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The Role of Community Engagement in Urban Innovation Towards the Co-Creation of Smart Sustainable Cities

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Abstract

One of the most recent topics in smart cities is community engagement which has been generally deliberated in both industrial and academic literature around the approaches and tools employed in urban environment. Accordingly, the purpose of this study is to advocate for community engagement as a key driver that supports the acquisition of knowledge and requirements needed for innovation and creativity towards achieving an equitable community for social sustainability. A semi-systematic review method is adopted to analyze 71 sources from Web of Science and Scopus databases. Secondary data from the literature is extracted and synthesized to provide narrative and descriptive analysis. Findings from this study presents a developed model that can support community engagement for urban innovation by specifying factors that influences community engagement for smart sustainable city development. The model enables citizens, policy makers, government, urban planners, academics, and enterprises in urban environment to connect, interact, engage, and co-create innovative services. More importantly findings from this research provides theoretical evidence on administrative and non-administrative stakeholder's involvement towards co-creation of urban services towards smart sustainable cities. Furthermore, this study provides recommendation on how community engagement perspective involving different stakeholders can help to achieve resilient technological driven city by supporting sustainable development and ultimately actualizing a socially inclusive urban space.

Keyword Knowledge society · Social sustainability · Community engagement · Co-creation · Urban innovation · Smart sustainable cities

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Introduction

Due to constant increase in urban population, the need for smart sustainable cities is becoming more evident to mitigate environmental issues, improve social inclusion, and economic growth (Leclercq & Rijshouwer, 2022; Paskaleva et al., 2021). A smart sustainable city is an urban environment that enhances social capital and human resources by interacting with economic and natural resources via digital innovation towards addressing societal issues and efficiently attaining high quality of life and sustainable development for multi-stakeholders (Fernandez-Anez, 2016). Interestingly, cities are increasingly digitalizing their critical utilities and infrastructures to be more efficient, thus becoming smart and sustainable (de Oliveira, 2016; Jnr et al., 2020). In this sense, the concept of smart sustainable city has created a new opportunity for cities to adopt information and communications technology (ICT) to improve residents living condition (Anthony Jnr, 2021a). Therefore, research and development towards smart sustainable cities have focused on how municipalities can achieve greener cities as medium for social, economic, and environmental growth (Gabrys, 2014; Yeh, 2017). In this context, municipalities are intensifying their efforts to make their cities more competitive and sustainable by becoming more digitalized (Lee & Lee, 2014). This calls for a transformative participatory governance approach in the way municipalities live, work, interact, and build their cities (de Oliveira, 2016; Jnr et al., 2021).

Additionally, the concept of smart sustainable cities needs to be extended beyond the adoption of technologies to support social sustainability within urban environment (Ortiz, 2022). One of the most current debates in which social sustainability can be attained within smart cities is via more responsive community engagement that provides feedback for environmental monitoring (Bouzguenda et al., 2019; Gabrys, 2014). Community engagement provides a medium of collaborating or informing a variety of stakeholders (Seo, 2022), aimed at obtaining public opinions and feedbacks on city planning and development (Aguilar et al., 2021; Fredericks et al., 2020). Hence, the need for engaging the community during urban development is becoming increasingly demanding ultimately shifting the governance paradigm across different stakeholders such as entrepreneurs, tourists, citizens, enterprises, researchers, universities, and government. (Fredericks, 2020; Nieto-Mengotti et al., 2019). Respectively, cities are recommended to create an urban environment that involves communities to enable a community-driven urban innovation and development that considers the views and perception of all stakeholders within the community (Capra, 2016; Hofstad et al., 2022; Karadimitriou et al., 2022). But findings from the literature (Přibyl et al., 2017; Thomas et al., 2016) highlighted that the actualization of a smart sustainable city that comprises of different stakeholders are scared as community hardly play any role in co-creating of innovate solutions within their cities.

Although cities are now establishing formal community engagement strategies to be undertaken, the overall engagement undertaken mostly informs citizens, thus limiting community input from different actors or stakeholders within

the city (Anthony Jnr, 2021b; Heikka & Carayannis, 2019). While the innovative technological aspects of smart sustainable cities have been addressed in the literature, the important role of the community in these cities has not been well researched (Carayannis & Campbell, 2014; Carayannis & Campbell, 2021). Too often, cities have not achieved their core goals because different stakeholders operating within the city were not appropriately involved during digitalization of cities into smart sustainable cities (Simonofski et al., 2019). Similarly, in the urban research, prior studies have highlighted the importance of community engagement in sustainable smart city (Carayannis et al., 2022; Vedeld, 2022). However, very few authors have investigated the inhibitors of community engagement in urban context (Berntzen & Johannessen, 2016; Kummitha & Crutzen, 2019). Hence, there is a need for a study that provides recommendation on how municipality administration, residents, and other stakeholders can deliberate in the overall decision-making process (Carayannis et al., 2021; Fredericks et al., 2020). Therefore, this article examines these research gaps by trying to answer the following research questions:

- How can a city enable community engagement for co-creation of innovative solutions towards actualizing a smart sustainable city?
- What are the challenges and recommendations to improve community engagement for co-creation of innovative solutions in smart sustainable cities?

This article intents to explore the following research questions by carrying out a semi- systematic or narrative review approach which is suitable for research domains that have been conceptualized differently and researched by different groups of researchers within diverse disciplines (Snyder, 2019), which in this study "smart sustainable city" involves several disciplines such as urban geography, computer science, and civil engineering. Accordingly, semi-systematic is adopted to explore how community engagement can be employed to support the co-creation of innovative solutions towards the actualization of smart sustainable cities. This article contributes to the knowledge gap by exploring which approaches can be adopted to foster community engagement in smart sustainable city development and to provide a model that helps in the management of community engagement for social sustainability. Grounded on secondary data from the literature, this study develops a model that can support community engagement for urban innovation by specifying factors that influences community engagement for smart sustainable city development. The model enables citizens, policy makers, government, urban planners, academics, and enterprises in urban environment to connect, interact, engage, and co-create innovative services. This study further presents identified challenges and recommendations to improve community engagement for co-creation of innovative solutions in smart sustainable cities.

Overall, this article is structured as follows. First, the methodology employed for this research is outlined. This is followed by findings of the study in the "Findings"section. Next, the developed model is presented in the "Developed Conceptual Model" section. The discussion is presented in the "Discussion" section, and implications of the study are provided in the "Implications of Study" section to highlight research, practical, and

policy insights towards community engagement. The conclusion of the study is presented in the final section.

Methodology

A semi-systematic literature review methodology was adopted to present evidence (Snyder, 2019). A semi-systematic literature review aims to expediently assess prior studies that are appropriate to the specific research topic to present a fair assessment of an investigated topic using a rigorous and trustworthy approach (Anthony Jnr, 2021a; Anthony Jnr & Abbas Petersen, 2021). The research flow for this study comprises of five phases as shown in Fig. 1.

Figure 1 illustrates the research flow for this study, where each phase is discussed below in the succeeding sub-sections.

Inclusion and Exclusion Criteria

In assessing the quality of the research, inclusion and exclusion criteria is one of the most significant steps when conducting systematic review (Snyder, 2019). The inclusion and exclusion criteria are the sampling or selection approach employed to choose suitable articles to provide answers to the research questions presented in the introduction section. Researchers such as Snyder (2019) maintained that inclusion criteria for a systematic review study should be conducted by the selected research question(s). Thus, the inclusion and exclusion criteria showed in Table 1 are linked to the research questions specified in the introduction section. As pointed out by Snyder (2019), the criteria that can be employed and are frequently used include, for instance, language of the article, year of publication, type of article (such as conceptual, experimental, and survey), and journal. The inclusion and exclusion criteria are summarize in Table 1. Most of the questions are adapted from prior study (Anthony Jnr & Abbas Petersen, 2021). Thus, an article is included for the current study if it meets up to the criteria in the inclusion column and is excluded if it satisfies any of the exclusion criteria.

Search Strategies and Data Sources

The sources employed in this study were retrieved through an extensive search of prior citizen engagement, citizen participation, and community engagement/participation adoption studies through Scopus and Web of Science databases as seen in Fig. 2.

To screen the retrieved articles, the Preferred Reporting Items for Systematic Reviews and Meta-Analysis (PRISMA) flowchart shown in Fig. 2 was employed as

Fig. 1 Research flow

Table 1 Inclusion and exclusion criteria

Inclusion	Exclusion
• Should involve research on stakeholders and citizen and/or community engagement, co-creation, and innovative solutions in a smart sustainable city	• Studies that do not present any evidence on stakeholders, citizen and/or community engagement, co-creation, and innovative solutions in a smart sustainable city
• Should be based on approaches, methods, and frameworks aimed at facilitating citizen/stakeholders/community engagement, co-creation, and innovative solutions in smart sustainable city	• Approach, methods, and frameworks employed in contexts other than citizen/stakeholders/community engagement, co-creation, and innovative solutions in smart sustainable city
• Should employ a scientific method such as experiment, survey, case study, and interview. Either quantitative, qualitative, mixed mode, or other	• Is not based on a well-grounded scientific method or the methodology adopted is not evidently reported in the study
• Should be mainly written in English language and published between 2000 and 2023	• Related studies not within 2000 to 2023 and are not written in English language
• Studies that provide practical and theoretical social sustainability, community, citizen, stakeholder's participation, challenges, benefits, and recommendations	• Studies with lack of evidence on social sustainability, community, citizen, stakeholder's participation, challenges, benefits, and recommendations

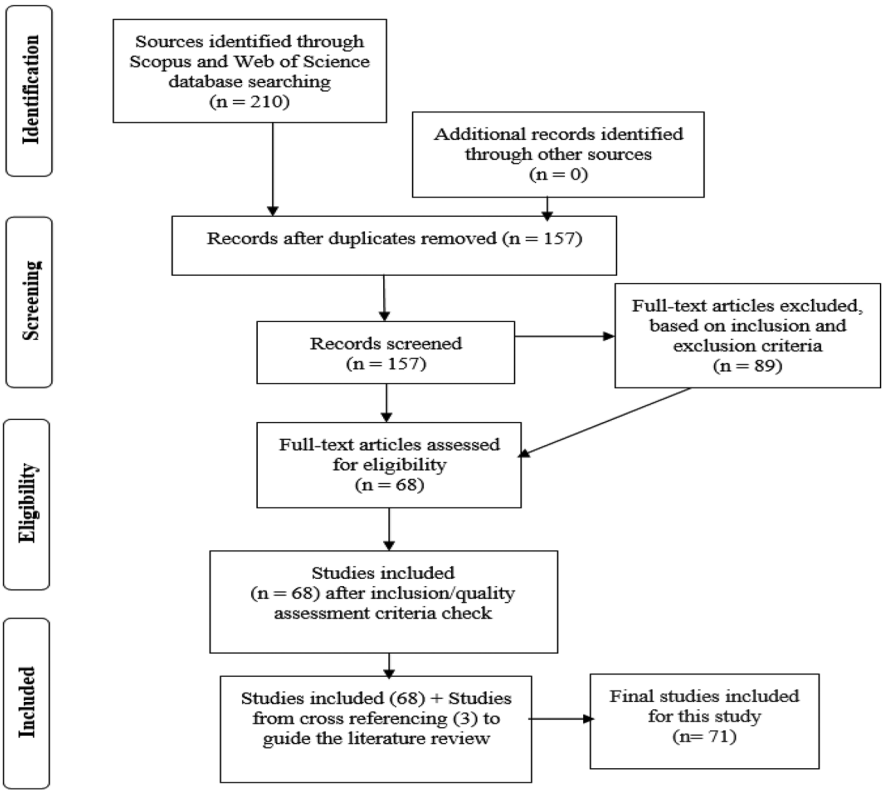

Fig. 2 PRISMA flowchart for the selected articles

previously utilized by Anthony Jnr (2021b), in the study that employed a systematic literature review. The final search resulted to 210 articles using the keywords above. The final sources selection from the search undertaken comprises of 35 articles (identified in January 2021), 11 articles (identified in July 2021), and 25 articles (identified in October 2022). The search terms are based on the title of this study and the research questions to be examined, and it includes the keywords ((“community engagement” OR “community participation” OR “community involvement”) AND (“smart city” OR “smart cities” OR “smart sustainable cities” OR “social sustainability” OR “citizen engagement” OR “stakeholders’ engagement”) AND (“approaches” OR “methods”)). The search combination is based on how prior search was conducted in the literature (Anthony Jnr, 2021b; Jnr et al., 2021).

These keywords were used to retrieve appropriate articles to provide empirical evidence regarding community engagement for co-creation of innovative solutions towards actualizing a smart sustainable city. Fifty-three papers were removed as duplicates. This is because some papers indexed in Scopus database were also indexed in Web of Science database, resulting to a total of 157. The articles were checked against the inclusion and exclusion criteria by the author(s), and 89 sources were removed since they were not mainly related to community engagement in smart sustainable city resulting to 68 articles. Next, 3 articles were retrieved from other sources to guide the systematic literature review (Tranfield et al., 2003; Snyder, 2019), as seen in Fig. 2 to guide the semi-systematic review process.

All included sources are presented in the reference section of this paper totaling to 71 articles. The included sources comprise of 52 journal articles, 11 conference proceedings, and 8 book chapters. One of the important benchmarks that are required to be checked with the inclusion and exclusion criteria is the quality assessment check as recommended by Anthony Jnr (2021a). This criterion helped to evaluate the quality of the selected studies. However, quality assessment check was confirmed as Scopus or/and ISI. Web of Science database was used to retrieve sources in this study.

Data Coding and Analysis

The final 71 studies are utilized to provide secondary data in response to community engagement for co-creation of innovative solutions towards actualizing a smart sustainable city. This helps to provide evidence on the explored research questions specified in the introduction section. The extracted data was manually coded without using any qualitative tool such as Atlas or NVivo. The coded data from the literature was mainly thematized into 7 different clusters: (i) year of publication, methodology, countries, and contexts, (ii) smart cities, (iii) smart sustainable cities components, (iv) social sustainability and community engagement, (v) community engagement for smart sustainable city, (vi) co-creation and community engagement approaches, and (vii) co-creation by community engagement for urban innovation). Thus, data from the literature is extracted and synthesized to provide narrative and descriptive data analysis.

Findings

This section aims to provide evidence regarding how a city can enable community engagement for co-creation of innovative solutions towards actualizing a smart sustainable city. Also, the challenges and recommendations to improve community engagement for co-creation of innovative solutions in smart sustainable cities are extracted and synthesized from the secondary sources and discussed accordingly.

Year of Publication, Methodology, Countries, and Contexts

Findings from Fig. 3 indicate that the selected studies ranged from 2003–2012 to 2023. Findings suggest that more studies related to community engagement for co-creation of innovative solutions towards actualizing a smart sustainable city were published in 2021 with $N = 16$ studies and 2022 with $N = 11$ studies, followed by 2019 with $N = 10$ and 2016 with $N = 9$ studies as compared the other years. Results from Fig. 3 suggest the increase of studies related to the potentials of community engagement in making cities smart and sustainable, highlighting research in co-creation of innovative solutions as a fruitful research area.

Considering the research methodology employed in the selected articles, findings from Fig. 4 show that literature review is the most employed method ($N = 20$). Next are studies based on case studies with $N = 15$, and studies that are based on conceptual approach with $N = 9$. The following are studies that used interview for data collection with $N = 7$, and studies which employed survey questionnaire with $N = 5$, experiments and workshop with $N = 3$, respectively, and proof of concept with $N = 2$. The remaining studies ($N = 1$) employed other methods as seen in Fig. 4. Overall, the result in Fig. 4 reveals that employing literature review grounded on secondary data to explore community engagement for co-creation is well accepted by researchers interested in making cities smart and sustainable. However, less studies have

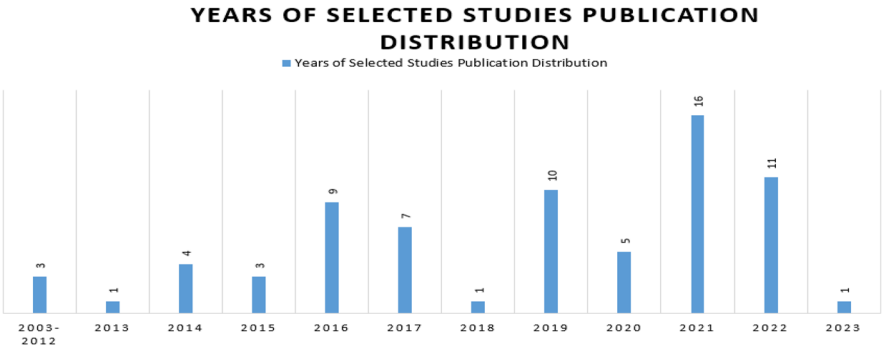

Fig. 3 Distribution of selected studies in terms of years

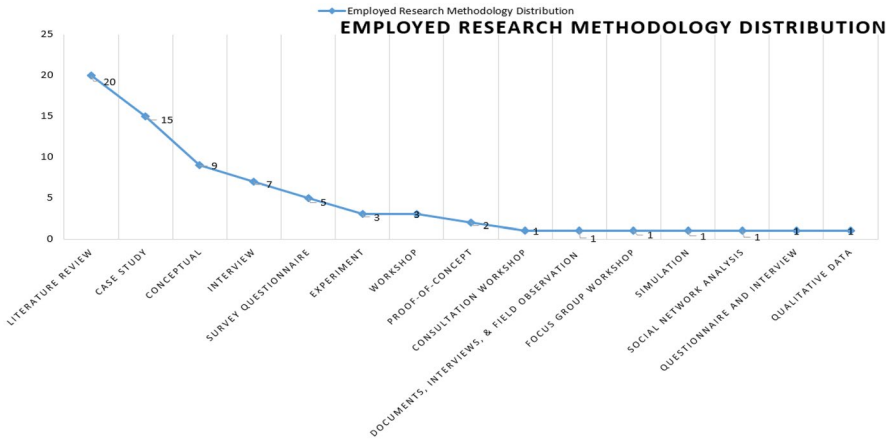

Fig. 4 Distribution of selected studies in terms of research methodology

employed primary data as compared to secondary data. Thus, there is a need for more empirical-based researches in the study area.

The selected article author country distribution is illustrated in Fig. 5. The findings suggest that most of the authors that published on community engagement,

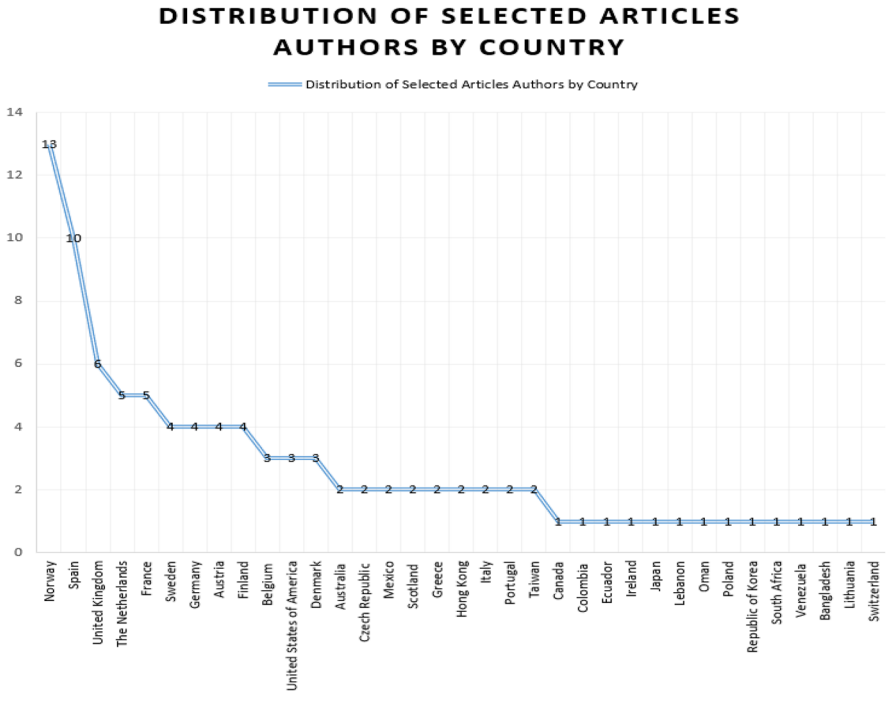

Fig. 5 Distribution of selected articles authors in terms of country

co-creation, and smart sustainable city are based in the Norway (N = 13), Spain (N = 10), and UK (N = 6), respectively. Next are the Netherlands and France with (N = 5) each. Sweden, Germany, Austria, and Finland with N = 4, correspondingly. Belgium, United States of America, and Denmark are recorded with N = 3, equally. Then, Australia, Czech Republic, Mexico, Scotland, Greece, Hong Kong, Italy, Portugal, and Taiwan with N = 2, individually. Lastly, (N = 1) study authors are from other countries as seen in Fig. 5. The result suggests the need for more research on community engagement and co-creation from other regions in Europe and across the world.

Figure 6 depicts the explored context as related to the selected studies included in this study. The findings in Fig. 6 suggest that community engagement, co-creation, and smart sustainable city have been studied more. Accordingly, N = 10 explored co-created smart city, N = 5 investigated citizen participation towards smart city, and N = 4 studies examined digital service in smart cities and quadruple/quintuple helix model, respectively. Additionally, N = 3 investigated citizen participation and smart city. While other authors explored other research areas which aimed at improving smart sustainable city development as seen in Fig. 6. The result suggests for more studies to be conducted in co-producing citizen centric cities as this is now addressed in the literature. The interplay of technology and social dimension can be exploited to champion radical community driven innovation to improve the sustainability and smartness of cities.

Besides, Fig. 7 demonstrates the distribution of the selected smart sustainable city context studies. The results indicate that most studies explored citizen participation (N = 11), general smart city (N = 6), stakeholder involvement (N = 5),

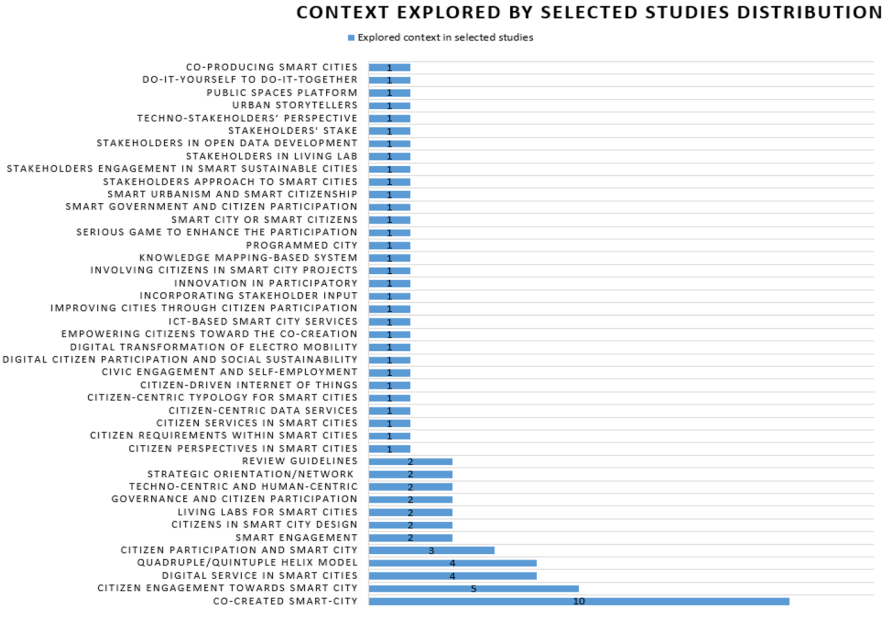

Fig. 6 Distribution of context explored by selected studies

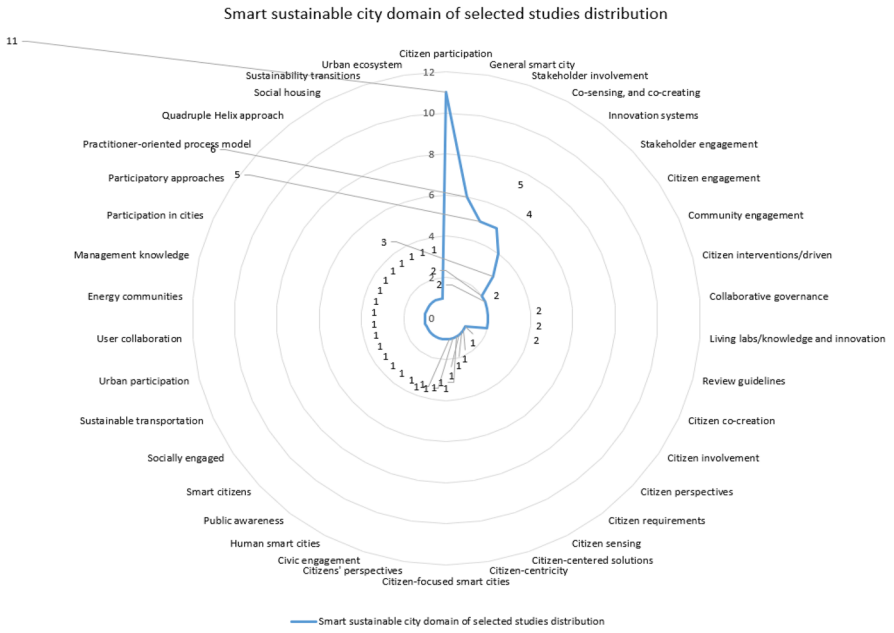

Fig. 7 Distribution of selected smart sustainable city context

co-sensing and co-creating (N = 5), innovation systems (N = 4), and stakeholder engagement (N = 3). This result suggests that there are fewer studies that explored community engagement for co-creation towards smart sustainable city attainment, as only N = 2 studies explored issues related to community engagement in urban environment. Additionally, the result from Fig. 7 points to key research topics that can be embarked on to promote community engagement, urban innovations, and co-creation towards the actualization of smart sustainable cities.

Overview of Smart Cities

Researchers have predicted that 70 percent of the world's inhabitants will reside in cities by 2050. The growing trend towards urbanization has led to different challenges as cities are a main cause of environmental deprivation and unsustainable use of natural resources (Huttunen et al., 2022). These urban problems call for innovative approaches that support cities to deploy environmentally friendly infrastructure to improve citizens quality of life (Akterujjaman et al., 2022; Rubalcaba et al., 2022). In this context, the term smart sustainable city was introduced based on different dimensions such as social, institutional, economic, technology, and environmental. The institutional dimension involves revision of urban policies, changes in administrative structures, and the initiation of smart communities as a medium to foster sustainable urban transformation (Gabrys, 2014).

Whereas the social and economic perspectives entail investments in innovative solution and human involvement, co-creation, and learning (Mahmoud et al., 2021; Morawska-Jancelewicz, 2022; Warnke et al., 2023). The technological perspective encompasses how ICT can be leveraged to make urban services smarter and more accessible to all stakeholders within the city (Aguilera et al., 2017; Anthony Jnr & Abbas Petersen, 2021; Capdevila & Zarlenga, 2015). The environmental perspective involves the protection of the natural environment from degradation and depletion (Mihailova et al., 2022). Likewise, smart city initiatives are being adopted by municipalities around the world with the main objective to achieve different perspectives (smart governance, smart mobility, smart economy, smart people, smart environment, and smart living), as seen in Fig. 8.

Figure 8 depicts the smart city dimension and perspectives aimed at improving regional competitiveness and social capital of enterprises in urban environment, facilitate urban planning outcomes, and enhance urban mobility networks (Partanen & Möller, 2012), ICT usage, modernize services provided to citizens for greater community participation of urban inhabitants (Fredericks et al., 2020; Anthony, 2021). Smart sustainable cities refer to the deployment of ICT to digitalize and improve the efficiency, interoperability, and integration of urban services which include healthcare, transportation, urban administration, public safety, and education. In practice, smart sustainable cities contribute to risk reduction (Haustein & Lorson, 2023), economic gains, and social stability by enabling enterprises to invest their resources and knowledge to improve urban development and provide residents with better living environment (Nunes et al., 2021; Yeh, 2017).

Researchers such as Kloppers (2016) argued that the technological aspect have been explored during a smart sustainable city development, but it is important to engage with society and not only focus on technology as the community is the most valued asset in a smart sustainable city development (Larios et al., 2016; Anthony Jnr, 2021a). In a smart sustainable city, the social dimension has been less investigated as compared to the other dimensions presented in Fig. 8. But it is important to

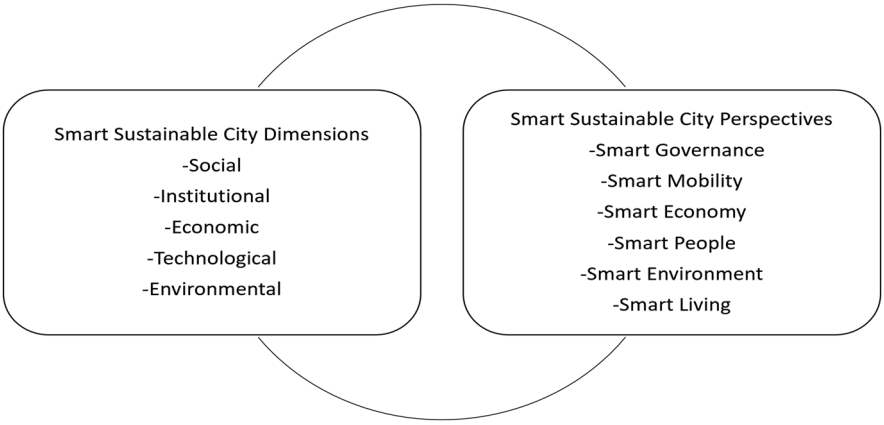

Fig. 8 Smart sustainable city components

explore the community participation as they are the end-users of the digitalized services provided by the municipality (Feiferytė-Skirienė et al., 2022; Paskaleva et al., 2021). Thus, the social dimension is linked to the "smart people" perspective which aims to achieve equality for social sustainability (Axelsson & Granath, 2018; Leino & Puumala, 2021). Hence, it is extremely significant that citizens' ideas and views of the neighborhood community (Mahajan et al., 2021) and groups within the city are taken into consideration during urban planning and development (Heaton & Parlikad, 2019; Yeh, 2017).

Positioning Social Sustainability and Community Engagement in Smart Cities

Over the years, the social aspect of sustainability has been explored under different themes and dimensions (Fredericks, 2020; Willems et al., 2017). One of the key goals of social sustainability is to deploy ICT to digitally empower citizens, to secure their privacy from exploitations and to stop corruption towards a more democratic (Carayannis & Campbell, 2014; Carayannis & Campbell, 2021), equitable, and viable economy (Cardullo & Kitchin, 2019). Due to its complexity, social sustainability has been less researched in urban context (Bouzguenda et al., 2019). Researchers such as Bouzguenda et al. (2019); Anthony Jnr (2021b); Paskaleva et al. (2021) argued that community engagement initiatives have a significant effect on the goal of social sustainability. Nevertheless, despite acknowledging the relevance of deploying community engagement, studies linked to how social sustainability can be achieved in smart cities have received less attention from researchers as compared to technological and environmental sustainability attainment in smart cities (Vácha et al., 2016).

Similarly, findings from prior study (Bouzguenda et al., 2019) mentioned that despite the potential of public participation in urban development, little work has focused on exploring actual practices of community involvement in smart cities. This has resulted to the socio-spatial issues and public impact of smart city initiatives not adequately well studied. But smart sustainable city development can only be fully accomplished through the inclusive of a mixture of technologies, smart people, and policies (Feiferytė-Skirienė et al., 2022; Paskaleva et al., 2021). To achieve social sustainability in smart cities, the citizens must have equal access to benefits from public investment while also being able to satisfy basic human necessities (safety and security, fair distribution of revenue, and affordable housing) (Rubalcaba et al., 2022). Efficient community engagement can impact social sustainability of smart cities. This is because in a socially sustainable society citizens should be able to participate and provide feedback in shaping or co-creating the social system they reside in (Bouzguenda et al., 2019).

However, findings from prior studies (Anthony Jnr, 2021b; Carayannis, Dezi, et al., 2021; Warnke et al., 2023), stated that existing community engagement approaches in smart cities are too technocratic and not aligned to the interests of the community and society at large. Thus, for community engagement to be efficiently deployed in smart cities, there should be open platform(s) for citizens to become sociable in smart city development (Bouzguenda et al., 2019). In urban context,

community engagement provides a process that gives all stakeholders in the neighborhood the chance to influence the administrative tasks and decision-making of the smart city development (Hofstad et al., 2022; Leino & Puumala, 2021). The emphasis on community engagement is also maintained by the open government movement, which suggested that residents and other stakeholders should be involved in urban development via transparent governance participation (Carayannis & Campbell, 2014), and collaboration to add value to public processes (Simonofski et al., 2019). To this end, this article discusses the role of community engagement as one of the key components of social sustainability.

Significance of Community Engagement for Smart Sustainable City

A community comprises of a virtual or physical group of people that perform actions either individually or collaboratively (Choque et al., 2019). In general, engagement or participation refers to the act of being involved in something and making decision on the process and outcome (Nunes et al., 2021; Vácha et al., 2016). Community engagement in a smart sustainable city can de denoted as a set of methods, principle, policy, or basically the act of taking part in urban activity (Vácha et al., 2016). Community engagement refers to an organized activity that involves the society in which the residents, enterprises, city administration, etc. partakes to achieve a common goal (Willems et al., 2017). Continuous community engagement provides citizens with a medium through which they can inform the municipality about their needs and issues faced within the city (Anthony Jnr, 2021b). Community engagement tackles the aspects of how cities can organically be developed with the participation of different stakeholders and not solely driven by the municipality's visions (Gutiérrez et al., 2017).

It provides an avenue for all stakeholders within the city to send recommendations for improvement. Basically, this is accomplished through requirements collection (Vácha et al., 2016). Thus, providing a medium for citizen to be progressively considered as active participants in policy making (Willems et al., 2017). Governments legislate that a formal community engagement should be carried out to inform communities about planned environmental assessments, legislative changes, and infrastructure developments (Fredericks, 2020). Presently, in municipalities, community engagement is generally undertaken as a top-down approach which involves multi-stakeholders such as enterprises, government agencies, and municipality administration with the aims of obtaining public opinions and feedback on the planning and development of the city (Huttunen et al., 2022; Nunes et al., 2021).

Community engagement in urban context comprises of an ecosystem of different stakeholders as seen in Fig. 9 collaborating from the start of urban planning development (Fernandez-Anez, 2016; Fredericks et al., 2020; Kummitha & Crutzen, 2019). The ecosystem comprises of the administrative stakeholders (governments (policy makers), private and public enterprises, city service, technology providers, municipality, and universities), and the non-administrative stakeholders (community associations, volunteers, everyday citizens, activists, scientists, researchers, and developers), as pointed out in the quadruple/quintuple helix innovation model towards

Fig. 9 A typical community engagement ecosystem

smart, sustainable, and inclusive solutions proposed in the literature (Carayannis, Campbell, & Grigoroudis, 2022; Carayannis, Dezi, et al., 2021; Morawska-Jancelewicz, 2022; Paskaleva et al., 2021). These multi-stakeholders form a new community of practice that engages to develop more democratic, smart, and sustainable society for the future. Besides, the community engagement ecosystem presented in Fig. 9 offers an opportunity for all stakeholders to articulate their views, concerns, and opinions to create an open discussion around the advantages and disadvantages because feedbacks and input provided are valid and can help bridge the gap between the top municipality administration to form partnerships with the people at the lower level (Fredericks et al., 2020; Ståhlbröst et al., 2015).

Presently, to facilitate community engagement, some approaches such as focus groups, city hall meetings, public hearings, citizen juries, surveys, and digital platforms are being adopted within local communities across the world (Choque et al., 2019; Ibrahim et al., 2017). But these approaches are faced with inequality as input and opinions are not gotten from the wider community, including immigrants, lingually diverse people, people with disabilities, culturally different people, poor citizens, younger people, and refugees who are mostly not considered and included during community engagement process (Fredericks, 2020). As such, the current community engagement activities are non-inclusive, outdated, and hardly achieve equitable and genuine outcomes (Carayannis & Campbell, 2021).

Accordingly, there is a need for novel approaches that facilitate collaboration and discussion between stakeholders. Such approaches should employ a playful and collaborative activities and tools that encompasses a variety of stakeholders and demographics that enhances the overall community engagement process by distributing the ownership and responsibility of decision making (Fredericks, 2020; Mahmoud et al., 2021; Rubalcaba et al., 2022). Besides, temporary located digital technologies can be employed in public spaces to improve community engagement aimed at attracting participation of stakeholders and promote playful collaboration to provide new opportunities for engaging, interacting, and connecting with residents in cities (Hofstad et al., 2022; Karadimitriou et al., 2022).

Co-Creation and Community Engagement Approaches

One of the medium to achieve social sustainability is via government involvement of citizens in the co-creation of social and technological innovation within the city (Mahajan et al., 2021). This is because co-creation activities which involve the society at large can stimulate urban development and create novel business models, new products, solutions, and services when diverse stakeholders are involved (Leino & Puumala, 2021). Through effective governance of technical and social innovation, community engagement can be achieved which can result to citizens having a sense of belonging and better well-being (Anthony Jnr, 2021b; de Oliveira, 2016). In co-creation for urban transformation, the citizens' experience can contribute towards better planning of the city's services and solutions (Huttunen et al., 2022). Since some residents have knowledge that can be applied to help reduce project risk failure, therefore, Berntzen and Johannessen (2016) maintained that community involvement is significant to achieve better services and solutions and to promote a democratic process. To achieve a co-creation process for a smart sustainable city, the citizens within the city need to be democratic contributors from the beginning to the end of urban project (Carayannis & Campbell, 2014).

As co-creating an urban service involves the active involvement of all stakeholders (see Fig. 9) in the various phases of urban project (Simonofski et al., 2017), hence, all stakeholders within the city should be involved in the ideation and co-creation of innovations that fulfil societal needs and are closer aligned to the municipality's vision of being a smart sustainable city (Kloppers, 2016). Therefore, there is a need for a transformational change in the way cities co-create innovation during urban development projects (de Oliveira, 2016). This calls for different community engagement channels which comprises of physical public space, digital visualization platforms, and hybrid approaches (Jnr et al., 2021). The physical public spaces provide a venue where participants involved in co-creation can physically provide their engagement as feedback or inputs through physical activities, which includes writing, drawing, and other tangible outputs (Fredericks et al., 2020). The physical public spaces provided a medium for the community to take ownership and voice their opinion in numbers and to ultimately take part in the decision-making process (Vedeld, 2022). Over the years, public spaces have been utilized by citizens as a platform to assemble, socialize, mobilize, and peacefully express their views (Karadimitriou et al., 2022).

The physical public space is a platform where individuals can be seen and heard by the government (Feiferytė-Skirienė et al., 2022; Fredericks, 2020). The digital public space provides an online platform where the society could digitally input their engagement responses and viewing the collected feedback from all participants via a digitally visualized output (Karadimitriou et al., 2022). Some researchers consider digitalization to be a powerful medium that promote and improve citizen engagement (Granier & Kudo, 2016). Citizens and enterprises within the city can also provide immediate feedback as regards to municipality's plan towards the development of the city in real-time (Jnr et al., 2020; Jnr et al., 2021). In the hybrid approach, both physical and digital co-creation activities are planned and carried out either in a situated controlled public space within the city or within a digital environment

(Leclercq & Rijshouwer, 2022). The physical public space, digital visualization platforms, and hybrid approach provides a community engagement platform that supports the interaction between different stakeholders, including government agencies, members of the public, local government representatives, members of parliament, industry experts, and community organizations (Fredericks et al., 2020).

Co-Creation by Community Engagement for Urban Innovation

The traditional method for urban innovation involved urban planners taking centralized decisions based on the municipality's vision for the city, but over the years, a new approach that takes advantage of all stakeholders within the city has emerged to address social sustainability goals (Simonofski et al., 2019); this approach is termed community engagement (Huttunen et al., 2022; Warnke et al., 2023). As previously discussed, community engagement can stimulate urban innovation and foster the active participation of stakeholders such as citizens in urban development (Anthony Jnr, 2021b; Nunes et al., 2021). The understanding of the functioning of community engagement can provide policy makers with tools for ensuring better citizen participation (Capra, 2016). In the field of smart sustainable city, the role of co-creation within community engagement for urban innovation can be a gateway to actualize social sustainability in urban context (Choque et al., 2019; Ibrahim et al., 2017). Similarly, co-creation for urban innovation is a new paradigm where municipality and the entire urban community draw on their knowledge, expertise, and skills to co-conceptualize novel urban services that are directly useful to citizens and the local environment (Akterujjaman et al., 2022).

To further the discourse findings, Paskaleva et al. (2015) confirmed that there is a positive relationship between open innovation and stakeholder engagement within urban context. In this way, co-creation becomes an integral part of a much broader shift for community engagement sectors within the city forming relationships between the academic, private, public, and voluntary stakeholders (Kloppers, 2016; Paskaleva et al., 2015). The European innovation system employs open urban innovation as one of the main elements that creates seamless interaction and connection of ideas between the quadruple helix components citizens academia, government, and industry to form an innovative urban ecosystem. Using participative open innovation such as living labs cities can invoke technological and societal dimensions simultaneously to develop community centric services (Paskaleva et al., 2015). This research is based on community engagement, which has proved to be a suitable tool for examining social sustainability of cities into smart sustainable cities (Capra, 2016).

Figure 10 depicts various approaches that can be employed to employ community engagement for co-creation of urban innovations in smart sustainable cities grounded on best practices identified from the literature (Feiferytė-Skirienė et al., 2022; Karadimitriou et al., 2022; Leclercq & Rijshouwer, 2022; Mahmoud et al., 2021; Rubalcaba et al., 2022; Simonofski et al., 2019). There exist several direct interaction approaches employed to collect community ideas such as carrying out interviews or focus groups discussion with experts and citizens, city hall meetings,

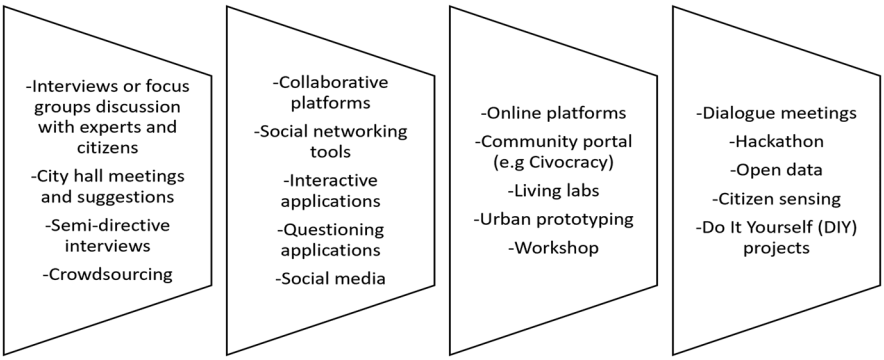

Fig. 10 Approaches to employ community engagement for co-creation of urban innovations

and suggestions (Simonofski et al., 2019). One of the co-creation approaches employed to foster community engagement is the use of digital environments such as community portal (Choque et al., 2019), which enables citizens to interact with municipality officials in an informal medium (Granier & Kudo, 2016). Collaborative platforms, social networking tools, interactive applications, and questioning applications can be employed to minimize community engagement costs by aiding citizens and other stakeholders to participate and co-create through their mobile devices any time and place remotely to improve democratic debates while facilitating citizen engagement (Granier & Kudo, 2016; Gutiérrez et al., 2017).

Digital tools such as social media can be utilized for community engagement as a medium to include a larger number of residents (Leclercq & Rijshouwer, 2022). Social media can be utilized for community engagement as a medium to include a larger number of residents (Simonofski et al., 2019). In countries such as South Korea, proprietary platforms such as government blogs are used by citizens to discuss policies and send comment which helped to increase trust between citizens and government representatives (Berntzen & Johannessen, 2016). These online platforms can collect citizens' experience and opinion on diverse public matters. For example, Civocracy is a civic online application that provides recommendation services to help municipalities to achieve co-creation operations within their cities. It also provides a digital platform that aims to involve citizens and other actors to urban issues by providing information and dialogue support (Simonofski et al., 2019). In the planning phase of co-creation, other activities such as workshop, dialogue meetings, and hackathon can be carried out by universities, local companies, and citizens (Axelsson & Granath, 2018).

Another approach is the direct interaction which is a citizen-oriented approach where semi-directive interviews are conducted to identify the critical requirements of the citizens as regards to a potential urban project. Other approaches are comprised of crowdsourcing which provide a means to collect data from citizens (Larios et al., 2016). The living lab is another popular approach which offers a community-driven open innovation ecosystem grounded on citizens-business-government collaboration which enables multi stakeholders' involvement in urban innovation

development (Larios et al., 2016; Mahmoud et al., 2021; Paskaleva et al., 2015; Rubalcaba et al., 2022). Living labs can be seen as playgrounds for open urban innovation processes. The living lab approach infers that the entire community is initial involved in urban development process when planning the city project as it increases the potential for active residents' participation (Paskaleva et al., 2015). The different stakeholders are also involved in the conceptualization of ideas and testing of urban prototypes (Simonofski et al., 2019). The living lab can help to carryout market appraisal and exploring different urban ideas and decrease of business risks for enterprise operating within the city (Simonofski et al., 2017).

Furthermore, open data can be employed as a medium to support co-creation for urban development as it is sourced from different stakeholders and can be used to address complex urban problems for instance to support and manage public traffic (Capdevila & Zarlenga, 2015; Ma & Lam, 2019). Open data refers to non-confidential and non-restricted data which is publicly produced and is disseminated without any restrictions on its distribution or usage (Capdevila & Zarlenga, 2015). In urban context, open data can be employed to improve the transparency of urban administration and provides innovative business opportunities for citizens, enterprise, and municipality administration (Anthony Jnr, 2021c; Capdevila & Zarlenga, 2015). However, researchers such as Berntzen and Johannessen (2016) argued that the distribution of open data will not inevitably lead to community engagement because actors such as citizens require some technical skills to transform and utilize the data for co-creation. Nonetheless, open source platforms or applications can be developed from open data to ease collaboration among citizens to address urban issues (Simonofski et al., 2019). Additionally, citizen sensing is another form of community engagement for achieving development-led and creative-practice engagements within smart sustainable cities. Do it yourself (DIY) projects can be propose as a medium to improve urban innovation by involving citizens using sensing technologies and participatory media (Gabrys, 2014; Mahajan et al., 2021).

Theoretical Background

Recent literature on smart sustainable cities mentioned that for cities to achieve economic, social, and environmental goals, municipalities adopt ICT to digitalize and improve urban services (Jnr et al., 2021; Leclercq & Rijshouwer, 2022). The technologies employed some help to achieve an interoperable and integrated systems needed to control and manage the administration of applications and data sources, thereby facilitating efficient urban systems (Kummitha & Crutzen, 2019; Feiferytė-Skirienė et al., 2022). Notwithstanding this understanding, the smart sustainable city literature highlights the need for a model that comprises of different community of stakeholders needed to promote smart sustainable city development (Kummitha & Crutzen, 2019). As such, a few studies have been published that aimed to promote community engagement of various stakeholders in urban context. Among these studies, Fredericks et al. (2020) examined community engagement within smart cities to connect, interact, and engage local communities. The study developed a smart

engagement ecosystem to support the connection of citizens via digital, physical, or hybrid approaches.

Another study by Bouzguenda et al. (2019) conducted a systematic review on the role of ICT on citizen participation in promoting smart sustainable city. The authors highlighted the role of ICT in improving citizen participation procedures towards the creation of human leaded smart cities. Simonofski et al. (2019) developed a framework to structure and assess citizen participation within smart cities. Grounded on literature review, the relevant enablers that impact citizen participation were presented within the developed framework. The framework was validated via the application to diverse smart cities and through interviews with key stakeholders in a smart city. Nieto-Mengotti et al. (2019) provided a study on smart city as a platform economy to improve civic engagement for the creation of platforms that foster smart city development. The authors mentioned that citizen participation is required in the creation of smart cities to have a favorable impact on the quality of life of citizens to improve decision-making. Likewise, Simonofski et al. (2019) investigated citizen participation for smart city design based on diverse enablers of citizen participation within smart city. The study developed a framework to foster citizen participation for smart city design. The authors considered smart cities as sociotechnical systems which comprises of citizens as urban end users.

Additionally, Axelsson and Granath (2018) explored stakeholders' relation and stake towards smart city actualization. A framework was developed that considers smartness and stakeholders dimensions during city planning towards evaluating the complexity associated outcomes linked to city planning. Gutiérrez et al. (2017) explored how to empower citizens to contribute towards the co-creation of sustainable cities. The authors mentioned that municipalities need to deploy their own smart city missions, by defining the policies to mobilize and engage citizens to participate in urban initiatives. De Oliveira (2016) presented an innovative form of participatory governance that involves human smart cities strategy. This approach helps to transform the way citizens live, work, and govern the processes with an optimum usage of urban resources. Granier and Kudo (2016) explored how citizens are involved within smart city development by examining citizen participation in smart communities. Their study aims to advance smart communities by involving citizens in urban governance in the co-production of urban services, mostly energy production and delivery.

Furthermore, Fernandez-Anez (2016) investigated different discourses that stakeholders embark on during smart city development. The author presented a concept around stakeholders' approach within smart cities and provided a comprehensive definition and various initiatives developed in the literature. Paskaleva et al. (2015) explored stakeholder engagement within smart cities based on living labs towards the development of urban services. Their study focused on addressing how citizens can be effectually involved for co-production of innovative services and how urban stakeholders can be engaged to contribute towards transformation of smart cities. Gabrys (2014) researched on environmentality and citizen sensing within smart city. The author discussed the distribution of governance within and through environmental technologies for how smart cities can be designed. Their findings highlighted

how the practices and operations of citizenship developed as a critical part towards the actualization of smart and sustainable cities.

Accordingly, findings from the literature (Ibrahim et al., 2017) highlighted the need of engaging different types of stakeholders in urban transformation projects from an early stage. None of these studies provided a systemic or holistic approach to realize community engagement towards smart sustainable city development. Likewise, findings from the discussed 12 studies explored either the role of citizen participation or stakeholder participation or community engagement towards smart city development. However, there are fewer studies that explored how municipalities can enable community engagement for co-creation of innovative solutions towards actualizing a smart sustainable city. Moreover, the reviewed studies did not present the challenges and recommendations on how cities can improve community engagement for co-creation of innovative solutions for smart sustainable cities attainment. This current study is original as it adds to exiting body of knowledge by addressing these short comings.

Developed Conceptual Model

This section aims to address the first research question specified in the introduction section by discussing how cities enable community engagement for co-creation of innovative solutions towards actualizing a smart sustainable city. This is achieved by identifying factors that influences community engagement for smart sustainable city development.

Factors that Influence Community Engagement

The deployment of community engagement is crucial to develop a democratic and trusted urban environment in which the entire community and municipality co-design urban solutions together. However, the deployment of community engagement for smart sustainable city is influenced by several factors. Therefore, the developed propositions (which is an assertion or statement that expresses an opinion or judgement) and factors are categorized as social, institutional, and technological factors as discussed below, similar to prior studies (Anthony Jnr, 2021b; Jnr et al., 2021) that developed propositions.

Social Factors

Perception of Citizens Community engagement forms a democratic citizen centric approach with regards to urban development (Carayannis & Campbell, 2021). However, the effectiveness of community's engagement depends on the readiness of citizens to partake in urban development (Ortiz, 2022). In fact, community's engagement means that residents should believe that their engagement is significant and will have a positive effect towards urban development (Mahajan et al., 2021; Mellouli et al., 2014). The involvement of different stakeholders enhances citizens

buy-in, increases transparency, and decreases oppositions (Ibrahim et al., 2017; Leino & Puumala, 2021). But conversely, researchers such as Capra (2016) highlighted that the attendance of different actors during the co-creation process with different perceptions regarding urban challenges may potentially lead to different strategies to be employed in address urban issues as the actors will have different perceptions regarding the problems thereby suggesting dissimilar solutions.

Unequal Demographics Traditional community engagement approaches tend to mostly involve a certain population and excludes others from the engagement process, such as younger/older citizens demographics, minorities, and people who are linguistically and culturally diverse (Heaton & Parlikad, 2019; Paskaleva et al., 2021).

Time Availability Community engagement requires investment in time, where contributors need to create time to partake in the co-creation activities. Thus, members of the community need to investment time and arrange other priorities such as family commitments, work, and social events. (Rubalcaba et al., 2022). Moreover, the demographics of a local community is crucial as it can help in adapting various engagement activities, selecting the correct timing and how the community engagement aligns with existing events (Fredericks et al., 2020). This might conflict with their timeframes allocated for other planned engagement (Vedeld, 2022). Based on the discussion regarding perception of citizens, unequal demographics, and time availability, the following proposition is made:

P1. The social factors employed within community engagement will significantly influence co-creation of innovative services within smart sustainable cities.

Institutional Factors

Distrust of Government Authorities In general, there is usually distrust of government motivated initiatives as its mostly driven by the aim of the municipality and less on the concerns and needs for the society (Carayannis & Campbell, 2014). This can result to lack of willingness for citizens to be engaged, consequently, leading to cynicism regarding whether the community's opinions will be considered at all (Fredericks et al., 2020).

Inadequate Fund Capital-intensive funds are mainly required for initiating urban innovations (Lee & Lee, 2014). The municipality and enterprises involving in the co-creation may provide sponsorship to fund the co-creation activities both physical and online (Anthony Jnr, 2021b).

Physical and Social Limitations Most residents may be limited to visit the physical location where innovation is being carried out such as residents living with

disabilities, elderly persons with cognitive function, physical frailty, and children not being able to partake in the co-creation process due to age restrictions (Seo, 2022). The social limitation relates to underprivileged and underrepresented people such as homeless people, displaced individuals, migrants within the community, and most time indigenous people (Fredericks, 2020). Based on the above discussion on distrust of government authorities, inadequate fund, and physical and social limitations, the proposition is stated as:

P2. The institutional initiatives employed within community engagement will significantly influence co-creation of innovative services within smart sustainable cities.

Technological Factors

Availability of Infrastructures This play a significant role in co-creation for urban innovation towards the actualization of a smart sustainable city as infrastructures embody the foundation for development of digital platforms to be employed for co-creation activities (Anthony Jnr, 2020; Berntzen & Johannessen, 2016). Nevertheless, in some cases, the unavailability of technology led to some participants developing low-cost ICT infrastructures (Choque et al., 2019; Mahmoud et al., 2021). As physical co-creating mostly involves providing Wi-Fi connection, optic fiber network in public spaces or in the case of living lab, this requires installing and configuring sensor and devices to be available for different providers and purposes (Capdevila & Zarlenga, 2015).

Technical Know-How Not all citizens are willing or possess the skill to utilize digital platforms during the co-creation process due to computer and digital literacy, language, or aptitude-related barriers (Gabrys, 2014).

Additionally, certain demographics within the community may be more interested and enthusiastic to engage with digital platforms to improve urban innovation (de Oliveira, 2016; Fredericks et al., 2020).

Data Security The use of different clouds platforms and data sources for community engagement may lead to security issues such as the data collected from participants involved in co-creation are mostly used for user profiling, data aggregation, processing, and visualization. (Anthony Jnr, 2021b; Heaton & Parlikad, 2019; Khan & Kiani, 2012). Third party users may have access to these data and use it for malicious purposes (Jnr et al., 2021). Grounded on the proceeding discussion on availability of infrastructures, technical know-how, and data security, this proposition is stated:

P3. The technological initiatives employed within community engagement will significantly influence co-creation of innovative services within smart sustainable cities.

Based on the identified social, institutional, and technological factors, a conceptual model is developed, grounded on the literature as seen in Fig. 11. The model

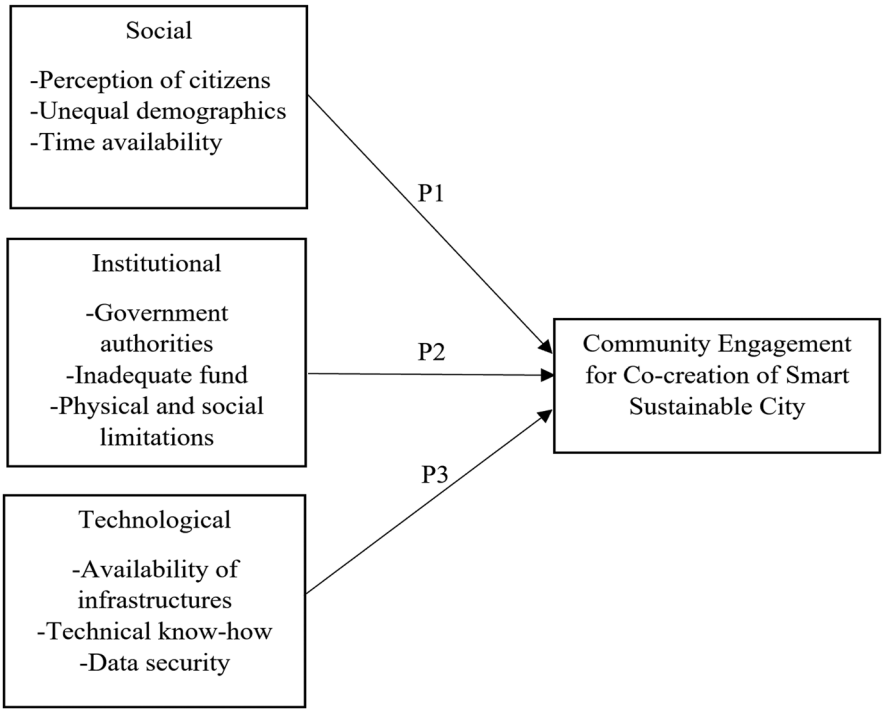

Fig. 11 Conceptual model for community engagement in smart cities

presents the factors that influence community engagement for co-creation of innovative solutions in smart sustainable cities. The developed model can support community engagement for urban innovation by specifying factors that influence community engagement for smart sustainable city development. The model can enable citizens, policy makers, government, urban planners, academics, and enterprises in urban environment to connect, interact, and engage and co-create innovative services.

Recommendations to Improve Community Engagement

The population in urban environment will increase to about 2.6 billion residents in the year 2050. Thus, cities are implementing smart sustainable initiatives to create a conducive environment to promote citizen quality of life. Municipalities in emerging economies are engaging in co-creation activities to encourage community participation which facilitates citizen-led interventions towards gaining legitimacy in decision making. A prerequisite for achieving smart sustainable cities is the involvement of the society. The participation of different stakeholders from the very beginning of urban project is needed for municipalities to develop their own smart sustainable

city vision (Gutiérrez et al., 2017). Thus, the municipality, enterprises, and universities need to collaborate to enhance urban innovations being initiated. On the other hand, citizens need to take the responsibility in community-led initiatives to achieve the needed visibility and acceptance (Kummitha & Crutzen, 2019). Findings from the literature confirm that cities' public participation in policy formulation positively impacts the adoption of sustainability policies (Berntzen & Johannessen, 2016).

Therefore, municipalities should motivate and involve citizens to participate in community lead engagement as citizens have a better overview of their neighborhoods and are the main influencers of the future co-creation process (Gutiérrez et al., 2017). Besides, the deployment of technology within the city does empower community engagement. Hence, municipalities are obliged to incorporate novel technological infrastructures to aid urban development (Anthony Jnr, 2021b). Evidently, citizens, universities, enterprise, and government are main stakeholders that can contribute positively to urban development, but this entails careful planning from the municipality. Engagement of these stakeholders can be realized with different methods, either digitally or physically (Haustein & Lorson, 2023). As such, city hall meetings, surveys, focus groups, dialogues, social media, discussion forums, workshops, polls, etc. may be employed to collect data from stakeholders regarding their opinions (Berntzen & Johannessen, 2016; Fredericks et al., 2020; Melendreras-Ruiz & García-Collado, 2013).

The physical public space by deploying informal interviews and meetings with different stakeholders within the city helps to gain an understanding of each actor's needs and concerns (Fredericks et al., 2020). The digital public space which provides urban stakeholders with alternative means of participating through digital platforms can improve community engagement process as it encompasses a wider demographic participation (Fredericks et al., 2020; Karadimitriou et al., 2022). Digital platforms can also improve citizens participation by providing information on new technologies that can adopted to improve smart sustainable city development (Leclercq & Rijshouwer, 2022; Rubalcaba et al., 2022; Simonofski et al., 2017). Digital community engagement via social media and discussion forums can facilitate citizen input as some participants may be unwilling to join a physical focus group or join a city hall meeting due to space and time constraints (Simonofski et al., 2017). Use of digital platforms can help address these constraints by providing opportunities for citizens to participate in the decision-making processes. However, it is important for municipality to communicate earlier the input that is required from the community and how it will help for urban development (Berntzen & Johannessen, 2016).

The digital public space platforms should be easy to access and user-friendly to citizens and enforce data security measures, respect the privacy of all users, allowing all stakeholders to freely express their concerns and opinions. Digital platforms also help to foster educational activities by facilitating brainstorming activities, the use of open data in developing citizen-centric applications citizens, introduction to programming, and competitions such as neighborhood games serious gaming and hackathon (Simonofski et al., 2017). Furthermore, to improve community engagement, financial incentives can be provided to help offset personal costs incurred during community engagement (Fredericks et al., 2020). As suggested by

Melendreras-Ruiz and García-Collado (2013), to improve community engagement, education programs regarding smart sustainable city can be regularly initiated for all ages. Regarding living labs, good governance structure should be initiated from the start of the project to help with formalization and governance structure of the living environment. Thus, the governance mechanism will help to manage associated complexity faced as living lab grows bigger (Paskaleva et al., 2015).

Discussion

Due to the increasing population in urban environment, cities need to become smart and sustainable to address the needs of citizens and other stakeholders (Ståhlbröst et al., 2015). Cities can be considered as a complex eco-system which comprises of different stakeholders (Anthony Jnr, 2021b). The actualization of smart sustainable vision embraces technological, environmental, economic, and social dimensions within the municipality, where the community plays a key role (Gutiérrez et al., 2017). But, for cities to become smart and sustainable, it is significance to involve the community. A smart sustainable city is a city that investments in social, human capital, and ICT to boost green economic growth and a better quality of life, with an efficient use of natural resources, via participatory governance (Simonofski et al., 2017; Ståhlbröst et al., 2015). The smart sustainable city facilitates the advancement of the technological infrastructures of the city. In urban development literature, societal participation refers to the engagement of the community in the planning and development processes of the city. Thus, the community should be at the center of the urban development via participation, collaboration with other stakeholders for transparent governance (Simonofski et al., 2017), although several authors have highlighted the importance of community engagement in urban research (Axelsson & Granath, 2018; Simonofski et al., 2017).

Over the decade, the technological dimension of smart sustainable cities has been explored in the literature; the important role of the community or the society has been less explored. Furthermore, there is lack of attention on the role of community participation for social sustainability (Granier & Kudo, 2016), and prior studies did not identify the factors that impact the community engagement in a smart sustainable city context. In this sense, this study argues that the human, social, or community aspect of the smart city has not been sufficiently integrated in the smart sustainable city research (Capdevila & Zarlenga, 2015). This study provides evidence from a societal perspective that goes beyond the technological focus as mostly explored in the literature. Therefore, this article carried out a semi-systematic literature review to explore how cities can enable community engagement for co-creation of innovative solutions towards actualizing a smart sustainable city. Findings from this study are aligned with social sustainability which is one of the dimensions of sustainability (see Fig. 8). Besides, findings present a typical community engagement ecosystem and different approaches to be employed to achieve co-creation and community engagement towards actualizing a smart sustainable city. Additionally, this study presents the challenges and recommendations to improve community engagement for co-creation of innovative solutions in smart sustainable cities. Accordingly, this

article provides a clear relationship between social sustainability and community engagement for urban innovations towards the co-creation of smart sustainable cities based on the designed community engagement ecosystem (as presented in Fig. 9).

Findings from this study provide approaches to employ community engagement for co-creation of urban innovations (see Fig. 10), as well as implications on how community engagement perspective involving different stakeholders can help to achieve the resilient technological-driven city by supporting sustainable development and ultimately actualizing a socially inclusive urban space. Further findings from this study present a developed model grounded on the literature (see Fig. 11) that can support community engagement for urban innovation by specifying factors that influence community engagement for smart sustainable city development. The model can enable citizens, policy makers, government, urban planners, academics, and enterprises in urban environment to connect, interact, and engage and co-create innovative services. However, researchers such as Axelsson and Granath (2018) argued that the governance processes involved in community engagement has become extremely complex as it requires an ecosystem of different agencies and stakeholder (e.g., citizens, local governments, urban planners, and organizations) that are often driven by different interests. Findings from this study are analogous with results from prior study (Mellouli et al., 2014) which suggested that to provide the expected values to citizens municipalities need not only to design innovate services to their citizens to enhance their quality of life, but also engage the citizens in the co-creation phase. Although researchers such as Cardullo and Kitchin (2019) stated that while citizens are stakeholders in the beginning of urban development, it is not certain they are referred to once the project reaches the stage final phase. Undeniably, in most cases, neither universities, citizens, nor enterprises are involved in urban development such as smart mobility, smart parking, and smart lighting.

Implications of Study

Implications for Research

Cities around the world are incessantly evolving as the process of planning and urban development are changing due to social, technological, economic, and environmental issues. Community engagement provides a platform for creating innovative services that can be utilized to achieve a more attractive urban environment and better quality of life to all residents. This study highlights the significant role of community participation in the move towards social sustainability and develops a model and propositions as the key to realize better smart sustainable cities. Theoretically, this research aims at filling a gap in knowledge by critically exploring the possible factors that influences community engagement for co-creation of innovative solutions in smart sustainable cities. This article provides an outline for planning, developing, and implementing community engagement for co-creation of urban innovations (see Fig. 10), re-enforcing social implication for community engagement being a key component for actualizing of smart sustainable cities.

Additionally, the co-creation and community engagement approaches presented in this study can be employed as a reference guide for practitioners, researchers, and municipality administrators when planning for urban development projects that require input from the community. Specifically, co-creation and community engagement approaches presented provide guidance on technological and social features that can be employed to create a social activity within a public space either via physical, online, or hybrid mode. Findings from this study suggest that co-creation via community engagement provides opportunities for raising awareness around human-related issues which has the capability to support discussion that contributes towards urban planning and development. The conceptual model developed in this study can be utilized by researchers, practitioners, and municipalities to understand the factors that impact co-creation of urban innovations. Additionally, the suggested approaches in Fig. 10 can help municipalities to collect feedback and input from different stakeholders via different co-creation platforms and activities. This helps to provide new opportunities for interacting, connecting, and engaging with urban dwellers across the cities.

Implications for Practice

While the literature on urban development outlines the need to promote community-based engagement, there are fewer evidences of community participation for smart sustainable city development. Therefore, this study develops a model that conceptualize the challenges faced in employing community engagement for co-creation of innovative solutions in smart sustainable cities. Findings from this article provide recommendations to ensure an efficient and effective community engagement process, providing a holistic and systematic guideline needed to improve community engagement for co-creation of innovative solutions for social sustainability. The model can be adopted by urban planner and decision makers, helping to facilitate the participation of different stakeholders during co-creation process of urban transformation. Practically, the presented approaches in Fig. 10 can help to raise awareness around the potentials of community engagement process and creates a medium for community discussion where information from local community can be used to foster smart sustainability goal of the city.

This study provides evidence from the literature on how citizens can be involved in the decision-making process by improving the transparency of urban governance and accountability process for all stakeholders involved. The public spaces suggested in this study provide an informed access to real-time poll results and opinion status of data collected from universities, citizens, enterprises, government, etc., either via digital or physical channels. Additionally, this study calls for the deployment of digital platforms that can be used as participation tools to support the co-creation and overcome low level involvement faced by municipalities. The developed model can be employed as a governance tool for municipalities that want to invest in a community-oriented urban development strategy. Finally, the approaches presented in Fig. 10 can be utilized as best practices for selecting tools to be employed for community engagement towards co-creation of urban innovations.

Implications for Policy

In developing policy to keep up with the swift urbanization and its related sustainability challenges, many urban planners and policy makers are presently seeking to transform their cities into smart sustainable city. Respectively, researchers have indicated the need of engaging different stakeholders within the society in smart sustainable city development. Community engagement in urban development can be seen as service creators which can highly impact the results of urban project. For example, the involvement of citizens, universities, and organizations can offer services and solutions within the city and may co-sponsor urban projects. But, notwithstanding the role and the importance of engaging community in urban projects, there are fewer studies in the literature that explore the benefits and challenges of community engagement process.

At the policy level, this study provides the importance of considering the community for participatory urban planning as contributors towards the actualization of social sustainability. This study also provides policy makers with tools (see Fig. 10), to be employed during the urban project planning required for effective digital community participation. Furthermore, the identified factors (see Fig. 11) that challenges community engagement for co-creation of innovative solutions in smart sustainable cities can be used as a benchmark tool for improving urban community engagement to ensure societal participation in the co-design of new services. This study offers guidance on the approaches to be employed for either digital or physical public space needed for the engagement process, starting from the identification of all stakeholders to be involved the community engagement process (see Fig. 10). Findings from this study provide recommendations to urban planners and policy makers on the perspectives and dimensions to be considered during smart sustainable city as well as the tools needed to achieve a social sustainability vision.

Conclusion

Community engagement in smart sustainable city is beneficial as it can help to increase project acceptation of by the society, thereby averting negative reactions, developing services based on real needs of citizens, and strengthening residents' interest in the urban development. However, despite the crucial role of the community, there are fewer studies that provides a holistic and systemic view on the different community participation approaches in the literature. Findings from the literature acknowledge the important role of citizen community participation in urban development; as such, stakeholders such as citizens should be considered as actors in smart sustainable city development. Therefore, to address the first research question specified in the introduction section, this article conducts a semi-systematic literature review to support community engagement for urban innovation by connecting different stakeholders involved in smart sustainable city development through digital and physical approaches. This study further explored how cities can enable community engagement for co-creation of innovative solutions towards actualizing a smart

sustainable city by providing a community engagement ecosystem and approaches to employ community engagement for co-creation of urban innovations. These findings provide different methods to be employed to promote community engagement towards a smart sustainable city (see Figs. 9 and 10).

This study provides insights towards community engagement and social sustainability. A model is developed to provide implications on how community engagement perspective involving different stakeholders can help to achieve resilient technological-driven city by supporting smart sustainable city development and ultimately actualizing a socially inclusive urban space. The findings also provide implications to address the challenges and recommendations to improve community engagement for co-creation of innovative solutions in smart sustainable cities to address the second research question. Overall, findings from this study are expected to help future researchers and practitioners interested to explore how cities can enable community engagement for co-creation of innovative solutions towards actualizing a smart sustainable city. This is one of the studies that explored the challenges and recommendations to improve community engagement for co-creation of innovative solutions in smart sustainable cities. Findings from this study are based on the evidence from secondary data from the literature and have not been validated with primary data. Future lines of investigation will involve validating the developed model as seen in Fig. 11. Therefore, data can be collected by employing semi-structured interview to provide valuable insight into the identified factors conceptualized into the developed model. Survey data can also be collected to further validate the model using statistical analysis to be conducted via structural equation modeling.

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