TALLINN UNIVERSITY OF TECHNOLOGY
School of Business and Governance
Ragnar Nurkse Department of Innovation and Governance

Obianuju Clement Onwuzulike

SMART CITY GOVERNANCE: TOWARDS THE DEVELOPMENT OF SMART CITIES IN LAGOS STATE

Master's thesis
Technology Goverance and Digital Transformation

Supervisor: Jaanus Müür, PhD

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Obianuju Clement Onwuzulike ……

(signature, date)

Student code: 214198HAGM

Student e-mail address: obonwu@taltech.ee; ujuclement@gmail.com

Supervisor: Jaanus Müür, PhD:

The paper conforms to requirements in force

……

(signature, date)

The paper conforms to requirements in force

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(signature, date)

Chairman of the Defence Committee:

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ABBREVIATIONS

AfDB	Africa Development Bank
AI	Artificial Intelligence
CSO	Civil Society Organizations
EU	European Union
GNT	Governance Networks Theory
ICT	Information and Communication Technology
IoT	Internet of Things
IT	Information Technology
LSG	Lagos State Government
NBS	National Bureau of Statistics
NGOs	Non-Governmental Organizations
NISER	Nigerian Institute of Social and Economic Research
NPC	National Population Commission
QoL	Quality of Life
SC	Smart City
SCs	Smart Cities
SCG	Smart City Governance
SSC	Smart and Sustainable City
TI	Technological Infrastructure
UN	United Nations
UN-Habitat	United Nations Human Settlements Programme

ABSTRACT

This study examines the involvement of different stakeholders in the development of smart cities in Lagos State. The findings suggest that a diverse range of stakeholders, including government agencies, industry players, academic institutions and citizens/civil society organizations should be involved in smart city development. However, the analysis also shows that the double-helix model of collaboration between government and industry is widely utilized in Lagos State. The State is utilizing the double-helix model of collaboration because of their inability to overcome several obstacles that hinder their partnership with citizens and universities. These challenges encompass a lack of trust, conflicting interest, a limited expertise to engage with citizens and universities, diverging or conflicting perception of problems, conflicting or dysfunctional rules and lack of coordination mechanism. Based on the findings, the quadruple-helix model of collaboration is preferred by most of the respondents of the survey, and is being proposed to Lagos State. This form of collaboration will bring together all essential stakeholders needed in the smart city development process, including the government, industry players, universities/research institutions, and citizens/civil society. The paper provides general solutions to the challenges that may hinder the adoption of this proposed model. Overall, this study highlights the importance of involving a diverse range of stakeholders in smart city development in Lagos State.

Keywords: Smart city, smart city development, smart city governance, collaboration, collaborative ecosystem, double-helix model, triple-helix model, quadruple-helix model, governance networks

1. INTRODUCTION

Urbanization is one of the most pressing challenges confronting the world today. The United Nations (UN) reports that 55% of the global population presently resides in urban areas, and this number is projected to rise to 68% by 2050 (UN, 2018). This rapid urban population growth has led to a myriad of social, economic, and environmental issues that necessitate the attention of policymakers, urban planners, and citizens alike. In Africa, urbanization is also accelerating at a rapid pace, with the urban population expected to increase from 36% in 2010 to 50% by 2030 (World Bank, 2016).

Lagos State is also facing the challenges of rising urbanization. According to the National Population Commission (NPC, 2021), the State's population is estimated to be over 22 million as of 2021, with an increase of approximately 85 people per hour, 2,028 people per day, and 740,000 people per year. According to the UN World Urbanization Prospects report (2018), Lagos is the second most urbanized city in Africa (with urbanization rate of 85.2%), following Cairo, Egypt with a rate of 95.7%. This indicates that the proportion of the population residing in urban areas is higher in Lagos than in any other city in Africa, except for Cairo. A study by the National Bureau of Statistics (NBS, 2019) estimates that Lagos State is home to approximately 10.6% of Nigeria's total population. Lagos is also one of the largest cities globally, with a growth rate of approximately 3.2 percent (Fadare and Oduwaye, 2009). By 2050, the population of Lagos is projected to reach about 33 million (Hoornweg and Pope, 2017).

Being Nigeria's largest and most urbanized city presents a slew of daunting challenges. According to a report by the Nigerian Institute of Social and Economic Research (2018), Lagos State faces inadequate infrastructure challenges in several areas, including transportation, housing, electricity, water supply, waste management etc. A UN’s report shows that less than 10% of the population of Lagos has access to pipe-borne water, and many people rely on contaminated sources for their daily water needs (UN, 2020). A report by Nigerian Institute of Social and Economic Research (NISER, 2018) shows that Lagos State's transportation system is characterized by severe traffic congestion, poor road conditions, and inadequate public transportation services. The report also shows that the State's road network is inadequate, with a road density of 1.3 km per 1,000 people, which is significantly lower than the recommended standard of 4 km per 1,000 people. Adelekan (2016) also validated the point that the city's transportation system is poorly developed, with a lack of reliable public transportation options and frequent traffic congestion. There is also a challenge of high level of poverty and inequality, which has resulted in widespread slum settlements and

lack of access to basic services for many residents. According to a report by the World Bank, over 60% of residents live in informal settlements, and these areas lack basic infrastructure such as paved roads, waste management systems, and health facilities (World Bank, 2019).

The State has over the years faced with the challenging threat of flooding and other environmental risks. According to Abiodun *et al.* (2021), the city is located on the coast and that makes it vulnerable to flooding, which is exacerbated by poor drainage systems and climate change. The city faces other environmental challenges such as air pollution and the degradation of natural habitats. The issues of governance and urban planning are visibly present in the State. Furthermore, the city has a complex governance structure that involves multiple levels of government, which can lead to fragmentation and a lack of coordination in urban planning and service delivery (Ibrahim, 2017). Additionally, urban planning in Lagos has been characterized by informal and ad hoc development, which has led to the proliferation of slum settlements and other informal settlements (Adelekan, 2016).

The rapid urbanization of Lagos State has presented significant challenges, but the State government sees the development of smart cities as a promising solution (Sanwo-Olu, 2021). Smart city development has become a topic of global interest in recent years as cities seek to leverage technology to improve citizens' quality of life (QoL). In the 21st century, smart city development has gained serious attention from governments around the world (Macke *et al.*, 2018). Smart cities are seen as a way to address a range of socioeconomic and environmental challenges facing cities (Yigitcanlar *et al.*, 2018; Martin *et al.*, 2019; Nesti, 2019). However, the collision of the digital world with non-digital issues such as social justice, politics, ideology, legality, and regulation has highlighted the complex governance of smart city development (Smith, 2017). This complexity is particularly pronounced in developing countries, which are still working to meet their citizens' basic needs. The governance of smart city development may be even more intricate in these countries, especially as rural-to-urban migration continues to put pressure on the ecological, social, and infrastructural systems of major cities (Tan and Taeihagh, 2020).

Smart city governance (SCG) according to Nam and Pardo (2011a), encompasses the processes, structures, and systems that facilitate collaboration, decision-making, and stakeholder engagement in the planning, execution, and delivery of smart city projects. Smart city implementation relies heavily on effective governance to ensure sustainable and impactful outcomes. Buettner *et al.*(2018) also emphasize the importance of governance in ensuring that smart city initiatives align with citizen needs and expectations, particularly in regions such as Africa where citizen participation in decision-making can be limited. However, implementing SCG in Africa presents

significant challenges, including insufficient funding, inadequate infrastructure, data privacy and security concerns, and limited citizen participation. Addressing these challenges requires a coordinated effort among all stakeholders, including the government, private sector, and citizens.

In recognition of the critical need for a global SCG framework, the United Nations Human Settlements Programme (UN-Habitat) conducted a comprehensive global study in 2022 to examine various approaches to SCG around the world (UN-Habitat, 2022). The study culminated in a framework that identified key governance areas that must be considered when managing the planning, implementation, and maintenance of smart city initiatives. The framework is structured around three pillars: Strategy, Collaborative Ecosystem and Technological Infrastructure (TI). While each pillar is vital, this thesis focus primarily on the second pillar (Collaborative Ecosystem) of the SCG framework. The report defines a Collaborative Ecosystem as the governance mechanisms required to manage networks of stakeholders involved in smart city initiatives, as well as the various tools used to form and manage collaborative partnerships that support the development of these initiatives. The success of smart city initiatives hinges on the establishment of collaborative partnerships. Without effective collaboration, the implementation and maintenance of smart city initiatives may not be feasible.

Lagos State recognizes the importance of developing effective governance for smart city development, as this can help to navigate the complex issues involved (Smith, 2018). Effective SCG is critical to the success of smart city initiatives, as it involves managing and operating the various aspects of smart cities, and requires collaboration among multiple stakeholders, including government agencies, private sector organizations, and citizens. As Giffinger *et al.*(2007) note, SCG involves a collaborative, multi-level and multi-actor approach that fosters partnerships among public and private stakeholders, and between local and regional actors. This collaborative approach ensures that smart city initiatives align with the needs of local communities, and that all stakeholders have a voice in decision-making processes.

Developing effective SCG with a focus on collaborative ecosystem will be critical for the success of smart city initiatives in Lagos State. The thesis aims to investigate and analyze the current state of governance in Lagos State, Nigeria, in relation to the development of smart cities, with a specific focus on the collaborative ecosystem (Mora *et al.*, 2019; UN-Habitat, 2022). The thesis aims to explore the extent to which the governance structure in Lagos State is supporting or hindering the development of a collaborative ecosystem for smart city development, including policy frameworks, institutional arrangements, stakeholder engagement, and collaboration mechanisms (Klijn and Koppenjan, 2016). It will also identify opportunities and challenges in developing a

collaborative ecosystem for smart city development and propose recommendations for improving governance to enhance the prospects for smart city development in the region. The thesis will provide insights into the role of governance in smart city development and contribute to the understanding of the challenges and opportunities in creating a sustainable and inclusive smart city in Lagos State.

Lagos State was chosen as the focus of the thesis topic due to its status as the economic and commercial hub of Nigeria and one of the fastest-growing cities in the world. According to the UN, Lagos is projected to become the world's third-largest city by 2025 (UN-Habitat, 2016). This rapid population growth has led to several challenges, including traffic congestion, poor waste management, and inadequate housing, among others. Furthermore, the State has shown a commitment to implementing smart city initiatives in recent years, with the launch of the Lagos Smart City Initiative in 2017 (Lagos State Government, 2017).

Several scholars have also emphasized the significance of Lagos as a case study for smart city development in Africa. For example, Oluwagbemi *et al.*(2019) argue that Lagos can serve as a model for other African cities looking to implement smart city initiatives due to its size, diversity, and complexity. Similarly, Afolabi *et al.*(2019) assert that Lagos State has a chance to become a leading smart city in Africa if the right strategies are implemented.

This thesis has one main research question:

RQ: What is the state of the collaborative ecosystem in Lagos State in the context of smart city development?

In order to create a well-structured quantitative survey that effectively addresses the main research question, the main research question was further divided into two sub-questions outlined below:

SRQ1: In the context of smart city development in Lagos State, who are the main actors?

SRQ2: Which is the model of collaboration for smart city development in Lagos State and why?

The first sub research question aims to identify and understand the key stakeholders or actors involved in a development of smart cities in Lagos State. By identifying these key actors, the author will provide insights into their roles, interests, and interactions, which will help the government and policymakers gain a better understanding of the various actors involved in smart city development and how they can work together to achieve a common goal.

The second sub-research question seeks to identify and evaluate different collaborative models that have been implemented for smart city development in Lagos State. Its goal is to understand

the various types of partnerships, networks, and collaborations that exist among different actors in the smart city ecosystem, and to determine which collaboration model has been widely used by the State and the reasons behind its selection. By answering this research question, the author will be able to identify the most effective collaboration model for smart city development in Lagos State, along with the key factors that will contribute to its success.

The thesis is organized into six chapters. Chapter 1 provides an overview of the entire thesis, including the research questions, rationale, and focus. Chapter 2 is dedicated to the literature review, which delves into the challenges and opportunities associated with smart city development, as well as the importance of governance and collaboration in driving such development. Chapter 3 outlines the research methodology and its justification. Chapter 4 covers the empirical analysis, the study's results, discussions, recommendations, and limitations of the study. Finally, Chapter 5 concludes the study.

2. LITERATURE REVIEW

2.1. Towards a Smart City Development

Smart city development is gaining attention, with information and communication technology (ICT) being a critical factor, as proposed by Alawadhi and Aloulou (2015). Caragliu *et al.*(2011) suggest a comprehensive framework considering economic, social, and environmental factors, while governance plays a crucial role with a need for participatory decision-making processes (Nam and Pardo, 2011a; Ojo *et al.*, 2015). Citizen engagement is also essential (Lee and Kim, 2015), and Silva and Almirall (2015) require a more comprehensive approach to measuring smart city performance. However, the lack of a clear roadmap for smart city development has led to disagreements over its status (Hollands, 2008), and there is an absence of consensus on its development. Kitchin and Dodge (2015) argue that it is "ill-defined" without a clear framework, while Graham and Marvin (2016) suggest that the term "smart city" is contested and ambiguous. This section and sub-sections aim to provide clarifications that will aid smart city development.

2.1.1. Smart city concepts and definitions

The increasing attention to smart cities can be attributed to the global trend towards urbanization. As cities become more crowded, they face a range of challenges, including traffic congestion, air pollution, and insufficient infrastructure. Smart cities are seen as a way to address a range of socioeconomic and environmental challenges facing cities (Yigitcanlar *et al.*, 2018; Martin *et al.*, 2019; Nesti, 2019). The term "smart city" first originated in the mid-1800s within the context of newly established self-governed cities in the American West. (Yigitcanlar *et al.*, 2018) and became associated with "smart growth" in the 1990s, particularly in transportation, mobility, and planning (Herrschel, 2013). In the 21st century, smart city development has gained serious attention from governments around the world (Macke *et al.*, 2018). Diverse smart city initiatives, whether led by the government or the private sector, have utilized ICT to develop a new optimized and effective solution to the growing challenges of cities and urban areas (Caragliu *et al.*, 2011; Su *et al.*, 2011).

The rapid advancement of software, hardware, and networks within the field of ICT has enabled the connection of people and city facilities (Pereira *et al.*, 2017). The smart city concept encompasses the integration of technology, government, and society, through the use of technological enablers like internet of things (IoT) and artificial intelligence (AI). This integration facilitates the development of multiple aspects of a smart city, such as transportation, governance, education, safety, and communication. In terms of defining what a smart city is, there has not been a universally accepted definition as different authors give their different definitions. However, it

is imperative to remark that the primary objective of early smart city initiatives was to improve the QoL for urban residents by addressing the disparity between demand and supply in different urban functions (Zanella *et al.*, 2014).

According to Caragliu *et al.*(2011), alternative names for smart cities can be achieved by substituting the term "smart" with other related terms such as "intelligent" or "digital." This results in a set of conceptual variants such as intelligent cities and digital cities, which emphasize the use of data and technology to improve urban systems. The terms "wired cities," "future cities," "sustainable cities," and "green cities" also represent other conceptual variants of smart cities that focus on different aspects of urban development, such as digital infrastructure, long-term vision, environmental sustainability, and social inclusiveness (Choenni *et al.*, 2015; Giffinger *et al.*, 2007; Krueger and Gibbs, 2013; Rocco and Stanghellini, 2015).

Silva *et al.*(2018) provide a general definition of smart cities as urban environments that use ICT and related technologies to enhance the efficiency of city operations and the quality of services provided to citizens. However, experts have proposed various definitions that consider different aspects and perspectives of smart cities. For example, Harrison *et al.*(2010) define a smart city as a city that integrates physical, social, business, and ICT infrastructure to improve its intelligence. Another definition, proposed by Kondepudi (2014), characterizes a smart city as a modern city that uses ICT and other technologies to enhance QoL, competitiveness, and operational efficiency of urban services, while ensuring resource availability for present and future generations in terms of social, economic, and environmental aspects. In order to meet the demands for a better QoL, modern smart cities prioritize sustainable and efficient solutions for managing energy, transportation, healthcare, governance, and other areas (Ejaz *et al.*, 2017). This is done to address the pressing needs brought on by urbanization.

2.1.2. Three strands in the smart city literatures

Meijer and Rodrı´guez Bolı´var (2013) distinguish three strands in the smart city literature that represent three different ways of conceiving how city smartness can be improved: the technical strand, the human resources strand, and the governance strand.

The technical strand

The technical strand of the smart city literature places a strong emphasis on the role of smart ICTs as the fundamental infrastructure for integrating all city components and dimensions. Hall (2000) was among the first to advocate for an integrated approach to smart cities, highlighting how a smart city can monitor and integrate the conditions of its critical infrastructures to optimize

resources, plan preventive maintenance, and enhance security while maximizing services to citizens. Dirks *et al.*(2009) build on this idea, suggesting that ICTs can be used to instrument and interconnect a city's core systems, leading to an organic integration of IT-based systems. By utilizing smart technologies, cities have the ability to enhance the intelligence, connectivity, and efficiency of their essential infrastructure components and services (Washburn *et al.*, 2010).

The human resources strand in the smart city literature

Meijer and Rodrı´guez Bolı´var (2013) argue that researchers in the human resource strand of the smart city literature place a central focus on people and their role in the operation of smart cities. Chourabi *et al.*(2012) stress the importance of considering people and communities as critical components of smart cities, despite their traditionally neglected status in the field. Smart cities require a robust social infrastructure that includes intellectual and social capital to foster the emergence of a creative class, a key asset for these cities (Albino *et al.*, 2015). Education, learning, and knowledge are essential for cultivating creativity and social innovation, which are considered key drivers of smart cities (Nam and Pardo, 2011b; TEPSIE, 2015). In this regard, making people smarter is a key objective of smart city initiatives, as smart, educated, and informed individuals represent a valuable resource that can help make cities smarter. These individuals not only contribute to a city's competitiveness and economic growth but can also become active users of smart services and participate in the governance and management of the city, ultimately shaping the success or failure of smart city initiatives (Chourabi *et al.*, 2012).

The governance strand

Governance in the smart city literature is often associated with citizen participation and collaboration among stakeholders (Caragliu *et al.*, 2009; Giffinger *et al.*, 2007; Lombardi *et al.*, 2011; Baccarne *et al.*, 2014; Ba˘ta˘gan, 2011; Chourabi *et al.*, 2012; Nam and Pardo, 2011a, 2011b; Scholl and Scholl, 2014). According to Meijer and Rodrı´guez Bolı´var (2013), this implies that government structures and operations may need to be reformed to some degree to create a smart city. While participation and collaboration are frequently used interchangeably in the context of smart cities, Bartenberger and Grubmu¨ller-Re´gent (2014) suggest employing the more limited concept of collaborative governance to keep SCG distinct from the more general notion of participatory democracy. Collaborative governance involves a fundamental shift in how governance is conducted. It emphasizes the importance of collective decision-making processes involving public and private actors. In the context of smart cities, this is facilitated by the use of ICTs (Misuraca *et al.*, 2011). In the context of SCG, this involves developing and executing

policies that aim to make cities smarter, necessitating the sharing of visions and strategies with relevant stakeholders (Nam and Pardo, 2011b). It also involves managing the implementation of smart city initiatives that aim to enhance the intelligence of the various components/dimensions of the city (Chourabi *et al.*, 2012).

2. 2. Smart City Governance and Collaboration

According to the UN-Habitat (2022) report, collaboration is a fundamental pillar of SCG. In order for SCG to be effective, it is essential to establish a collaborative ecosystem that brings together various stakeholders involved in the development of smart cities. This section will provide an overview of SCG, its key concepts, and its significance in the development of smart cities. We will also explore the critical role that collaboration plays, not only within the SCG framework but also in the overall development of smart cities.

Manville *et al.*(2014) and Praharaj *et al.*(2018) have pointed out that the primary obstacle to transforming the majority of cities into smart cities is the absence of suitable governance arrangements. The complex, multi-level ecosystem of diverse agencies and stakeholder groups (such as local governments, citizens, and urban planners) with competing interests renders city governance incredibly challenging (Bibri and Krogstie, 2017). Testoni and Boeri (2015) assert that in order to manage the dynamics of smart cities, a new governance model is required, as well as strong coordination by the local government, to assist in managing complex collaboration processes with a variety of stakeholders, particularly citizens. In this scenario, it is imperative to redefine the roles of governments, citizens, and other social actors, and to explore emerging information technologies to devise a new governance model that incorporates new relationships, processes, and government structures (Gil-Garcia, 2012).

While there is no clear definition of SCG, Pereira *et al.*(2018) note that attempts have been made to identify the main perspectives in which governance is applied to smart cities SCG was conceptualized in four ideal-typical ways by Meijer and Bolivar (2016): smart city government, smart decision-making, smart administration, and smart urban collaboration. Meijer (2016) posits that SCG entails the use of new technologies (not necessarily the most advanced) to develop innovative governance arrangements and improve outcomes and processes. This means that new and innovative forms of governance are required to address the challenges of smart cities that go beyond traditional institutions and traditional governing processes (Bolvar, 2016).

The literature pertaining to SCG highlights two essential characteristics. The first one places significant emphasis on the involvement of different stakeholders (as pointed out by Albino *et al.*,

2015 and Nam and Pardo, 2011b). In SCG, the process of consensus-building among stakeholders is highly valued as it helps to foster agreement among stakeholders (Snow *et al*., 2016; Ruhlandt, 2018). This interaction between stakeholders can also facilitate innovative and sustainable urban development (Nam and Pardo, 2011a). The second characteristic of SCG involves the utilization of ICT to promote transparency in decision-making, encourage active participation and collaboration among stakeholders (Harrison *et al.*, 2010; Pereira *et al*., 2017). Digital technologies play a crucial role in supporting collaboration and consensus-building in SCG (Albino *et al*., 2015; Pereira *et al*., 2017).

The role of citizens in decision-making and their contribution to creating public value in the city or urban context is crucial. Effective SCG is built on the foundation of citizen engagement (Castelnovo *et al.*, 2015). A citizen-centric approach to decision-making in smart cities is key to assessing the impact of SCG on generating public values, such as economic growth (Castelnovo *et al.*, 2015; Meijer and Bolvar, 2016; Meijer *et al*., 2016). Meijer *et al.* (2016) suggest that a practical smart city strategy involves creating contextual conditions, governance models, and public value. The traditional approach to citizen engagement involves encouraging participation in decision-making by gathering suggestions and opinions on how to enhance public services (Castelnovo *et al.*, 2015). However, to reach a wider audience and include those who are typically excluded or uninterested in traditional participation methods, decision-makers can use ICT-based applications such as social media to encourage greater public engagement, and make more informed decisions that align with the needs of the population (Kleinhans *et al.*, 2015; Castelnovo *et al.*, 2015).

Fundamentally, effective collaboration and partnerships are considered crucial components of SCG for achieving success, as highlighted by various studies (Chourabi *et al*., 2012; Coe *et al*., 2001; Moss Kanter and Litow, 2009; Nam and Pardo, 2014; Scholl and Scholl, 2014). For a smart city, collaboration among departments and with communities is essential (Bătăgan, 2011), ensuring the involvement of various stakeholders in the decision-making process (Albino, 2015). The relationship between city government and its citizens is particularly important, and studies have emphasized the need to pay attention to this aspect (Giffinger *et al.*, 2007; Lombardi *et al.*, 2012; Paskaleva, 2011).

Furthermore, Meijer and Bolívar (2016) have identified collaboration as the dominant strategy in the governance models proposed in smart city literature. Collaboration in smart cities revolves around the entire city ecosystem, relationships between city government and organizations from all sectors, and the relationship between government and citizens (Mills *et al.*, 2021). Chun *et*

al.(2012) define collaboration as a process or set of activities where two or more agents work together to achieve shared goals. Several aspects of collaboration have been studied over the years, such as team collaboration and collaborative learning (Cheng *et al.*, 2016). According to Harrison *et al.*(2012), collaboration in the context of government involves the sharing of responsibility and authority for decisions on operations, policies, or actions of the government, and requires the involvement of multiple stakeholders. In conclusion, collaboration occurs at multiple levels, including inter-organizational, cross-sectoral, and government-citizen relationships (Nam and Pardo, 2014). Internal collaboration, also known as collaborative governance, refers to collaboration within or between public organizations, either inter-departmental or inter-institutional, and is facilitated by ICT (Chun *et al.*, 2012). Improving collaboration and integration across departments has become a priority for governments worldwide (Alhusban, 2015). External collaboration involves the participation of governmental and non-governmental entities, such as corporations, non-profits, civic groups, or individual citizens (Gabriela *et al.*, 2017).

Figure 1 below (Wirtz and Müller 2022, 10) illustrates the interdependence of various types of stakeholder collaboration in developing smart cities, summarizing interactions among stakeholders.

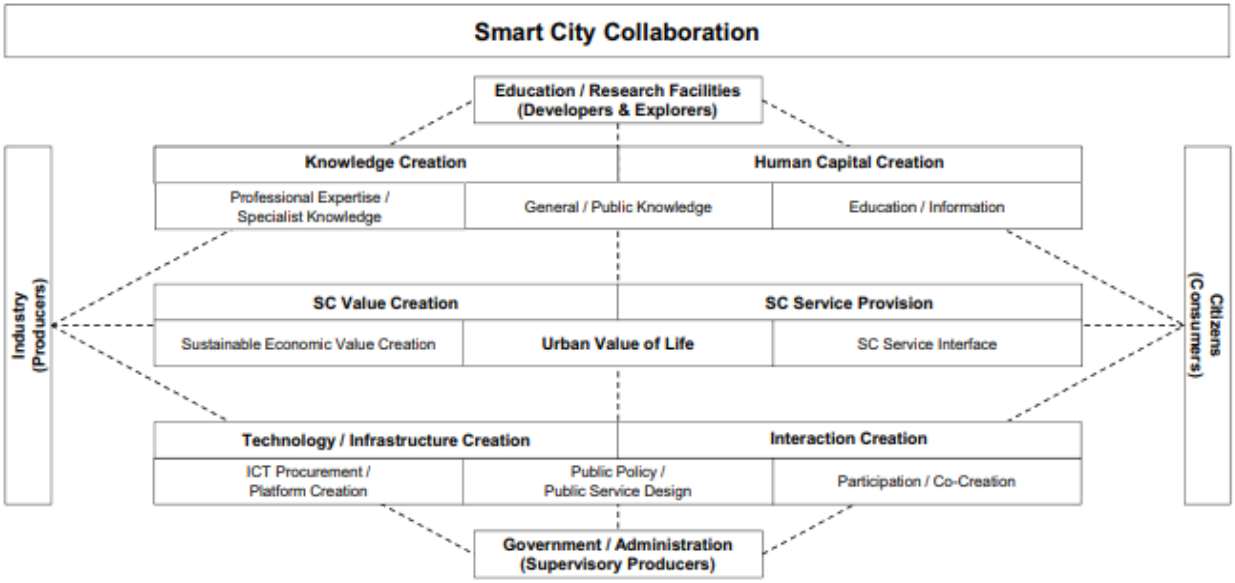

Figure 1. Collaboration among major stakeholders in SCs. Source: Wirtz and Müller (2022, 10).

2.2.1. Models of collaboration

According to Mora *et al.*(2019), there are three models of collaboration for city government to consider when developing smart cities. They are double-, triple-, or quadruple- helix model. The double, triple or quadruple-helix model of collaboration is a smart city development framework

that brings together diverse stakeholders from various sectors such as government, industry, academia, and citizens. This model places significant importance on collaboration and cooperation among stakeholders to achieve a common objective of creating a sustainable and livable city. Each of the collaboration models will be explained in more detail below.

Double- helix model

The double-helix model involves collaboration between two main stakeholders, the government and industry. The government provides the regulatory framework and policy guidelines, while industry provides the necessary technological expertise and resources to implement smart city solutions. This model has been criticized for not including other important stakeholders such as academia and citizens. It fails to provide the necessary intellectual capital required for driving smart city development (Leydesdorff and Deakin, 2011; Baccarne *et al.*, 2014a; 2014b); Dameri, 2014; 2017).

Triple- helix model

The triple-helix model has been utilized to promote collaboration between universities, industry, and government in the development and implementation of smart city solutions (Caragliu *et al.*, 2011). Universities contribute by providing research and knowledge on emerging technologies and their potential applications, while industry partners develop innovative products and services that address the city's needs. Government agencies provide funding and support for research and development activities, as well as policy and regulatory frameworks that promote the adoption of smart city technologies (Lombardi *et al.*, 2012).

For instance, the city of Barcelona, in collaboration with local government and academic institutions such as the Universitat Politecnica de Catalunya and the Institute of Advanced Architecture of Catalonia, has implemented sensors and data analytics to improve waste management, energy efficiency, and new mobility services (Caragliu *et al.*, 2011). In another example, the Smart Dublin initiative has brought together academic institutions, industry partners, and local government agencies to develop and implement smart city solutions such as smart parking systems, energy-efficient lighting, and data-driven public transport services (O'Brien, 2018).

Despite the usefulness of the triple-helix model, some critics argue that it neglects the role of citizens and civil society in shaping smart city solutions. Additionally, others argue that the model is too focused on economic growth and innovation, and it fails to consider social and environmental factors (Nam and Pardo, 2011a). Nonetheless, the triple-helix model remains a

valuable framework for facilitating collaboration between universities, industry, and government in the development of smart cities.

Quadruple-helix model

The quadruple-helix collaboration model is a framework that emphasizes collaboration among government, industry, academia, and civil society, with a focus on co-creation and co-design of smart city solutions. Civil society is added as a fourth actor to the triple-helix model, representing the needs and interests of citizens and communities. The quadruple-helix model has been found to be effective in promoting collaboration among stakeholders in smart city development and has been adopted by several successful smart city initiatives around the world (Carayannis and Campbell, 2009).

In the quadruple-helix model, universities provide research and knowledge on emerging technologies, while industry partners develop innovative products and services that address the needs of the city and its citizens. Government agencies provide funding and support for research and development activities, as well as policy and regulatory frameworks that promote the adoption of smart city technologies. Civil society groups represent the needs and interests of citizens and communities and are involved in co-creation and co-design of smart city solutions (Carayannis and Campbell, 2009).

An example of the Quadruple-Helix model in action is the Amsterdam Smart City initiative. This initiative involves collaboration among the Amsterdam municipality, academic institutions, businesses, and citizens to develop and implement smart city solutions that focus on sustainability, innovation, and citizen participation (Kamargianni *et al.*, 2016). Projects under this initiative include electric vehicle charging infrastructure, smart street lighting, and the use of sensor networks to improve waste management.

Despite its successes, the quadruple-helix model has also faced criticism for being too focused on economic growth and innovation, with a neglect of social and environmental considerations (Nam and Pardo, 2011a; Carayannis *et al.*, 2012). However, it remains a useful framework for promoting collaboration and citizen participation in the development of smart city solutions.

In conclusion, the quadruple-helix model provides a framework for including civil society and citizen participation in the development of smart city solutions. The involvement of all stakeholders in the co-creation and co-design of smart city solutions has been depicted to be effective in promoting successful smart city initiatives.

2.3. Governance Network Theory

2.3.1. Definitions, overview and application

Governance networks theory (GNT) is a theoretical framework that explains how collaborative relationships among actors in a network can lead to effective governance outcomes (Klijn and Koppenjan, 2016). According to this theory, governance networks are formed by a set of actors who are interdependent and connected through a web of relationships, and who work collaboratively to solve complex societal problems. The governance networks theory argues that such collaborative networks are essential for effective governance, especially in situations where traditional hierarchical governance structures are insufficient.

Bovaird and Löffler (2012) defined governance network as collaborations among a diverse group of public, private, and nonprofit organizations, engaged in public management or policy implementation, who work interdependently to address public problems or produce public goods.

According to Sørensen and Torfing (2011), governance networks are characterized by a multiplicity of actors, the diversity of their interests and beliefs, the presence of ambiguity and uncertainty, and the absence of formal authority. Governance networks emerge as responses to problems that are too complex and too interdependent for any one actor to solve alone. Collaboration is a central feature of governance networks. Collaboration can be defined as a process of joint decision-making, where actors work together to achieve a shared goal. Collaboration can be facilitated through various mechanisms, such as negotiation, consensus building, and joint problem-solving. Collaboration can also involve sharing of resources, information, and knowledge among the actors in the network (Ansell and Gash, 2008). GNT has been applied to research a wide range of topics. Some of the examples are environmental management (Armitage *et al.*, 2018), public health (Thijssen *et al.*, 2018), urban planning (Healey and Robinson 2011) and social welfare (Bovaird and Löffler 2012).

Furthermore, smart city development has been a popular area of application for GNT, with a number of research studies utilizing this framework. For instance, Chen *et al.*(2019) employed GNT to explore the governance structure of smart city development in China, with a particular focus on the roles played by government, industry, and civil society. Similarly, Lee and Kim (2019) utilized network analysis techniques to analyze the governance structures of smart city development in Seoul, South Korea, highlighting key actors and their impact on smart city initiatives. Deakin and Reid (2018) also applied GNT in their book to examine the governance

challenges and opportunities associated with smart city development, arguing that governance networks are essential for managing the multi-stakeholder nature of such initiatives.

GNT acknowledges the fundamental role of complexity in understanding the relationships and interactions between diverse actors within a network. The theory recognizes the intricate nature of these relationships and the complex dynamics that arise in the interactions between them. More so, the complexity of governance processes within networks is a recurring theme in the literature on governance networks, and as such, the author of the thesis would shade light on the different types of complexities in governance network and how to manage them.

2.3.2. Complexity in governance networks

Governance networks are multi-actor systems that are not merely complicated, but characterized by inherent complexity. The complexity of the governance processes within these networks is clearly emphasized in the majority of the literature on governance networks (Klijn and Koppenjan, 2014).

Most of the literature on networks stresses that complexity is not simply caused by the fact that multiple actors are present within governance, although this is an important condition (Klijn and Koppenjan, 2014). Gerrits (2012) posits that the presence of diverse components in a system may create a complicated system, but not necessarily a complex one. The complicatedness of a system can be managed by gaining a thorough understanding of the components and their relationships. However, complexity cannot be tamed and this is because complexity arises from the dynamic nature of a system's components and their relationships, making it extremely challenging to predict how the system will behave and what outcomes it will produce (Kickert *et al.*, 1997; Koliba *et al.*, 2010; Morçöl, 2012; Teisman *et al.*, 2009).

Koppenjan and Klijn (2004) and Klijn and Koppenjan (2016) identified three types of complexity that are present in governance networks: substantive complexity, strategic complexity, and institutional complexity.

Substantive complexity

Substantive complexity arises when actors involved in policymaking, policy implementation, or public service delivery face challenges in comprehending the nature of the problem (Klijn and Koppenjan, 2016). Governance networks face substantive complexity not because problems are complicated or due to a lack of information and knowledge, but because of uncertainty and a lack of consensus on the nature, causes, and solutions to these problems. Policymaking, problem solving, and service delivery involve numerous actors with varying perceptions and interpretations

of information. Therefore, information and knowledge gathering alone cannot solve the complexity of wicked problems when information is subject to varying interpretations (Sabatier 1988; 2007; Rein and Schön 1992) within the public sector.

The notion of "wicked" policy problems, as explained by Rittel and Webber (1973), Head (2008), and Weber and Khademian (2008), arises due to the presence of diverse and conflicting perceptions regarding the problem and potential solutions. These problems are not just complex due to their technical nature or the involvement of many components or actors, but rather because the actors involved have diverse perceptions of the problem and its potential solutions. In other words, "wicked problems" are characterized by their inherent complexity stemming from the varying and often conflicting perspectives of the actors involved.

Strategic Complexity

Strategic complexity arises from the strategic choices made by actors as they attempt to articulate complex problems (Allison, 1971; Kingdon, 1984). Due to the autonomy of actors and the absence of clear hierarchical control structures in networks, each actor chooses their own strategy. This can result in the development of multiple, and possibly conflicting, strategies around complex issues (Koppenjan and Klijn, 2004). In addition, actors in networks are known to anticipate and respond to each other's strategic moves (Scharpf, 1997). As a result of these interactions, it becomes challenging to predict which strategies actors will choose, how these strategies will evolve throughout the process, and how the interactions among these strategies will impact the problem-solving process. Reducing or eliminating the strategic complexity that emerges from these interactions is no easy feat. In a complex society that is defined by interdependencies (Castells, 1997), actors have the autonomy to make their own decisions, which further contributes to the strategic complexity of the system.

Institutional complexity

In addition, governance networks are characterized by institutional complexity, as defined by Klijn and Koppenjan (2014). Institutions, as defined by Scharpf (1997) and Ostrom (1990), refer to sets of rules that regulate behavior. According to Klijn and Koppenjan (2014), networks are enduring relationships between actors that give rise to specific sets of rules characterizing those relationships. Given that each network has a distinct set of rules, by making actor behavior more predictable, it may be possible to reduce complexity and improve cooperation. However, complexity can pose challenges to interactions between actors representing different networks, as

they may be guided by different rules, routines, and professional languages (Ostrom, 2005; Baumgartner and Jones, 2009).

2.3.3. Managing the complexities of governance networks

Klijn and Koppenjan (2016) put forward that the success or failure of governance networks and the issues they address depends on the degree to which the actors involved exhibit mutual learning behavior in relation to the three types of complexity identified.

The criteria to assess learning success or failure in relation to substantive (the content side of interactions), strategic (the process side of interactions), and institutional (the network structure) complexity are shown in the table below (Klijn and Koppenjan 2016, 255).

Criteria
Content
• Joint image building
◦ frame alignment and consensus building
◦ the development of negotiated knowledge
• Goal intertwinement (win–win situations)
◦ ex post satisficing
◦ enrichment, integration of services, and inclusiveness of solutions
Process
• Transaction costs and duration
• Quality of the process
◦ The degree to which parties become acquainted, develop interaction rules, and choose cooperative and negotiation-focused strategies
◦ Lack of non-functional blockages and stagnation; realization of timely breakthroughs
• Inclusiveness, democratic legitimacy, and accountability
◦ Openness: the involvement of third parties and their interests
◦ Democratic legitimacy (political accountability; voice; due deliberation with regard to input, throughout, and output of network processes)
◦ Accountability (enhancing and reconciling democratic, legal, administrative, and market accountability)
Network
• The development of relationships, shared perceptions, institutional rules, and a high level of trust
• Internal and external support for the network (legitimacy, resilience, and reliability)

Table 1: Assessment criteria for governance networks processes. Source: Klijn and Koppenjan (2016, 255)

- The success or failure of governance networks and their processes in addressing substantive complexity hinges on the extent to which actors can effectively engage in joint image building that aligns with available knowledge and scientific insights, as well as intertwine their objectives to generate innovative policies and services. Additionally, the satisfaction of those involved after the fact is crucial to the success of these efforts.
- The success or failure of governance networks and their processes in addressing strategic complexity hinges on the extent to which they can effectively align their strategies, manage transaction costs by avoiding dysfunctional impasses and achieving timely breakthroughs, and

organize their processes in a manner that is transparent, accessible to third parties, and accountable. Additionally, the network's democratic legitimacy is essential for ensuring its success.

- The success or failure of governance networks and their processes in dealing with institutional complexity is determined by their ability to establish lasting relationships, stable patterns of perceptions, and institutional rules, as well as a high level of trust among actors involved. Furthermore, the network must garner internal and external support to maintain its legitimacy and resilience, which, in turn, enhances the reliability of policies and services it provides.

The degree to which governance networks and their processes regarding institutional complexity are successful or unsuccessful depends on how well they are able to establish long-lasting relationships, consistent perception patterns, institutional rules, and a high level of trust, as well as how well they are able to secure internal and external support that contributes to the legitimacy and resilience of the network and the reliability of the policies and services they offer (Klijn and Koppenjan, 2016).

By focusing on these three dimensions of complexity and evaluating progress based on these criteria, Klijn and Koppenjan (2016) argue that governance networks can enhance their capacity to address complex problems and achieve their desired outcomes.

3. RESEARCH METHODOLOGY

This chapter provides detailed actions taken in the design and analysis of empirical findings. The research methodology adopted for this study are broken down and discussed under four sub-headings. The first sub-heading focuses on the research design used for this study and a detailed overview of data collection methods. The second shows how the generated data was analyzed. The final sub-heading concentrates on the validity and reliability procedure used in this study and summary.

3.1. Research Design

In the context of smart city development in Lagos State, this study aims to identify the key actors involved. Additionally, it will seek to identify the model of collaboration for smart city development in Lagos State and why.To achieve this, a quantitative survey approach in the form of a close-ended questionnaire was utilized. The questionnaire approach was chosen because of its simplicity and capacity to reach a significant number of individuals within a short timeframe (Tan, 2011).Also, it allows for the collection of data in a relatively short time frame and can be administered remotely, making it more convenient for respondents (Babbie and Mouton, 2015). While the thesis focuses on Lagos State, the author was located in Tallinn, Estonia during the writing of this thesis. Moreover, the political instability that emerged after governorship election in Lagos State discouraged several government officials from opening up during the survey. The questions were designed to determine the specific complexities related to governance networks present in Lagos, as outlined by Klijn and Koppenjan's (2016) framework. Additionally, the questions aimed to identify the prevailing SCG model in the city, based on the model proposed by Mora *et al.*(2019).

A questionnaire survey is a suitable data collection method used in this study. This method is cost-effective, time-efficient, and allows for the collection of data from a diverse range of respondents. Also, a questionnaire survey is useful when seeking to gather data on participants' opinions and recommendations on a particular topic (Sekaran and Bougie, 2016). The research questions are embedded into these questionnaires and are administered electronically. By adopting electronic questionnaires, the respondents will be given the wider opportunity to respond from any location they might be as long as they have internet connectivity. According to Richardson (2005), one of the advantages of self-completed electronic questionnaires is the cheapness and saving of the researcher’s time. The survey was carried out among government officials, professionals and individuals with knowledge of smart cities, urban matters and infrastructural development. They

include relevant LSG public officials, industry practitioners, technology experts, researchers, architects, non-governmental organizations (NGOs), civil society and activist. The survey questions were presented on checklist type multiple indicator measures (choice questions). In this question format, respondents were presented with a list of options and asked to select one or more options that apply to them.

For efficient administration, the respondents were categorized into four sectors: the public sector (comprising relevant LSG officials), the private sector (including industry practitioners), the academic sector (encompassing research institutions), and CSO/NGOs. The survey was conducted electronically from April 8th to April 17th, 2023.

To achieve the study's objectives, the author utilized a snowball sampling approach to identify relevant professionals from various sectors in Lagos State. As a management consultant who has previously consulted for both the Lagos Chamber of Commerce and Industry and the Institute of Directors Nigeria, the author had access to a diverse network of professionals across different sectors. Therefore, the author identified a select group of professionals from these institutions and asked them to recommend other individuals who could provide valuable insights for the study. Through this method, a total of 110 participants were identified and sampled accordingly.

The questionnaire was divided into three distinct sections. The initial section gathered information about the participants' demographics, while the second section focused on the actors involved in the development of a smart city in Lagos. This section was specifically designed to identify the specific complexities related to governance networks, as outlined by Klijn and Koppenjan's (2016) framework. The third and final section aimed to determine the predominant SCG model in Lagos, utilizing the model proposed by Mora *et al.*(2019). The demographics section included gender, age, educational qualification, profession (by sector), and years of experience.

3.2. Data Analysis Method

The data collected in this survey was analyzed using descriptive statistics, utilizing Microsoft spreadsheet software as the data analysis program. Descriptive statistics is an essential tool in data analysis that enables researchers to summarize, interpret, and present data in a meaningful way, leading to valuable insights and informed decision-making (Gravetter and Wallnau, 2016; Howell, 2012; Weiss, 2012). To analyze the responses to the research questions, the author of this research calculated the frequencies and percentages for each response option using Microsoft spreadsheet software. By employing this method, the author gained a deeper understanding of the main actors and model of collaboration for smart city development in Lagos State.

3.3. Validity and Reliability Procedure

Validation in research refers to the process of ensuring that research findings and data are accurate, reliable, and representative of the phenomenon or population under study (Polit and Beck, 2017). It is a critical component of research because it ensures that the data collected and the conclusions drawn from the data are trustworthy and credible. There are various of types of validation in research, including content validity, face validity, criterion validity, and construct validity. For the purpose of this study, construct validity was used. This procedure ensures that the research instrument measures the intended construct and is valid for the research questions (Polit and Beck, 2017).

The reliability of data in any research is very important. The reliability refers to the degree to which the results of research are consistent and dependable over time and across different researchers or contexts (Bryman, 2016). For this study, internal consistency reliability was used. Internal consistency reliability measures how consistently different items or questions on a questionnaire or survey are measuring the same underlying construct or idea.

4. EMPIRICAL ANALYSIS

4.1. Case Description: Lagos State

Lagos State was formerly the capital of Nigeria until 1991 when the capital was moved to Abuja. The State is the economic hub of Nigeria and one of the largest economies in Africa, contributing significantly to Nigeria's GDP and generating a substantial portion of the country's revenue. Lagos accounts for over 80% of the country's foreign trade flows, and generates over 50% of Nigeria's port revenues, and as of 2016, the State's GDP was $145.141 billion making it the sevent-largest economy in Africa (Lagos State Government, 2020).

The State has a diverse economy with significant contributions from various sectors, including trade, finance, real estate, manufacturing, and services (AfDB, 2019). Lagos is also a significant hub for the country's entertainment industry, with the famous Nollywood film industry headquartered in the city (Ogunsanya *et al.*, 2019). The State is home to many multinational corporations, including banks, oil and gas companies, and telecommunications firms (*ibid*).

Lagos State is considered as one of the fastest-growing cities in the world, with a rapidly increasing population and economy. It is also one of the largest cities globally, with a growth rate of approximately 3.2 percent (Fadare and Oduwaye, 2009). By 2050, the population of Lagos is projected to reach about 33 million (Hoornweg and Pope, 2017). According to the UN World Urbanization Prospects report (2018), Lagos is the second most urbanized city in Africa (with urbanization rate of 85.2%), following Cairo, Egypt with a rate of 95.7%. This indicates that the proportion of the population residing in urban areas is higher in Lagos than in any other city in sub-Saharan Africa. A study by the NBS (2019) estimates that Lagos State is home to approximately 10.6% of Nigeria's total population.

Lagos being Nigeria's largest and most urbanized city presents a slew of daunting challenges. According to a report by NISER (2018), the State faces inadequate infrastructure challenges in transportation, housing, electricity, water supply, and waste management. A UN's report shows that less than 10% of the population of Lagos has access to pipe-borne water, and many people rely on contaminated sources for their daily water needs (UN, 2020). A report by NISER (2018) shows that Lagos State's transportation system is characterized by severe traffic congestion, poor road conditions, and inadequate public transportation services. The report also shows that the State's road network is inadequate, with a road density of 1.3 km per 1,000 people, which is significantly lower than the recommended standard of 4 km per 1,000 people. Adelekan (2016) also validated the point that the city's transportation system is poorly developed, with a lack of

reliable public transportation options and frequent traffic congestion. There is also a challenge of high level of poverty and inequality, which has resulted in widespread slum settlements and lack of access to basic services for many residents. According to a report by the World Bank, over 60% of residents live in informal settlements, and these areas lack basic infrastructure such as paved roads, waste management systems, and health facilities (World Bank, 2019).

However, the Lagos State sees the development of smart cities as a promising solution to the numerous urbanizations challenges the State is being confronted with (Sanwo-Olu, 2021). The LSG aims to leverage technology to improve the State's infrastructure, transportation, and waste management systems. The State has shown a commitment to implementing smart city initiatives in recent years, with the launch of the Lagos Smart City Initiative in 2017 (Lagos State Government, 2017).

4.2. Results

In this section, the author presents the findings of the data analysis, which were obtained by utilizing frequencies, percentages, and tables to answer the research questions. The results were reported in a concise and clear manner, making it easy for readers to understand the implications of the findings.

Firstly, the demographic characteristics of the respondents, such as age, gender, and education level, were introduced using descriptive statistics. This provided a snapshot of the sample population and aided in the interpretation of subsequent results.

The study received responses from a total of 110 participants. The bar charts presented below illustrate the various demographic characteristics of the survey respondents, including their gender, age distribution, educational qualifications, profession by sector, and years of experience.

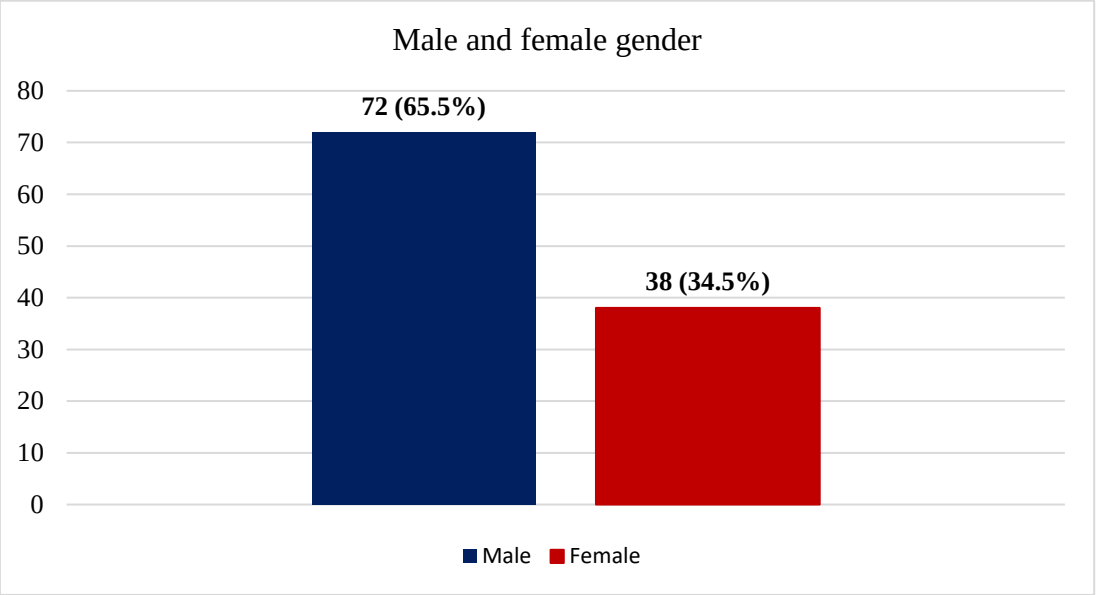

Figure 2: Gender of respondents. Source: Author's analysis

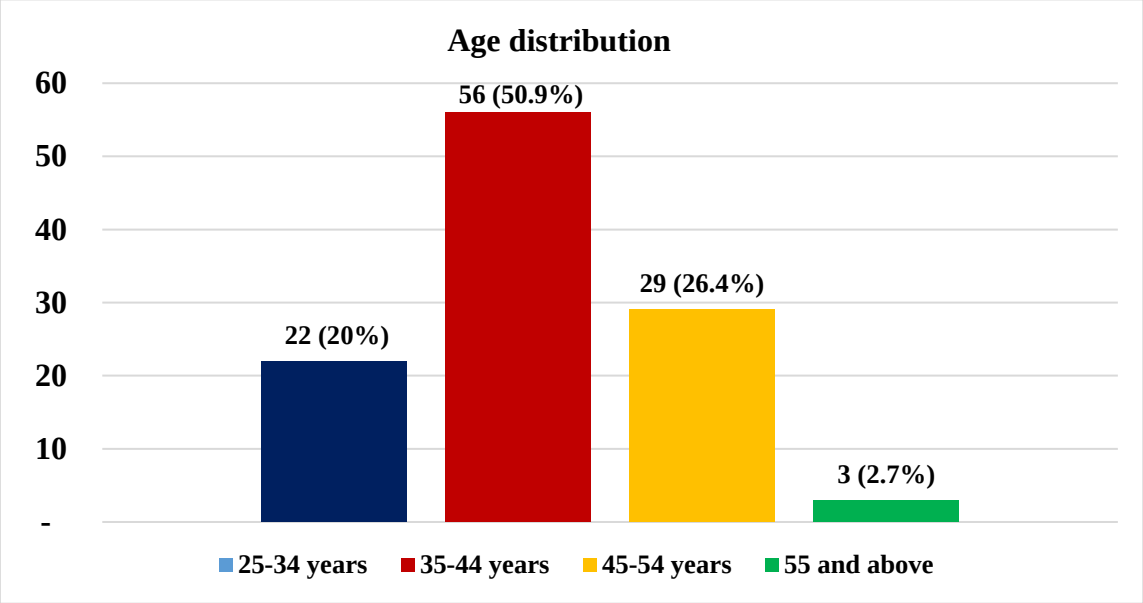

Figure 3: Age distribution of respondents. Source: Author's analysis

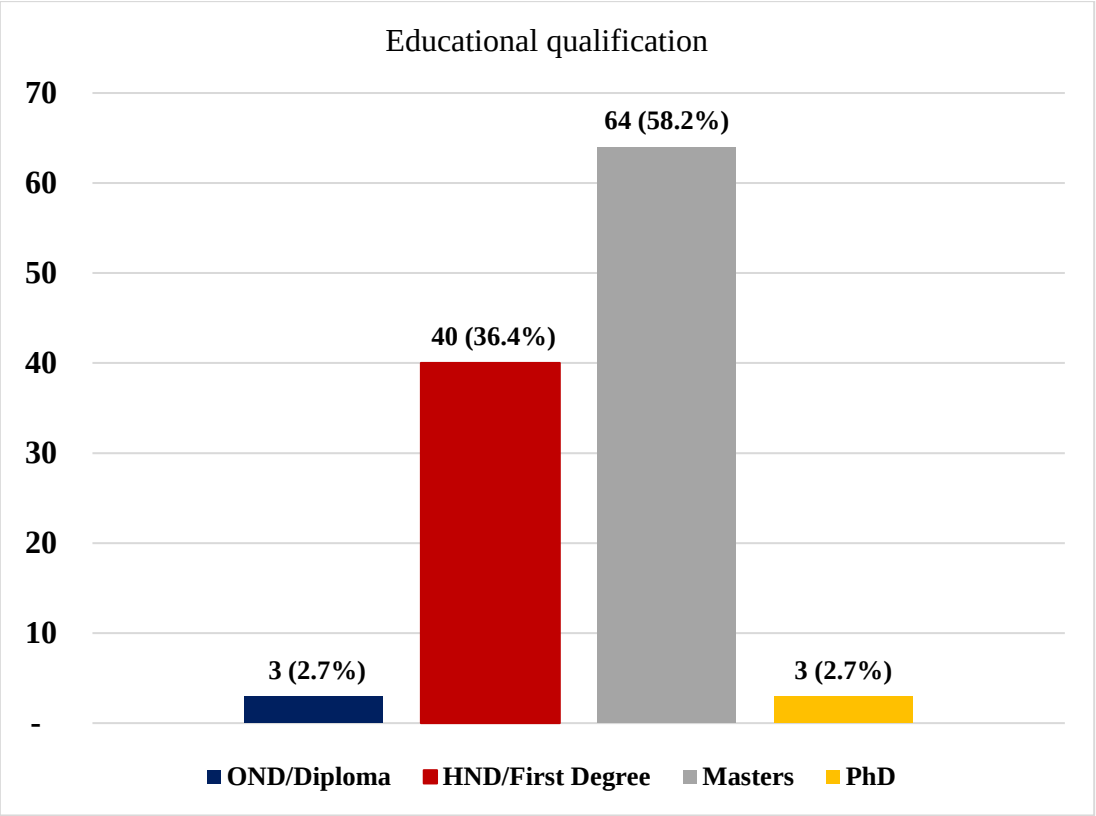

Figure 4: Educational qualification of respondents. Source: Author's analysis

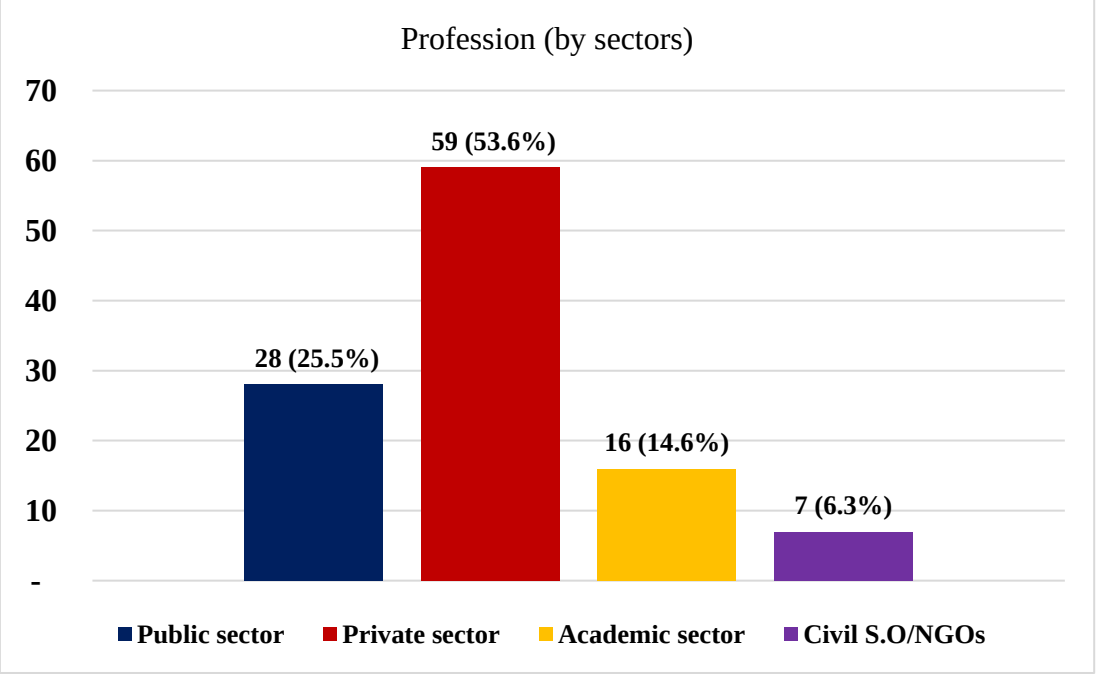

Figure 5: Profession of respondents by sectors. Source: Author's analysis

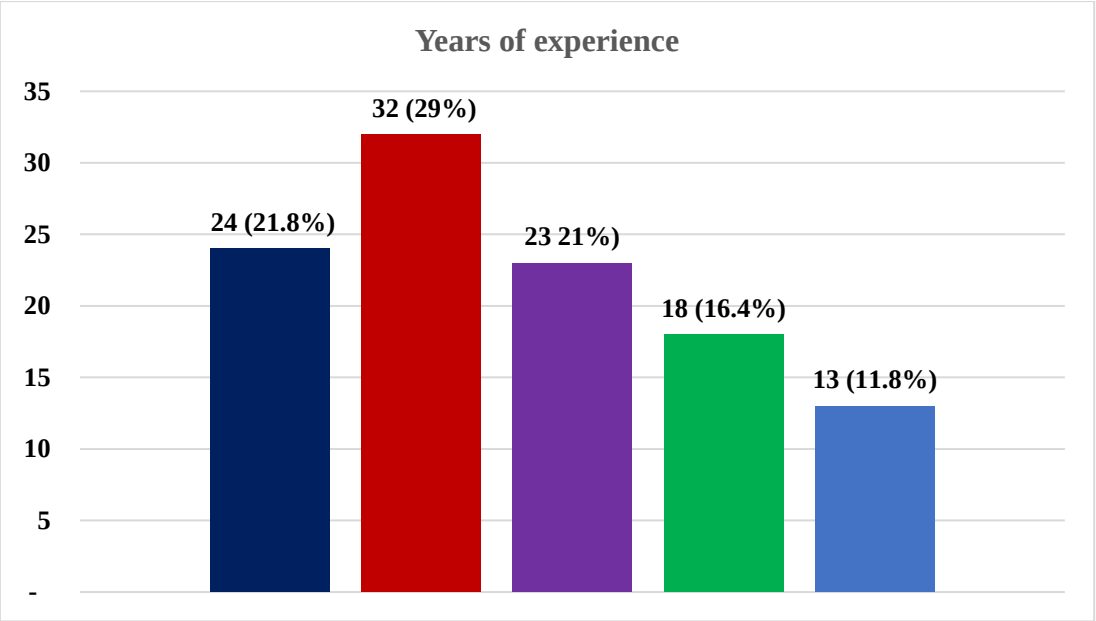

Figure 6: Years of experience of respondents. Source: Author's analysis

To proffer answers to the research questions, a quantitative survey approach in the form of a close-ended questionnaire was utilized. In this question format, respondents were presented with a list of options and asked to select one or more options that apply to them. In order to analyze the responses of the questions, the author of this research calculated the frequencies and percentages for each response options.

Sub-Research Question 1: In the context of smart city development in Lagos State, who are the main actors?

Based on the questionnaire responses from 110 participants regarding the main actors in the development of Lagos State's Smart city initiatives, the analysis reveals the following findings:

Government agencies: 94 out of 110 participants (85.5%) selected government agencies as stakeholders who should be involved or seen as main actors in the Lagos State Smart city development initiatives. Of the respondents, 45 are from the private sector, 27 from the public sector, 15 from the academic sector, and 7 from CSO.

Industries/Private companies: 102 out of 110 participants (92.7%) selected industries/private companies as stakeholders who should be involved or seen as main actors in the Lagos State Smart city development initiatives. Of the respondents, 57 are from the private sector, 23 from the public sector, 15 from the academic sector, and 7 from CSO.

CSO/NGOs: 79 out of 110 participants (71.8%) selected CSO/NGOs as stakeholders who should be involved or seen as main actors in the Lagos State Smart city development initiatives. Of the

respondents, 38 are from the private sector, 22 from the public sector, 15 from the academic sector, and 4 from CSO.

Universities/research institutions: 95 out of 110 participants (86.4%) selected universities/research institutions as stakeholders who should be involved or seen as main actors in the Lagos State Smart city development initiatives. Of the respondents, 51 are from the private sector, 25 from the public sector, 14 from the academic sector, and 5 from CSO.

These results highlight the importance of involving various actors in the development of Lagos State Smart city initiatives. The responses indicate that all four stakeholder groups - government agencies, industries/private companies, CSO/NGOs, and universities/research institutions - should be involved or seen as the main actors in the development process.

Although all the four categories received high resonses, the CSO/NGOs got lower response (71.8%) compared to industries/private companies that got 92.7%, universities/research institutions (86.4%) and government agencies (85.5%). Overall, the results suggest that the participants appreciate the value of a diverse range of stakeholders in smart city development.

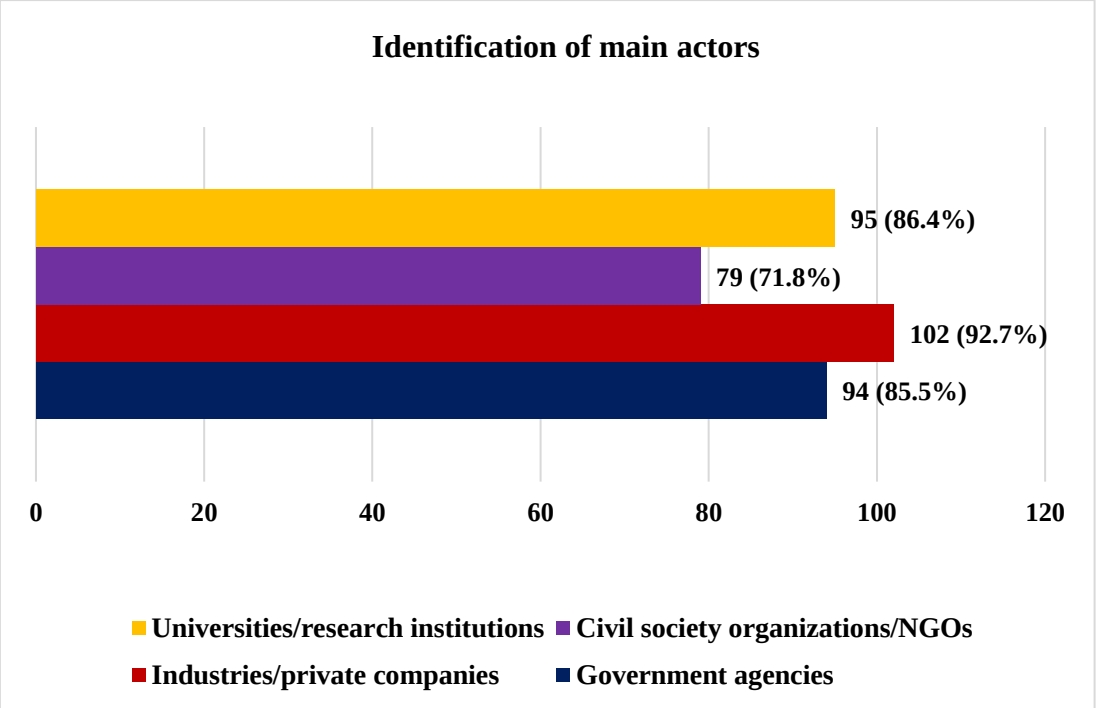

Figure 7: Which of the following stakeholders do you think should be involved or should be seen as the main actors in the Lagos State Smart city development initiatives? Source: Author's analysis

In an attempt to determine which CSO are involved in smart city development initiatives in Lagos State, the author included a survey question asking respondents to name CSO they think are involved in these initiatives. However, from the received responses, it was evident that the majority of respondents were unable to provide any names. This could indicate a lack of awareness among the respondents about the various CSO involved in smart city development in Lagos State.

However, despite the challenges mentioned, a few respondents were able to identify specific CSO that they believed could play a role in smart city development initiatives. These organizations include Lagos Civil Society Participation for Development (LACSOP), Paradigm Initiative Nigeria, Co-Creation Hub (CcHUB), Lagos State Civil Society Partnership for development, Fabulous Urban Foundation, and Future Africa.The Lagos Civil Society Participation for Development (LACSOP), Paradigm Initiative Nigeria , Co-Creation Hub (CcHUB), Lagos State Civil Society Partnership for development, Fabulous urban foundation, Future Africa.

In an attempt to determine which universities/research institutions are involved in smart city development initiatives in Lagos State, the author included a survey question asking respondents to name universities (if possible, specific faculties or departments in universities) and research institutions they think are involved in these initiatives. However, from the received responses, it was evident that the majority of respondents were unable to provide any names.

Notwithstanding, a few were able to provide specific names of organizations that they believed could play a role in smart city development initiatives. The University of Lagos' Department of Urban and Regional Planning, Department of Environmental Sustainability, and Faculty of Architecture and Building, as well as the Federal Institute of Industrial Research located in Oshodi, Lagos, and Lagos State University, were identified as potential contributors to smart city development initiatives.

In attempt to determine which organizations are involved in smart city development initiatives in Lagos State, the author included a survey question asking respondents to name the industry partners they think are involved in these initiatives. However, from the received responses, it was evident that the majority of respondents were unable to provide any names. This could indicate a lack of awareness among the respondents about the various organizations involved in smart city development in Lagos State.

Despite this, some respondents did manage to mention a few names of organizations they believed to be involved in smart city development initiatives. These included Julius Berger, a construction company with a significant presence in Nigeria; Mobile Telephone Network (MTN), a major telecoms company; General Electric, a multinational conglomerate; Cisco, an American technology company; Main One Cable Company, a telecom infrastructure provider; as well as several banks and other telecom companies. While the number of responses was limited, these names provide a starting point for further investigation into the industry partners involved in smart city development initiatives in Lagos State.

Sub-Research Question 2: Which is the model of collaboration for smart city development in Lagos State and why?

According to the survey questionnaire, which asked respondents to identify the model of collaboration currently being used for smart city initiatives in Lagos State, 110 people participated and provided their answers. The results show that the double-helix model, which involves collaboration between the government and industry, is the most commonly perceived model, selected by 60.91% of respondents (67 people). The makeup of the 67 people who selected this model is as follows: private sector (26), public sector (23), academia (13) and civil society (5). This shows that a considerably lower percentage of respondents from the private sector, specifically 44.1%, perceive the double-helix model as the most prevalent when compared to the public sector, academia, and civil society, with percentages of 82.1%, 81.3%, and 71.4%, respectively.

The government-only model is the second most perceived model, chosen by 27.27% of respondents (30 people). The makeup of the 30 people who selected this model is as follows: private sector (21), public sector (5), academia (3) and civil society (1). This shows that a higher percentage of respondents from the private sector, specifically 35.6%, perceive the government-only led model as the most prevalent in comparison to the public sector, academia, and civil society, where the percentages are 17.9%, 18.8%, and 14.3%, respectively. The triple-helix model, which involves collaboration between government, industry, and universities/research institutions, was selected by only 7.27% of respondents (8 people), making it the least likely model of collaboration being used. The quadruple-helix model, which involves government, industry, universities/research institutions, and citizens, was perceived as being used by only 4.55% of respondents (5 people). This analysis shows that the double-helix model (involving government and industry) is the most widely perceived model of collaboration being used for smart city initiatives in Lagos State.

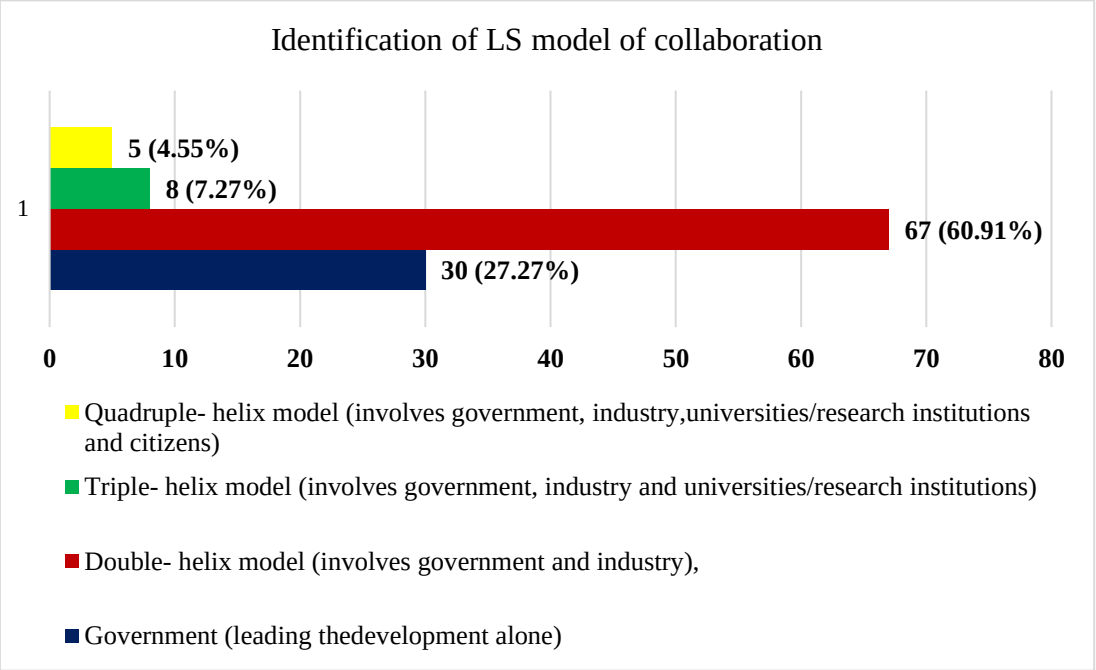

Figure 8: Identification of Lagos State (LS) model of collaboration. Source: Author's analysis

Making reference to question 2 above regarding the model of collaboration for smart city development in Lagos State, the author provides insightful answers to the 'why' component of the question.

By analyzing the collaboration model currently being utilized in Lagos State (as shown above), it becomes clear that the LSG is not effectively engaging with all relevant stakeholders. Specifically, it appears that universities and citizens are not being properly consulted or collaborated with, despite their potential contributions to the development of smart cities in Lagos State.

Assessing the inclusion of citizens and civil society by the LSG for smart city development initiatives

The responses from the 110 participants who completed the questionnaire shed light on the perception of citizens regarding the LSG's recognition of the value of collaborating with citizens on smart/urban development initiatives. The results of the survey (in figure 9) show that a majority of the respondents (57.3%) do not believe that the government recognizes the value of collaboration. On the other hand, 16.4% of the respondents indicated that they believe the government recognizes the value of collaboration. While this is a smaller proportion of the total respondents, it still highlights the fact that some citizens do feel that the government is open to collaboration and citizen participation in smart city development initiatives. The survey also revealed that a significant proportion of the respondents (26.3%) were not sure about the

government's stance on citizen participation in smart city development. Overall, these survey results underscore the point that citizens in Lagos State are not consulted on smart/urban development initiatives.

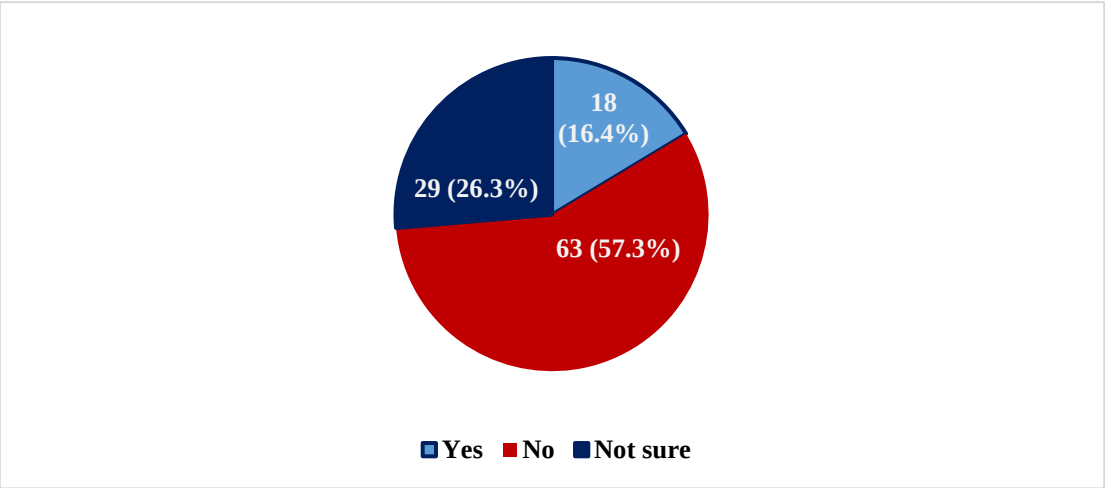

Figure 9: Do you think the LSG recognizes the value of collaborating with citizens on smart/urban development initiatives? Source: Author's analysis

Furthermore, the author of this work has drawn on the insights of Koppenjan and Klijn (2004) and Klijn and Koppenjan (2016) to highlight the various complexities that exist within governance networks. By identifying these complexities, the author is able to identify likely challenges that make it difficult for the LSG to collaborate with citizens and CSO in smart city initiatives.

To shed light on some of the barriers to effective collaboration and partnership between the government and citizens in the context of smart city development in Lagos State, the author has designed a questionnaire survey. The findings of these challenges are discussed below:

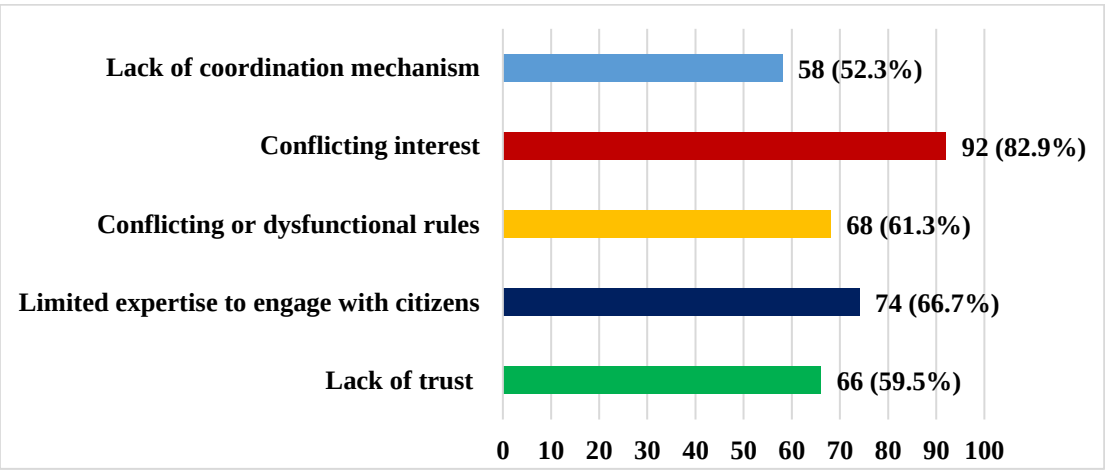

Figure 10: What are the challenges that make it difficult for LSG to collaborate with citizens/CSO in smart city initiatives? Source: Author's analysis

The survey results suggest that the respondents perceive several challenges that make it difficult for the LSG to collaborate with citizens and CSO in smart city initiatives. The most commonly selected challenge was "conflicting interest," chosen by 82.9% of the respondents (92 people). The breakdown of the 92 individuals who chose "conflicting interest" is as follows: 48 from the private sector, 23 from the public sector, 15 from academia, and 6 from civil society. This shows that a significant majority of respondents across different sectors perceive conflicting interests as a major challenge. Specifically, 81.4% of respondents from the private sector, similar to 82.1% in the public sector, 93.8% in academia, and 85.7% in civil society.

The second most commonly selected challenge was "limited expertise to engage with citizens," chosen by 66.7% of the respondents (74 people). The breakdown of the 74 individuals who chose this option is as follows: 46 from the private sector, 16 from the public sector, 8 from academia, and 4 from civil society. This shows that a significant proportion of respondents from the private sector, approximately 78%, perceive "limited expertise to engage with citizens" as a major challenge. Similarly, respondents from the public sector, academia, and civil society also identified this challenge, but with comparatively lower percentages of 57.1%, 50%, and 57.1%, respectively.

"Conflicting or dysfunctional rules" was chosen by 61.3% of the respondents (68 people). The breakdown of the 68 individuals who chose this option is as follows: 31 from the private sector, 22 from the public sector, 14 from academia, and 1 from civil society. This shows that conflicting or dysfunctional rules are perceived as a greater challenge by a significant percentage of respondents across different sectors. Specifically, 52.5% of respondents from the private sector and 78.6% of respondents from the public sector identify this challenge, while a much higher percentage of 87.5% of respondents from academia perceive it as a major challenge. On the other hand, only 14.3% of respondents from civil society perceive this challenge to be significant.

"Lack of trust" was chosen by 59.5% of the respondents (66 people), indicating that there is a lack of trust between the government and citizens/organizations that hinders collaboration. The breakdown of the 66 individuals who chose this option is as follows: 44 from the private sector, 13 from the public sector, 5 from academia, and 4 from civil society. This shows that a substantial percentage of respondents in the private sector, approximately 74.6%, perceive the lack of trust as a major challenge. This percentage is significantly higher than that of the public sector, where only 46.4% of respondents identified lack of trust as a significant challenge. Similarly, in academia, only 31.3% of respondents considered this to be a major challenge, while in civil society, 57.1% of respondents identified lack of trust as a significant challenge.

Finally, "lack of coordination mechanism" was chosen by 52.3% of the respondents (58 people), indicating that there is a perceived lack of coordination between the government and citizens/organizations in smart city initiatives. The breakdown of the 58 individuals who chose this option is as follows: 26 from the private sector, 14 from the public sector, 13 from academia, and 5 from civil society. This shows that a significant proportion of respondents from different sectors perceive the lack of coordination mechanisms as a major challenge. In particular, 44.1% of respondents from the private sector identified this challenge as significant, which is comparable to the 50% of respondents in the public sector. However, a higher percentage of respondents in academia (81.3%) and civil society (71.4%) identified this challenge as significant.

The results of the questionnaire shows that there are multiple challenges facing the LSG in collaborating with citizens and CSOs in smart city initiatives, including a lack of trust, limited expertise, conflicting or dysfunctional rules, conflicting interests, and inadequate coordination mechanisms.

The benefits of collaborating with citizens/CSOs

The survey responses presented in figure 11 reveal that citizens and CSO have several opportunities to contribute to the development of smart cities in Lagos. The top two selected options were "Community engagement" and "Providing feedback", with 87.3% and 85.5% of respondents selecting them, respectively. This indicates a strong desire among the public to be involved in the city's development and to have their voices heard.

Additionally, 70.9% of respondents recognized the importance of "Embracing technology" in smart city development, indicating a willingness to adopt new technologies that can improve the QoL of life in Lagos. Furthermore, 67.3% of respondents selected "Promoting sustainability", demonstrating a growing awareness of the need to create sustainable and environmentally-friendly cities. This presents an opportunity for CSO to advocate for sustainable practices and educate the public on their importance.

The survey also revealed that citizens are interested in having a greater role in governance, with 62.7% of respondents selecting "Participating in governance". Lastly, 46.4% of respondents selected "Pilot projects and testing", suggesting that there is recognition of the importance of testing and piloting new initiatives before implementing them on a larger scale.

However, a small minority of respondents (2.7%) indicated that they do not believe any of the options listed would be a significant contribution to smart city development. Despite this, the

survey results overall demonstrate the potential contributions that citizens and CSO can make to smart city development initiatives in Lagos, including community engagement, providing feedback, embracing technology, promoting sustainability, participating in governance, and pilot and project testing.

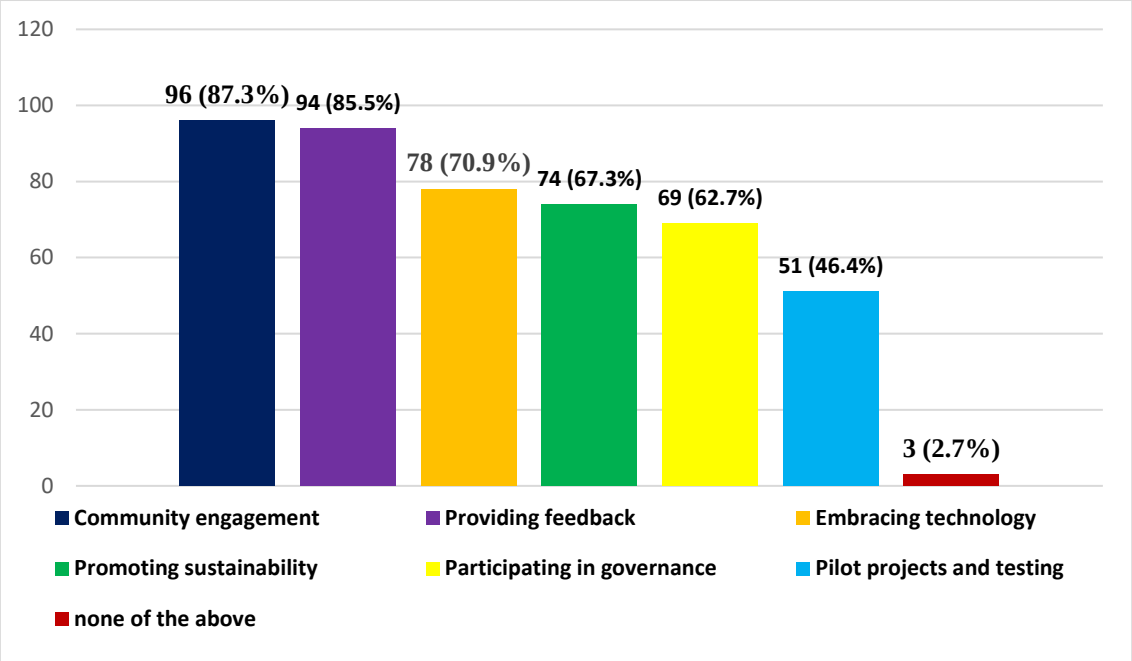

Figure 11: What contributions do you think the citizens/CSO will make towards smart city development in Lagos? Source: Author's analysis

Assessing the inclusion of academia by the LSG for smart city development initiatives

The responses from the 110 participants who completed the questionnaire shed light on the perception of universities/research institutions regarding the LSG's recognition of the value of collaborating with universities/research institutions on smart/urban development initiatives. Based on the responses of the 110 people surveyed, it appears that there is a lack of recognition from the LSG regarding the value of collaborating with universities and research institutions on smart/urban development initiatives. Of the 110 respondents, only 17 (15.5%) answered "Yes" to the question of whether the LSG recognizes the value of collaborating with universities and research institutions. Among the 17 respondents who answered Yes, 13 are from the private sector, 3 are from the public sector and 1 from the academic sector. Meanwhile, 63 (57.3%) respondents answered "No," indicating that they do not believe the LSG recognizes this value. Of this 63 respondents, 22 are from the public sector, 21 from the private sector, 14 from the academic sector, and 6 from CSO. The remaining 30 (27.2%) respondents were unsure. Among the respondents who are unsure, 26 are from the private sector, 2 are from the public sector, 1 is from the academic sector, and 1 is from a civil society organization. This survey results underscore the point that

universities/research institutions in Lagos State are not consulted on smart/urban development initiatives.

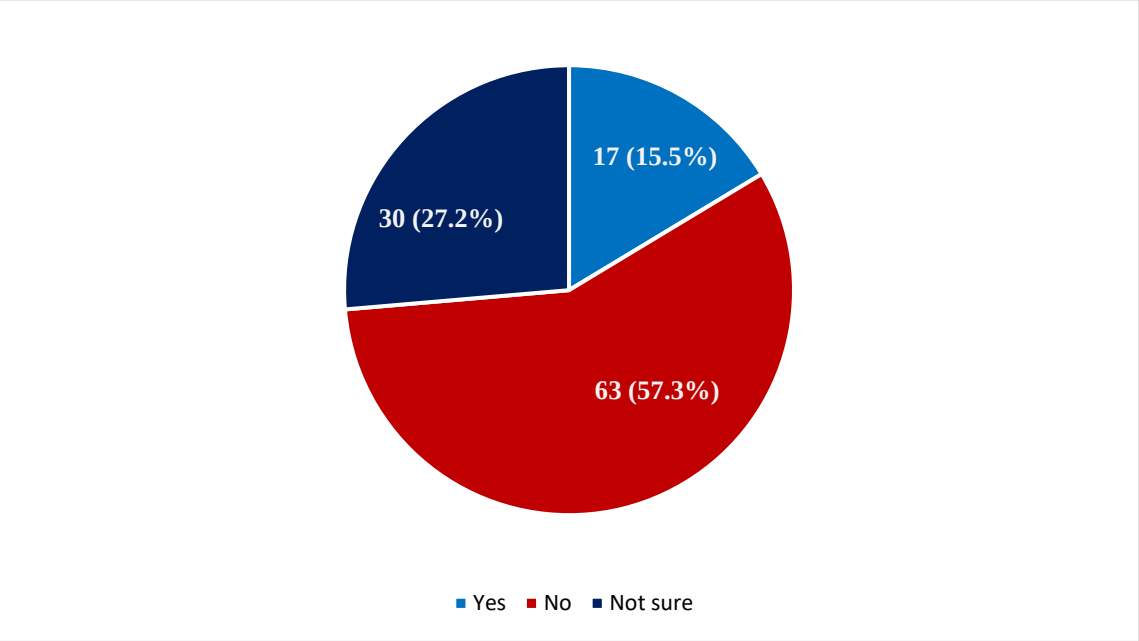

Figure 12: Do you think the LSG recognizes the value of collaborating with universities/research institutions on smart/urban development initiatives? Source: Author's analysis

Furthermore, the author of this work has drawn on the insights of Koppenjan and Klijn (2004, 2016) to highlight the various complexities that exist within governance networks. By identifying these complexities, the author is able to identify likely challenges that make it difficult for the LSG to collaborate with universities/research institutions in smart city initiatives.

To shed light on some of the barriers to effective collaboration and partnership between the government and universities/research institutions in the context of smart city development in Lagos State, the author has designed a questionnaire survey. Through this survey, the author seeks to better understand the challenges and barriers that prevent effective collaboration and partnership between the government and universities/research institutions in the context of smart city development. By identifying these barriers and challenges, the LSG can work towards addressing them and creating a more effective and inclusive collaboration model that engages with universities/research institutions. This can help to foster research, innovation and capacity building towards the development of smart cities.

The findings of these challenges are discussed below:

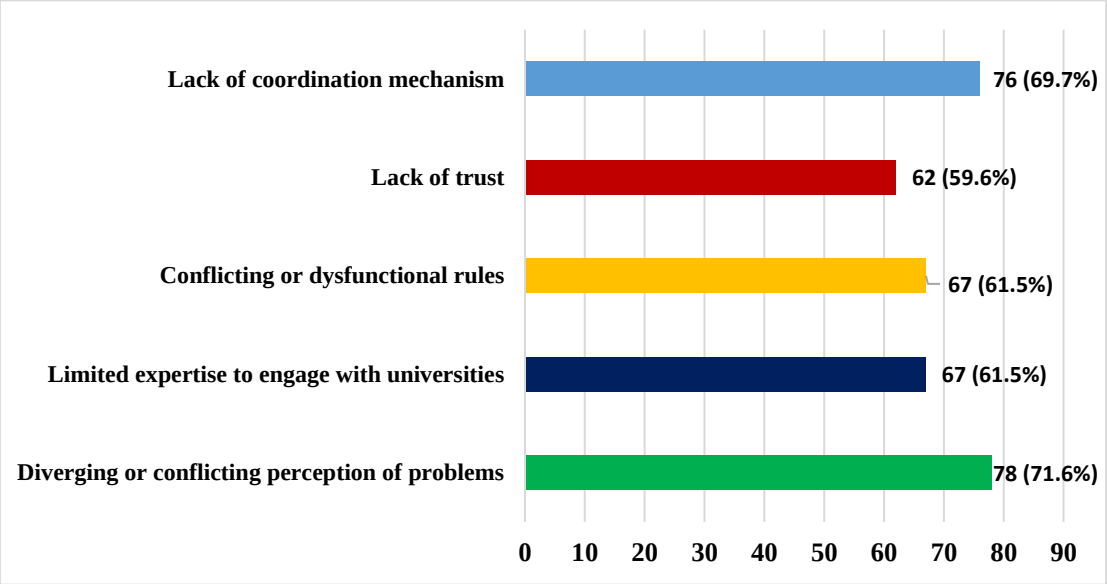

Figure 13: What are the challenges that make it difficult for LSG to collaborate with universities/research institutions in smart city initiatives? Source: Author's analysis

Based on the responses from the 110 participants, the analysis of the challenges that make it difficult for LSG to collaborate with the universities and research institutions in smart city initiatives are as follows:

Diverging or conflicting perception of problems: This challenge was selected by 78 participants (71.6%). This suggests that there are differences in understanding or interpretation of the issues related to smart city initiatives between the LSG and the universities/research institutions. This can lead to miscommunication, misunderstanding, and lack of alignment in their collaborative efforts. Lack of coordination mechanism: This challenge was selected by 70 participants (69.7%). This indicates that there is a lack of coordination mechanism between the LSG and the universities/research institutions. This can lead to duplication of efforts, miscommunication, and inefficiencies in their collaborative efforts. A proper coordination mechanism can help ensure that all parties are working towards a common goal and that resources are used effectively.

Limited expertise to engage with universities: This challenge was selected by 67 participants (61.5%). This implies that the LSG lacks the necessary skills and knowledge to effectively engage with universities and research institutions on smart city initiatives. It may be difficult for the government to understand the academic jargon and research methodologies employed by these institutions. Conflicting or dysfunctional rules: This challenge was also selected by 67 participants (61.5%). This indicates that there are conflicts or inconsistencies in the rules and regulations governing the collaboration between the LSG and the universities/research institutions. This can

lead to delays, legal issues, and inefficiencies in their collaborative efforts. Lack of trust: This challenge was selected by 62 participants (59.6%). This suggests that there is a lack of trust between the LSG and the universities/research institutions. This may be due to past experiences, cultural differences, or communication breakdowns. Without trust, it can be difficult to establish effective partnerships. These results shows that there are several challenges that make it difficult for the LSG to collaborate with universities and research institutions in smart city initiatives.

After analyzing the data, the author gained insight into the reason why the double-helix model of collaboration is widely utilized in Lagos State. The current state of collaboration within the LSG is the result of their inability to overcome several obstacles that hinder their partnership with citizens and universities. These challenges encompass a lack of trust, conflicting interest, a limited expertise to engage with citizens and universities, diverging or conflicting perception of problems, conflicting or dysfunctional rules and lack of coordination mechanism.

The benefits of collaborating with universities/research institutions

The survey responses presented in figure 14 reveal that an overwhelming majority (97.3%) of the participants believe that universities/research institutions will primarily contribute to smart city development in Lagos through research and innovation, with 107 out of 110 participants selecting this option. This highlights the crucial role of academic institutions in driving innovation and advancing knowledge in the development of smart cities.

Furthermore, the survey results indicate that a significant number of respondents (85.5%) recognize the importance of universities/research institutions in contributing to smart city development through education and training. This underscores the need for academic institutions to provide individuals with the necessary skills to participate in the smart city agenda.

The survey also identified other significant contributions, such as pilot projects and testing (71.8%), policy and advocacy (64.6%), and public engagement (62.7%). However, a small minority of respondents (1.8%) indicated that they don't believe any of the options listed would be a significant contribution to smart city development. These responses show the diverse ways in which universities/research institutions can contribute to smart city development, including testing and implementing smart city technologies, influencing policy decisions, and engaging with the public to ensure that smart city development is inclusive and benefits everyone.

In summary, the survey responses demonstrate that universities/research institutions are seen as crucial contributors to smart city development in Lagos. The results highlight that academic institutions can contribute in various ways as listed above such as: research and innovation,

education and training, pilot project and testing, policy and advocacy, and public engagement. These findings emphasize the importance of universities/research institutions in shaping the future of smart cities in Lagos and suggest that their contributions will be essential for the successful implementation of smart city technologies and initiatives.

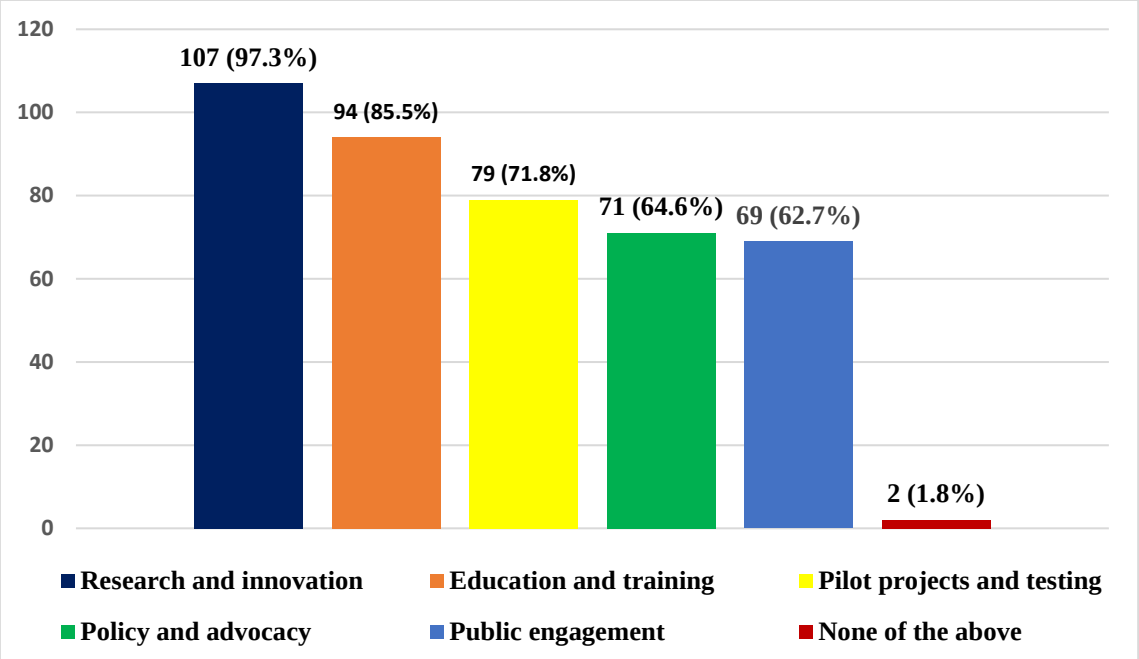

Figure 14: What contributions do you think the universities/ research institutions will make towards smart city development in Lagos? Source: Author's analysis

Assessing the inclusion of industry partners by the LSG for smart city development initiatives

According to the survey responses depicted in figure 15 below, 64.6% of the total respondents, or 71 people, answered "Yes" when asked if they believe that the LSG brings industry partners on board for smart city development initiatives. A very small proportion of the respondents, only 3.6% or four people, answered "No." The remaining 31.8% or 35 respondents selected "Not sure," suggesting a lack of information or knowledge on the matter. Based on these results, a significant majority of the respondents believe that the LSG brings industry partners on board for smart city development initiatives. The small percentage of respondents who answered "No" indicates that there are still some doubts or skepticism among a few people. The number of respondents who answered "Not sure" indicates a lack of knowledge or information on the subject matter.

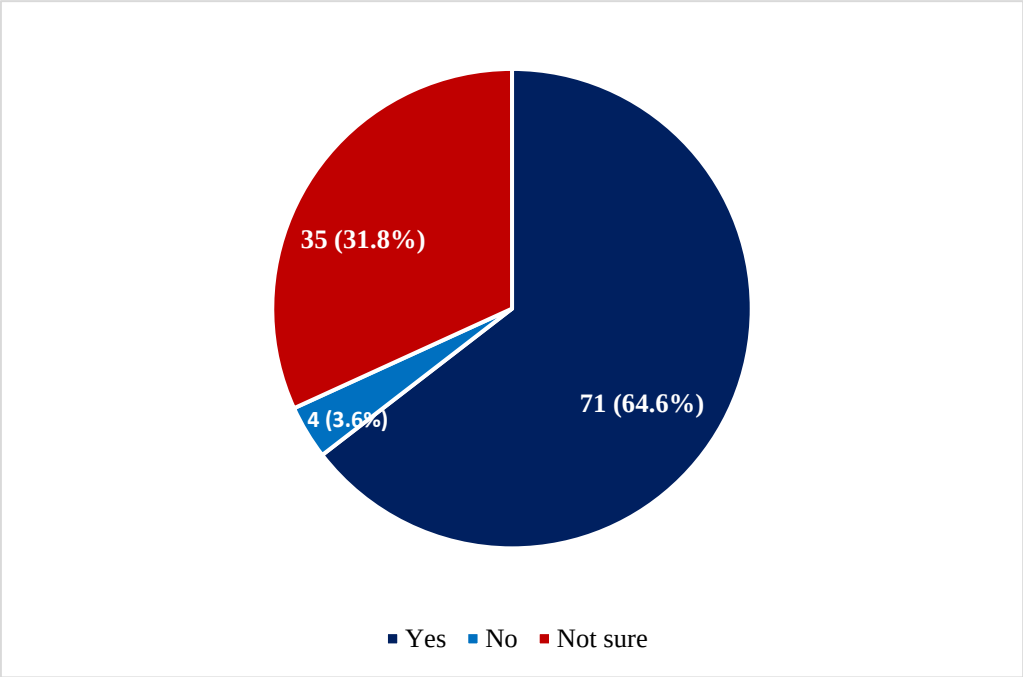

Figure 15: Do you think that the LSG brings industry partners on board for smart city development initiatives? Source: Author's analysis

The challenges that might affect the industry collaboration with the LSG on smart city development

Based on the responses from the 110 people surveyed (figure 16), the analysis of the challenges that might affect the industry collaboration with the LSG on smart city development are as follows: Diverging or conflicting perception of problems: 85 respondents, which represents 77.3% of the total, chose this option. This suggests that most of the respondents see diverging or conflicting perceptions of problems as a significant challenge that could hinder collaboration between industry actors and the LSG.

Conflicting strategies on the part of industry actors: This was selected by 81 respondents, which represents 73.6% of the total. This indicates that the majority of respondents perceive conflicting strategies among industry actors as a major challenge that could impede collaboration with the LSG on smart city development.

Limited regulatory framework: 79 respondents, which represents 71.8% of the total, selected this option. This suggests that a significant number of respondents see the lack of a regulatory framework as a significant challenge that could affect industry collaboration with the LSG on smart city development.

Lack of coordination mechanism: This was selected by 71 respondents, which represents 64.5% of the total. This suggests that most of the respondents see the lack of a coordination mechanism as a challenge that could hinder collaboration between industry actors and the LSG.

Conflicting or dysfunctional rules: 65 respondents, which represents 59.1% of the total, selected this option. This indicates that a majority of respondents perceive conflicting or dysfunctional rules as a challenge that could impede collaboration with the LSG on smart city development.

Lack of trust: 61 respondents, which represents 55.5% of the total, chose this option. This indicates that a majority of respondents perceive the lack of trust as a challenge that could impede collaboration with the LSG on smart city development.

The majority of respondents identified conflicting strategies, diverging or conflicting perception of problems, and limited regulatory framework as the top three challenges that could affect industry collaboration on smart city development with the LSG, with 73.6%, 77.3%, and 71.8% of respondents selecting these options respectively. The other three options, conflicting or dysfunctional rules, lack of coordination mechanism, and lack of trust, were also identified by more than half of the respondents as potential challenges. These results suggest that improving communication and coordination between industry actors and the government, as well as developing clearer and more comprehensive regulations and guidelines, could be key to overcoming these challenges and facilitating successful collaboration on smart city development in Lagos.

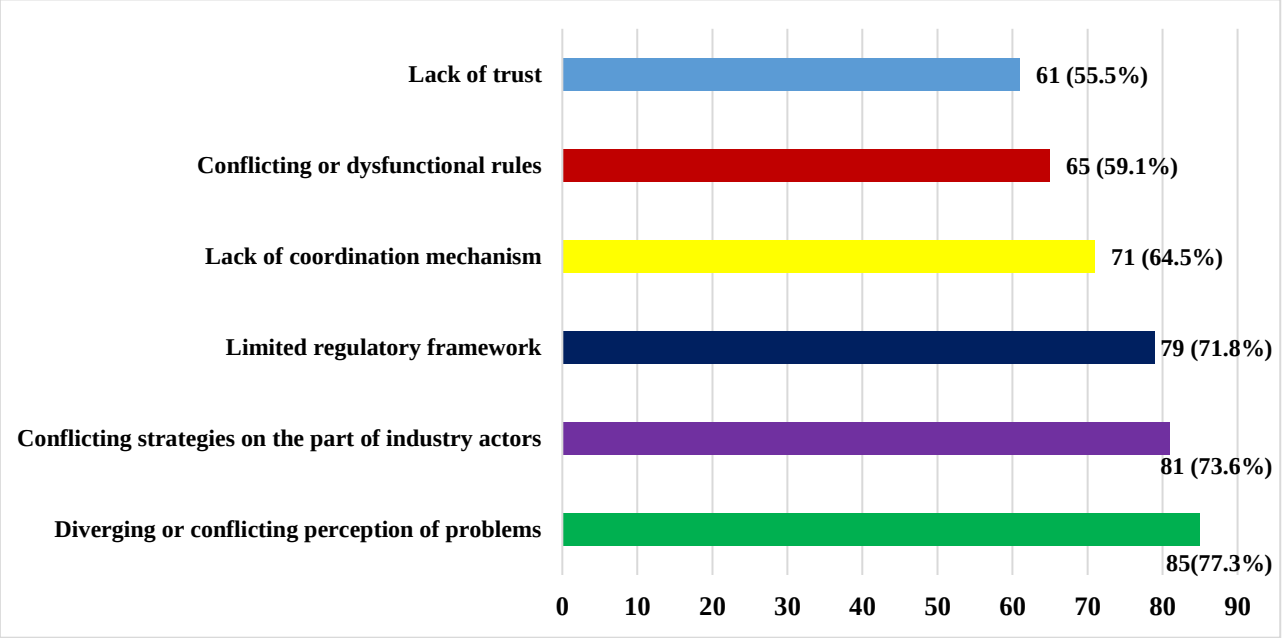

Figure 16: What are the challenges that might affect the industry collaboration with the LSG on smart city development? Source: Author's analysis

The benefits of collaborating with industry partners

Based on the survey responses shown in figure 17 below, the industry partners are expected to make significant contributions towards smart city development in various ways. The majority of respondents (92.7%) believe that investment and funding will be a significant contribution from industry partners. This is followed closely by expertise and innovation (90%) and infrastructure and technology (85.5%). It is worth noting that a significant number of respondents (67.3%) also believe that industry partners will contribute through pilot projects and testing. Only a small minority of respondents (1.8%) believe that industry partners will not make any contributions towards smart city development. Overall, it seems that industry partners are expected to play a crucial role in the development of smart cities, with investment and funding, expertise and innovation, and infrastructure and technology being the most important contributions expected from them.

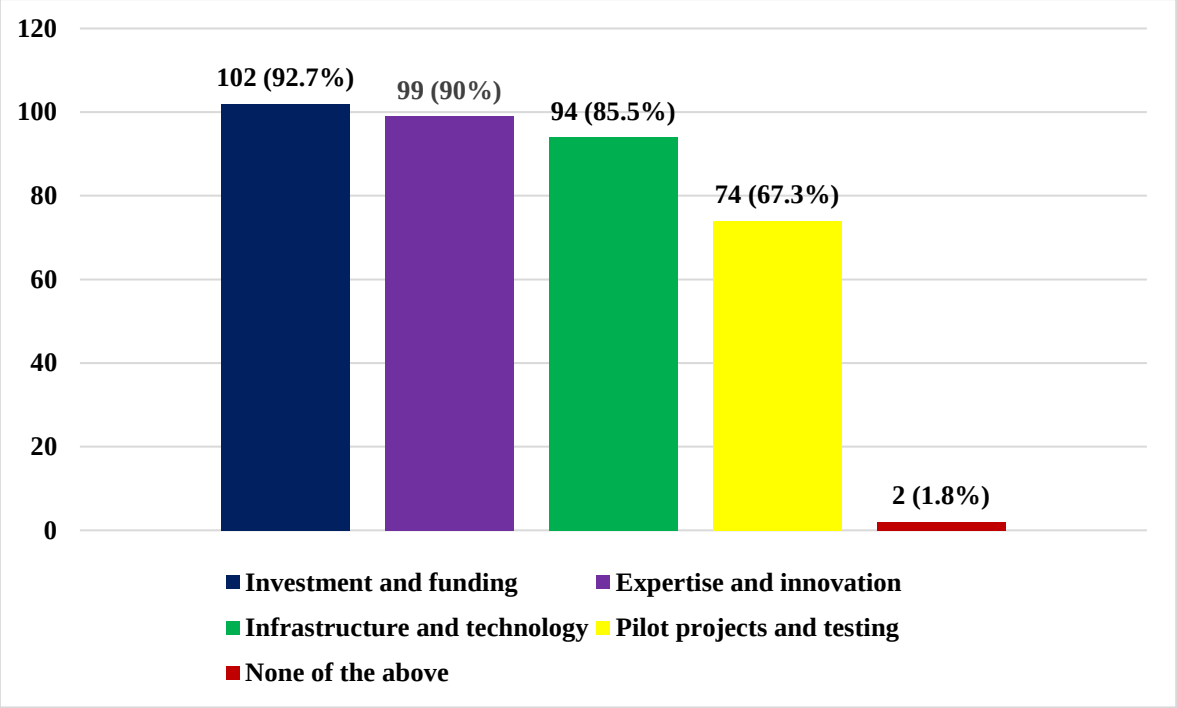

Figure 17: What contributions do you think the industry partners will make towards smart city development? Source: Author's analysis

The proposed model of collaboration that will drive smart city development initiatives in Lagos State

Based on the responses received in figure 18 below, the majority of the participants (77.3%) suggest that the LSG adopt a quadruple-helix model for collaboration to support smart city initiatives. This model involves not only the government and industry but also universities/research institutions and citizens/civil society. The triple-helix model, which involves

government, industry, and universities/research institutions, was suggested by 12.7% of the participants, indicating that they believe that collaboration between these three sectors is important but not sufficient for building a collaborative ecosystem to support smart city initiatives. The double-helix model, which involves government and industry only, was suggested by 6.4% of the participants, indicating that they believe that collaboration between government and industry alone is not enough to support smart city initiatives. Finally, only 3.6% of the participants suggested that the government should lead the development alone, which suggests that the majority of the participants believe that collaboration with other sectors is crucial for successful smart city initiatives. The results suggest that most participants recognize the importance of collaboration between government, industry, universities/research institutions, and citizens/civil society for building a collaborative ecosystem to support smart city initiatives in Lagos.

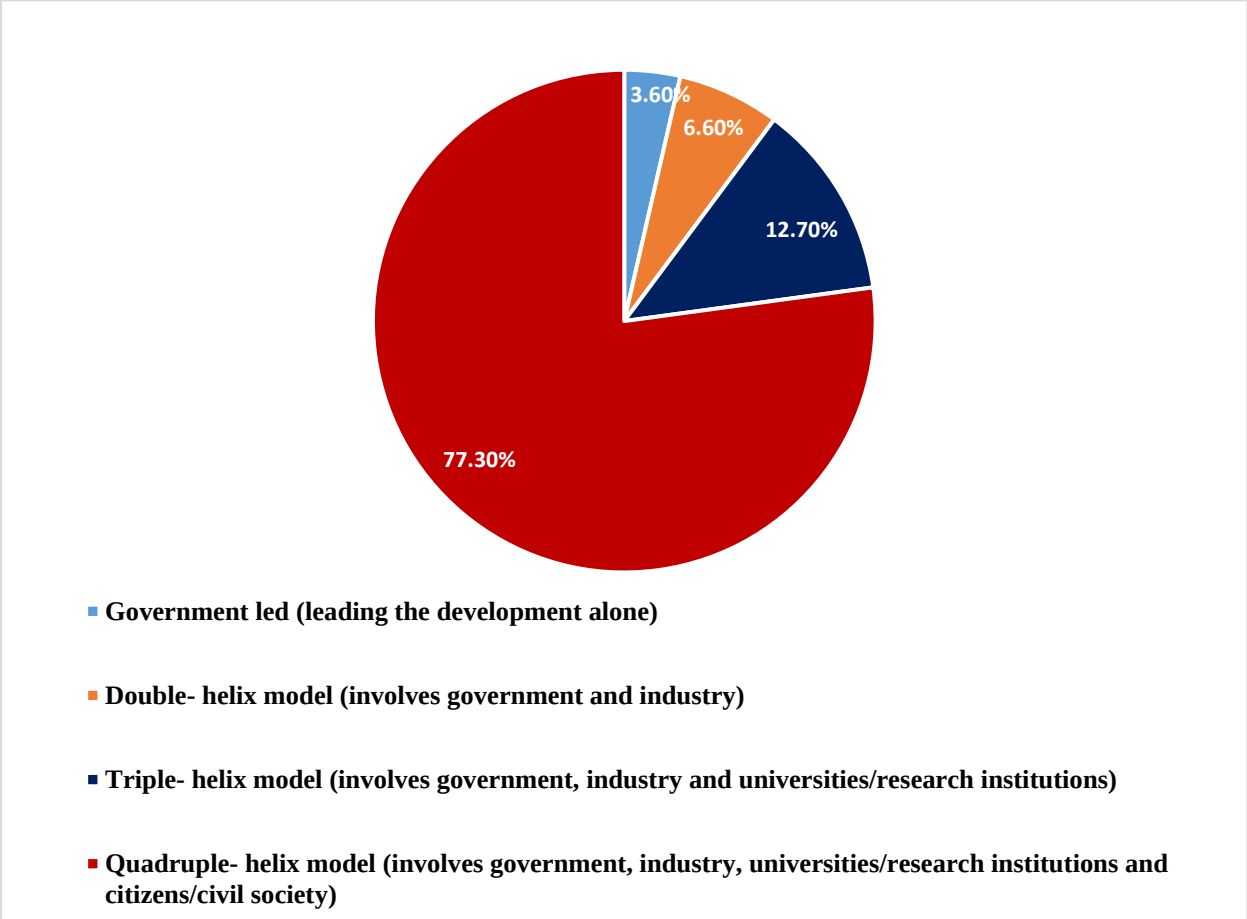

Figure 18: In order to build a collaborative ecosystem that will support smart city initiatives in Lagos, what model of collaboration would you suggest for the LSG? Source: Author's analysis

4.3. Discussion and Recommendations

As one of the main findings of this study, the author discovered that the double-helix model was prevalent in Lagos State due to the ease of collaboration between the government and industry, while other stakeholders were largely excluded from smart city development initiatives. However, as pointed out previously, the main challenges of this model are related to limited intellectual capital caused by the exclusion of academia and citizens (Leydesdorff and Deakin, 2011; Baccarne *et al.*, 2014a; 2014b; Dameri, 2014; 2017). Several reasons were identified that have contributed to the adoption of double-helix model, which are linked to different complexities. The lack of trust and conflicting interests are linked to strategic complexity, while limited expertise and diverging or conflicting perceptions of problems are linked to substantive complexity. Furthermore, conflicting or dysfunctional rules and a lack of coordination mechanisms are linked to institutional complexity (Klijn and Koppenjan, 2016).

Lack of trust is a common challenge in collaborative governance networks, which occurs when actors perceive that others do not share their goals or have the capability to fulfill their obligations. This can lead to reluctance to share information, resources, or decision-making power, which hinders effective collaboration (Ansell and Gash, 2008). Conflicting interests can arise when actors have different goals, values, or preferences, and may lead to competition rather than cooperation. This can occur when actors prioritize their own interests over the collective goal or when resources are scarce (Klijn and Koppenjan, 2016).

Limited expertise is another common challenge in governance networks, where actors may lack the necessary knowledge, skills, or experience to effectively participate in decision-making or implementation processes. This can lead to suboptimal outcomes or delays in the achievement of goals (Sørensen and Torfing, 2007). Diverging or conflicting perceptions of problems can also create challenges, as actors may have different views on the nature, causes, or solutions to a problem. This can lead to disagreements, misunderstandings, or resistance to certain courses of action (Ansell and Gash, 2008). Conflicting or dysfunctional rules can also create barriers to effective collaboration, as actors may be bound by conflicting rules, legal or regulatory frameworks that limit their ability to cooperate or make decisions (Klijn and Koppenjan, 2016). Also, a lack of coordination mechanisms can impede effective collaboration in governance networks, as actors may not have clear roles, responsibilities, or communication channels to facilitate cooperation and information sharing (Sørensen and Torfing, 2007).

However, the study also found that the majority of participants recommended the adoption of a quadruple-helix model of collaboration, which involves collaboration among government, industry, academia, and civil society. Although, the majority of the participants support the adoption of quadruple-helix model of collaboration for Lagos State, at the same time, they perceive involving academia to be more feasible than engaging civil society. The findings of the study reveal that the majority of respondents hold academia in high regard, considering it to be as important as both the private and public sectors. This is demonstrated in Figure 7, where the author seeks to identify the main actors in the LS smart city development initiatives.

The research findings, as illustrated in figure 10 and figure 13, suggest that citizens exhibit a high degree of distrust compared to academia. Additionally, the study indicates that the LSG lacks the necessary expertise to effectively engage citizens, in contrast to academia. Consequently, it appears that involving academia in the collaborative process may be more feasible than involving citizens. The respondents also recognize the issue of conflicting interests between citizens and the government, which further complicates matters. In this regard, the respondents believe that universities can play a vital role not only in conducting research and innovation related to smart city development initiatives but also in building capacities and knowledge that can enhance coordination among stakeholders. Therefore, the author contends that the government is more inclined to involve academia before citizens.

However, as shown in figure 11 and figure 14, the study suggests that by involving citizens and universities in the Lagos State smart city collaborative ecosystem, there will be numerous valuable contributions they can bring to the table. Citizens can provide valuable feedback, engage with their communities, embrace technology, promote sustainability, participate in governance, and assist with pilot projects and testing. Similarly, universities and research institutions can contribute by conducting research and innovation, providing education and training, undertaking pilot projects and advocacy, and engaging with the public.

Although the quadruple-helix model is the ideal framework for collaboration, the author recognizes that the LSG may find it more feasible to begin with the triple-helix model, as previously discussed. Notably, by drawing upon key concepts and principles of governance networks, the author addresses potential challenges to implementing the quadruple-helix model. To overcome these challenges, the author recommends that the LSG creates a transparent and inclusive decision-making process, establishes mechanisms for dispute resolution, and regularly monitors and evaluates collaborative efforts to ensure accountability and transparency. The author also suggests that the government creates a shared vision of the desired outcome, invests in training

and capacity building for their employees, partners with universities and research institutions to leverage their expertise and knowledge, and ensures inclusivity in the problem definition process.

Additionally, the author recommends that the State develops clear and transparent rules and regulations that guide the collaborative ecosystem, ensures that the rules are flexible and adaptable to changing circumstances, establishes clear communication channels and mechanisms that facilitate coordination and collaboration among stakeholders, invests in technology platforms that enable effective collaboration and information sharing, and establishes mechanisms for regular review and evaluation of the coordination mechanisms to ensure that they are effective and relevant.

Finally, the author emphasizes that while the government may be more inclined to involve academia before citizens, it is important to adopt a quadruple-helix model of collaboration in Lagos State. By implementing the above recommendations and adopting the quadruple-helix model of collaboration, the LSG can overcome potential challenges and establish an efficient collaborative ecosystem that supports the development of smart cities in Lagos State.

5. CONCLUSION

The survey results indicate that, while most respondents acknowledge the importance of all quadruple-helix stakeholders, the prevalent collaboration model in smart city development initiatives in Lagos State is the double helix. This may be attributed to several challenges impeding partnerships with citizens and universities, such as a lack of trust, conflicting interests, limited expertise to engage with citizens and universities, diverging perceptions of problems, conflicting or dysfunctional rules, and lack of coordination mechanisms.

However, citizen and university involvement in smart city initiatives can add significant value, such as providing feedback and promoting sustainability, conducting research and innovation, undertaking pilot projects and advocacy, and engaging with the public. Hence, adopting the quadruple-helix model of collaboration, involving government, industry players, universities/research institutions, and citizens/civil society, is crucial in creating a collaborative ecosystem that fosters the development of smart cities in Lagos State. This approach will encourage collaboration with universities and citizens, promoting a more inclusive and diverse approach to smart city development.

To facilitate the adoption of the quadruple-helix model of collaboration and overcome the challenges hindering its implementation, the author suggests adopting the triple-helix model as a mid-goal. In the discussion section, the author provides recommendations based on the governance network literature that can help Lagos State leverage the potential benefits of quadruple-helix collaboration and facilitate the development of sustainable smart cities. These findings align with the literature of Mora *et al.* (2019), which emphasizes the significance of multi-stakeholder collaboration in SCG networks.

Finally, the current study can only provide initial insight on the main issues related to smart city development and it is limited in providing answers on why exactly these issues exist in Lagos. This would require additional research. For example, the author found out that lack of coordination mechanisms, mistrust, and conflicts of interest are some of the main issues that prevent collaboration with academia and the civil society. However, the reasons behind these challenges and the exact form they manifest remain unclear and require further investigation.Therefore, additional research would be necessary to gain a better understanding of the underlying causes of these issues and identify potential solutions to address them.

LIST OF REFERENCES

Abiodun, B. J., Salami, A. T., Oladipo, E. O., and Ogundele, O. J. (2021). Urban flooding in Lagos: challenges and way forward. Environmental Science and Pollution Research, 28(16), 19823-19832.

Adelekan, I. O. (2016). Urbanization and slum development in Lagos, Nigeria: A review of the literature. Journal of Sustainable Development, 9(1), 133-146.

Afolabi, M. O., Akinladejo, B., and Ige, O. (2019). Smart city development in Nigeria: Lessons from Lagos State. Journal of Information Technology and Economic Development, 10(1), 19-37.

Africa Development Bank. (2019). Nigeria Country Economic Review. Retrieved from https://www.afdb.org/en/documents/document/nigeria-country-economic-review.

Alawadhi, S., and Aloulou, H. (2015). The Role of ICT in the Smart City Concept. In A. Bisello, D. Vettorato, and R. Stephens (Eds.), Smart and Sustainable Planning for Cities and Regions (pp. 89-98). Springer.

Albino, V., Berardi, U., and Dangelico, R. M. (2015). Smart cities: Definitions, dimensions, performance, and initiatives. Journal of Urban Technology, 22, 3–21.

Alhusban, M. (2015). The practicality of public service integration. Electronic Journal of e-Government, 13(2), 94–109.

Allison, G. T. (1971). Essence of decision. Boston, MA: Little, Brown.

Armitage, D. R., Plummer, R., Berkes, F., Arthur, R. I., Charles, A. T., Davidson-Hunt, I. J., Diduck, A. P., Doubleday, N. C., Johnson, D. S., Marschke, M., McConney, P., Pinkerton, E. W., and Wollenberg, E. K. (2018). Adaptive co-management for social-ecological complexity. Frontiers in Ecology and the Environment, 16(5), 307-314. https://doi.org/10.1002/fee.1796.

Baˇtaˇgan, L. (2011). Smart cities and sustainability models. Informatica Economica, 15, 80–87.

Babbie, E., and Mouton, J. (2015). The practice of social research. Oxford University Press.

Baccarne, B., Mechant, P., and Schuurman, D. (2014). Empowered cities? An analysis of the structure and generated value of the smart city Ghent. In R. P. Dameri and C. Rosenthal-Sabroux (Eds.), Smart city—How to create public and economic value with high Technology in urban space (pp. 157–182). Heidelberg, Germany: Springer.

Baccarne, B., Mechant, P., Schuurman, D. (2014a). Empowered cities? An analysis of the structure and generated value of the smart city Ghent.

Baccarne, B., Schuurman, D., Mechant, P., De Marez, L. (2014b). The role of urban living labs in a smart city. In: XXV ISPIM Innovation Conference: Innovation for Sustainable Economy and Society, Dublin, 8–11 June 2014. International Society for Professional Innovation Management, Manchester.

Bartenberger, M., and Grubmu¨ller-Re´gent, V. (2014). The enabling effects of open government data on collaborative governance in smart city contexts. eJournal of eDemocracy and Open Government, 6, 36–48.

Bătăgan, L. (2011). "Smart cities and sustainability models", Informatica Economică, Vol.15 No.3, pp. 80-87.

Baumgartner, F. R., and Jones, B. (2009). Agendas and instability in American politics (2 nd ed.). Chicago, IL: University of Chicago Press.

Bernd W. Wirtz and Wilhelm M. Müller (2022): An Integrative Collaborative Ecosystem for Smart Cities — A Framework for Organizational Governance, International Journal of Public Administration, DOI: 10.1080/01900692.2021.2001014.

Bibri, S. E., and Krogstie, J. (2017). Smart sustainable cities of the future: An extensive interdisciplinary literature review. Sustainable cities and society, 31, 183-212.

Bolívar, M. P. R. (2016). Mapping Dimensions of Governance in Smart Cities: Practitioners versus Prior Research. In Proceedings of the 17th International Digital Government Research Conference on Digital Government Research, 312–324. Shanghai: China, ACM. Doi: http://doi.acm.org/10.1145/2912160.2912176.

Bovaird, T., and Löffler, E. (2012). Public management and governance. Routledge.

Bryman, A. (2016). Social research methods (5th ed.). Oxford University Press.

Buettner, R., Kühn, R., and Wiest, G. (2018). SCG: A review of the literature and a proposed typology. Journal of Urban Technology, 25(4), 3-27.

Caragliu, A., Del Bo, C., and Nijkamp, P. (2009, October 7–9). Smart cities in Europe. Paper presented at 3rd European conference in regional science—CERS 2009, Kosˇice, Slovak Republic.

Caragliu, A., Del Bo, C., and Nijkamp, P. (2011). Smart cities in Europe. Journal of Urban Technology, 18(2), 65-82. https://doi.org/10.1080/10630732.2011.601117.

Carayannis, E. G., and Campbell, D. F. (2009). “Mode 3” and “Quadruple Helix”: Toward a 21st century fractal innovation ecosystem. International Journal of Technology Management, 46(3-4), 201-234.

Carayannis, E.G., Barth, T.D. and Campbell, D.F. (2012). The Quintuple Helix innovation model: global warming as a challenge and driver for innovation. J Innov Entrep 1, 2 (2012). https://doi.org/10.1186/2192-5372-1-2.

Castells, M. (1997) The Power of Identity, Oxford: Blackwell Publishers.

Castelnovo, W., Misuraca, G., and Savoldelli, A. (2015). Smart Cities Governance: The Need for a Holistic Approach to Assessing Urban Participatory Policy Making. Social Science Computer Review, 34(6), 724-739, Doi: https://doi.org/10.1177/ 0894439315611103.

Chen, Y., Zhang, X., and Yao, X. (2019). A governance network perspective on smart city development in China. Sustainability, 11(12), 3393.

Cheng, X., Fu, S., and Druckenmiller, D. (2016). Trust development in globally distributed collaboration: A case of U.S. and Chinese mixed teams. Journal of Management Information Systems, 33(4), 978– 1007.

Cheng, X., Yin, G. P., Azadegan, A., and Kolfschoten, G. L. (2016). Trust evolvement in hybrid team collaboration: A longitudinal case study. Group Decision and Negotiation, 25(2), 267–288 Choenni, S., Janssen, M., and Scholl, H. J. (2015). Digital cities: The next generation. Springer.

Chourabi, H., Nam, T., Walker, S., Gil-Garcia, J. R., Mellouli, S., Nahon, K., ... Scholl, J. R. (2012, January 4–7). Understanding smart cities: An integrative framework. Paper presented at the 45th Hawaii International Conference on System Sciences, Maui, HI (pp. 2289–2297).

Chrislip, David D., and Carl E. Larson. (1994). Collaborative Leadership. San Francisco: Jossey-Bass.

Chun, S. A., Luna-Reyes, L. F., and Sandoval-Almazán, R. (2012). Collaborative e-government. Transforming Government: People, Process and Policy, 6(1), 5–12.

Chun, S. A., Shulman, S., and Sandoval-Almazan, R. (2012). Government 2.0 and social media technologies: Challenges and opportunities for democratic engagement. Springer Science and Business Media.

Coe, A., Paquet, G., and Roy, M. J. (2001). E-governance and smart communities: A social learning challenge. Social science computer review, 19(1), 80-93.

Dameri, R.P. (2014). Comparing smart and digital city: initiatives and strategies in Amsterdam and Genoa. Are they digital and/or smart? In: Dameri, R.P., Rosenthal Sabroux, C. (Eds.), Smart City: How to Create Public and Economic Value with high Technology in Urban Space. Springer, Berlin, pp. 45–88.

Dameri, R.P. (2017). Smart City Implementation: Creating Economic and Public Value in Innovative Urban Systems. Springer, Cham.

Deakin, M., and Reid, A. (2018). Smart cities: Governing, modelling and analyzing the transition. Routledge.

Dirks, S., Keeling, M., and Dencik, J. (2009). How smart is your city? Helping cities measure progress. Somers, NY: IBM Institute for Business Value.

Ejaz, W., Naeem, M., Shahid, A., Anpalagan, A., and Jo, M. (2017). Efficient energy management for the internet of things in smart cities. IEEE Communications Magazine, 55, 84–91.

Fadare, W., and Oduwaye, L. (2009). Rebranding Lagos through regeneration. Real Corp 2009 Proceedings/Tgungsband Sitges.

Gabriela Viale Pereira, Maria Alexandra Cunha, Thomas J. Lampoltshammer, Peter Parycek and

Maurício Gregianin Testa (2017). Increasing collaboration and participation in smart city governance: a cross-case analysis of smart city initiatives, Information Technology for Development, 23:3, 526-553, DOI: 10.1080/02681102.2017.1353946.

Gerrits, L. (2012). Punching clouds: An introduction to the complexity of public decision-making. Litchfield Park, AZ: Emergent Publications.

Giffinger, R., Fertner, C., Kramar, H., Kalasek, R., Pichler-Milanovic´, N., and Meijers, E. (2007). Smart cities: Ranking of European medium-sized cities. Vienna, Austria: Centre of Regional Science (SRF), Vienna University of Technology.

Gil-Garcia, J. R. (2012). Towards a smart state? Inter-agency collaboration, information integration, and beyond. Information Polity, 17(4), 281-292.

Graham, S., and Marvin, S. (2016). Splintering urbanism: Networked infrastructures, technological mobilities and the urban condition. Routledge.

Gravetter, F. J., and Wallnau, L. B. (2016). Statistics for the behavioral sciences. Cengage Learning.

Hall, R. E. (2000, September 28). The vision of a smart city. Proceedings of the 2nd International Life Extension Technology Workshop, Paris, France.

Harrison, C., Eckman, B., Hamilton, R., Hartswick, P., Kalagnanam, J., Paraszczak, J., et al. (2010). Foundations for smarter cities. IBM Journal of Research and Development, 54, 1–16.

Harrison, T. M., Guerrero, S., Burke, G. B., Cook, M., Cresswell, A., Helbig, N., … Pardo, T. (2012). Open government and e-government: Democratic challenges from a public value perspective. Information Polity, 17(2), 83–97.

Head, B. (2008). Wicked problems in public policy. Public Policy, 3(2), 110–118.

Healey, P., and Robinson, J. (2011). Janus planning? A comparative review of planning in ten countries. Planning Theory and Practice, 12(3), 387-401. https://doi.org/10.1080/14649357.2011.582947.

Herrschel, T., 2013. Competitiveness and sustainability: Can ‘smart city regionalism’ square the circle? Urban Stud. 50, 2332–2348.

Hollands, R. G. (2008). Will the real smart city please stand up? City, 12(3), 303-320.

Hoornweg, D., and Pope, K. (2017). Population predictions for the world’s largest cities in the 21st century. Environment and Urbanization, 29(1), 195–216.

Howell, D. C. (2012). Statistical methods for psychology. Cengage Learning.

Ibrahim, A. (2017). Urban governance in Lagos: Challenges and Prospects. Journal of Sustainable Development, 10(3), 187-197.

K. Su, L. Jie, and F. Hongbo. (2011). Smart city and the applications in Proc. Int. Conf. Electron., Commun. Control (ICECC), Ningbo, China, Sep. 2011, vol. 25, no. 8, pp. 265–282.

Kamargianni, M., Li, W., Matyas, M., and Scholten, H. (2016). Smart City Logistics: A Living Lab Approach for the City of Amsterdam. In Living Labs: Design and Assessment of Sustainable Living (pp. 283-302). Springer.

Kickert, W. J. M., Klijn, E. H., and Koppenjan, J. F. M. (Eds.). (1997). Managing complex networks: Strategies for the public sector. London: Sage.

Kingdon, J. W. (1984). Agendas, alternatives and public policies. Boston/Toronto: Little, Brown.

Kitchin, R., and Dodge, M. (2015). The (in)security of smart cities: Vulnerabilities, risks, mitigation, and prevention. Journal of Urban Technology, 22(1), 3-21.

Kleinhans, R., Ham van, M. and Evans-Cowley, J. (2015). Using Social Media and Mobile Technologies to Foster Engagement and Self-Organisation in Participatory Urban Planning and Neighbourhood Governance. Planning Practice and Research, 30(3), 237-247. Doi: http://dx.doi.org/10.1080/02697459.2015.1051320.

Klijn, E.H. and Koppenjan, J.F.M. (2014). Complexity in governance network theory. In: Complexity, Governance and Networks, 1 (1), 61-70. doi: 10.7564/14-CGN8.

Klijn, E.H. and Koppenjan, J.F.M. (2016). Governance networks in the public sector.

Koliba, C., Meek, J., and Zia, A. (2010). Governance networks in public administration and public policy. Boca Raton, FL: Taylor and Francis/CRC Press.

Kondepudi, S. (2014). Smart sustainable cities analysis of definitions. The ITU-T Focus Group for Smart Sustainable Cities.

Koppenjan, J. F. M., and Klijn, E. H. (2004). Managing uncertainties in networks: A network approach to problem solving and decision making. Routledge.

Krueger, R., and Gibbs, D. (2013). Sustainable urban development reader. Routledge.

Lagos State Government. (2017). Lagos Smart City Initiative. Retrieved from https://www.lagossmartcity.ng/.

Lagos State Government. (2020). About Lagos. Available at: https://lagosstate.gov.ng/about-lagos/.

Lee, S. H., and Kim, S. (2019). Examining governance structures in smart city development: Network analysis of Seoul's urban innovation ecosystem. Sustainability, 11(18), 4902.

Leydesdorff, L., Deakin, M., (2011). The triple-helix model of smart cities: a neo-evolutionary perspective. J. Urban Technol. 18 (2), 53–63.

Lombardi, P., Giordano, S., Farouh, H., and Wael, Y. (2011, June 15–18). An analytic network model for Smart cities. Proceedings of the 11th International Symposium on the Analytic

Hierarchy Process, Sorrento, IT.

Lombardi, P., Giordano, S., Farouh, H., and Yousef, W. (2012). Modelling the smart city performance. Innovation: The European Journal of Social Science Research, 25(2), 137-149.

Macke, J.; Casagrande, R.M.; Sarate, J.A.R.; Silva, K.A. (2018). Smart city and quality of life: Citizens' perception in a Brazilian case study. J. Clean. 182, 717–726.

Manville, C., Cochrane, G., Cave, J., Millard, J., Pederson, J., Thaarup, R., ... Kotterink, B. (2014). Mapping smart cities in the EU. Retrieved from http://www.europarl.europa. eu/RegData/etudes/etudes/join/2014/507480/IPOL-ITRE-ET(2014)507480-EN.pdf.

Martin, C.; Evans, J.; Karvonen, A.; Paskaleva, K.; Yang, D.; Linjordet, T. (2019). Smart-sustainability: A new urban fix? Sustain. Cities and Soc. 2019, 45, 640–648.

Meijer, A. (2016). SCG: A local emergent perspective. Gil-Garcia J., Pardo T., Nam T. (eds) Smarter as the New Urban Agenda. Public Administration and Information Technology, vol 11, 73-85. Springer, Cham.

Meijer, A. J., and Bolívar, M. P. R. (2016). Governing the smart city: a review of the literature on smart urban governance. International Review of Administrative Sciences, 82(2), 392-408. Doi: https://doi.org/10.1177/0020852314564308.

Meijer, A., and Rodrı´guez Bolı´var, M. P. (2013, September). Governing the smart city: Scaling-up the search for socio-techno synergy. Edinburgh, Scotland: EGPA.

Meijer, A., Bolívar, M. P. R., and Escudero, L. F. (2016). Understanding smart cities: Innovation ecosystems, technological advancements, and societal challenges. Journal of Urban Technology, 23(4), 1-21. doi: 10.1080/10630732.2016.1205172.

Meijer, A., Bolivar, M.P.R. (2016). Governing the smart city: a review of the literature on smart urban governance. Int. Rev. Adm. Sci. 82 (2), 392–408.

Mills, D.E.; Izadgoshasb, I.; Pudney, S.G. (2021). Smart City Collaboration: A Review and an Agenda for Establishing Sustainable Collaboration. Sustainability, 13, 9189. https://doi.org/10.3390/ su13169189.

Misuraca, G., Reid, A., and Deakin, M. (2011). Exploring emerging ICT-enabled governance models in European cities: Analysis of the mapping survey to identify key city governance policy areas most impacted by ICTs. Seville: European Commission, JRC Technical Notes.

Mora, L.; Deakin, M.; Reid. (2019). Strategic principles for smart city development: A multiple case study analysis of European best practices. Technol. Forecast. Soc. Chang., 142, 70–97 Morçöl, G. (2012). A complexity theory for public policy. New York: Routledge.

Moss Kanter, R., and Litow, S. S. (2009). Informed and interconnected: A manifesto for smarter cities. Harvard Business Review, 87(7/8), 122-123.

Nam, T., and Pardo, T. A. (2011a, September 26–28). Smart city as urban innovation: Focusing

on management, policy, and context. Proceedings of the 5th International Conference on Theory and Practice of Electronic Governance—ICEGOV2011, Tallinn, Estonia, pp. 185–194. New York, USA: ACM Press.

Nam, T., and Pardo, T. A. (2011b, June 12–15). Conceptualizing smart city with dimensions of technology, people, and institutions. In Proceedings of the 12th Annual International Conference on Digital Government Research, College Park, MD, pp. 282–291. New York, USA: ACM Press.

National Bureau of Statistics. (2019). Demographic Statistics Bulletin. Retrieved from https://nigerianstat.gov.ng/download/726.

National Bureau of Statistics. (2021). States and FCT GDP Report 2020. Retrieved from https://www.nigerianstat.gov.ng/download/662.

National Population Commission. (2021). NPC releases 2021 population figures. Retrieved from https://population.gov.ng/npc-releases-2021-population-figures/.

Nesti, G. (2018). Defining and assessing the transformational nature of SCG: Insights from four European cases. Int. Rev. Adm. Sci., 0020852318757063.

Nigerian Institute of Social and Economic Research. (2018). Infrastructure and Sustainable Development in Lagos State: Issues, Challenges and Prospects. Retrieved from https://www.niser.gov.ng/images/Publications/Research_Reports/RR2_2018.

O'Brien, C. (2018). Smart Dublin: A triple helix approach to smart city development. In A. Caragliu, C. Del Bo, and P. Nijkamp (Eds.), Smart cities in the post-algorithmic era: Integrating technologies, platforms and governance (pp. 173-183). Edward Elgar Publishing.

Ogunsanya, A., Olajide, A., and Adewumi, O. (2019). Lagos State: A Hub of Creative and Entertainment Industry in Africa. In Handbook of Research on Entrepreneurship in the Contemporary Knowledge-Based Global Economy (pp. 138-155). IGI Global.

Ojo, A., Curwell, S., and Deakin, M. (2015). Smart cities: A Delphi study. In Proceedings of the 14th International Conference on Sustainable Energy Technologies, pp. 14-16.

Oluwagbemi, O. O., Okuboyejo, S. A., and Adeoye, O. S. (2019). Smart city development in Africa: The Lagos, Nigeria example. Smart and Sustainable Built Environment, 8(2), 144-160.

Ostrom, E. (1990). Governing the Commons: The Evolution of Institutions for Collective Action. Cambridge University Press.

Ostrom, E. (2005). Understanding institutional diversity. Princeton, NJ: Princeton University Press.

Paskaleva, K. (2011), "The smart city: A nexus for open innovation?", Intelligent Buildings Internationali, Vol.3 No.3, pp. 153-171.

Pereira, G. V., Parycek, P., Falco, E., and Kleinhans, R. (2018). Smart governance in the context of smart cities: A literature review. Information Polity, 23(2), 143-162. https://doi.org/10.3233/IP-170067.

Pereira, V. G., Macadar, M. A., Sarubbo, L. A., and Júnior, A. C. (2017). Increasing collaboration and participation in SCG: A cross-case analysis of smart city initiatives. Information Technology for Development, 23(3), 526-553.

Polit, D. F., and Beck, C. T. (2017). Nursing research: Generating and assessing evidence for nursing practice. Wolters Kluwer Health/Lippincott Williams and Wilkins.

Praharaj, S., Han, J. H., and Hawken, S. (2018). Towards the right model of SCG in India. International Journal of Sustainable Development and Planning, 13(2), 171–186. http://dx.doi.org/10.2495/SDP-V13-N2-171-186.

Rein, M., and D.A. Schön. (1992) Reframing policy discourse, in: F. Fischer and J. Forester (eds): The Argumentative Turn in Policy Analysis and Planning, Durham, NC: Duke University Press: 145–166.

Richardson, L. (2005). Writing: A method of inquiry. In N. K. Denzin and Y. S. Lincoln (Eds.), The SAGE Handbook of Qualitative Research (3rd ed., pp. 959-978). SAGE Publications.

Rittel, H. J. W., and Webber, M. M. (1973). Dilemmas in a general theory of planning. Policy Sciences, 4, 155–169Rhodes, R. A. W. (1997). Understanding governance. Buckingham, UK: Open University Press.

Rocco, R., and Stanghellini, S. (2015). Green cities in the world. Springer.

Ruhlandt R.W.S. (2018). The governance of smart cities: A systematic literature review.

Sabatier, P.A. (1988) An advocacy coalition framework of policy change and the role of policy-oriented learning therein, Policy Sciences, 21(2–3): 129–168. Sabatier, P.A. (ed.) (2007) Theories of the Policy Process (volume 2), Boulder, CO: Westview Press.

Sabatier, P.A., and C.M. Weible (2007) The advocacy coalition framework: innovations and clarifications in: P.A. Sabatier (ed.): Theories of the Policy Process (volume 2), Boulder, CO: Westview Press: 189–220.

Sanwo-Olu, B. (2021). Gov. Sanwo-Olu's keynote speech at the Ehingbeti Summit 2021. Retrieved from https://www.premiumtimesng.com/news/headlines/444727-full-text-gov-sanwo-olus-keynote-speech-at-the-ehingbeti-summit-2021.html.

Scharpf, F. W. (1997). Games real actors play. Actor-centered institutionalism in policy research, Boulder, CO: Westview Press.

Scholl, H. J., and Scholl, M. C. (2014). Smart governance: A roadmap for research and practice. In M. Kindling and E. Greifeneder (Eds.), iConference 2014 Proceedings (pp. 163–176). Urbana-Champaign, USA: iSchools.

Sekaran, U., and Bougie, R. (2016). Research methods for business: A skill building approach.

John Wiley and Sons.

Si Ying Tan and Araz Taeihagh. (2020). SCG in Developing Countries: A Systematic Literature Review.

Silva B N., Khan M., Han K. (2018). Towards sustainable smart cities: A review of trends, architectures, components, and open challenges in smart cities.

Silva, J. S., and Almirall, E. (2015). Developing a Research Agenda for Smart City Evaluation. In J. Ramon Gil-Garcia, T. A. Pardo, and T. Nam (Eds.), Smarter as the New Urban Agenda: A Comprehensive View of the 21st Century City (pp. 71-91). Springer.

Smith, K. (2017). The inconvenient truth about smart cities. Available online: https://blogs.scientificamerican.com/ observations/the-inconvenient-truth-about-smart-cities/.

Smith, M. (2018). The smart city: Changing urban landscapes and new opportunities. In D. Johnson (Ed.), The future of cities: Opportunities, challenges and the way forward (pp. 45-63). Routledge.

Snow, C. C., Hakonsson, D. D., and Obel, B. (2016). A smart city Is a collaborative community. California Management Review, 59(1), 92–108. doi:10.1177/0008125616683954.

Sørensen, E., and Torfing, J. (2007). Theories of democratic network governance. Palgrave Macmillan.

Sørensen, E., and Torfing, J. (2011). Enhancing collaborative innovation in the public sector. Administration and Society, 43(8), 842-868.

Tan, W.C.K. (2011). Practical Research Methods. Singapore: Pearson Custom.

Teisman, G. R., van Buuren, A., and Gerrits, L. (2009). Managing complex governance systems. London: Routledge.

TEPSIE. (2015). Growing the field of social innovation in Europe, a deliverable of the project: ‘‘The theoretical, empirical and policy foundations for building social innovation in Europe’’ (TEPSIE). European Commission Framework Programme. Brussels, Belgium: European Commission, DG Research.

Testoni, C., and Boeri, A. (2015). Smart Governance: urban regeneration and integration policies in Europe. Turin and Malmö case studies. International Journal of Scientific and Engineering Research, 6(3), 527-533.

Thijssen, P., Jenniskens, K., and Kooiman, J. (2018). Governance networks in pandemic preparedness and response. In J. Kooiman and S. Jentoft (Eds.), Governance of Marine Fisheries and Biodiversity Conservation: Interaction and Coevolution of Governance Multi-level Networks and Agency (pp. 337-356). Oxford University Press. https://doi.org/10.1093/oso/9780198784287.003.0018.

United Nations-Habitat. (2016). World Cities Report 2016: Urbanization and Development –

Emerging Futures. United Nations Human Settlements Programme.

United Nations (2018). World Urbanization Prospects 2018. United Nations Department of Economic and Social Affairs. https://population.un.org/wup/Publications/Files/WUP2018-KeyFacts.

United Nations (2020). SDG 6: Water and Sanitation. Retrieved from https://www.un.org/sustainabledevelopment/water-and-sanitation/.

United Nations-Habitat (2022). Global Review of SCG Practices.

Washburn, D., Sindhu, U., Balaouras, S., Dines, R. A., Hayes, N. M., and Nelson, L. E. (2010). Helping CIOs understand ‘‘smart city’’ initiatives: Defining the smart city, its drivers, and the role of the CIO. Cambridge, MA: Forrester Research.

Weber, E., and Khademian, A. (2008). Wicked problems, knowledge challenges and collaborative builders in network settings. Public Administration Review, 68(2), 334–349.

Weiss, N. A. (2012). Introductory statistics. Pearson Education.

World Bank. (2016). Africa's Cities: Opening Doors to the World. World Bank Group.

World Bank. (2019). Nigeria – Urbanization Review. Retrieved from https://www.worldbank.org/en/country/nigeria/publication/nigeria-urbanization-review.

Yigitcanlar, T.; Kamruzzaman, M.; Buys, L.; Ioppolo, G.; Sabatini-Marques, J.; da Costa, E.M.; Yun, J.J., (2018). Understanding ‘smart cities’: Intertwining development drivers with desired outcomes in a multidimensional framework.’ Cities Vol 81, 145–160.

Zanella, A., Bui, N., Castellani, A., Vangelista, L., and Zorzi, M. (2014). Internet of things for smart cities. IEEE Internet of Things Journal, 1, 22–32.

APPENDICES

Appendix 1. Questionaire for the study

SECTION A: PERSONAL DATA

1. Sex
   - Male
   - Female

2. Age group
   - 25-34 years
   - 35-44 years
   - 45-54 years
   - 55 and above

3. What is your highest educational qualification?
   - OND/Diploma
   - HND/First Degree
   - Masters
   - PhD

4. In what sector is your profession?
   - Public sector
   - Private sector
   - Academic sector
   - Non-governmental / civil society organization
   - Other (please specify)

5. How many years of experience do you have in your profession?
   - 1-5 years
   - 6-10 years
   - 11-15 years
   - 16-20 years
   - 21 years and above

SECTION B: ACTORS FOR SMART CITY DEVELOPMENT IN LAGOS STATE

1. Do you think the Lagos state government recognizes the value of collaborating with citizens on smart/urban development initiatives? (for example, in the initiation and construction of the Eco Atlantic City)?
   - Yes
   - No
   - Not sure

2. What are the challenges that make it difficult for Lagos state government to collaborate with citizens and CSO in smart city initiatives? (Select all that apply)
   - Lack of trust

- Limited expertise to engage with citizens
- Conflicting or dysfunctional rules
- Conflicting interest
- Lack of coordination mechanism

3. What contributions do you think the citizens and CSO will make towards smart city development in Lagos? (Select all that apply)

- Providing feedback
- Community engagement
- Embracing technology
- Promoting sustainability
- Participating in governance
- Pilot projects and testing
- None of the above
- Other (please specify)

4. Can you name CSO involved in smart city development initiatives in Lagos State?

5. Do you think the Lagos state government recognizes the value of collaborating with universities and research institutions on smart/urban development initiatives?

- Yes
- No
- Not sure

6. What are the challenges that make it difficult for Lagos state government to collaborate with the universities and research institutions in smart city initiatives? (Select all that apply)

- Diverging or conflicting perception of problems
- Limited expertise to engage with universities
- Conflicting or dysfunctional rules
- Lack of trust
- Lack of coordination mechanism

7. What contributions do you think the universities and research institutions will make towards smart city development in Lagos? (Select all that apply)

- Research and innovation
- Education and training
- Pilot projects and testing
- Policy and advocacy
- Public engagement
- None of the above
- Other (please specify)

8. Can you name universities (if possible, specific faculties or departments in universities) and research institutions involved in smart city development initiatives in Lagos State?

9. Do you think that Lagos state government brings industry partners on board for smart city development initiatives?

- Yes
- No

- Not sure

10. What are the challenges that might affect the industry collaboration with the Lagos state government on smart city development? (Select all that apply)

- Conflicting strategies on the part of industry actors
- Diverging or conflicting perception of problems
- Limited regulatory framework
- Conflicting or dysfunctional rules
- Lack of coordination mechanism
- Lack of trust

11. What contributions do you think the industry partners will make towards smart city development? (Select all that apply)

- Investment and funding
- Expertise and innovation
- Infrastructure and technology
- Pilot projects and testing
- None of the above
- Other (please specify)

12. Can you name industry partners involved in smart city development initiatives in Lagos State?

13. Which of the following stakeholders do you think should be involved or should be seen as the main actors in the Lagos State Smart city development initiatives? (Select all that apply)

- Government agencies
- Industries/private companies
- Civil Society Organizations/NGOs
- Universities/research institutions
- Other (please specify)

SECTION C: MODEL OF COLLABORATION FOR SMART CITY DEVELOPMENT IN LAGOS STATE

1. Under which of the following sectors are there most smart city initiatives in Lagos state? (Select all that apply)

- Energy and utilities
- Transportation and logistics
- Real estate and construction
- IT and telecoms
- Other (please specify)

2. Which of the following models of collaboration do you think is currently being used for smart city initiatives in Lagos State? (Please select one)

- Government (leading the development alone)
- Double- helix model (involves government and industry)
- Triple- helix model (involves government, industry and universities/research institutions)

- Quadruple- helix model (involves government, industry, universities/research institutions and citizens)

3. In order to build a collaborative ecosystem that will support smart city initiatives in Lagos, what model of collaboration would you suggest for the Lagos State Government? (Please select only one)

- Government led (leading the development alone)
- Double- helix model (involves government and industry)
- Triple- helix model (involves government, industry and universities/research institutions)
- Quadruple- helix model (involves government, industry, universities/research institutions and civil society/citizens)

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