

ARTICLE

Building Urban Mobility through Smart Cities and Sustainable Policies

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ABSTRACT

This study examines how smart cities and sustainable policies build urban mobility. Research data from a highly reputable journal indexed by Scopus yielded 321 documents. The search criteria included the title-abs-key "urban mobility," document type "Article," subject area "Social Science," language "English," source type "Journal," and the exact keyword "urban mobility" for publications between 2019 and 2023. This research employed a qualitative approach with bibliometric analysis. Data analysis was conducted using VOSViewer and NVivo12 Plus software to visualise data in images and graphs. The research findings indicate that urban mobility is a pivotal consideration in urban development projects. The United States emerged with the highest focus on urban mobility, accounting for 47 publications, or 16% of the total. Recent research has particularly emphasised topics related to COVID-19, parking management, bicycle infrastructure, mobility services, mobility patterns, and sustainable urban planning, with a significant concentration in 2021. Notably, urban mobility initiatives have fostered collaboration, with a prominent partnership observed with Universidade de São Paulo (13 publications or 17%). These initiatives underscore the importance of establishing networks, groups, and services to advance the development of smart cities and sustainable urban policies.

A. INTRODUCTION

The city's rapid development makes the authorities synergise in building smart cities and sustainable policies to realise urban mobility (Lapinskaitė, Stasytytė, & Skvarciany, 2022; Van Der Berg, 2022). These issues and challenges are essential to provide protection rights to the public (Jonge, 2022). Plus, urbanisation continues to occur at a breakneck pace. The most significant sustainable challenge of the twenty-first century is likely to be urban, as three-quarters of the global population is projected to live in cities by 2050 (Devisscher et al., 2021). Cities cover about 3% of the land surface but account for 60-80% of energy consumption, 70% of carbon emissions, and 75% of resource consumption (Devisscher et al., 2019).

Urban mobility is an essential social resource and articulator in society because it is directly related to the movement of people between different socio-spatial hierarchies and the ability of change to move from one place to another (Costa, Neto, & Bertolde, 2017). Urban

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mobility is driven by technological developments expected to provide solutions that include socioeconomic and environmental perspectives (i.e., shared mobility, autonomous vehicles, and electrification) (Miskolczi et al., 2021). Meanwhile, sustainable policies encourage greater disclosure of big data and provide new opportunities to meet the demand for evidence-based policymaking (Liu & Dijk, 2022). The Organization for Economic Cooperation and Development (OECD) revealed that intelligent cities are effective initiatives or approaches utilising digitalisation to improve citizens' well-being by providing services and urban environments that are more inclusive, sustainable, and efficient through multi-stakeholder collaboration and processes (OECD, 2020). The model of building innovative and sustainable cities in urban mobility is based on top-down and bottom-up community-based data; these two perspectives mutually complement and strengthen collaboration between different city stakeholders (Capdevila & Zarlenga, 2015; Nochta et al., 2021).

Each country has a different strategy regarding smart cities and sustainable policies to support urban mobility due to the other urban characteristics and problems faced (Grindsted et al., 2022). Responding to the complex issues of urban mobility, the Association of Southeast Asian Nations (ASEAN), on the agenda of the 32nd ASEAN Summit on 28 April 2018, has launched twenty-six intelligent city pilot projects in urban mobility to build shared resources in the urban environment. innovative and sustainable (Jonge, 2022). In contrast, Japan faces two ways of reducing the population significantly in the urban transportation sector. Toyama, Japan, applies more structural changes, such as the so-called "stick and dumpling" approach, with land use incentives and Light Rail Transit reinforced by bus routes as the backbone of its strategy. Kanazawa relies on the downtown revitalisation plan to condense housing use in the city centre (Balaban & Oliveira, 2022). However, urban mobility in the United States pays special attention to illegal immigrants living regularly as they tend to live in dense urban environments (Kaufmann et al., 2022). Similar to urban mobility in the UK, it is more likely to involve homeless and black voluntary organisations to play an essential role in supporting smart cities and sustainable policies in restructuring the country and knowing the rights granted (Child, 2021).

Based on the previously elaborated urban mobility problems, this research aims to uncover how smart cities and sustainable policies contribute to establishing urban mobility, thereby addressing the development gap in innovative urban environments (Angelidou et al., 2018a). Due to the complexity of urban mobility problems, there is a need to design healthy places that have the potential to be economical and environmentally efficient around intelligent cities to reduce urban polarisation (Kumar et al., 2018). It takes a proactive attitude in making policies to impact locally and globally (Angelidou et al., 2018b) so that it does not threaten urban resilience capacity and its relationship to economic, social, and environmental well-being (da Silva et al., 2020). Therefore, the urban mobility problem focuses on how to turn the challenges faced by smart cities into opportunities for the community (Thakur, Parida, & Raj, 2022), especially in building smart cities by utilising intelligent and sustainable ICT (Ribeiro et al., 2021).

Thus, it is essential to establish smart cities and sustainable policies to build an effective and efficient urban mobility environment. This study aims to analyse how smart cities and sustainable policies build urban mobility to reveal the factors and trends to be considered in making sustainable decisions and policies in creating an innovative city environment in urban mobility. This study used data from reputable journals indexed by Scopus in the last ten years, with some necessary limitations that are considered important.

B. LITERATURE REVIEW

Smart City

The smart city paradigm is defined as a response to the goal of creating a future city, focusing on (1) industrial development, (2) the welfare and rights of its citizens, and (3) environmentally friendly urban planning (Sánchez-Corcuera et al., 2019). Smart cities can also be considered an architectural form of a system developed by each policy leader coordinating with other systems (Prasetyo & Lubis, 2020). In South Korea, smart cities encourage the development of ecosystems and their technology standards to expand their industrial areas (J. Yang, Kwon, & Kim, 2021). In contrast, the development of smart cities in China prioritises addressing medical problems, unbalanced education, and traffic congestion (Guo et al., 2016).

On the other hand, smart cities often get criticised because they ignore technology's negative impacts (Estevez et al., 2021). However, the innovative city system is a solution to urban challenges and will have a significant positive impact in the future (Paskaleva et al., 2021). A smart city is undeniable as it has become a modern reality in the increasingly digital and rapidly changing world, bringing many multidimensional challenges for sustainable career development (Curşeu, Semeijn, & Nikolova, 2021). Thus, smart cities must be supported to overcome the problems faced by big cities in terms of urban mobility. Smart cities are considered to have the potential to shape a better future design for urban users (Leitheiser & Follmann, 2020).

Sustainable Policy

Sustainability policy must consider several aspects: (i) the policy must consider an environmental point of view because it facilitates the understanding of shared values (ii) a sense of community must be included in smart and sustainable city policies; (iii) policies should be proposed from an environmental perspective, as they facilitate the understanding of shared values; (iii) the design of neighbourhoods and cities should prioritise social interactions, to build social capital and facilitate policy implementation (Macke et al., 2019). It is more important to say that sustainable policies can be carried out comprehensively if they are encouraged by the community (Yigitcanlar & Cugurullo, 2020). However, the effectiveness of sustainable policies hinges on collaboration, as it is believed to be the optimal approach to shifting mindsets and policies—interconnected and balanced drivers—for both humans and non-humans in constructing a sustainable urban future (Yigitcanlar, 2021).

It is different when viewed metrically; measuring the performance of smart and sustainable city development is susceptible, politically and militarily, to macro-micro institutionalisation in the wider urban policy arena (Alsaid, 2021). In addition, the use of engineering design has also attracted particular attention in sustainability research, comparing the evolution of the subject with a broader perspective of policy and practice regarding the global recognition that using it can lead to change in the industry (Bhamra & Hernandez, 2021). Meanwhile, in his research, Khan explained that a diverse population and lack of infrastructure are significant challenges hindering extensive data integration in innovative city development (Khan et al., 2021). This means that sustainable policies are needed to realise a smart city in overcoming urban mobility problems, prioritising the involvement of the public in achieving sustainable urban development goals (De Guimarães et al., 2020).

Urban Mobility

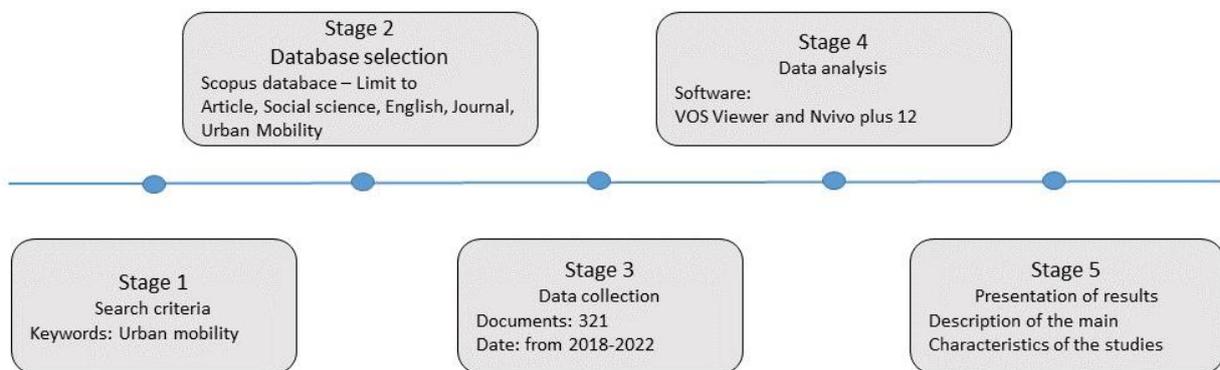
One of the goals of urban mobility is to reduce traffic congestion in urban areas (Farda & Balijepalli, 2018). The United States has also experienced this condition; urban mobility is carried out to deal with congestion problems in 437 regions, where Americans travel up to 4.2 billion more hours (Schrank et al., 2015). China, a highly economic country, has implemented

urban mobility and an intelligent court system to improve the quality of formal law and hierarchical control from an urban perspective (Zheng, 2020). In contrast to the problems of urban mobility faced by developing countries, some restrictions exist on using vehicles, privatisation, new technologies, and transportation pricing (Cavoli, 2021). Additionally, urban mobility cannot be ruled out for its role in handling the global COVID-19 pandemic (Asriadi & Mutiarin, 2023), where stakeholders must restrict the movement of citizens using dense mass urban transportation (Nian et al., 2020; Pase et al., 2020). In line with European guidelines, the Sustainable Urban Mobility Plan (SUMP) should consider risk perceptions, accidents, and health emergencies (Spadaro & Pirlone, 2021).

This condition shows that urban mobility is essential to minimise problems in increasingly crowded urban areas. Therefore, individuals in rural and urban areas need experience to provide inputs, strategies, and sustainable policies to encourage smart cities (Visvizi & Lytras, 2018). If mobility within densely populated urban areas proceeds slowly, it will inevitably lead to numerous significant impacts, resulting in socioeconomic imbalances (Campisi et al., 2021).

C. METHOD

This research employed a qualitative research method with a bibliometric analysis approach. Data from 321 documents was obtained from the Scopus database with the search engine used were "urban mobility" with limitations on the document type "article," subject area "social science," with language "English," source type "journal" and exact keyword "urban mobility" within the last five years. At the data analysis stage, the VOSViewer and NVIVO 12 Plus software elaboration was used to visualise the primary data from Scopus into images and graphs for easy understanding by readers and other researchers. These two data processing applications were chosen because they can visualise data manually and accurately in presentation. Sinkovics (2016) revealed that specific literature collections are visualised using VOSviewer and NVivo software to investigate themes identified in greater depth. Research with the same elaboration analysis was done in Artificial Intelligence research with a bibliometric analysis approach (Djen et al., 2023). Therefore, using the elaboration analysis of these two softwares is essential to see the trend of themes and correlations in the collected literature (Nurmandi et al., 2021). Figure 1 presents the details of the research stages.



(Source: Šūmakaris et al. (2020))

Figure 1. The Steps of the Research Method

Figure 1 explains that this study uses five steps. The first stage used the keyword Urban Mobility. Stage 2 began to collect data in the Scopus database because it was known for its high reputation and scientific accountability. In this section, the researchers limit the title-abs-key "urban mobility," document type "article," focusing on the subject area "social science," with a limit to language "English," source type "journal," and exact keyword "urban mobility." This study found the final data of 321 relevant documents within the last five years from the

Figure 4 illustrates the density visualisation conducted with VOSViewer to explore recent research trends in urban mobility studies, including COVID-19, parking, bicycles, mobility services, mobility patterns, and sustainable cities in 2021. Notably, in 2020, research in developed countries predominantly focused on urban transportation, travel behaviour, public transport, urban growth, carbon emissions, transportation systems, cycling, big data, car usage, car ownership, and policy formulation. Visualisation data indicates that urban mobility research was primarily conducted during this period.

In 2021, the primary focus of new research shifted to COVID-19 due to its emergence at the end of 2019 and subsequent global spread, affecting numerous regions until 2021. Consequently, many researchers focused on studying the relationship between COVID-19 and urban mobility in developed countries (Asriadi & Nurmandi, 2022; Fraser et al., 2021). Following a comprehensive analysis of 321 datasets retrieved from the Scopus database using NVivo 12 Plus software, researchers identified several prominent gaps in urban mobility research, which serve as the focal points of their investigation in developed countries. Further details are depicted in Figure 3.



(Source: Scopus data analysed using NVivo12 and visualised with Word Cloud (2023))

Figure 5. The focus of the Urban Mobility Gap in 2019-2023

Figure 5 depicts that research focusing on urban mobility trends predominantly examines urban transportation. This is logical, given that countries with extensive urban areas experience high metropolitan accessibility and urban population density. For instance, urban mobility issues in the United States have led to a 0.9% increase in the intensity and duration of road congestion, an 8.9% decrease in transit passengers, and a negligible change in vehicle ownership (Diao et al., 2021). Establishing a smart system to enhance urban mobility is imperative to foster a healthy environment and ensure that urban governance delivers high-quality services to the public (Jin et al., 2014). Collaboration among stakeholders in developing such a smart system is crucial to expedite access to urban environments accessible by all modes of transportation, facilitating fast and convenient urban services for residents (Kessler, 2015). Urban mobility problems require immediate resolution because they have a broad impact on social, economic and environmental aspects (Docherty, 2018a). This assertion is reinforced by identifying the top ten affiliated entities engaged in research on urban mobility studies.

Figure 8 highlights the prioritised characteristics of urban mobility, emphasising the importance of delivering quality services to urban communities to ensure effective urban governance. This is vital for fostering smart cities and sustainable policies, leveraging information technology (Bridi, Santos, & Viera, 2020). Meeting this demand requires providing faster and more efficient access to urban areas (Redman et al., 2013). Consequently, it's evident from the visualisation that the network theme is widely studied in urban mobility, reflecting the increasing reliance on technology in this era (Lalicic & önder, 2018). As technology plays an indispensable role, its integration is crucial for supporting the development of smart cities and sustainable policies to enhance urban mobility.

E. CONCLUSION

Urban mobility has become imperative for developed countries due to congestion, high road user density, access to infrastructure, and the increasing number of car users and cyclists. This study is crucial for shedding light on how to provide better services and convenience to urban dwellers. Stakeholders must possess the necessary skills to comprehensively address urban mobility challenges, considering various aspects before embarking on project development to foster innovative and sustainable cities. The United States stands out among developed countries due to its densely populated urban areas and high levels of urban activity. Studies on urban mobility in developed countries have focused on addressing challenges related to COVID-19 until 2021 and on developing urban transportation systems, reducing carbon emissions, promoting cycling, and managing car ownership and usage. The Universidade de São Paulo emerges as the leading institution consistently researching urban mobility in developed countries, contributing 17% of the research output with 13 journal articles. Urban mobility characteristics are characterised by three essential elements: network, group, and service.

The implications of this research extend to fostering intelligent cities and sustainable policies in developed countries. However, it is essential to note that this study solely relies on data from the Scopus database, utilising VOSViewer and NVivo Plus 12 software for data visualisation. Further research is warranted, employing different methodologies and comparing urban mobility in developed and developing countries using data from sources such as the Web of Science to address better the challenges communities worldwide face in maximising urban mobility.

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