



Africa’s Population Growth: Adopting the Smart City Model in Nigeria as a Blueprint For it’s Future Cities

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Abstract:

Africa is currently experiencing impressive population growth and Nigeria at the helm of it all, the continent is envisioned to hit a population of 2.4 billion between 2016-2025. This population growth will highly favour urban areas over rural areas but also pose a threat if these cities are not ready to harness the population potentials. Lagos with its alarming population growth has taken a proactive step to begin the construction of a smart city called the Eko Atlantic city. But Lagos is not the only city which has an alarming population on the other end of Nigerian Map is Kano state with a highly growing population and also a high commercial presence. This paper aims to bring to foresight the need for Nigeria to be responsive towards its population growth and in that regard make proactive design considerations in planning her cities. Through a critical review of literature gathered from secondary data of similar situations from countries around the world that have overcome similar challenges and analysed through content analysis. Findings reveal that a major setback of smart cities evolving in Africa is as a result of economic, environmental, cultural and financial factors. It is however recommended that while implementing government policies, urban development agencies should take into consideration the rapid growing population in the planning of its cities to meet the sustainable, resilient and responsive cities as advocated by the UN sustainable development goals.

Keywords: Population, Urbanization, Smart Cities, Sustainability, Nigeria.

LITERATURE REVIEW

The world faces a challenge of population upsurge with Nigeria experiencing an increase which will gradually become a threat if not checked in time. The nature of population increase in Nigeria has been termed as rapid rate of urbanization characterized by economic growth without infrastructural development. This kind of development is characterized by a major neglect of the rural areas and little improvement on infrastructure to support the growing population in urban areas, the cons will be that it chauffeurs in pressure on limited resources while escalating social inequality. The UN-Habitat (2006) asserts that in the next two decades 95% of growth in the developing world will be in the cities. Venables (2016) asserts that the African continent needs to build at least twice the urban capital stock that it has built over the whole of its previous history, a state of emergency on infrastructural development. Similarly, Lagos state has been ranked the fastest-growing city overall in the 2017-2030 timeline according to (Euro monitor international, 2018). Meanwhile, the year 2030 marks the target deadline for the sustainable development goals by the United Nations Development Programme. These SDGs are set out goals to promote prosperity in the world while protecting the environment, these 17 integrated goals are a call by the United Nations for forward development and amongst these 17, 1 goal directly affect the development of future cities.

Goal 11: sustainable cities and communities.

The research intends on increasing habitant's productivity by establishing healthier communities, reducing carbon footprint and ensuring a healthier community through sustainable design and healthy community living, in that regard; the adoption of smart city concept in the blueprint design of megacities can increase the operational efficiency and improve the quality of life of habitants of that city.

The state of urbanization in Africa

Major African cities are experiencing rapid development, they are now over populated when compared to rural areas, Africa has been dubbed to reach majority urbanized state by the year 2030 (WUP 2005). Fay and Opal (2000) made a case that the rate of urbanization is not as a reflection of the economic growth, they said it has nothing to do with the economic growth of the country rather in the African context that it is an inverse relationship to the level of urbanization in a country. Most developing countries share a particular sentiment towards urbanization and decide to develop the rural communities. However research has proved this wrong and that developing the rural area will not reduce urbanization if anything it will act as an enabler to the exodus of rural to urban migration to continue as seen in Fig 2.1.

Africa's rapid urbanizing population

While the rest of the world host the most urban population for now, it is projected that Asia and Africa will host most of their population in urban areas from 2030 going forward, and will continue to dominate. Most investors are looking at the young urbanizing population of Africa as the future of the world due to the various opportunities that comes as an advantage of population. Asia with 54.5 percent of its population living in cities, and Africa with 53.5 percent of its population urban. Asia alone will account for more than half the world's urban population (2.66 billion out of a global urban population of 4.94 billion); and the urban population of Africa (748 million) will by 2030 be larger than the total population of Europe at that time (685 million).

Competition between urbanizing cities

It is often important that the definition of cities does limit it to be viewed on the bases of population, cities are more than just concentration of people and resources, and it is a hub for trade, culture, information and industries. In developed countries cities drive the economy by generating over 80 percent of the national economic output. Developing cities economies are globally reliant on advanced producer service for their income. In today's economies major cities play pivotal roles in global networking not just by producer service for goods or a host for institutions but also generating related economic and civil society activity in other cities. In the new millennium, cities around the world are already beginning to have several key impacts on developing regions as well, these cities have been able to link resources, population and revenue together, cities like Lagos are already establishing cultural trends in their countries, regions and countries, also included are cities like Istanbul and Mumbai.

Figure 2.1 Showing the Rural and urban population by region in 2005 and as projected by 2030

Source: United Nations, World Urbanization Prospects: The 2003 Revision.

Population (Millions)	Europe	North America	Africa	Asia	Latin America and the Caribbean	Oceania
Rural Population 2005 - (Millions)	0-700	0-400	0-800	0-3900	0-500	0-100
Urban Population 2005 - (Millions)	0-500	0-250	0-350	0-1600	0-450	0-100
Rural Population 2030 - (Millions)	0-650	0-500	0-1500	0-4800	0-650	0-100
Urban Population 2030 - (Millions)	0-500	0-350	0-700	0-2600	0-550	0-100

Figure 2.2 urban growth in the world's largest cities, 1950-2020
 Source: United Nations, *World Urbanization Prospects: The 2003 Revision*

Population (Thousands)	New York	Tokyo	Lagos	Sao Paulo	London	Delhi
Rural Population - 1900 (Thousands)	12,500	11,000	1,000	2,500	8,000	2,000
Urban Population - 2005 (Thousands)	18,000	35,000	12,500	18,000	7,500	15,500
Rural Population - 2015 (Thousands)	19,500	36,000	17,000	20,000	7,500	21,500
Urban Population - 2020 (Thousands)	20,000	37,000	21,000	21,000	7,500	24,000

Smart city paradigm

The world has presented a significant number of future city models in order to improve the management of population and resources addressing urban processes and inhabitants requirements, for the most part of the 20th century the smartness of a city was a media science fiction, but as a result of telematics and ICT development it has become a reality, ICT development on one hand has helped in automation, monitoring, analysis and planning the city. Sabr (2016) asserts that smart city is rooted in intelligent infrastructures ICTs-Human connections. He pointed 3 axes which the city growth must pay attention to:

- i. Sustainability: by improving the city/environment relationship and using green economy.
- ii. Smartness: context aware economy and governance.
- iii. Inclusiveness: by fostering a high-employment, economy delivering social and territorial cohesion.

Smart cities' concept can be seen as the surest way to have sustainable, liveable, secure and connected city designs, through the use of ICT.

Nam and Pardo (2011) opined that a city is smart when it has achieved economic sustainability growth fuelled by its investment in human and social capital, modern transport system, communication infrastructure and a participatory government that manages its natural resources well.

Caragliu *et.al* (2013) suggests, smart growth encompasses not just transportation but a mind-set towards creating a holistic and sustainable community with great quality of life.

Geller (2003) asserts that it is a self-decisive and independent city, with great performance in its economy, government, people, environment and living.

Consequently, desk study has highlighted the under listed variables as a result of their implication in the adoption of smart city ideas in the design of future cities in Africa. However some weigh more than others and have better implication of fostering this course rather than hindering it in the most effective way.

- i. Sustainability
- ii. Internet of things (IoT) incorporation
- iii. Global Inclusiveness
- iv. Public and Private Partnerships
- v. Political will
- vi. Citizen Participation

Harnessing Nigeria's population in creating smart cities

Identifying the indicators that make a smart city a smart city lie in different concepts, that is why in dealing in urban development related topics like smart cities Roche *et., al* (2012) asserts that smart cities are like an urban area with a layer of technology, overlaid on the urban structure and fabric of the city. This establishes a major relationship between ICT features and

infrastructure; which creates an environment for citizens of that city to share, interact, bringing on the net different stakeholders to transfer real time information between each other and the city. Thereby optimizing the city's potentials to development. Since smart cities will depend on population, in 2017 during the Nigerian smart city summit, Demola (2017) opined that it was time for Nigeria to harness its population as a reality rather than a threat adopting a polycentric approach to sustainable urban development. The use of "Swarm Intelligence", which is a decentralized system that makes use of the organization of a collective population sort of how ants work together in their environment to achieve a common goal, this intelligence system relies on feedback from various electronic devices like handheld devices to give feedback of the environment and the same concept is what is used in Google maps to give feedback on real time traffic situations and the more population it gets feedback from the more accurate the result. Thereby using technology to successfully harness population in giving accurate information.

The global smart city index Fig 2.2 above shows a low rating of the only two Nigerian cities that made it to the ratings and out of a total of 102 cities that were rated. It revealed that Abuja was ranked 97th and Lagos state ranked 102nd both with a "D" rating. These cities are renowned as one of the fastest growing cities in the world and a the biggest city in Nigeria respectively according to the United Nations; and with the 2030 SDGs deadline approaching, Nigeria should be looking to harness its already existing population as a catalyst to adapt some of its most populated cities into smart urban spaces.

Smart city index

Figure 2.3 showing amongst a host of other cities the rankings of Nigerian cities according to the smart city index

Source: United Nations, World Urbanization Prospects

1-10 Ranked Countries			93-102 Ranked Countries		
Overall ranking	City	Overall rating	Overall ranking	City	Overall rating
1	Singapore	AAA	93	Cape Town	C
2	Zurich	AAA	94	Manila	C
3	Oslo	AA	95	Athens	C
4	Geneva	AA	96	Rio de Janeiro	C
5	Copenhagen	AA	97	Abuja	D
6	Auckland	A	98	Bogota	D
7	Taipei city	A	99	Cairo	D
8	Helsinki	A	100	Nairobi	D
9	Bilbao	A	101	Rabat	D
10	Dusseldorf	A	102	Lagos	D

METHODOLOGY

Qualitative research method was used in carrying out this study, using content analysis once the sources (articles) were selected for inclusion in the study. Relevant literature sources in context with the title of the paper as regards urbanization and smart city development was recorded in a spreadsheet. The spreadsheet was designed containing columns that were established considering the indicators deduced from desk study. Consequently, the study considered a total of 80 articles which were initially identified. The articles include 70 that were electronically accessed amongst thesis writings as well as journal articles. Thereafter the study exclusively made use of 63 articles which were selected and evaluated using the

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keywords and title to select only the papers who dealt with the aforementioned variables to determine which would be relevant to the study. After reading the abstracts and considering which of them provided information on sustainable urban smart cities, 50 articles were selected for the final analysis.

Across these literatures it was observed that there exist significant levels of inconsistencies, while some authors may come to a definitive conclusion others seem to conclude with setting up of criteria, suggestions or even indicators. Therefore data were coded in more general terms to suggest where they would best fit, however these designations were further explained in the research discussions.

Despite the efforts to assemble systematic relevant data in the context of this study, it was met by certain limitations. For the first part this research is entirely limited to journal articles; secondly, the content analysis is drawn from the conclusions of the works of other authors, with little or no space to argue the quality of their findings, biases and conclusions. However it is a work that presents a broad reading of literature, findings, trends, consistencies reported by other researchers.

Table 3.1: showing variables for the study

SN	VARIABLES
i	Sustainability
ii	IoT Incorporation
iii	Global Inclusiveness
iv	Public And Private Partnerships
v	Political Will
vi	Citizenry Participation

Table 3.2: Showing Articles reviewed for comparative study

Sn	Author(s), Topic	Year	Themes
1	Margerum, R.D (2002).; <i>Evaluating collaborative planning: Implications from an empirical analysis of growth management</i>	2002	Citizens and civil society should Participate in the formulation and enforcement of urban policies.
2	Kim, H.-J. ; <i>Smart era, expansion and transformation of urban planning</i>	2007	Smart city era would change urban planning as it is known just as the introduction of ICT revolutionised e-services.
3	Washburn, D.; Sindhu, U.; Balaouras, S.; Dines, R.A.; Hayes, N.; Nelson, L.E. <i>Helping CIOs understand "smart city" initiatives</i>	2009	The use of the Chief information officers (CIO) expertise to further interoperability of smart city systems and stakeholders.
4	Ramin Keivani; <i>A review of the main challenges to urban sustainability, International Journal of Urban Sustainable Development</i>	2010	A Necessity to understand sustainability and break the 'silo mentality' of the disciplines that are involved in urban development.
5	George C L.; Mariacristina R; <i>Definition methodology for the smart cities model</i>	2012	Smart city models should be simple and comprehensive to citizens.
6	Lazaroiu, George Cristian & Roscia, M.; <i>Definition methodology for the smart cities model. Energy.</i>	2012	In the modelling of a real city's smart city plan expert contribution from various chosen fields should be involved in the research to enable a very workable city model.
7	Cho, Young. <i>Designing Smart Cities: Security Issues.</i>	2012	Use of CCTV detection and speech recognition in smart cities.

8	Cretu, L. G.; <i>Smart cities design using event-driven paradigm and semantic web</i>	2012	The architecture of Event-driven Smart City is the kind of city where digital artefacts enable the interoperability between Internet of Services.
9	Deakin, Mark. <i>From Intelligent to Smart Cities: CoPs as organizations for developing integrated models of eGovernment Services.</i>	2012	European cities using the intelligence of communities of practice (CoPs) as the organizational means to be smart in developing models of eGov services.
10	Beniamino, M.; Giuseppe, B; <i>Cities and Smartness: A Critical Analysis of Opportunities and Risks.</i>	2013	Coordinating and harmonizing urban players through ICT.
11	Claudio Marciano; <i>Unpacking a Smart City Model: The Hegemony of Ecological and Information Paradigms in Urban Space</i>	2013	Maintaining a sustainable and zero energy lifestyle.
12	Emre Ronay Roman Egger; <i>NFC Smart City: Cities of the Future A Scenario Technique Application.</i>	2013	The implementation of ICTs in cities is the key success factor to encounter the global problems like achieving sustainability.
13	Khan, Zaheer & Anjum, Ashiq & Kiani, Saad. <i>Cloud Based Big Data Analytics for Smart Future Cities. Journal of Cloud Computing.</i>	2013	Use of Big data for processing data, Cloud-based analysis service that can be developed to support decision making.
14	Bettencourt, Luis. <i>The Uses of Big Data in Cities. Big Data.</i>	2014	The use of big data must be to continue to enable the creation of new knowledge by people and not replacing it.
15	Angelidou, M. <i>Smart city policies: A spatial approach. Cities</i>	2014	Certain spatial factors differentiate smart city development policies.
16	Wenge R, Zhang X, Dave C, Chao L, Hao S <i>Smart city architecture: a technology guide for implementation and design challenges.</i>	2014	Architecture designed from different perspectives of technological knowledge to address the sustainability challenges of future
17	Neirotti, P.; De Marco, A.; Cagliano, A.C.; Mangano, G.; Scorrano, F. <i>Current trends in smart city initiatives: Some stylised facts.</i>	2014	Policy makers in leadership roles must find ways to relieve the path dependence on technology adoption.
18	Moir, E.; Moonen, T.; Clark, G. <i>What Are Future Cities? Origins, Meanings and uses.</i>	2014	The concept of digital city have been almost totally replaced by the concept of the smart city, which aims to operate integrated cities.
19	Korea Communications Agency. <i>Smart City of Major Countries around the World Analysis Case; Policy Research Division Fusion Policy Research Department in Korea: Seoul, Korea</i>	2014	Songdo city will be built as a high-tech business city with ICT convergence through the Songdo City Integrated Operation Centre
20	Angadi, Srinivas & Padmavathi, M & Mamillapalli, Raja; <i>Challenges in Adopting Smart City Concepts and their Sustainability in Indian Conditions.</i>	2015	Concept of a smart cities is as a system consisting of multiple systems, with no preferred framework of adoption.
21	Sethi, Mahendra; <i>Smart Cities in India: Challenges and Possibilities to attain Sustainable Urbanization.</i>	2015	The urban planning effort of harmonizing technology, government policies, urban planning and sustaining all by ICT.
22	Mattoni, B., Gugliermetti, F., & Bisegna, F. <i>A multilevel method to assess and design the renovation and integration of Smart Cities. Sustainable Cities and Society</i>	2015	A way to integrate the various aspects of a Smart City is a balance among hardware and software aspects, technology and human capital through the definition of the relations existing among all the subsystems of the city, considered as a whole (human) organism.
23	Haq, Muhammad & Merish, Adnan & El-Abd, Mohammed. <i>A Smart City Model Implementation.</i>	2016	The use of a hierarchical control structure model to solve major environmental problems.

24	Cilliers, Liezel & Flowerday, Stephen & McLean, Sean.; <i>A crowdsourcing, smart city model for a developing country</i>	2016	Adopting a smart city to a developing country majorly requires; the city management, trust of citizens and the crowdsourcing system.
25	Karakiewicz, Justyna; <i>EVER SMARTER, CITIES THAT LEARN: the application of complex adaptive systems theory to urban development.</i>	2016	Adequate attention should be given to the city structure design through the implementation of complex feedback loop systems in creation of resilient cities.
26	Dlodlo, Nomusa. <i>The internet of things for the safety and security of smart cities.</i>	2016	The adoption of IoT in in carrying out various city logistics like crime detection indicators, crowdsourcing and crowd sensing.
27	Adnan, Yasmin & Hamzah, Hasniyati & Md Dali, Melasutra & Md, Dali & Daud, Mohd & Alias, Anuar. <i>Comparative Overview of Smart Cities Initiatives: Singapore and Seoul.</i>	2016	Singapore's highest place in the ranking index was assured by its full commitment in using ICT to improve all facets of city development.
28	Arroub, A., Zahi, B., Sabir, E., & Sadik, M. <i>A literature review on Smart Cities: Paradigms, opportunities and open problems</i>	2016	Many Smart City initiatives are intensively using technology (ICT).
29	Bifulco, F., Tregua, M., Amitrano, C. C., & D'Auria, A.; <i>ICT and sustainability in smart cities management</i>	2016	Development of new smart city models that integrate drivers, ICT, and sustainability in an all-in-one perspective.
30	Peyman, K., Hamid, F., and Samira, M.; <i>Planning for Future Urban Services in the Smart City Era: Integrating E-services in Urban Planning Process</i>	2016	An integrated conceptual service delivery process as well recommendations for integrated development of e-services from different planning dimensions.
31	Charles Consel, Milan Kabáč. <i>Internet of Things: From Small-to Large-Scale Orchestration.</i>	2017	IoT infrastructures range from small scale (e.g., homes and personal health) to large scale (e.g., cities and transportation systems).
32	Gebhardt, Christiane. <i>Humans in the Loop: The Clash of Concepts in Digital Sustainability in Smart Cities.</i>	2017	The transition from normal cities to smart cities is a socio-economic problem of ensuring sustainability and a visionary government.
33	Matijosaitiene, Irina & Petriashvili, Ana; <i>Urban Planning and Design for Terrorism Resilient Cities. Journal of sustainable architecture and civil engineering.</i>	2017	Professionals should consider Crime Prevention Through Environmental Design (CPTED).
34	Hasbini, Mohamad Amin & Tom-Petersen, Martin; <i>The Smart Cities Internet of Access Control, opportunities and cyber security challenges.</i>	2017	IoT is the best option in access control in overpopulated metropolises around the world however it poses a threat to cyber security which is still under perfection.
35	Taylor Buck, N. <i>Competitive urbanism and the limits to smart city innovation: The UK Future Cities initiative</i>	2017	The development of new technologies made possible the connection of independently developed devices share data.
36	Parth, J S;, Theodoros A;, Arkady Z;, Sara B: <i>A stochastic optimization framework for planning of waste collection and value recovery operations in smart and sustainable cities</i>	2018	Harnessing IoT in smart city management using sensors.
37	M Nagabhushan, K.Nikitha, C.Lakshmi, C.Karthik; <i>Internet of Things on Smart Villages</i>	2018	IoT combines the benefits of multiple technologies, the result is an intelligent city.
38	Achmad, Kusuma & Nugroho, Lukito & Djunaedi, Achmad & Widyawan, Widyawan. <i>Smart City Model: a Literature Review.</i>	2018	Review of IoT systems that deal with peoples demands improving living conditions of populations and encourage creative economy.
39	Sinha, Deepak; <i>The Counter Terror Dimension to the Planning of Smart Cities.</i>	2018	Counterterrorism requirements should have statutory backing in order to make not just smart but safe cities.
40	Smart City Stakeholders <i>Stakeholders Analysis, SMART CITY SOLUTIONS.</i>	2018	The level of stakeholder integration, and their close collaboration is integral to the achievement of mutually beneficial end results.

41	I Makarova, A Boyko, I Giniyatullin and A Ahmadeeva; <i>Development of transport infrastructure in smart cities.</i>	2019	Develop smart mobility system using eco-friendly smart mobility systems.
42	Jiongxu Mou; <i>Mining and forecasting of infectious disease transmission data based on smart cities</i>	2019	In disease management and pandemics introduction of technology in the form of smart indicators and prediction systems result in early detection and better management.
43	Dora S; <i>Measuring the smart cities performance in the capital cities of the EU</i>	2019	Smart city definitions are basically 3 groups which are; technology oriented, complex theories and ranking method.
44	Khalatbari Limaki, Armita; <i>Climate change and urbanization responsibility: A review of smart city importance in reducing the negative impacts of urbanization.</i>	2019	For better energy conservation in cities Architects must design intelligent structures that synergizes the fundamental items of intelligence; Big data, IoT and ICT.
45	Anthopoulos, Leonidas & Janssen, Marijn & Weerakkody, Vishanth. <i>A Unified Smart City Model (USCM) for Smart City Conceptualization and Benchmarking</i>	2019	The model uses ICT and technology to create a more enabling thriving environment.
46	Nigel J. W. Browne; <i>Regarding Smart Cities in China, the North and Emerging Economies—One Size Does Not Fit All</i>	2020	Emerging economies cannot rely on one model in adopting IoT.
47	Gustavo C. N., Elaine T.; <i>Assessing the Role of Big Data and the Internet of Things on the Transition to Circular Economy</i>	2020	Circular economies (CE) are driven by population pressures.
48	Michal Lom & Ondrej Pribyl; <i>Smart city model based on systems theory</i>	2020	The Information management approach i.e. the strength lies in information sharing.
49	Schwarz-Herion, Odile. <i>The Role of Smart Cities for the Realization of the Sustainable Development Goals.</i>	2020	The demand of energy amount and resources needed in running a smart city would hamper the attainment of the SDGs.
50	Mervi Hämäläinen <i>A Framework for a Smart City Design: Digital Transformation in the Helsinki Smart City.</i>	2020	The framework considers a smart city from the perspective of four dimensions: strategy, technology, governance, and stakeholders.

RESEARCH DISCUSSIONS

This section of the research discusses the results of the 50 selected articles, the discussions include the similarities and trends, to highlight the critical indicators that define the typology of a smart city model for Nigeria. The discussion categorises the themes from the articles in 6 smart city phrases which are: Smart Economy, smart people, smart governance, smart mobility, smart environment and smart living, as much as this phrases are used in categorising the thematic summary on scholars' discussions, it does not mean they are exclusive to the discussion on the subject matter. The smart city topic is a complex one that entails an intertwined relationship between all categories for it to be successful nonetheless. This phrases common to the smart city context are further broken down to make clear their emphasis under the subheading in the research discussions.

Table 4.1: Showing the trend in years and progression of smart city themes

Categories

SN	YEARS	TRENDS	THEMES
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1	2000 - 2005	Smart city policies	Smart Governance Smart Economy
2	2005 - 2010	Access to and sharing of information amongst governments by the use of ICT	Smart Governance Smart Living
3	2010 - 2015	The Sustainable development goals	Smart Living Smart Environment
4	2015 - 2020	Harnessing the power of IoT to fully achieving Smart cities	Smart People Smart Mobility

Discussions

Smart Environment

India uses sustainable policies as a result of their demographic make. These adoption fosters harmony between government planning and the urban populace confirming smart city development as a social problem and it has treated it as such, the Nigerian makeup is a demography comprised of different units or sub systems no different from India and both environments having an alarming population, contrary to the way sustainability in smart cities are portrayed as a green flourishing city and even though it would be one, running a smart city in Africa requires a lot of energy and it seems unlikely that the 2030 deadline for the SDGs is anyway realistic date. Through design professionals in the built industry especially architects can guide the progression of this curve and for starters prevent crime by adopting sustainable methods of designing smart cities such as the use of CPTED, other sustainable design considerations can be made to usher Africa smoothly into an era of smart cities, but firstly, a conscious mind set in design.

Sustainability is a multifaceted topic and there is a need for deeper understanding of the disciplines involved in ensuring a sustainable society to break the wide silo mentality amongst environmental science professionals and create a sustainable balance between hardware, software, technology and human capital to propagate Smart living, proper pollution and waste management ensuring attractive natural conditions.

Smart Mobility

The incorporation of ICT into urban development has brought about IoT which involves the use of many electronic sensors to collect and manage data. In fact in a comparative study of Seoul and Singapore, a major contributor as why Singapore ranks highest than Seoul in the study and also tops the smart city index rankings is as a result of its commitment to using ICT in developing several facets of its developments in the country. Looking at the budding population of Africa it is easier to understand the role it would play in IoT incorporation, according to data on mobile subscription in 2015 the result showed 7.2 billion subscriptions worldwide with three-quarters of that coming from Africa and Asia, this young internet hungry population is a reservoir which this numbers can aid in information management. The use of IoT combines many technologies and devices already in use to send back an information about a city they are already in, although there is a disadvantage in overpopulated areas when it comes to internet of access control, this threats creates an opportunity in advancing cyber security. The big city data would continue to create and enable new knowledge and not replace it, by making people smarter.

A key advantage of adopting IoT in designing future smart cities is that they can leverage small to large infrastructure, from as little as a start light or signage on a storey building the cloud based big data is able to generate intelligent information to support decision making in the city, from vacancy of spaces for rent down to the weather report a constant loop of intelligent transfer.

In waste management in the city smart bins can be used to gain feedback on type of waste collected, in tourism and also in logistics to track and ensure security.

IoT incorporation encompasses living in good health conditions and public security, in the category of data mining and model prediction; a comparison study between using traditional infectious disease management and smart indicators in the case of a pandemic to detect and curb the spread and death tolls, the introduction of ICT in form of the ARIMA model to detect arising cases proved effective, this model uses a learning algorithm to predict future trends, in china where the study was carried they face an important challenge in low detection rates, low pathogen diagnosis rate, low screening rate and high drug resistance rate. Early prediction warning models improve the chances of survival of infected patients and based on this reduce the effect of the pandemic.

Smart Living

E-governance offers collaborative opportunity between government and in all forms of smart governing the use the cloud based big data to be able to support decision making, smart governing provides opportunity for transparency in government and also policy making, global sustainable actions like having a circular economy is checked towards ensuring sustainable cities creative and collaborative economies. The smart city governance is one that ensures dialog before decision making in the smart ecosystem. In Europe the smart governance ecosystem is funded by global international organisations as digital urban development is a prioritized agenda to ensure sustainable environment development, smart governance is like being a government part of a coalition of government with similar global agenda such as achieving the sustainable development goals.

Smart Economy

Public and Private partnership are encouraged in achieving this vision since both are stakeholders and beneficiaries in the eventuality of a smart city, currently different researches are going on around the world for countries to create their own smart city; creative channels for city building encouraging local innovations, the possibilities of CE and other smart city innovations in different scales across the major key stakeholder sectors, the smart city model encourages the smartness of an individual or a the people this can further foster the smartness of the city and improve security by making use of crowd sensing, street lighting to give feedbacks, this can surely be supported by partnership of these sectors. Critical study revealed that economically the smart city uniformly deals with innovations (mostly ICT-based) in the urban space that aims to enhance 6 dimensions (people, economy, government, mobility, living and environment) in other words smart cities would encourage running an innovation based economy, which is a more sustainable economy just like the CE rather than the crude oil economy which encourages unsustainable practices. In the limitation to such innovations a study on the future of U.K cities draws attention to weakened capacity of urban governments to control their infrastructural destiny and also constraints on the ability of the public and private sectors to innovate.

Smart Governance

Certain Progressions in governments are implored to create policies that support technological advancement in the design of urban areas, such as using IoT systems to harmonize key urban players by the government in urban planning, to produce high value services and economical innovations after observing citizen demands; the government's willingness and responsibility to address some of this demands will yield in a more sustainable community, adoption of a smart city can in fact help understand the plight of the people, through feedback from sensors

that retrieve data in the most affected areas. In prioritizing dialog as a government with key stakeholders before making smart city decisions, the discussion becomes inclusive harnessing crowd sourcing and crowd sensing for better progression. In Helsinki governance attracts various organisations and stakeholders, smart city governance ensures an approach that secures all stakeholder interest and manage their common affairs, providing strategic leadership that considers long term financial needs such a political environment is what is needed to a thriving economy, in the planning of a smart city there is slow progress in political rivalry. Leadership should encourage adoption of smart city as it reduces a wide range of corrupt practices because governance becomes transparent, this sole reason can however be a major reason why the most corrupt countries are sort of hesitant into adopting smart city ideas. But the stakeholder integration, and collaboration between stakeholders is important in the achievement of mutually beneficial end results like flexibility of labour market, sustainable resources management and public and social services provision.

Smart People

How smart can a city really be without involving its citizens, this first hand is essential to a fully functional smart city. Having the confidence of the citizens in the smart city initiative is one of the variables to ensure success, because unless a large amount of people participate the project cannot be successful. In crowdsourcing which is an integral aspect of ensuring a successful smart city model, fuelled by population pressure crowd sourcing takes into account two important constructs; information security and user experience. Many cities are adopting the use of ICT and taking advantage of the citizen participation to effectively share information within the cities, just as in the use of social media, almost everyone in the cooperate world has an email or a Facebook account, today Facebook is amongst the biggest sellers of information and this large amount of data would not be possible without people participation. In the planning of urban policies civil societies and citizenry must participate as it helps for transparency and builds trust. Smart living entails healthy living conditions of individuals in a smart community, innovations for infectious disease spread through the use the data collected from citizens is able to forecast more accurate results on spread according to a research in china, the accuracy is relative to the citizenry participation.

POLICY IMPLICATIONS AND CONCLUSION

The study revealed the need for relevant sharing of information amongst agencies in Nigeria. This information sharing will in turn provide a safer environment, one with more accountability to enable better tracking of individuals. Insurgency and other vices that result in insecurity would be curbed with necessary biometric data of individuals collected and used in investigative purposes.

The era of ICT brought a lot of opportunities which negligence on the part of the people and government has paid a big role in not tapping from; to the people a lot of public sensitisation should be put out to create awareness on what really this new technologies bring and its advantages. On the part of the government a commitment to ensuring that this sensitisation is carried out in the most public friendly manner and not imposed on them, because it is important for the citizenry to participate wilfully. The use of IoT oriented infrastructure to give relevant feedback for proper data recording, like in the case of an offender this sort of innovation should be welcomed, so that certain civil disobedience and vices like whenever an individual neglects a traffic law or sign a CCTV camera can be pick the details of the individual ready to be downloaded for further actions by the relevant agencies involved in prompting quick response to such crime scenes.

IoT in the built environment has led to innovations in designs and a city should run as a smart buildings would, smart signage that give individuals information on traffic are some of the innovations that yield in improved fluidity in navigating around the cities with high population and traffic. This paper calls on a national adoption and pro-activeness in the aspect of ICT adoption in urban development in the country, as the country faces a rapid growth of population in many parts while also experiencing a slow growth in Infrastructure.

The SDG deadline approaches and it should be the responsibility of every individual or company operating within Nigeria or Africa to adopt sustainable practices and sustainable design. Professionals in the built environment need to be more vocal and practical about their design decisions, the activity of one person should not cause discomfort to another person or worst make an inhabitable environment for future generation, from the drawing board the topic of sustainability should not be an option, where if a designer is making his design decisions, he may or may not decide to adopt sustainable design measures, it should be a mandatory action of every designer, from conceptualisation to material selection and construction methods.

There is also a need for a transition into a circular economy to reduces wastage and promote recycling, Nigeria already has a lot of local recyclers who have taken it upon themselves to locally gather and recycle materials however, the introduction of ICT and providing smart bins opens the world of recycling to every location where a smart bin can be placed leading to a more effective circular economy which would in turn make safer ocean habitats and reduce drainage blockage which causes flooding.

In conclusion, the study features a comparative review of articles in Fig. 3.2 to arrive at themes that guide easy adoption of a smart city model, the findings of this research has opened more research possibilities in line with this study. It has also revealed that in taking the smart city agenda more serious it ensures a more effective and sustainable environment, observing the kinds of crisis Nigeria goes through whether it be in the health, economy or its territorial integrity a problem of security has been a reoccurring issue. The comparative study in this research reveal similar challenges in other countries and proffers solution in addressing some security challenges as is discussed in the research discussion. It would be beneficial to the Nigeria if the government and Africa as a whole shows more interest in preparing for a future with a high population and the intricacies of not preparing for it. With the appropriate infrastructure and sensitisation put in place the road to a more sustainable future for cities with high population becomes clearer, however it is not late if proactive measures are put in place now before the government is left with a reactive management crises of population growth. Furthermore, the findings of this study suggest that a city is truly smart when it is able to capitalize, harness and harmonize all its resources through a sustainable approach.

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