A review of the pathways, opportunities, challenges and utility of geospatial infrastructure for smart city in Nigeria

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Abstract Smart city is one of the fastest growing socio-economic and scientific initiative in the world. Still, it is only in principle and a mere blueprint for many developing countries. This study reviews literature on smart city in Nigeria and developing countries. Our aim is to explore ways to improve the quality of Nigeria's urban areas, based on recent research on the concept of smart city and its implementation. We summarise key research findings, and gather evidence that shows what composition of urban governance, social, economic, and environmental factors, that would influence actualising a smart city in Nigeria. Although knowledge has grown tremendously in the current literature on the definition, significance, governance, policy, and implementation of a smart city, its significance in Nigeria and other developing countries is supplemental. As an environmentally friendly initiative, a smart city will support urban sustainability and livelihood in Nigeria in a myriad of ways—environmental protection, and mainstream urban services, including public security and safety, access to quality health care, efficient power supply, clean water distribution, assets management, smart transportation, etc. However, despite her unique traditional urban agglomeration trends, Nigeria is unambitious and constrained towards actualising a smart city. Actualising a smart city in Nigeria and other developing countries would require radical and ambitious policies on development of human and infrastructural capacity, as well as institutional reinforcement. This highlights the need for more research, of which we are optimistic that the findings of this research will support with its new insight and clear guidelines.

Introduction

A smart city is modern architectural philosophy, focusing on the use of information and communication technology (ICT) to solve problems endogenous to the city, and to power vital activities. It represents a major transformation from the traditional urban agglomeration to a twenty-first-century metropolis, which advances city functions, promotes economic growth, and improves the quality of life for citizens (Bakıcı et al., 2013). One obvious benefit of a smart city is the level of government response to the needs

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and well-being of citizens through positive interaction between the government and citizens, aided by technology-driven policies and services. When we look at some of the smart cities in the world today for example Singapore, San-Diego, Barcelona, and Hong Kong, we could find that smartness of cities creates applications and urban services that combine technology and promotes the development of policies and practices to address the social, economic, and environmental challenges facing today's urban areas (Su et al., 2011).

Considering the values of a smart city, places in developing countries come to mind. For example, in Nigeria, which is the focus of this study, urban agglomeration and its increasing challenge and pressure are limitations to sustainable development (Idowu, 2013). A large number of human populations increases geographical footprint, and the lack of space for a myriad of city projects and functions (Asogwa et al., 2020). The result of this is that human activity, which is the way of life for survival, creates more city distortions rather than being a major source of socio-economic development. Some of the everyday indicators of what is happening in urban areas in Nigeria are traffic congestion, lack of parking space for automobiles, indiscriminate dumping of waste, widespread crime and social disorder, natural hazards, and burning of fossil fuels to generate energy (Olarinmoye et al., 2020; Xu et al., 2021). All these are sources of major impasse for the country's sustainable urban development.

Thinking carefully about how to address these issues should highlight the need to emphasize smart city initiatives for developing countries. For Nigeria, such an initiative raises two important questions that would motivate research: (1) *How can a smart city address Nigeria's biggest urban problem?* And (2) *Is Nigeria readily pliable to a smart city project or is a smart city a sustainable project in Nigeria?* There is a lack of research in Nigeria on smart cities. Few studies (e.g., Adenle et al., 2021; Aghimien et al., 2020; Kabir, 2019; Nwakanma et al., 2019; Okehielem et al., 2019) that examined smart cities for Nigeria also discussed similar but broader questions. Still, there is no conclusive explanation. The questions are still important considering that a smart city is a constantly evolving project and Nigeria, as of now, is still in its infancy, with challenges

and development issues, especially ICT, which is the core of a smart city.

Ample research in the geosciences, environmental modeling, human geography, and global development literature underscores the surging interest in smart cities within a diverse spatial context. Thus, one can imagine the need to explore smart cities with a view of the pathways, opportunities, and challenges in various world's geographies, linking with the proliferation of geospatial infrastructure which widens human-development opportunities today. Knowing how to achieve this for Nigeria is the aim of this study. We reviewed existing literature on the smart city to answer the questions of this research, and to offer knowledge on the utility of geospatial technology in smart city initiatives. The novelty of this research lies in its context-specific discussion on Nigeria's pliability for achieving a smart city through the utility of geospatial technology. We believe that the government and citizens will find this research useful towards more efficient functional urban areas in Nigeria.

Review of literature on the current understanding and ongoing debate of smart cities

The techno-utopian and neoliberalist perspectives that underlie the idea of smart cities have since informed much research in geography, cities, and urbanism (Batty et al., 2012; Datta, 2015; Angelidou, 2015; Wing 2015; Martin et al., 2018; Aurigi & Odendaal, 2021). While the techno-utopian paradigm explicates the contextual clues and reflects on smart cities merely as an ideal urban situation where technology fixes every foreseeable urban problem, the neoliberalists perceive a smart city as a technologically-enhanced situation in which digital versions of essential services are scaled up to promote capitalist 'takeover' and administering of the city. It fosters a globalized business ecosystem, a business-dominated technological interest, rather than a radical and comprehensive urban planning. Each of these perspectives has been intelligently critiqued in the current literature. For example. Watson (2015) warns Africa and India of the consequences of envisioning a revolutionary city against the foreground of 'fantasy cities', such as Dubai and Singapore. Although Grossi and Pianezzi, (2017) defended the view of a smart

city being a techno-utopian system, whilst at the same time it acts as a generator of a collective imaginary, the authors insist that it promotes the shared interests of business elites and devolves the city development attention away from urgent urban problems, such as urbanization. Regardless of the points of variation or polarity, how smart city is perceived, and the research efforts that emerge from those views collectively contend that smart cities provide digitized, intelligent, flexible, and 'updatable' systems to enhance the quality and performance of urban services that currently overwhelm traditional urban agglomerations (Dong et al., 2022; Lai et al., 2020; Myeong et al., 2021).

It is a truism that smart cities inform strategies for sustainable urban development (Angelidou et al., 2017; Basiri et al., 2017; Masik et al., 2021). This is what the neoliberalist ideology upholds, and why many social-scientific studies have focused largely on addressing the pivotal elements of smart technology–ICT and IoT–but with only minimal attention to how policy, governance, spatial science, and strategic planning can provide the best possible innovative reinforcement towards optimizing the current benefits of cities (Voordijk & Dorrestijn, 2021). But the transition from traditional agglomerations to smart cities is tactical, adroit and confronts many challenges, which policymakers and urban planners are still searching for ways to circumvent and make today's cities lively, interactive, safe, and able to deliver all the necessary ingredients that can support both ecological and entrepreneurial existence at a marginal cost of living. This raises the issue of Anthropocene across many world geographies which is the reason why smart cities are thought of in the first place. How is it possible that in the period in which we live, in which human activities have been the dominant influence on the environment and climate, smart cities should only satisfy the business agenda of a select few? Does the scholarly community have to agree with Yigitcanlar (2018) that smart city efforts are insufficient to meet the challenges of the present Anthropocene? Of course, such an argument will pale into the reality of today's city and how transitionary it always 'has been, and would-be', ever-evolving into more complex geographical and ecological topologies. Until our best rational argument assimilates this fact, the idea of a smart city will remain elusive to societies that are notorious for not moving at the pace of advancement in science and technology.

Rooting this discussion on the present composition of cities which includes geographies, topography, geomorphology, and their topologies raises the question of how well a smart technology can balance with urban planning and governance, especially in the global south such as Nigeria—which is the focus of the present study—where Anthropocene manifests extensively in the present geographic footprint. Concerning the Global South where policy and practice are often misaligned, the actuality of a smart city might require dredging the present understanding of the smart city and determining what the realities on the ground hold—the 'cores' and 'the connectivities'. This is important to ideal urban planning and governance and as Lin et al. (2019), Ma et al. (2020), and Nelli et al. (2022) suggest, measuring and analyzing the urban cores and their connectivities underscore the importance of geospatial technology in actualizing a smart city. But geospatial technology, particularly its trademark, 'GIS', has not featured prominently as has smart technologies in the literature of smart cities. This constitutes a poor conceptualization of smart city, a weak construction of knowledge for its actualization, and ultimately would deny poor developing societies sufficient access to knowledge base and resources to advance their current urban agglomerations to smartness. This is particularly important now that many GIS tools are becoming open source. A situation of this nature needs both research and policy attention, to give especially many of the developing countries of the world enough window of opportunity to join in the race to smartness.

Chronicling the evolution of knowledge and research in the smart city should unify various sides of the argument in terms of what should be the aim of a smart city and how it should be actualized regardless of the conceptual lens with which any place views a smart city. However, it should also highlight the key themes that are still the problem and motivations of ongoing research. Kitchin (2015) judiciously attempted to balance both sides of the divides in a seminal review which concluded that a smart city requires a *critically orientated scholarship while making vital conceptual and political interventions.* Consequently, the author highlighted four challenges within which current prospects of actualizing smart cities are currently embroiled in. These challenges that spotlight, where many developing countries are currently placed on the overall scale of smart city

development, are: (1) lack of a chronological description of the evolution of the knowledge of the smart city, key issues, and actualization strategy, (2) the use of only standard examples and similar narratives in the literature to discuss issues surrounding smart cities, (3) lack of in-depth study of smart city development, and little comparative research that highlights how smart city develops at various regions of the world, and (4) Little to non-participation of various stakeholders in the actualization of smart. Intuitively, there is no simple way to address these issues collectively. However, looking at individual case studies to assess the workability and prospects of smart city projects might well be useful to address some of them, and that is what the present study attempts to achieve concerning Nigeria.

Method and data

Description of the study area

Nigeria's quest to plan and prepare for her ever-growing human population and to solve a myriad of economic, social, and environmental challenges within her major cities highlights the importance of a smart city for the country. Whereas certain conditions need to be met before actualizing a smart city for any place, it is important to study the major aspects of Nigeria in a way to put in the right context the pathway, challenges, and opportunities of a smart city and the availability of geospatial resources. Information and communication technology (ICT), and Internet of Things (IoT) essentially play a role in the formation of a smart city for any country, but probably not in isolation, so there are other factors, resident within the overall characterization of any country that enable actualization of a smart city. Therefore, a critical analysis of pathways, opportunities, and challenges for a smart city should prompt at least some crucial debates on what makes up Nigeria in terms of technology, people, and institutions (economy, politics, and juridical framework) – Fig. 1. These are the three cardinal elements, which many studies regarding smart cities have referred to as benchmarks for building a smart city anywhere in the world (Eremia et al., 2017).

Nigeria has a notable political and demographic reputation in sub-Saharan Africa and among the
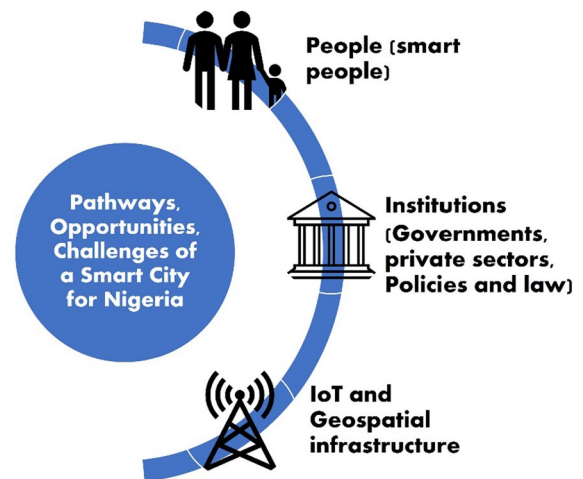

Fig. 1 The three cardinal elements – people, Institutions, and technology – which this research employed to review the pathway, opportunities, challenges of actualising a smart city in Nigeria

Global South nations. There are over 200 million people currently living in Nigeria of which the overall size and geographical landmass are approximately 924,000 Km^2. Urban growth has been rapid with many rural dwellers migrating to cities for a better life (Idowu, 2013). This shrinks urban space, undermines city aesthetics, and swells the sources of city distortions such as overcrowding, land contamination, noise pollution, and social disorders (Obi-Ani, & Isiani, 2020; Olarinmoye et al., 2020). Based on the annual rate of population growth, which is set at 2.58%, the World Bank (2020) and World Population (2021) believe Nigeria's current population figure and its density, which is about 226 persons per square kilometer of land is set to snowball in the nearest future. This of course will heighten the need for sustainable land management and urban governance. The prospect of more functional cities to keep urban development at equilibrium with the growth in the human population is of critical importance.

Recent World Bank data estimate that over 50% of Nigeria's overall population live in the city presently, and by 2050 Nigeria's largest city, Lagos, will contribute to the significant growth of the global urban population in Africa and Asia. A good number of the workforce and unemployed population are subject to urban–rural migration. This undoubtedly implies high urbanization and unsurprisingly accounts for the

increase in ecological and geographical footprints in the country. Agglomeration of cities might be one of the organic ways many people find a lifeline to survive in Nigeria seeing that informal economy such as home-based enterprises (HBEs) is fast-growing and engaging many people who could not find themselves profitable engaged in the formal economy in the urban areas (Adeokun & Ibem, 2016). The Nigerian cities are now a major hub of economic survival for many families which is why Akujobi et al. (2017) and Kadiri et al. (2019) were of the view that Nigeria's highly complex characteristics regarding human behavior, conflicts, variations, and adaptation that sit in the demographic and socio-economic profile of the citizens also account for the proliferation of settlements, crimes, urban distortions, and other social problems.

Within these characteristics, Nigerian cities often succumb to fragility, evidenced by many urban dwellers living in overcrowded and under-serviced slums, while a good number of the citizens, trek to work or travel with highly congested buses due to lack of affordable transport. The strain on basic services and natural resource endowments, as Nigeria's electricity supply shows, will increase. To evade the risk of Nigerian cities becoming both unliveable and indebted requires a change of mindset from the traditional agglomerations to the smart cities. This is the significance of the present research, which examines

how to achieve a smart city for Nigeria, despite her current urban situation. Figure 2 is a conceptual model upon which we built the present study.

Data, literature search, and selection

A critical view of Nigeria against the backdrop of smart city raises two important questions—(1) *What is the current knowledge regarding the smart city, its logical construct, economic, political, juridical, and geospatial ramifications, and current aspiration for a smart city in Nigeria*? (2) *what is the viability of Nigerian current areas and urban governance to support a smart city?* These questions highlight the importance of an in-depth investigation to clarify the ontology, SWOT (strength, weaknesses, opportunities, and threats), and geospatial base for a smart city in Nigeria. Therefore, the present study undertook a literature review of previous studies.

The review of literature focused on studies published primarily in smart cities and related concepts in urbanism and geosciences, geography and geospatial technology, and sustainable development research. This review covered peer-reviewed journal articles, key papers from international conferences, and mainline reports extracted from structured online search systems and local offline libraries. The review made use of literature from a variety of electronic databases and libraries including environmental

Fig. 2 Conceptual model of the present research methodology, showing the design and implementation of the present research
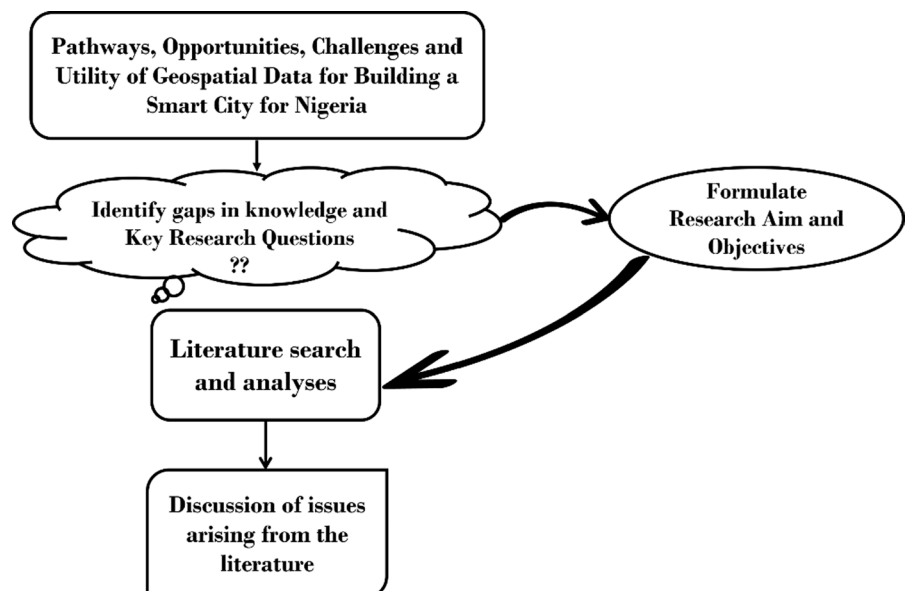
sciences, geography, social and political sciences, geosciences such as GeoBase, Sage, Zetoc, JSTOR, Scopus, PUBMED, BMC, EBSCO, Clarivate Web of Science, ranked in Thompson Reuter. The aim was to identify and select from the body of the extant literature articles relevant to the present study.

The literature search and selection procedure followed ethics and academic standard relevant to literature review studies (see for example Nkwunonwo et al., 2020). The search strategy used keywords—and their combination. For examples, 'smart city, 'digital city', 'connected city', 'internet-driven city', 'smart city for Nigeria', 'smart city for developing countries', 'smart city and geospatial technology, 'smart city and Nigeria's geospatial infrastructure', 'prospects of a smart city for Nigeria', 'smart city in Nigeria and the present political landscape', 'smart city and economy' and 'smart city and the Nigerian institutions.' For each article that comes through search, we first surveyed the topic and examined the abstract to determine articles' relevance to our study. The selection of any literature depends on two key factors: (1) the study must have been peer-reviewed papers and (2) The language of the published research article is in English. Our selection and review ignored short communication, letters, conference presentations, and abstracts with extended perspective.

The literature search aims to use issues arising from previous studies to make sense of the pathways, opportunities, challenges, and utility of geospatial data for building a smart city in Nigeria. The studies that emerged from our literature search bring to light a wide range of discussions on the critical nature of the smart city, its prospects for developing the social-economic, and environmental dimensions of Nigeria's urban areas, and the challenges faced with developing such a project for Nigeria. Based on the search and selection criteria, only sixteen studies funneled through the review and emerged for discussion. The key topics covered in the selected studies include (1) smart city concept and ontologies of smart city, (2) current social, environmental, and economic challenges of Nigerian cities (3) prospects of a smart city for Nigeria; (4) significance of geospatial infrastructure for building a smart city in Nigeria; and (5) Research issues and a way forward towards realizing Nigeria's smart city project. Table 1 summarises the relevant studies upon which the present review anchors.

Results and discussion

Research on smart cities in Nigeria has existed for over a decade. The idea of a smart city for Nigeria probably started with the development of Abuja in the mid-1980s. Various discussions surrounding the blueprint and master plan of Abuja were not short of the smart city mindset (Dukiya, 2020). Another evidence of the historicity and timeline of smart city research in Nigeria comes from the Nigeria Smart City Initiative (NSCI) which was launched in Abuja, Nigeria on 8th August 2017 (Kabir, 2019). NSCI was the first national summit to rollout sound actionable strategies for transforming Nigerian major urban centers from the traditional dysfunctional agglomerations to modern, efficient, responsive ones capable of satisfying the needs of present and future generations of Nigerians. This was a major milestone that stimulated discussion in the built environment and other urban development research. However, despite these steps which partly undergirded Abuja and some other cities in Nigeria, the rate of knowledge growth and transformation for a smart city in Nigeria has been slow. This is a major gap and issue that should motivate research, considering that rapid urbanization and population growth along with economic and human development challenges should have been the rationale for Nigeria becoming the epicenter of research in the concept of smart cities.

Based on the present literature review, much of the studies focused on four major cities in Nigeria: Abuja (Jiriko et al., 2015), Lagos (Ajibade, 2017; Dano et al., 2020), Niger (Zubairu, 2020), Owerri (Okehielem et al., 2019). Discussions encompass what becoming smart cities can offer to these Nigerian agglomerations and their readiness to become smart cities. These studies largely acknowledged that a smart city for Nigeria would address most of the challenges facing the traditional agglomeration, typically evidenced in the growing number of urban dwellers to outpace the present urban governance plans and efforts. Despite these research efforts, there are major challenges emerged. Various political government setups have failed to address the challenges associated with the growing number of people living in Nigerian cities (Kadiri et al., 2019). The philosophy of a smart city and its implementation within the Nigerian contexts is not well-discussed. Unlike many other places for examples China and the United States, current

Table 1 Summary of the relevant literature that provided data for discussion in the present research

S/No	Author (s)	Study	Context
1	Dada (2014)	Towards understanding the benefits and challenges of Smart/Micro-Grid for electricity supply system in Nigeria	Smart city for electricity supply system in Nigeria
2	Jiriko et al. (2015)	The evolution of Abuja as a 'Smart City's prognosis	Abuja and the context of a smart city
3	Ajibade (2017)	Can a future city enhance urban resilience and sustainability? A political ecology analysis of Eko Atlantic City, Nigeria	Prospects of a smart city in Lagos, Nigeria
4	Akujobi et al. (2017)	Role of a smart city in sustainable urban development in Nigeria	Prospects of smart city for sustainable urban development in Nigeria
5	Adamu et al. (2017)	Smart cities: the foundation for future citizen service delivery in Nigeria	Smart city and citizen's welfare in Nigeria
6	Adejuwon (2018)	Internet of Things and Smart City Development:	Nigeria's readiness for a smart city based on emerging technology
7	Monyei et al. (2018)	Nigeria's energy poverty: Insights and implications for smart policies and framework towards a smart Nigeria electricity network	Smart city and electricity in Nigeria
8	Kabir (2019)	Nigeria smart city initiatives (NSCI): The geospatial perspectives	Smart city and geospatial tool
9	Kadiri et al. (2019)	Smart Cities Implementation: Challenges in Nigeria	Challenges of smart city development in Nigeria
10	Nwakanma et al. (2019)	Model-Driven Decision Support System for Broadband Penetration in Nigeria: Smart City Challenge	IoT challenges to building a smart city in Nigeria
11	Okehielem et al. (2019)	Evolution of a Smart City from the Challenge of Flood Disaster: Case Study of New Owerri Capital City, Southeast of Nigeria	Pathway, and strategies of setting up a smart city in Owerri, Imo state
12	Olarinmoye et al. (2020)	Microplastic Presence in Sediment and Water of a Lagoon Bordering the Urban Agglomeration of Lagos, Southwest Nigeria	Current urban agglomeration in Nigeria Lagos
13	Aghimien et al. (2020)	A fuzzy synthetic evaluation of the challenges of smart city development in developing countries	Challenges of smart city development in developing countries
14	Zubairu (2020)	Assessment of the implementation of the national urban policy, 2012 and formulation of sub-national urban policy and smart city strategy by Niger State government, Nigeria	Pathway, and strategies of setting up a smart city in Niger state Nigeria
15	Dukiya (2020)	Climate change and smart city development: The challenge of non-implementation of Abuja-Nigeria light rail project	Climate change and smart city: pathway for Abuja
16	Dano et al. (2020)	Transformative urban governance: Confronting urbanisation challenges with geospatial technologies in Lagos, Nigeria	Urbanisation challenges and geospatial technology in Lagos, Nigeria

There is little research on smart cities in Nigeria which suggests the poor level of knowledge of smart cities and their implementation

literature is not clear on how to address Nigeria's concept of smart city, which largely aligns with its seemingly elusive effort and strategies for implementation of a smart city.

It is clear from the generality of these studies that smart city for Nigeria will aid in solving the many challenges that confront the country's traditional agglomerations including power supply challenges (Patrick et al., 2013; Dada, 2014; Monyei et al., 2018), housing, urban poverty, inadequate formal land development, urban decay and fragility, slum settlements, and absence of essential services (Ogbazi,

2013), and encourage sustainable development. Ajibade (2017) explored the costs and risks of this smart city in the broader context of resilience planning, capitalist urbanization, disaster risk, and climate change. The quality of life will significantly improve as citizens enjoy inclusive management policy and enhanced access to quality essential services. Nature is better conserved and becomes friendlier as the city, in tandem with human activities, becomes sustainable, innovative, and environmentally friendly.

Against the background of these prospects, a major issue raised in virtually all the studies is the pathway and readiness of Nigerian cities to move towards smartness. Aghimien et al. (2020) used a fuzzy synthetic method to evaluate the challenges of smart city realization in developing countries, using Nigeria as a case study. The study found that limitations with realizing smart city in Nigeria interrelated with governance, economic, social, technological, environmental, and legal issues being the dimensions of the challenges the country must deal with in actualizing a smart city. Adejuwon (2018) examined how Nigeria is leveraging emerging technology to improve efficiency in public service delivery. In NSCI's proposal for Nigeria smart city, ICT, and other smart technologies linking sensors and software to generate and manage information that improves efficiency in decision making and in arriving at smart solutions to everyday issues in the operations and management of those cities are inevitable conditions. So also, are robust geospatial technologies, human and socio-cultural environments, among other interactive platforms. Every object is location-based and in that wise, location is a primary attribute of the city and the citizens and the heart of ICT and the Internet of Things (IoT). Geospatial technologies that can continuously provide accurate, concise, timely, and relevant location information are among the primary tools on which to base smart solutions and smart management of cities.

With Nigeria's urban characteristic features, in which heavy industrialization and increasing human population are major variables, the pathway to actualizing a smart city, is metaphoric of an intricate maze, hard to find the best possible route unless by a thorough maneuvering act. This is an enormous challenge for administrators, architects, and urban planners. Thus, Nigeria needs an interagency and diversified approach to make a smart city a reality. Such is the

mindset that informed the analysis of literature in the present study. We combined the discussion presented in Kadiri et al. (2019) which examined the challenges of implementing a smart city for Nigeria (S_c), and a wealth of evidence highlighting the prospects of a smart city for Nigeria (S_p), with the conceptual framework of Nigerian smart city, based on the eight points presented by Chourabi et al. (2012) (S_m). Mathematically, this would mean an integral from zero evidence to infinity of all the factors concerned. From the three components, we extracted a simplified ideological, empirical model through which a smart city can be realistic for Nigeria.

The Venn diagram in Fig. 3 explains our literature analyses in this study. Thus, we can link pathway to achieving a smart city for Nigeria to a sequence of three theoretical and practical issues, which include: (1) development of a working plan / proper conceptualization of a smart city within the Nigerian context, (2) National reorientation of the citizenry (3) infrastructural development, especially in building a strong geospatial base and ICT, as well as (4) reinventing of our institutional capacity – public and private.

Conclusion

A smart city represents a shift both in mindset and architectural framework from the traditional agglomeration of roads, public utilities, and amenities to a modern system that uses big data and ICT to enhance
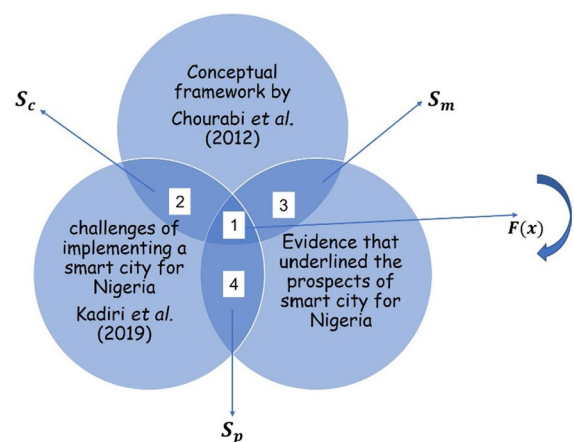

Fig. 3 New Model for achieving smart city for Nigeria

the livelihood of the citizens and government policy and program of service delivery within the city. This is a major incentive for research and policy towards the sustainable development of cities. There is also an opportunity to tackle urban scenic distortion and to provide a more dynamic and diversified science to address common issues – such as climate change, increasing frequency, and severity of crimes, social disorders, and disasters – arising from urban agglomerations and the burgeoning human population in cities.

For the developing countries (DCs) such as Nigeria – the focus of this study – a smart city's conceptualization is slightly skewed because of the vagaries of challenges to its actualization. Thus, the idea of a smart city is still more utopian than realistic. However, the future of the DCs is arguably a smart city because of the complex urbanizations and predictions that places within the DCs will contribute significantly to the global urban populations, which is estimated at 90% of the global population by 2050. Therefore, to address the attendant problems that prevail presently in the DCs' urban areas – which include environmental, economic, and human development issues – a smart city is a potent option.

This study reviewed literature around the challenges facing the present cities in Nigeria, interspersed with issues arising from the literature regarding the prospects, limitations, and utility of geospatial data for smart city actualization in Nigeria. Whilst there is sufficient evidence of how a smart city will help the government, urban planners, and citizens among other stakeholders navigate the ugly tides of the present agglomerations in Nigeria, a big question still lingers which is related to how to actualize this laudable architectural aim. What is the pliability of Nigeria to actualize a smart city project? The problem within Nigeria suggests that actualizing a smart city portends a range of urgent research issues, including socio-economic development, institutional capacity building, partnership, recalibration of the national psyche of the citizenry, and smart investment.

There is ample research evidence of the utility of geospatial infrastructure for smart cities, although what existing literature reports about the availability, assessment, and applications of these science tools in the study area does not motivate any reasonable action. Geospatial tools such as satellite remote sensing imagery, geographic information (GIS), and global positioning systems are the core of building a smart city. Therefore, urban planners in Nigeria, geoscience researchers must focus attention on finding the sources and availability of the geospatial resources to leverage future efforts on developing smart cities on the utility of geospatial tools. This study recommends a more scientific, modeling approach for a future study that will examine these issues and how they influence an ingenious and invaluable pathway to achieve a smart city for Nigeria.

Declarations

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