

SUSTAINABLE PLANNING AND DEVELOPMENT OF SMART CITY

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Abstract. This study aims to provide a comprehensive understanding of sustainable planning and development strategies for smart cities by conducting a systematic literature review of research published in reputable international journals. The analysis was carried out using the Scopus database, focusing on studies published in 2020 that examined the relationship between urban planning, sustainable development, and smart city implementation. A total of 270 relevant articles were identified and analyzed using bibliometric techniques with the VOSviewer software to map keyword networks, thematic clusters, and research trends. The findings reveal four dominant thematic clusters: (1) governance and implementation challenges in smart city planning, (2) infrastructure and digital services, (3) sustainability frameworks and policy objectives, and (4) information systems and citizen engagement. The study highlights that sustainable smart city planning requires integration across governance, technology, environment, and social participation dimensions. Moreover, the research indicates that effective planning and development depend on adaptive policies, data-driven decision-making, and multi-stakeholder collaboration. Despite significant progress, disparities in technological infrastructure and governance capacity remain critical challenges, particularly in developing countries. This paper contributes to the conceptual and methodological advancement of smart city research by mapping global knowledge trends and proposing future research directions for sustainable urban development.

Keywords: smart city, sustainable development, urban planning, bibliometric analysis..

I. INTRODUCTION

Globalization has implications for the very rapid development of Science and Technology (IPTEK). The projection of smart city development is an innovative effort made by urban ecosystems in overcoming various problems and improving the quality of human and community life. It is undeniable that the latest products are starting to emerge, causing the stigma of modern society to shift and the meaning of being a digital society being expanded. Over time, many countries have begun to look at the use of information technology to provide maximum and even optimal public services. The implementation of information systems and communication technology is growing very rapidly in the world of bureaucracy and companies [1]. The problem of the flow of urbanization gives birth to new problems for urban areas starting from waste, education, transportation, socio-economic, disaster, and health. On the other hand, an increasingly modern and well-established society has a myriad of expectations, such as a comfortable living and work environment, adequate public areas, and the ease of managing all forms of public services. The concept referred as a smart city is a concept that presents a smart city arrangement that can play a role in making it easier for people to get information quickly and precisely. The smart city concept is presented as the answer for efficient resource management. It can be said that the concept of a smart city is the integration of information directly with urban

communities. According to Kominfo in Susanto (2009) there are 6 dimensions to a smart city, including smart governance, smart branding, smart economy, smart living, smart society, and smart environment. The big cities in the world make this dimension as the foundation for a smart city. To support various urban infrastructure development activities and provide good services to the community, local governments need adequate technology to carry out all of their activities. In order to create a global, competitive society, as well as a smart and livable city, the government as a stakeholder must determine the right policy by preparing a quality future city development concept, which is called Smart City. The concept of a smart city is predicted to be a solution to the problem of urban development in the region. Smart Cities are designed to be able to increase the productivity of people who live there, resulting in the arrangement and management of the city that is carried out by utilizing information and digital technology optimally in all aspects. Starting from the building management system, environmental quality management, and public services. In short, the city is developed into an engine of economy and productivity which in turn makes the people healthy, productive and prosperous. The difference between this study and other previous studies is related to the focus of the study. The previous studies focused more on smart city development strategies, while this study focused on examining how the transformation of planning and smart city development.

The concept of realizing a smart city affects various things. Along with the increasing demand for energy for various purposes, intelligent multi-energy systems have become a trend in urban development. In such a smart environment, it is possible and important to consider traffic flow guidance for electric and non-electric vehicles in urban transport networks.[2]]. This illustrates that there are challenges in the planning process to realize a smart city, especially regarding the arrangement of the multi-energy system planning concept. This study focused on future transportation management factors, natural gas energy reserves, and distribution networks. The first is about integrated energy station infrastructure, meaning the need for media or connecting components whose purpose is to convert energy sources to what is needed, distribute energy and store energy reserves. This study is more about how to optimize investment and operational strategies for renewable energy generators, energy converters, storage devices, and charging facilities in a coordinated manner. If the concept of the study is implemented in a structured and massive manner, it enables the flow of non-electric vehicles and its navigation to charging facilities can be incorporated into the concept of future transportation with renewable energy.

Related articles discussed [3]. With today's global urban problems such as climate change, urbanization, and energy problems, smart cities are proposed as one of the solutions in urban planning. This study introduces smart city initiatives in South Korea by examining the recent history of smart city policies and their limitations. This case study reflects the experience of one of the fastest growing countries to build smart cities as their main national industry to drive economic growth. It also analyzes smart city trends using big data analysis techniques. Despite obstacles such as economic recession, failure to distinguish cities, low service level of the expected smart city functions, we can recognize the current status of smart city policies in South Korea such as 1) Korea's smart city development project is actively implemented, 2) The public consensus suggests that the application of advanced technology and the active role of the government needs, 3) A comprehensive and strategic approach with integration and the application of advanced technology is also required, 4) Investment by the private and public sectors is necessary to provide social improvement. This study suggests the future direction of smart city governance in South Korea as a reference for smart city planning and development in the world.

The path of smart city development is highly dependent on the specific conditions of the city. In order to be successful in managing smart city projects, it is important to understand the conditions of urban development, which involve multiple parties (community, government, private) that can control digital, physical, and human infrastructure and the context of the city's circumstances such as geographic, demographic, and structural at the city level. Although many studies have investigated the management-related dynamics that are intrinsically linked to smart city development, they have not considered the influence of urban contextual elements [4]. Therefore, it is still become a challenge to understand how contextual factors specifically affect the dynamics of smart city development. To address

this issue, previous researchers built a structural equation model (SEM) to measure the dynamics of a manageable smart city and to assess the maturity level of enablers and the level of achievement of performance goals in 50 smart cities. Then, the study analyzed the evolutionary trend of these evaluation scores under the influence of urban contextual variables. The results show the specific effects of economic development, geographic area, density, and size of smart cities on their maturation.

Talking about transportation, especially in the large cities in the world, it has an impact on the quality of oxygen. Where today's vehicles are still dominated by fossil fuel vehicles. Moreover, fossil resources are also decreasing day by day, therefore the innovation of resources that are electrical in nature may becomes recommendation for transportation resources in the future. The development of electric vehicles (EV) is driven by the need for a cleaner and more efficient road transport, but vehicle charging poses a significant challenge to power grids and electricity sector planning [5]. Researchers are more concerned about what if the concept is brought to an archipelagic country with a dense population. The researcher chose Singapore as an example, with a limited space as an option for planning the electricity sector. This study describes the impact of the deployment of electric vehicles if they have mushroomed, meaning that in this situation the majority of people are already using electric vehicles. Researchers found that if electric vehicles are widespread, of course, it will have an impact on the electricity sector regardless of the state of the development of modern technology. Viewed from the perspective of urban planning that has a large quantity of electric vehicles, it is necessary to think about the infrastructure of energy sources from a technical and economic perspective. The travel time constraint for the road transport network is very important [6]. This problem is actually very attached to big cities, because many people choose private vehicles. The government should implement the smart city concept, not just focus on the study of renewable energy. However, regarding the ongoing traffic jams, the focus of the researchers is more on evaluation in order to improve congestion factors, reduce private vehicles, and encourage people to use public transportation.

It is undeniable that as the world's population increases, the waste will increase too. Especially if we look at the situation in Indonesia, especially the DKI Jakarta which most of the people already have a pragmatic tradition, so that waste is everywhere and ignored. With the continuous progress of urbanization, the disposal of urban solid waste has greatly affected human production/life and social ecological health, and waste disposal has become one of the major problems worldwide [7]. This study focuses on smart technology, related to renewable innovations regarding the waste development process by prioritizing the principles of smart city development and discussing what are the needs of sustainable development strategies. Researchers propose an intelligent urban waste disposal process using robotic operating system ROS (Route Operation System) and RRT (Rapid Exploration of Random Trees) path planning algorithm. The process of running the system is done by managing data management per family. Automatic waste

disposal will directly carry out automatic communication from homes where the waste is deemed full enough to be directly connected to the garbage collection vehicle (WCV) and then an automatic carry out will be done by the WCV. The system is added with IoT (Internet of Things). This system gives scientific data support for smart environmental layout with a better ecosystem development.

China as the largest population in the world, of course, has many challenges if we talk about urban environmental management. Of course, if we correlate it with the development approach, the government is required to meet the needs of its people and develop the concept of smart city energy (SEC), because it cannot be denied that over time the need will increase and cities are forced to adapt by emphasizing smart cities for the future. With the serious challenges of urbanization and energy, China can provide a prominent case for further deepening understanding of this concept in the backdrop of a rapidly developing country [8]. This study emphasizes the context of the recommendation of a new concept of smart city (SET) against the background of the implementation that has been carried out by China. In this study SEC is found. SET emphasizes the importance of carrying out energy development and planning to address the challenges of urbanization, as well as demonstrating on business model innovations to support economic development. Of course there are obstacles in this development process, namely in the planning process and policy support. This is due to a lack of funding for projects and the capacity of local companies to carry out the development process. Hopefully the government and the private sector will collaborate hand in hand by strengthening planning and investment in every region in China to promote the SET project.

Future cities in the Southern World will not only rapidly urbanize, but will also become warmer from the impacts of climate change and urbanization [9]. It is undeniable that the southern states have high temperatures, of course with these climatic conditions it has positive and negative impacts. The negative impact is that the demand for coolers will increase manifold due to hot temperatures, and of course the demand for energy sources will increase. But on the other hand this also has a good impact, by utilizing the potential of sunlight as an energy source, by placing the tool on the roof of the house. This enables photo-voltaic (PV)-based decentralized energy and optimized application for various peer-to-peer environmental areas. This study found that cooling energy can be reduced by up to 80% if it is balanced with the utilization of the sun's potential as energy.

This is related to the rapid development of information and technology in today's era, so that the demand for needs also increases. Creating a smart e-city requires a full participation of city management organizations in various sectors [10]. This study explains who the key factors in smart city transformation are. As the role of the government here is very central where the government must encourage the project or support it by making policies and regulations that can cover smart cities. The application of the smart city approach as a sustainable system for the management and delivery of infrastructure development is increasing, especially in developed and some

developing countries [11]. However, this study emphasizes the resilience factor in the scope of smart cities. The factors that influence the resilience of smart cities are climate, education, food security, community security, and the threat of disease. The most serious are related to the development of literacy and technical skills of residents, regeneration of agricultural land, and local food production. Eradicating poverty, reducing inequality, and achieving economic prosperity and well-being are global challenges [12]. Village as a small part of a city also needs attention from the government as a smart village through an approach of discovery, planning, resources, and implementation. When this approach is implemented with integrity, it can certainly lift and develop smart villages in the future.

The way residents interact with the city affects the overall quality of life. Their participation in social decisions is critical to assisting public decisions that affect governance, regulation and education [13]. With the reality of today's society that looks at the world of blockchain, which is able to encourage social and economic use of Information and Communication Technology (ICT). However, the government as a policy maker still doubts if blockchain can boost the economy. Therefore, this study will explain the intensity that occurs from the use of transparent and sustainable technology in the concept of the city in the future.

The ongoing Covid-19 outbreak has caused various activities to be hampered. Of course we are obliged to keep our distance from each other. The government certainly has to work extra in monitoring, especially in public places. Therefore, there is a need for tools that can monitor the community in a state of the Covid-19 outbreak. More precisely, data-driven smart applications that efficiently manage scarce resources offer a futuristic vision of smart, efficient and secure city operations [14]. Researchers provide recommendations to reduce COVID-19 through mass video surveillance by using a monocular camera, which is then identified and validated anyone who commits a violation. It becomes important to categorize complete urban planning scenarios for architecturally, socially, and economically viable cities due to the unbearable population growth [15]. The researcher suggests that the smart city concept opens up opportunities for integrated sustainability hybrid developers who broadly implement three main parameters regarding social, economic, and environmental components for sustainability.

II. RESEARCH METHODS

This study aims to examine various scientific articles that discuss plans related to smart city development that have been published in reputable international journals. Furthermore, the review article in this study is directed at the conceptual study of the relationship between planning and smart city development which will be explained through the following questions, namely: (1) What is the relationship and clustering between planning and sustainable development of smart cities? (2) What are the dominant themes in the study of the relationship between planning and sustainable development of smart cities? (3) What are the topics related

to the study of the relationship between planning and sustainable development of smart cities? (4) What type of mapping is used in the study of the relationship between smart city planning and development? (5) What concepts are used in the study of the relationship between smart city planning and development? Some of the questions above will be explained based on the topic of the study, framework, and some previous research findings that have been indexed in the Scopus database. Articles that will be reviewed in this study will go through several stages (1) Article search and (2) Topic Mapping.

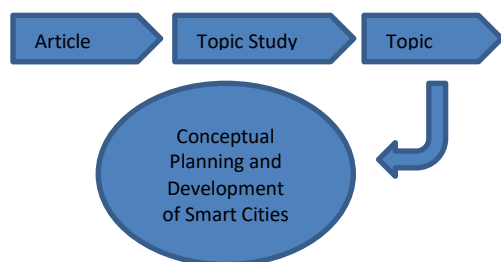


Figure 1. Article review process

This article was searched through several stages. The first stage is to identify articles, then the articles are taken from publications of various publishers using the SCOPUS database. The next step, the researcher entered the keyword "Smart City Planning Development" and only took articles published in 2020. The search resulted in a display of 270 articles relevant to the topic of this research. This figure is obtained from the number of files in the form of (.ris) which are then exported into Mendeley software.

III. RESULTS AND DISCUSSION

In this section, the researcher performs bibliometric analysis with network, overlay, and density visualization using VOSviewer to obtain information on the bibliometric network that exists among previous downloaded articles. It should be noted that this bibliometric network consists of nodes and edges. Nodes are depicted through visualizations whose contents are journals, researchers and keywords. While the edge describes the relationship between pairs of nodes. Edge not only serves to describe the existence of a relationship, but also describes the strength of the relationship which is represented by distance. The closer the distance of the node to other nodes, the higher the relationship. The following are the results of network visualization, overlay, and density based on the relationship and grouping of keywords. In the network visualization (figure 2), each circle represents a keyword taken from the title and abstract of the article. By visualizing the size of the circle, it means that the number of journal publications that have a relationship with the keyword, both in journals and journal abstracts. The larger the circle size, the greater the number of articles that have relevance to these keywords. From the results of the analysis, it was found that there were 75 articles out of a total of 146 which were further identified

into 4 clusters. Each cluster is represented by a different color which is used to see a list of dominant concepts from each cluster. With this classification, the aim is to identify how many themes are often discussed in previous research.

TOPIC 1: Keyword Linkage and Grouping

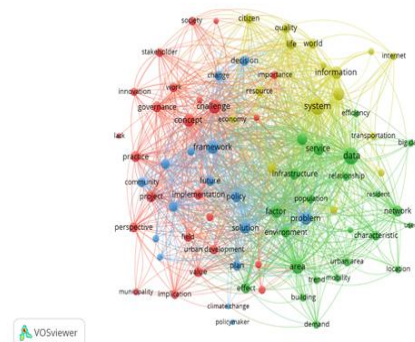


Figure 2. Network visualization on mapping and clusters of 75 articles that have been identified

According to Figure 2, it can be seen that cluster 1 represented by a red circle, which includes the challenge keyword; concepts; economic development; fields; governance; implementation; importance; investment; lacks; municipality; perspective; practice; projects; regions; smart city concept; smart city development; society; stakeholders; urban development; urban environment; values; work. Cluster 2 in green includes area keywords; big data; characteristics; comparison; data; demands; effect efficiency; environment; factors; infrastructure; location; mobility; networks; population; relationships; residents; services; trends; urban areas; urban planning; users. Cluster 3 is blue which includes the keyword change; climate change; community; decisions; frameworks; futures; goals; opportunities; plans; policies; policymaker; problem; solutions; sustainability; sustainable development. The 4th cluster in yellow includes the keyword application; citizens; economy; effectiveness; information; integration; Internet; life; performance; quality; resources; sustainable development; systems; transportation; urbanization; world.

Table 1. Grouping of themes in the relationship between planning and sustainable development of smart cities.

Cluster	Concept Name	Total
Cluster 1	Challenge, Concept, Economic, Developemnt, Field, Governance, Implementation, Importance, Investment, Lack, Municipality, Perspective, Practice, Project, Region, Smart City Concept, Smart City Development, Society, Stakeholder, Urban Development, Urban Environment, Value, Work.	22
Cluster 2	Area, Big Data, Characteristic, Comparison, Data, Demand, Effect, Efficiency, Environment, Factor, Infrastructure, Location, Mobility, Network, Population, Relationship, Resident, Service, Trend, Urban Area, Urban Planning.	20
Cluster 3	Change, Climate Change, Community, Decision, Framework, Future, Goal, Opportunity, Plan, Policy, Policymaker, Problem, Solution, Sustainability, Sustainable Development.	15

Cluster	Concept Name	Total
Cluster 4	Application, Citizen, Economy, Effectiveness, Information, Integration, Internet, Life, Performance, Quality, Resource, Sustainable Development, System, Transportation, Urbanization, World.	16

In this section, the first cluster will explain the challenges and implementation in smart city planning and development. The article that is considered related to the first cluster is "Challenges and Solutions for Organizational Design in Urban Digitalization" written by [16]. This article discusses the challenges and solutions for smart city development. Result of the research conducted by [16] shows that investment and policy-making are very central in the transition to smart city development. Therefore, early planning must be conceptualized with integrity, especially for stakeholders. However, previous researchers forgot the participation factor of the community where the community here can be said to be connoisseurs of service, which can be used as a check and balance to see how far the projections of planning and sustainable development are. In addition, articles of the same nature as the first cluster of [17] entitled "The Smart City as Mobile Policy: Insights on Comtemporary Urbanism" which explains that the mobility of an intensive, quality policy allows it to answer the challenges of urban problems. This means that regulatory factors affect how smart cities run. It can be said that in the world, the stigma of smart cities only regarding on the transparency of government information that has not yet reached the overall social activities of the community, for example including transportation infrastructure and manufacturing, optimizing renewable energy for households, and easy access to public services.

The second cluster related to services and infrastructure. The article relevant to the second cluster is "Optimal Design of Energy Storage System to Buffer Charging Infrastructure in Smart Cities". In research conducted by [18], it talks about the dramatic growth of electric vehicles (EVs), but in reality EVs have challenges such as (1) Energy gap in fuel stations due to high demand (2) Lack of infrastructure due to high construction costs. Researchers found innovations where there is a solution by bringing up electrical energy storage technology (large batteries), which are predicted to save 20% -36% for energy storage. In this case, it proves that planning is the most important in the development process. When the production of goods has been successful, likely the supporting infrastructure can become a problem. Since we find many development projections that are neglected due to the absence of sustainability, lack of funds or no benefits (profits for investors) when the projection is successful. In addition, there is a related research conducted by [19] entitled "The Transition From Traditional Infrastructure to Living Soc and Its Effectiveness for Community Sustainability: The Case of South Korea" Precisely in 2018 the South Korean government implemented a social overhead capital policy whose further impact of the policy can improve livelihoods by referring to the the concept of inclusive city, smart city, balanced development of metropolitan and provincial cities. Based on a review of the existing literature and relevant

policies from South Korea, researchers [19] explores the application of this policy and provides some suggestions for its sustainability by comparing the state of existing South Korean urban facilities and looking at the balance of facilities between metropolitan cities and provinces. This is used to distinguish the types of facilities that must be prioritized by the central and local governments. This article identifies stages and identifies existing facilities which intersect with the types of facilities proposed in the planning process. The results show that urban infrastructure in South Korea is well distributed between metropolitan cities and provinces. However, urban planning shows that there are shortcomings in that it can minimize the distance between public facilities and residential zones.

The third cluster deals with the objectives and factors that influence smart city planning and development. The article relevant to the third cluster study is "Exploring the Smart Future of Participation: Community, Inslusivity, and People with Dusabilities" written by [20] which explains that the use of technology affects the potential involvement of civil society, especially persons with disabilities since with technology anyone in anywhere can communicate. Regarding persons with disabilities, the researcher wants accessibility, usability and equality by accommodating a smart future framework that connects people with disabilities to services. Then related to policy, one article that is considered relevant is "Policy Framework and Mechanism of Life Cycle Management of Industrial Land (LCMIL) in China" [21] which discusses the improvement and optimization of industrial land use, this is a never ending problem if we mention urbanization and rapid population growth in urban areas. [21] focuses on the design of industrial land use policies against the backdrop of limited land in urban areas. The Life Cycle Management of Industrial Land (LCMIL) model consists of six stages, namely land transfer, land development, land use (development period), land use (maturity period), expiration of land contracts, and land withdrawals, is determined based on LCM theory and practical application in major cities in China. Shanghai was used as a case study to analyze the implementation and mechanism of LCMIL. The results show that a policy system involving third-level local government, as well as an evaluation system that includes economic, social, and environmental indicators can support the implementation of LCMIL and can increase industrial land use. Four key mechanisms are recommended, namely 1) Division into fixed stages and a clear mechanism for departmental responsibilities at different stages of land use; 2) Rigid and flexible evaluation mechanisms; 3) New land withdrawal mechanism based on environmental assessment; 4) Collaborative governance and information sharing based on big data. Our research not only provides innovative solutions to existing industrial land use policy challenges in China but also represents a new approach to applying LCM theory in public policy decision making.

In cluster four, the dominant keywords are systems and information. The article that is deemed relevant is "Digital Information Tools for Urban Regeneration: Capital's Approach in Theory and Practice" [22]. This research describes the state of the city slumped, and the need

for repair or renovation in all factors, particularly related to the governance structure and capital of the city environment. In addition, there is also the need for community participation, so that the quality of the environment and the quality of life of the community increases. With the presence of technology it is possible to promote the availability of public services, because on the other hand it affects the regeneration of urban conditions and systematizes existing digital information devices that can empower the regeneration process. The thing that is not forgotten in people's lives is about health in the smart city concept, that the world of health in today's era must optimize health care information strategies. This is considered to be able to reduce treatment costs without reducing service quality. The minimum cost of care is due to the proper evaluation of the use of health data information systems. The model is carried out by developing management accounting innovations, so as to help in making decisions regarding the allocation of resources and activities to each information system. In addition, one of the articles entitled "City Information Modeling: A Conceptual Framework for Research and Practice in Digital Urban Planning" [23] stated that digitalization is an urban development process driven by the need for informed, evidence-based, collaborative and participatory urban planning and decision-making, exemplified in the Smart City concept. This digital transformation is made possible by the development of information technology in various fields such as 3D city models, Digital Twins, Urban Analysis and Informatics, Geographic Information Systems (GIS), and Planning Support Systems (PSS). In this context, City Information Modeling (CIM) has recently emerged as a concept related to the various driving forces of these technologies. In this article, we review the state of the art CIM (definition and application) in the academic literature and propose a general definition and conceptual framework. [23] offers a context for transdisciplinary work, and a focus on integration challenges, for research and development, in both academia and industry. This will contribute to advance the debate on digitizing the development process of the built environment in the Smart City area.

After being classified based on clusters with Smart City Planning Development research, the articles are classified based on the year of publication. The data obtained from the overlay using VOSviewer can be used to identify trends regarding the relationship between planning and sustainable development. In this overlay visualization, node colors are used to represent a keyword and indicate the year the article was published containing that keyword. The darker the color, the longer the year the article was published. The overlay visualization below shows that key words such as challenge; infrastructure; projects; services; areas; plans; innovations; stakeholders; networks; concept was discussed in the early 2020 period. While the keyword solution; perspective; frameworks; governance; problem; citizens; systems; society; urban development; values; Information is widely discussed in the 2020 medium period. Next is the topic environment; futures; change; life; big data; sustainable cities; Economic development was widely discussed at the end of 2020. The following topics became the trend of

discussion in the concept of the relationship between planning and sustainable development of smart cities. From the results of the overlay visualization below, we can see all articles published in 2020. However, as a researcher, I divide the classifications of publications into early, middle and late periods. One of the articles that aligns with the keywords in the original article is "The Smart City as Mobile Policy: Insight on Contemporary Urbanism". The result of research conducted by [17] talks about smart city discourse about urbanism. Increasingly sophisticated technology makes information and transparency of a policy more mobile. Improved policy mobility allows the government to manage cities effectively and efficiently, also can cope the challenges of urban problems.

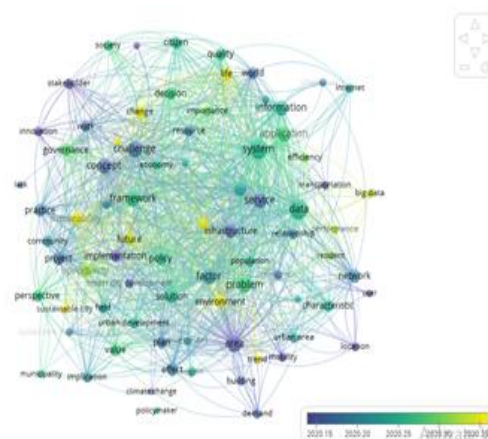


Figure 3. Classification of articles according to year.

In addition to the relevant article for 2020 mid-term "Moving Towards Smart Cities: Solutions that lead to the Smart City Transformation Framework". The authors [1] explain that urban development planning is driven by transparent, collaborative and participatory decision-making which is in line with the smart city concept. The transformations made possible by the development of science and technology such as 3D city models, Urban Analysis and Informatics Geographic Information Systems (GIS), and planning support systems (PSS). Furthermore, one of the keys that is widely discussed in the final 2020 period is the environment. One of the relevant discussions is "Developing WSN/BIM-Based Environmental Monitoring Management System for Parking Garages in Smart City". [24] states that building Information Modeling (BIM) in collaboration with a wireless sensor network (WSN) will make the technology have sensing and control capabilities located in parking garages with the aim of collecting carbon monoxide (CO), knowing and checking the temperature, and humidity in real time. Furthermore, after visualizing the overlay, the density visualization is done. This visualization shows that there are keywords that have stigma. This is seen from the thickness of the color. If the color of the circle is getting thicker, it indicates that the keyword is dominantly discussed by previous research related to the research topic.

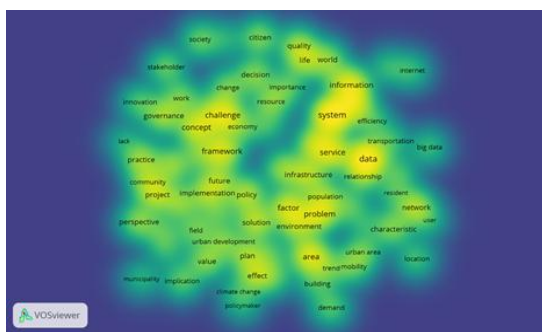


Figure 4. Density Visualization, Mapping and Clustering based on dominant keywords.

In accordance with the third picture, it can be seen that the dominant keywords include (1) System; (2) Data; (3) Information; (4) Problems; (5) Challenges; (6) Concepts. In the third picture, these keywords are often discussed by previous studies related to the topic of discussion of the relationship between planning and sustainable development of smart cities. Keywords about system and data are very important aspects in planning because without data and systems it is impossible for planning to be integrated and comprehensive. Other than that, the keywords factor and problem describe empirically where many cities in the world previously made the transition to smart cities. It is hoped that other cities can use this empirical study as a consideration for smart city planning and development. The last keyword is concept, which is useful to emphasize when a smart city project has been planned, such as the sustainability of supporting policies and supporting infrastructure. Whereas, the other keywords are only supporting keywords that have the same discussion objectives, so they support the dominant keywords, and vice versa.

TOPIC 2: Correlation and Grouping of Authors in the Relationship Between Planning and Smart City Development.

After visualizing the network, overlay, density related to the key, the next step conducted is visualizing network, overlay, and density regarding the author in research on planning and development of smart cities. The 4th image visualization depicts several authors who contributed and conducted previous research according to the relevant discussion topics according to the researchers' research on smart city planning development. It can be seen in the network visualization. There are 3 clusters consisting of 7 author items. Cluster 1 is red, cluster 2 is green, cluster 3 is blue.

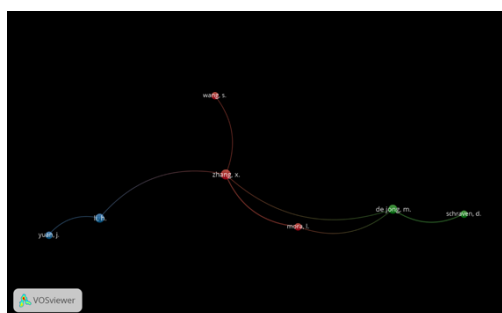


Figure 5. Network author visualization related to previous research.

In the first cluster, it is seen that Zhang X is the dominant author. Zhang X is an author who has written an article entitled "Understanding Intra-Urban Human Mobility Through an Exploratory Spatiotemporal Analysis of Bike-Sharing Trajectories". Result of the research conducted by [25]] describes a smart city but with an ecological approach where urban communities are mobile using bicycles, besides that the city government can carry out its role as urban development planning to promote green transportation and to reduce traffic congestion. In addition, in a relevant article entitled "Smart City Oriented Ecological Sensitivity Assessment and Service Value Computing based on Intelligent Sensing Data Processing". [26]] reveal that sustainable development and environmental protection using the sanshui river research area in Xunyi, which integrates the network system in the control center of the ecological space in the countryside.

Table 2. Author clustering

Cluster	Author Name	Total
Cluster 1	Zhang,x; Moral; Wang, s;	3
Cluster 2	De Jong M; Schavren;	2
Cluster 3	Yuan, j; Li, h;	2

In the second cluster, de Jong, m is the dominant actor. De Jong,m once wrote an article entitled "Input-Output Modeling for Smart City Development". [27]] express about the concept of a smart city by describing various aspects and developing it with an Input-Output model in policy making and analysis of appropriate development choices during planning to implementation, so that readers know the impact of a choice that has been made. It should be noted that the development of smart cities in this journal focuses more on dealing with challenges, such as climate change, air pollution, and congestion.

In the third cluster, the dominant actor is Li,h. [5] once wrote an article entitled "Impacts of Electric Vehicle deployment on the electricity sector in a strictly urbanized environment" which discussed the development of electric vehicles in order to create a clean environment. However, there is a problem where there are still obstacles regarding refueling electricity. Researchers think small area like Singapore with dense population conditions has a very limited space if it is used as an option for electricity development. In addition, another article entitled "An Intelligent Waste Removal System for Smarter Communities" reveals the conditions of continued urbanization until environmental problems related to waste. In the conceptual direction towards smart city development, the use of appropriate technology can be used as a solution to the problem of waste. This system model uses ROS (Route Operation System) robot operation and algorithms in accordance with RRT (Rapid Exploration of Random Trees) path planning. Then after the mapping and clustering of author with smart city research planning development is

done, the mapping of author based on publishing year will be carried out.

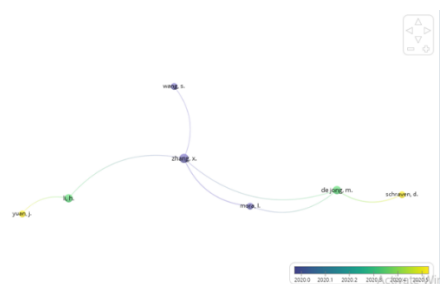


Figure 6. Visualization of the author's Overlay related to previous research by year classification

According to the overlay visualization in Figure 6, it can be seen that there are 3 clusters that all of them were published in 2020. The difference is the categorization of the early, middle, and final period. In early 2020, one of the articles published was "The Optimal Planning of Smart multi-energy System Incorporating Transportation, Natural Gas and Active Distribution Network", written by Wang, s. Then the article published in 2020 for the medium period is "Mapping the Knowledge Doman of Smart City Development to Urban Sustainability: A Scientometric Study", written by Li, p. Finally, for the late 2020 period, one of the published articles entitled "Past, Present, Future: Engagement with Sustainable Urban Development Through 35 City Lables in the Scientific Literature 1990-2019" which is written by Schraven, D.

After visualizing the overlay is done, the density visualization is carried out. Figure 6 shows the author's name which has a distinction from the thickness of the color. The thicker and lighter the author's color indicates that the author is dominant in previous research related to the topic of discussion.

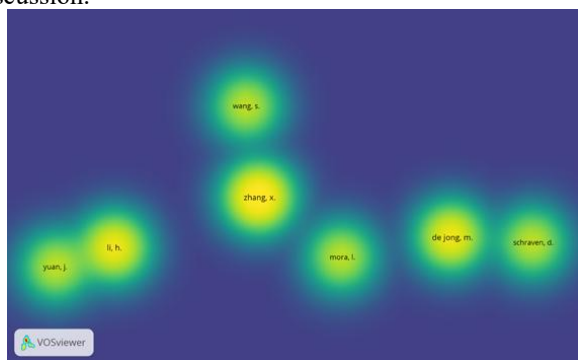


Figure 7. Visualization of Density Mapping and Clusters by dominant author.

Based on the density visualization data in Figure 6, it can be seen that the most dominant authors are Zhang, De Jong, m, and Li, h. The three authors are related to each other. Zhang often collaborates with L in writing for example in one of his articles entitled "Panoramic Visual Perception and Identification of Architectural Cityscape Elements in a Virtual-Reality Environment". In addition, De Jong, M often collaborates with N. Noori, and Janssen, which has been proven by the emergence of the journal "Input-Output

Modeling for Smart City Development". Then the article entitled "Mapping the Knowledge Domain of Smart City Development to Urban Sustainability: A Scientometric Study" written by li, h is done in collaboration with Z. wu, M. Jiang

IV. CONCLUSION

A smart city is a system concept that is located in a city where the entire existing system make it easier for all parties involved in a city. To create a smart city, it requires a common paradigm regarding a real smart city. In addition to the need for clear regulations, the need for direct regulation of smart cities requires good cooperation from several parties who both want to focus on the vision for smart city development as a public service to the community. From the results of research that has been taken from various library sources, it appears that China dominates in the advancement of smart cities. Viewed from the development of smart cities, the factors that cannot be separated are the use of information and technology facilities. Overall, the smart city concept has six characteristics, namely smart city, smart economy, smart mobility, smart environment, smart people and smart living. However, in reality the strategy in smart city development must adapt to the potential and conditions of each region. This is reflected in what happened in Korea, precisely in Soul, indeed smart cities have been implemented and run well, but there are problems related to community culture. There are many people who are not ready with the smart city concept. There are still many people who still live with the traditional approach. The limitations of this study are the lack of journal sources that match the title, so it is necessary to find new things to reveal problems in the smart city development planning process.

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