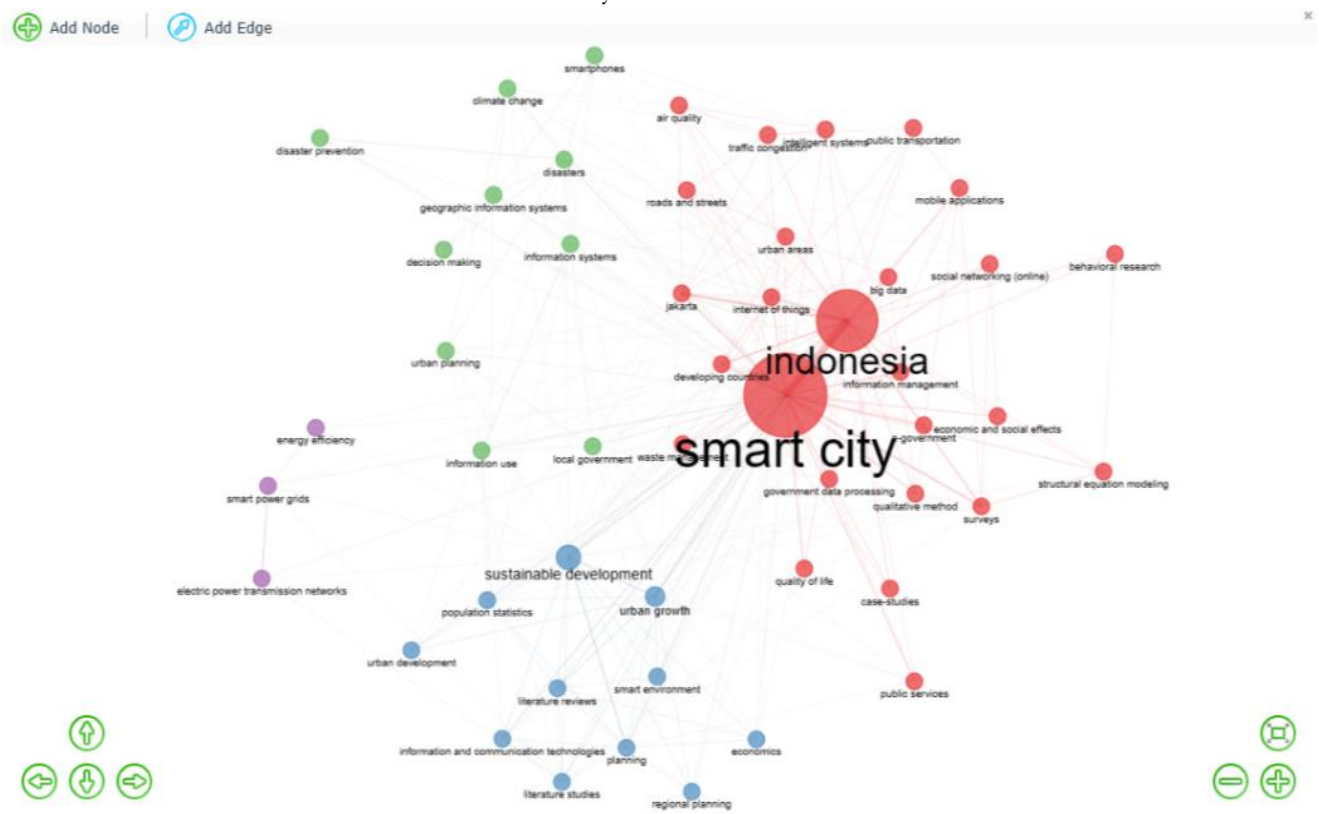


Figure 3: Word Clustering

Word cloud, word tree map and clustering above reveal a description of the words that often appear in the data collection paper under the theme of Smart city in Indonesia in different forms, but the results are the same, namely the words that appear most often in a row, namely: 'Smart city, Indonesia, sustainable development, and urban growth'.

The Word cloud displays an overview of words with various sizes according to the quantity of the number of words appearing. In terms of placement, the word cloud tends to be random, but the dominating words are placed in the middle so that they are more visible with their large size.

Meanwhile, the Word Tree Map displays words that often appear in boxes similar to regions on the map, where the more words appear, the larger the square area. The clustering displays the words in colored clusters by considering the relationship between one word and another.

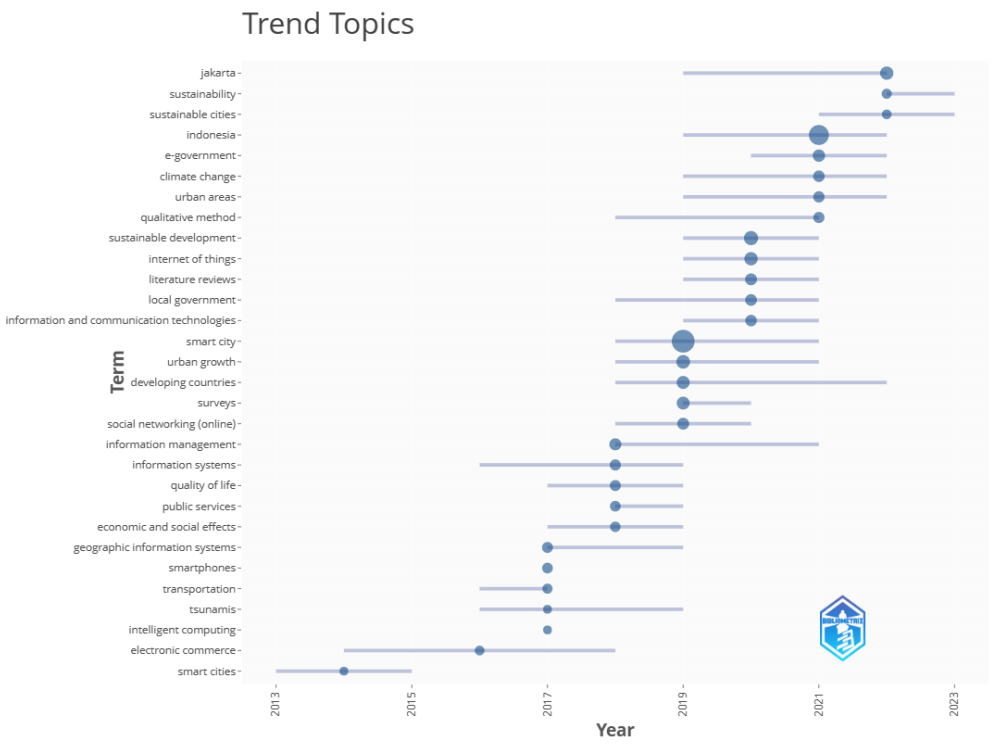


Figure 4: Trend Topics

Topic trends are also a part of this research, where the picture above shows an overview of the development of topics from time to time by division per year, so that it is known what topics have been used for a long time and what topics have been recently used. The emergence of topics is also adjusted to the frequency of the quantity of the word appearing in this research on the theme of Smart city in Indonesia, the higher it indicates that the more words are used, and the to the right, the more recent the word is used. The development of the topic began to experience a significant increase since 2013.

Based on the data above, the topics used since the beginning of the development of the theme of Smart city in Indonesia is 'smart cities'. There are two reasonably consistent topic, namely electronic commerce dan developing country. The reason for this is because these two topics are used most frequently, which is 5 times compared to other topics. Then, topics widely used in 2023 include sustainability and sustainable cities.

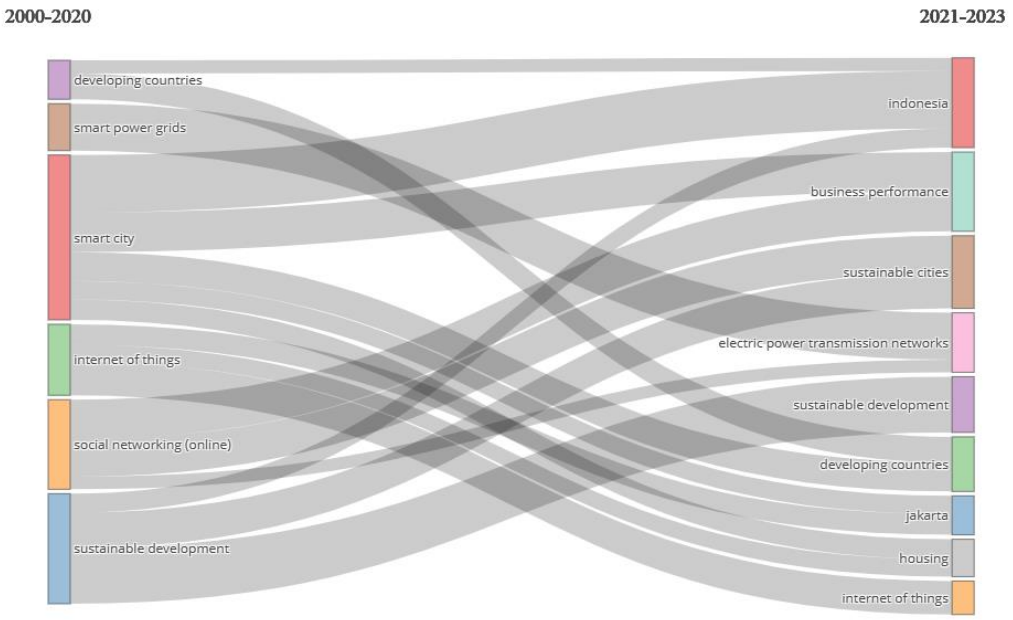


Figure 5: Thematic Evolution

The themes used in papers that are the object of research continue to change, especially from papers that have recently been published when compared to papers that have been published for a long time. The evolution of the theme is shown in the image above. Although the theme of this research is Smart city in Indonesia, this data shows several sub-themes that are widely used. The left side shows some of the themes that are widely used from 2000 to 2020, there are 6 themes listed with different sizes depending on the quantity of use of the theme. The theme "Smart city" took first place, followed by other themes.

The second part or the right part shows some of the themes that were widely used from 2021 to 2023. Some of the themes that emerged during this period were an evolution from the previously used themes and had some connection in their content. In this section, the most widely used theme are 'Indonesia, business performance, sustainable cities'.

## Findings

**Table 3:** Findings

| Rank | Keywords occurrence | Highest authors publication | Journals with the highest publication |
|---|---|---|---|
| 1 | Smart city | Rachmawati R | IOP conference series: earth and environmental science |
| 2 | Indonesia | Supangkat SH | Sustainability (Switzerland) |
| 3 | ICT | Susanto TD | International conference on ICT for smart society, ICISS 2016 |
| 4 | Urban | Arman AA | Journal of physics: conference series |
| 5 | Covid-19 | Darmawan AK | ACM international conference proceeding series |
| 6 | IOT | Fatimah YA | Procedia manufacturing |
| 7 | Bandung | Ghiffari RA | Proceeding - 2018 international conference on ict for smart society: innovation toward smart society and society 5.0, ICISS 2018 |
| 8 | Quality of Life | Muda I | Proceeding of 2017 international conference on smart cities, automation and intelligent computing systems, icon-sonics 2017 |
| 9 | Sustainability | Nasrullah N | International conference on ict for smart society, ICISS 2017 |
| 10 | Smart Governance | Santosa E | International conference on information technology systems and innovation, icitsi 2017 - proceedings |

The results of the research above show bibliometric analysis using the biblioshiny from journal articles that are digital object identifier (DOI) equipped in the Smart City in Indonesia theme indexed by the Scopus database. From the bibliometric analysis, it was found that research related to smart cities is still growing and becoming an interesting discussion, as evidenced by the development of topics relevant to the topic of smart cities. Based on the three field plots in Figure 1, apart from the smart city topic that is the theme of this research, other topics that have a connection to the smart city research theme that have been sorted based on the most usage by researchers are 'Indonesia, ICT, Urban, COVID-19, and IOT'.

So far, there is no exact definition of the term smart city. From some previous research, there are varied definitions, some of which include the popular smart city definition from Giffinger et al. (2007) "smart city is a city well performing in a forward-looking way in economy, people, governance, mobility, environment, and living, built on the smart combination of endowments and activities of self-decisive, independent, and aware citizens". According to Caragliu & Del Bo (2009), smart city refers to city management using ICT to improve the economy, quality of life, and natural resource management through good and participatory governance.

In another definition, the Bandung Institute of Technology, through the Smart City and Community Innovation Centre (SCCIC ITB), has formulated the definition of a smart city as "a city that can improve the quality of life of its citizens by managing all its resources effectively and efficiently through innovative, integrated, and long-term solutions" (Firmanyah et al., 2017). A smart city is a concept of urban transformation that should aim to achieve a more environmentally friendly

city with a higher quality of life that offers economic growth opportunities for all its citizens while taking into account the distinctiveness of each region and its existing population (Toli & Murtagh, 2020).

From this definition implies that a smart city is a city concept that applies information communication technology (ICT) by involving various aspects, such as economic, social, and sustainability (O'grady & O'hare, 2012; Iker et al., 2016). ICT as one of the supports of smart cities can be used as an effort to build the bridge and connection between citizens, government, and other stakeholders (Kusumastuti et al., 2022), which is then applied in the form of interaction and responding to each other (Yeh, 2017; Soyata et al., 2019). This is important because cities often have insufficiently understood the needs of their citizens and lack of motivating their citizens toward productive and positive behaviour (Gao et al., 2020; González-Zamar et al., 2020) (Kusumastuti et al., 2022). In addition, citizen engagement in policy and decision-making is also rare (González-Zamar et al., 2020).

In the smart city concept, maximizing the application of ICT in many public services is critical. It is because the idea of smart city is not only the capacity to automate activities such as public services or traffic systems, but also the ability to monitor, analyze, and build city management systems in real time to improve efficiency, social equality, and quality of life (Batty et al., 2012; Hasmawaty et al., 2022). Andrea Caragliu et al. (2011), in their research, provide characteristics of smart cities that distinguish them from conventional cities. These characteristics are development based on economic growth; utilisation of technology infrastructure and computer networks; increased role of the technology industry and creative industry in development; community participation in the implementation of development and public services; and sustainable natural resource and environmental management. In other words, smart city concepts are concerned with increasing the quality of public services (Hasmawaty et al., 2022).

The following are some previous studies that apply different methods and approaches in developing smart cities that are adjusted to the conditions of provincial, city, and district governments around the world (Hasmawaty et al., 2022). First, the research conducted by Mora et al., (2019) used information, communication, and technology (ICT) innovations for a sustainability approach to encourage environmentally friendly waste management and reduction with a mobile-based e-waste information system development strategy. In another study, Duan et al., (2019) employed a people, society, and technology approach. Evans et al., (2019) utilised a green information technology approach to developing an environmentally friendly-based smart city strategy. Xie et al., (2019) have successfully used the features of blockchain to improve smart city services and promote smart city development. The latter research also examined how blockchain technology is applied to smart cities in the world.

**Table 4:** Previous studies on green smart cities in Indonesia

| No | Dimensions | References |
|---|---|---|
| 1 | Governance, Branding, Economy, Living, Society, and Environment | (Larasati et al., 2018) |
| 2 | Tourism, Health, Safety and Security, Government, Energy, Environmental, Circular Economy, and Education | (Mahesa et al., 2018) (Kurniawan et al., 2020) |
| 3 | Services, Resources, Architecture, and Goals | (Achmad et al., 2018) |
| 4 | Academic, Business, Government, Community Partner, and Media | (Effendi et al., 2016) |
| 5 | Environment Regulation, Availability of Green Space, Pollution, Investment, and Energy Efficiency | (Afrianto & Tamnge, 2015) |
| 6 | Human Resource Capability | (Rachmawati, 2019) |
| 7 | Social and Political Approach | (Suartika & Cuthbert, 2020) |
| 8 | Environment, Social, Culture, and Economic | (Hayati et al., 2020) |
| 9 | Pollution Prevention, Product Stewardship, and Clean Technology | (Hasmawaty et al., 2022) |

*Source: Hasmawaty et al. (2022)*

Meanwhile, the smart city concept that is currently being developed in Indonesia is the green smart city. This can be seen from several previous studies. For example, Rachmawati (2019) developed ICT-Based Innovation in the Smart City Masterplan and Its Relation to Regional Planning. The case studies used

were two districts in Indonesia, namely Kendal and Blora districts which are part of the Central Java province. Furthermore, Hayati et al. (2020) proposes "smart cities" as environments of open and user-driven innovation based on field trip observation for further urban development that integrates the local potential aspects including local innovation strategies for the environment, people, living and building heritage which is closer to Human Driven Method (HDM).

Hasmawaty et al. (2022) present a case study on public services of South Sumatra government programs in order to develop a green smart city concept by combining smart city and green IT concepts which aim to align and incorporate green IT components, including pollution prevention, product stewardship, and clean technology into conceptual variants, essential elements, and strategic principles.

The concept of green smart city is a relatively new concept that is gaining popularity in Indonesia. It is a type of smart city that focuses on sustainability and environmental protection. Green smart cities use technology to improve the efficiency of resources, reduce pollution, and promote a healthy environment.

**Lessons for Sumatra**

The development of Smart Cities varies depending on local factors, local government policies, and the level of technology adoption. More specifically about Smart Cities in Sumatra, several cities have implemented information and communication technology to improve the quality of life, efficiency of public services, and environmental sustainability (Hasmawaty et al., 2022; Mahesa et al., 2019; Sanjaya et al., 2018).

Sulaiman & Adiwinoto (2018) discuss the design of an ontology for semantic web-based tourism information to support Pangkalpinang in the development of Smart City. The results of the study indicate that ontology can be used to improve the quality of tourism information in Pangkalpinang.

Annisah (2017) proposes a Smart City planning: Smart Governance of Mukomuko District Government. The results of the study indicate that Smart Governance can improve the quality of public services in Mukomuko District.

Triyanto et al. (2022) examine Collaborative Governance in Bengkulu City, Indonesia. This study uses qualitative methods. The results of the study indicate that Collaborative Governance can improve the effectiveness of Smart City development in Bengkulu City.

Anwar (2019) examines the implications of Smart Environment on Old Palembang Cultural Heritage Places. This study uses qualitative methods. The results of the study indicate that Smart Environment can enhance the tourist appeal of cultural sites in Palembang.

Meiwanda (2020) examines the challenges of Smart City: Local government in Pekanbaru City and the community. This study uses qualitative methods. The results of the study indicate that the challenges of Smart City in Pekanbaru City are the lack of support from local governments and the community.

Adela et al. (2020) examine Digital Democracy and Regional Autonomy: Opportunities and Challenges Implementation of Medan Smart City Policy. This study uses qualitative methods. The results of the study indicate that Digital Democracy can improve public participation in the development of Smart City in Medan.

Sulistyaningsih et al. (2023) examine Smart City Policy: Strategy and Implementation to Realize Smart Urban Governance in Indonesia. This study uses qualitative methods. The results of the study indicate that Smart City Policy can improve the quality of public services and sustainable urban governance.

Handayani et al. (2021) examine the problem of realizing Smart City policies in Indonesia: The case of Bandar Lampung City. This study uses qualitative methods. The results of the study indicate that the problem of realizing Smart City policies in Bandar Lampung City is the lack of support from local governments and the community.

Sukmawati & Sari (2022) examine Smart City Masterplan Policy Innovation In Public Service Development In The City Of Padang Panjang. This study uses qualitative methods. The results of the study indicate that Smart City Masterplan can improve the effectiveness of public services in Padang Panjang.

Suhendra & Ginting (2018) examine Local government policies in the development of Smart City in Medan City. This study uses qualitative methods. The results of the study indicate that local government policies in the development of Smart City in Medan City are not yet optimal.

Sholeh & Firman (2022) examine Adoption and Diffusion of Urban Policy Innovation in Kepulauan Riau. This study uses qualitative methods. The results of the study indicate that the adoption and diffusion of urban policy innovation in Kepulauan Riau are not yet optimal.

Overall, the studies show that the development of Smart Cities in Sumatra is still in the early stages and faces various challenges, such as the lack of support

from local governments and the community, as well as the lack of resources. However, the studies also show that Smart Cities have the potential to improve the quality of public services and sustainable urban governance.

The development of Smart Cities in Sumatra is still in its early stages, but there are a number of lessons that can be learned from the experiences of cities in the region. One key lesson is that the development of Smart Cities requires a holistic approach. This means that it is not enough to focus on technology alone. Instead, it is important to also consider the social, economic, and environmental impacts of Smart City initiatives. Another important lesson is that the participation of local stakeholders is essential. This includes citizens, businesses, and government agencies. By working together, these stakeholders can ensure that Smart City initiatives are aligned with the needs and priorities of the community.

Smart City projects can improve the quality of life for citizens in a variety of ways. For example, Smart City projects can be used to improve public transportation, traffic management, waste management, water management, and e-government. The development of Smart Cities can face a number of challenges, including a lack of support from local governments and communities, as well as a lack of resources. Smart City policies can be effective in improving the quality of public services and sustainable urban governance.

Based on these lessons, there are a number of recommendations for the development of Smart Cities in Sumatra. These recommendations include: (1) The development of Smart Cities should be guided by a clear vision and strategy that is aligned with the needs and priorities of the community, (2) The participation of local stakeholders should be ensured throughout the development and implementation of Smart City initiatives, (3) The development of Smart Cities should be supported by adequate funding and resources. By following these recommendations, Sumatran cities can build sustainable and impactful Smart Cities that improve the quality of life for their citizens and address urban challenges.

By leveraging information and communication technology, cities in Sumatra can improve the quality of life for their citizens and address urban challenges. The development of Smart Cities is not just about technology, but also about public participation in planning and decision-making. In addition, regulatory, infrastructural, and budgetary factors also play a crucial role in realizing the vision of Smart Cities.

The development of Smart Cities in each city in Sumatra is constantly evolving to meet local needs and the level of technology adoption. Local governments, academic institutions, and the private sector all have a role to play in driving innovation and development of sustainable and impactful Smart City concepts.

# CONCLUSION

This bibliometric study contributes to a comprehensive understanding of the Smart City research landscape in Indonesia. The examination of various bibliometric indicators and visualizations provides valuable insights into the key themes, trends, and collaborative networks that shape the discourse surrounding Smart City development. The prominence of keywords such as "smart city," "sustainability," and "urban growth" underscores the multidimensional nature of Smart City initiatives, encompassing technological innovation, environmental sustainability, and urban planning. The visualization of collaboration networks highlights the interconnectedness of researchers and institutions working towards the common goal of addressing urban challenges through innovative technologies. In the other hand, the development of Smart Cities in Sumatra is still in its early stages. However, there are a number of studies that have been conducted on the topic, and these studies have shown that Smart Cities have the potential to improve the quality of life for citizens and address urban challenges. Some of the specific areas where Smart Cities can be beneficial include public transportation, traffic management, waste management, water management, e-government, health information, and security. By identifying research trends and collaborative networks, this study provides a foundation for informed decision-making and strategic planning in the context of Smart City development in Indonesia.

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