

CP929

Lagos State as an Emerging Smart City; Review and Recommendation

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Abstract

Over the last several years, the Smart Cities concept has become apparent from the academic world of conferences and workshops to the strategic planning of national governments and primary commercial projects of global IT corporations, multinational infrastructure providers as well as system integrators. Smart city unlike the conventional city is anticipated as a prime city of wellbeing, prosperity and productivity. The urge to embrace the smart city concept which is fundamental to sustainable development has been on the rise. In the same vein, Lagos state as an African commercial hub has embarked in her journey to city smartness. The current administration has put various measures and strategies in place to ensure that Lagos state does not lag behind in this "smartness" race. This is evident in some finished and current laudable projects already embarked upon as part of her city smartness revolution. These include amongst others; the construction of the Eko Atlantic city, activation of toll free emergency services, city heritage MOU it signed with Dubai and free Wi-Fi in public parks. This paper evaluated Lagos states' accomplishments as an emerging smart city by exploring current working definitions of smart city and a diversity of various conceptual relatives similar to smart city vis- a- vis the present situation of the state. The study recommended strategic measures in conformity with international best practices that can be adopted by Lagos state government to enhance her city smartness.

Keywords: *Innovation, Lagos state, Smart city, Sustainable development*



1.0 Introduction

Cities are ever-changing; the dynamism of the urban environment is a microcosm of the societal interactions that we have built throughout history, National League of Cities (NLC) (2016). Over the last several years, the concept of Intelligent or Smart Cities has been fast moving from the academic world of conferences and workshops to the strategic planning of national governments and primary commercial projects of global IT corporations, multinational infrastructure providers as well as system integrators. Smart city, creative city or retrofitted city unlike the conventional city is anticipated as a prime city of wellbeing, prosperity and productivity. According to Dameri and Rosenthal-Sabroux (2014) who asserted that smart city can be seen as a fundamental strategy that can be employed to improve the quality of life of city dwellers. Abdoullaev (2011), described smart city as an urban settlement characterized with intelligent information systems, technology embedded infrastructure, transport systems, utilities, energy networks as provision for social infrastructures and good governance for its citizenry.

The urge to embrace the smart city concept which is part of the sustainable development goals has been on the rise. In the same vein Lagos state as an African commercial hub has embarked in her journey to city smartness. This quest to smartness is indeed a dive in the right direction. The current administration has put various measures and strategies in place to ensure that Lagos state does not lag behind in this “smartness” race. This has been evident in some finished and current laudable project that had been embarked upon as part of her city smartness revolution. These include amongst others; the construction of the Eko Atlantic city, activation of toll free emergency services, city heritage MOU it signed with Dubai and free Wi-Fi in public parks and the ongoing construction of 10 lane light project along Lagos- Badagry express way, etc.

Cities hold the ability to create synergies by providing great development opportunities to their inhabitants. However in a bid to ensure innovativeness and competitiveness, they generate a wide range of problems that can make governance a difficult task as they grow in size and complexity. If such situations are not properly managed, the negative effects of embracing a smart city can surpass the positive ones [Chourabi, Nam, Walker, Gil-Garcia, Mellouli, Nahon and Scholl (2012) & Monzon (2015)].

This paper intends to evaluate Lagos states' accomplishments as an emerging smart city vis-à-vis the indicators of a smart city established by theoretical and conceptual frameworks of a smart city. Stemming from the current situation, recommendations would also be made on strategic measures to adopt from international best practices to enhance city smartness.

2.0 Literature Review

2.1 Definitions of a Smart City

According to Sustainable smart city (2014), there is no standard definition of a "Smart City". The concept of "Smart City" is notoriously liquid, scarcely formalized and, in some degree, subject to different ideological interpretations and as such there is a multidisciplinary approach to its definitions (e.g. Hollands 2008; Deakin and Al Waer 2011; Caragliu, Del Bo, & Nijkamp, 2011). However, elements like data, information and communication technologies and urban governance are almost ubiquitous in discussions about Smart Cities." (Caragliu et al., 2011). Lee and Hancock (2012) opined that the smart city concept originates from various perspectives, including those of the 'information city', 'intelligent city', 'digital city' and (in a similar term to 'smart city' itself) 'ubiquitous city'. These different 'brands' of the city concept have some characteristics in common, as well as individual elements, while the definitions have a different scope and place different emphases. The terms 'smart' and 'intelligent' are used interchangeably throughout the literature (Hollands, 2008 & Pardo et al., 2012). Therefore various definitions and concepts of smart cities according to various authors are as follows;

Some scholars gave their submissions of a smart city as being 'smart' human and social capital and traditional (transport) and modern (ICT) communication infrastructure are being invested in as a means to fuel sustainable economic development and a high quality of life, with a wise management of natural resources, through participatory governance" (Caragliu et al, 2011; Lee & Hancock, 2012). Some authors also defined smart city from the perspective of enhancing the quality of life of the citizenry (Dameri & Rosenthal-Sabroux 2014 and Hall 2000). In that regard, Giffinger, Fertner, Kramar, Kalasek, Pichler Milanovic and Meijers (2007), gave a definition of Smart city as "a city well performing both on the smart combination of endowments and activities of self-decisive, independent and aware of its citizens". Setis Eu (2012) gave a broader

concept by defining Smart city as a “city in which it can combine technologies as diverse as water recycling, advanced energy grids and mobile communications in order to reduce environmental impact to offer its citizens better life”. International Business Machines (IBM) (2010) on the other hand gave a technological definition of smart city as the use of information and communication technology to sense, analyze and integrate the key information core systems in running cities. The European Union (EU) gave it assertion on smart city from the area of governance, thus it defined “a city seeking to address public issues via ICT-based solutions on the basis of a multi-stakeholder, municipally based partnership” (European Union, 2014).

2.2 Theoretical/ Conceptual Framework for Smart City

Researchers present different types of frameworks suitable to fit their message and support their view on the Smart City concept. This paragraph gives an overview of different frameworks and their applications.

In their study, Nam and Pardo (2011) advocated that the Smart City concept is an organic connection among technological, human and institutional components. They further proposed that a model for smart city which hinges on three core factors of influence. Due to this mix of influencing factors, according to Nam and Pardo (2011) “a socio-technical view on smart city is needed”. Three underlying factors of Smart City implementation are presented to countervail the pre-dominant focus on technology in the past: institutional, human, and technology factors

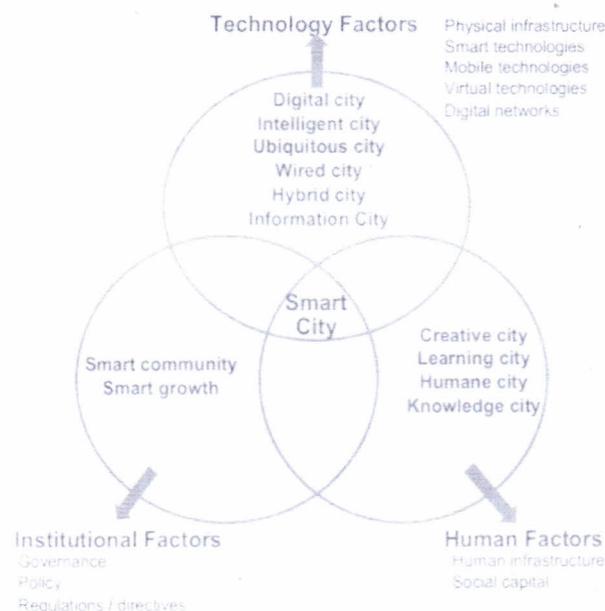


Figure II Fundamental components of Smart City (Nam & Pardo 2011)

These three components are influencing a limited number of Smart City characteristics, which can be seen as objectives for the Smart City initiative but at the same time as already (partly) developed strength or 'smartness in certain areas

2.2.1 Six Axes Approach Definition of a Smart City

Table 1: Six-axes approach to characterize a Smart City, by European Cities Project

Smart Economy (Competitiveness)	Smart People	Smart Governance (Participation)
Innovative spirit	Level of qualifications	Participation in decision making
Entrepreneurship	Affinity to lifelong	Public and social services
Economic image & trade images	Social and ethnic plurality	Transparent governance
Productivity	Flexibility	Political strategies and perspective
Flexibility of Labor Market	Creativity	
Embedded Internationally	Cosmopolitanism/open mindedness	
Ability to transform	Participation in public life	
Smart Mobility	Smart Environment (Natural Resources)	Smart Living (Quality of Life)
Transport & ICT	Attractiveness of natural conditions	Cultural facilities
Local accessibility	Pollutions	Health conditions
Inter(national accessibility)	Environmental protection	Individual safety
Availability of ICT	Sustainable resource	Educational Facilities

Sustainably Innovative and Safe Transport Systems	management	Tourist attractiveness Social Cohesion
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Source: (Giffinger, 2007)

Table 1 above presents the concept of Smart Cities as a complex of components from environmental to social perspective. The ability to integrate these components with the help of innovative technologies will therefore ensure project success. In summary, a Smart city remains: A city where citizens and services providers have an access to enhanced information flow and as such maximizes the utilization of its key resources by leveraging data gathered through widespread embedded sensors and controls, real time data analytics and ubiquitous communications.

A smart city combines disparate data sets to offer productivity insights and enhancement to its citizens and service providers, thereby maximizing the economies of scope and scale across its multiple infrastructure layers through a common service delivery platform, or Urban Operating System (“Urban OS”). A smart city also uses innovative technology to strive to go beyond economic targets, to deliver sustainable and improved quality of life for its citizens, industries and the local government.

2.3 *Challenges of a Smart City*

As cities continue booming tirelessly, their challenges need to be carefully thought through so that population growth, economic development and social progress walk on the same path (Monzon, 2015). They are confronted with grand challenges, among others far reaching demographic transformations, environmental decay and climatologically change; unequal social participation and ever-rising mobility trends. This observation calls for appropriate long-range policy strategies for urban areas (Menninga, Nijkamp, Noll, & Polt, 2011) and new and innovative ways to manage the complexity of urban living problems (Chourabi et al., 2012). Making a city “smart” is a strategy to mitigate the aforementioned challenges according to Chourabi et al (2012) and Dameri & Rosenthal-Sabroux (2014).

Smart City initiatives have been beset with an array of issues such as technical, management and governance issues, mainly due to high uncertainty of these smart city projects, increased

Figure II Fundamental components of Smart City (Nam & Pardo 2011)

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complexity of the city itself, and the inherent nature of smart city as a complex “socio-technical System of Systems” (Ojo et al., 2014). Next to these scientific results, practical studies, by the European Commission (EU) (2013) and Cisco (2012) confirm this last issue. The EU Commission states “When it comes to devising and implementing a Smart City strategy, it is the complexity of the city itself and of the institutional (decision-making) processes that need to be put in motion to change the status-quo” (European Commission, 2013b). Cisco findings based on engagements with smart city stakeholders’ worldwide, show “the complexity of cities (multiple parties, stakeholders, and processes) remains the most significant barrier to adopting Smart City solutions” (Falconer & Mitchell, 2012).

Finally, next to human, technological and institutional factors, external factors (and contextual factors of a city) can play a major role influencing the process and the development of smart city implementation. Neirotti, De Marco, Cagliano, Mangano and Scorrano (2014) opined that city policy makers are urged to understand the local context factors in order to shape appropriate strategies for their Smart Cities, ranging from national economic and financial issues to changes in the municipal political landscape.

2.4 *An Overview of Lagos as an Emerging Smart City*

Lagos, the commercial capital of Nigeria, is a source of mixed emotions for its more than 20 million inhabitants. Despite its shortcomings which she faces from the challenges of urbanization, Lagos is a city of great potential. With a gross domestic product (GDP) of about US\$136bn in 2017, the city is already acclaimed to have the seventh-largest GDP in Africa. (The state government believes it is the fifth-largest in Africa and aspires to become the third-largest by 2020) Additionally, the Lagos economy is estimated to constitute about a third of Nigeria’s output and certainly earns the highest annual tax revenue of all 36 federal states and the federal capital territory; which is in excess of \$1bn. Lagos leads Nigeria on a number of other metrics. While the economy of metropolitan Lagos has enormous competitive assets, it faces challenging trends in rapid population growth, urbanization, relentless demands for infrastructure as well as macroeconomic pressures from the national level. The city’s expansion is estimated to continue over the next couple of decades.

The present administration of the state has acknowledged that we are in the knowledge era and as such embrace the smart city concept by taking advantage of ICT and leveraging on its tools in moving towards a smart city. In order to achieve this, Lagos state as embarked on some laudable project in quest for city smartness. In June 2016, the Lagos State government signed a memorandum of understanding with Dubai Holdings LLC, owners of Smart City (Dubai) LLC to develop sustainable, smart, globally connected knowledge-based communities that drive a knowledge economy; to be located in Ibeju-Lekki on the outskirts of Lagos. A Smart City Lagos will be the pride of all Lagosians, just as we have Smart City Dubai, Smart City Malta and Smart City Kochi (India).

To assess its potential, it is important to examine the evolution of smart cities elsewhere. Investments and jobs have been touted as potential gains of a smart city, which is the case for Smart City Dubai. However, there are many advantages Dubai has over Lagos. Just about five years after the Dubai Smart City project was launched in 2013, Dubai is at the forefront of research in artificial intelligence, autonomous vehicles and so on. Also in May 2017, Lagos state started the installation of free Wi-Fi infrastructure across the city. Toll free emergency services and ambulances were put in place to ensure smart response to crisis. The state government commenced training of her staff to align them with its smart city vision. For instance, staff in the Lagos central business districts (CBDs) had their training session in January 2018. Other ongoing projects include construction of Lekki deep sea port, Eko Atlantic city, Dangote refinery etc.

3.0 Research Methodology

3.1 Research Method

A literature review was conducted to determine what a smart city strategy is and to explore the factors that constitute a smart city strategy. This study was limited to keyword searches that resulted in the most relevant results. A keyword combination search was used since in this way the study aims and objectives are better attained. Keywords were identified related to the topic: smart city, smart governance, smart economy, smart living, smart transportation, smart health care and strategy and success factors.

3.2 *Search Strategy*

Search for literatures for this review was conducted throughout the period of the study to track new developments and published reports and articles. The search period was from February 2018 to June 2018. This study adopted a qualitative approach, so as to adequately describe the study aims and objectives. Secondary data were adopted for this study; this included papers, journals, direct observation and relevant documents from the state government.

3.3 *Keyword Search Parameters*

This study was limited to keyword searches that resulted in the most relevant results. A keyword combination search was used since in this way the study aims and objectives are better attained. The following keyword combinations were used in all cases of the literature searches. The keyword searches were performed in three phases:

First phase keyword search

Smart city, smart economy, smart governance, Lagos state, smart world, smart transportation and quality of life. Eighty two (82) journals were retrieved here.

Second phase keyword search

Additional keywords used in the search were United States, Asia, Europe or Africa. This additional search was performed to ensure an up-to-date review and recommendations for enhancing Lagos state as a smart city. Seventy Two (72) Journals were retrieved here.

Third phase keyword search

This third phase literature search was necessarily based on the retrieved results of the second phase backward reference searches. The third phase keywords combination included the following: Smart Transportation Index, Education Index, Pollution Index, Medical Intelligence systems, Tourism, Cost of Living, Lagos state GDP Index, Public health surveillance systems, Nigerian medical intelligence and Nigerian surveillance systems. Sixty One (61) Journals were retrieved here.

In total, after several reviews at different stages, forty six (46) journals were analyzed for the study. For the purpose of this study, Lagos state would be analyzed based on Six Axes Approach indicators of a smart city by (Giffinger et al, 2007)

4.0 Data Analysis

This section reviews the Lagos state as an emerging smart city in relation to Six Axes Approach indicators of a smart city by (Giffinger et al, 2007). Discussion of findings, suggestions and recommendations were made on how the State can improve on its smart city agenda.

Table 2: *Smart City Indicator Table*

	Excellent	Moderate	Bad
Smart Economy (Competitiveness)			
Innovative spirit		✓	
Entrepreneurship	✓		
Economic image & trade images		✓	
Productivity	✓		
Flexibility of Labour Market		✓	
Embedded Internationally		✓	
Ability to transform		✓	
Smart People			
Level of qualifications	✓		
Affinity to lifelong			✓
Social and ethnic plurality	✓		
Flexibility		✓	
Creativity	✓		
Cosmopolitanism/open mindedness			✓
Participation in public life		✓	
Smart Governance (Participation)			
Participation in decision making			✓
Public and social services		✓	
Transparent governance			✓
Political strategies and perspective		✓	
Smart Mobility			
Transport & ICT		✓	

Local accessibility		✓	
Inter(national accessibility)			✓
Availability of ICT		✓	
Sustainably Innovative and Safe Transport Systems		✓	✓
Smart Environment (Natural Resources)			
Attractiveness of natural conditions			✓
Pollutions			✓
Environmental protection			✓
Sustainable resource management			✓
Smart Living (Quality of Life)			
Cultural facilities		✓	
Health conditions		✓	
Individual safety		✓	
Educational Facilities			✓
Tourist attractiveness			✓
Social Cohesion		✓	

4.1 Smart Mobility

4.1.1 Current Status of Transportation in Lagos

The transport network in the state is predominantly road based with 90% of total passengers and goods moved through that mode. The state has natural water ways for ferry services and federal rail network which will be complemented by the emerging state rail network. The demand for trips in the Lagos megacity region by all modes (including walking) was estimated at 22 million per day with walk trips accounting for 40% of total trips in metropolitan Lagos. See Table 3 below. The rapid increase in population and standard of living will bring the daily demand for trips to about 40 million/day by 2032 (Lagos Metropolitan Area Transport Authority (LAMATA), 2015)

Table 3: *Passenger Traffic per Day in Lagos*

S/N	Mode	No. of passengers/day	Percentage ratio/total passengers
1.	Walking	8,800,000	40%

2.	Bus Rapid Transit	90,000	0.41%
3.	Regulated bus (LAGBUS)	150,000	1%
4.	Private Cars	2,508,000	11%
5.	Semi – Formal Mini Buses (Danfos)	9,982,000	45%
6.	Federal Mass Transit Train	132,000	1%
7.	Water Transportation system	74,000	0.34%
8.	Other Non- data Modes	264,000	1%
9.	Total Passengers Traffic	22,000,000, 100	

Source: Lagos Metropolitan Area Transport Authority, 2015

4.1.2 *Challenges in the Transportation Sector in Lagos*

The challenges in the transportation sector are multifaceted ranging from inadequacy of infrastructure, non-standardization of operations, poor management and technical capacities.

Transportation in Lagos state is confronted with the problems of inadequacy of formal modes of transportation. With the formal public transportation contributing only 2.75% of daily mobility in the city, it is clear that these modes cannot meet the demand of the Lagos residents, hence semi-formal and informal operators from mini buses , motorcycles , tricycles and boats sectors will continue to fill the gap. The incursion into the transportation sector by semi-formal and informal operators who exhibit unethical behavior has also contributed to traffic chaos and abnormal situations in the traffic sector of the state population who seek means of livelihood has contributed to traffic chaos and unethical behavior among the informal operators. In addition the road infrastructure is grossly inadequate to meet the trips demand of the residents. The road network density, put at 0.6 kilometers per 1000 population, is low. Alternatively, Lagos State has 80 cars per 1000 people, with a high car density of 264 vehicles per kilometer of roadway. The network's efficiency is similarly low, with a limited number of primary corridors carrying the bulk of the traffic.

Inadequately designed interchanges, where they exist at all, provide only partial access to the primary network. Many tertiary roads play the roles of secondary ones. So far few junctions have been signalized while transport stations, where available, are in a disorganized state.

Table 4: Traffic Comparison Index (Lagos vs. New York)

S/N	Index	Lagos, Nigeria	New York, United States
1.	Traffic Index	378.18	165.70
2.	Time Index (in minutes)	71.55	43.36
3.	Time Exp. Index	34,250.64	2,769.70
4.	Inefficiency Index	394.35	182.30
5.	CO ₂ Emission Index	10,343.64	3,159.50

Source: www.numbeo.com April, 2018

The information provided in the traffic comparison table above indicates that the transportation system in Lagos state still needs to be seriously improved upon to attain the level of smart transportation as seen in smart cities in other developed countries. The traffic time Index in Lagos is 71.55 minutes compared to 43.36 minutes in New York indicates that commuters spend more time in transit which may result in loss of productive time in transit. The carbon emission index of 10,342.64 is way higher in Lagos compared to 3, 159.50 in New York. This shows that there are so many cars on the road which may be due to inefficient mass transportation system in the state. High carbon emission is also hazardous to human life as well as the ecosystem in general which would in turn have effects on health and quality of residents of Lagos state. Use of subways system of transportation and improved mass transportation systems would help combat the problems of high traffic index and high carbon emissions. Improvement of transportation (road, rail and water ways) network systems in Lagos state would have a significant effect on the overall traffic situation as commuters would spend less time in transit and productivity and economic activities would be improved upon.

Smart transportation can be enhanced in Lagos state by adopting international best practices in transportation embraced by other developed smart cities like Barcelona, Tokyo, Beijing, and New York amongst others. Barcelona is another city regarded among the top five Smart Cities in the world. It has made extensive use of sensors to help monitor and manage the traffic condition in the city, including smart parking, and smart streetlights and sensors for monitoring air quality and noise. Having a smart transport system in Lagos state requires a mixture of several solutions

such as smart parking system, smart traffic management, industrialized rail systems, subways, waterways and well developed road network.

4.2 Smart Living (Quality of Life)

Table 5: Quality of Life Index Table; Comparison between Lagos, Nigeria and New York, United States

S/N	Index	Lagos State	Rate	New York	Rate
1.	Purchasing Power Index	18.84	Very Low	100.0	High
2.	Safety Index	35.56	Low	55.51	Moderate
3.	Health Care Index	51.58	Moderate	65.20	High
4.	Climate Index	65.65	High	79.65	High
5.	Cost of Living Index	33.76	Very Low	100	High
6.	Property Price to Income Ratio	18.63	Very High	11.60	Moderate
7.	Traffic Commute Time Index	71.55	Very High	43.36	Moderate
8.	Pollution Index	84.60	Very High	57.87	Moderate
9.	Quality of Life Index	53.61	Low	138.52	High

Source: www.numbeo.com June 2018

The health care system in Nigeria has experienced several down-falls. (World Health Organization, 2011; Wang & Liu, 2009; Mendoza et al, 2013) Despite Nigerian's strategic position in Africa, the country is greatly underserved in the health care sphere and by extension Lagos state is experiencing its fair share of inadequate health care facilities. According to Adebara, Adebara, Olaide, Emmanuel, and Onigbogii (2017), numerous challenges are encountered on a frequent basis in assessing health information and services in Nigeria; these challenges include low doctor: patient ratio, high cost of transportation, long waiting period, non-availability of clinic space, and delay in decision-making due to non-release and/or loss of laboratory results. The health care index of 51.8% is an indication that Lagos state government has made conscious effort to improve her health care system in several ways. There have been upgrades of existing primary health care centers, construction of new health centers, provision of ambulance and emergency response services and free immunization etc. nonetheless there are still loop holes that needs to be improved upon.

The place of technology in improving health and quality of life cannot be overemphasized. Adopting smart health care system is a vital index of smart city. This technology is poised to

alter how healthcare is delivered, the quality of patient experience and the cost of healthcare [Wang & Liu (2009) and West (2012)]. Mobile health therefore offers opportunities to breach these barriers and reach communities in ways that traditional health services cannot offer. Mobile health (mHealth) is the use of mobile and wireless technologies, such as mobile phones, patient monitoring devices, personal digital assistants, and mobile software applications to support the achievement of health objectives (WHO, 2011 and Mendoza, Okoko, Morgan & Konopka, 2013). Osain (2011) suggested that adoption of medical intelligence and surveillance is useful tool in enhancing health care delivery in Nigeria. As it represent a very useful component in the health care system and control diseases outbreak, bio attack, etc.

The Quality of Life Index of 53.61% in Lagos state is low compared to 138.52 in New York which is very high. Quality of life is a combination of so many factors as shown in the table 6 above. The improvement of other indicators of smart city such as economy, people, governance, mobility and environment would enhance smart living and quality of life of the people.

4.3 *Smart People*

4.3.1 *Lagos Population Growth*

Lagos has enjoyed tremendous growth, reaching 21 million from just 1.4 million as recently as 1970. The city now generates 25% of Nigeria's total gross domestic product. It is also the 7th fastest growing city in Africa. Unlike the rest of Nigeria, Lagos is a great example of what is possible when the government offers energy and other initiatives to its residents. Lagos is also a window to the future. In about 25 years, at the rate Nigeria is currently growing, it will have a population of 300 million, or the same as the present-day United States, all living in an area the size of Nevada, New Mexico and Arizona. With the population doubling over the last 15 years, living standards across Nigeria remain poor. Today, 25% of Africans are Nigerian. By 2050, Lagos' population is expected to double, which will make it the 3rd largest city in the world but with less infrastructure than any other large cities of the world.

4.3.2 *Nigeria/Life Expectancy*

Table 6a: Life Expectancy Index Table; Comparison between Nigeria, United Kingdom and United States

S/N	Index	Nigeria	United Kingdom	United States
1.	<i>Life expectancy</i>	54.5years Lagos; 70years	81.60 years	78.74 years

Source: World Bank
Table 6b: Life Expectancy Index Table.

Male	Female	Total	World Rank
53.4 years	55.6 years	54.5 years	177

Source: World Bank

According to the latest WHO data published in 2017 life expectancy in Nigeria is: Male 53.4, female 55.6 and total life expectancy is 54.5. This gives Nigeria a World Life Expectancy ranking of 177. We suffer a low life expectancy rate; chances are that a billion things are just in place to stop citizens from reaching the biblical 70 years. Now people just die in their golden age. Our history of child mortality has led parents to produce sufficient children as a bargain against the onslaught of death. They assume that the more children they have the more some would survive the forces of death that litter the land. It all led to increase population but life expectancy remains very low. It seems citizens must stop at age below 50.

But that might be over as Lagos State is leading the way. It has pegged life expectancy rate for Lagosians at 70 years with a blueprint to bring it to fruition. It is as a result of this it began the pilot phase of the Strategic Management Framework Implementation centering on education, health, infrastructure among other sectors.

4.4 *Smart Governance*

Nwogwugwu & Etareri (2015) in their study on Nigerian government opined that accountability and transparency is still at a very low level in the administration of local governments in Nigeria, as state governors and state houses of assembly have overbearing influence on the operations of local governments. They further stated that the election and selection process for leaders is not transparent and so long as these anomalies are not addressed achieving effective accountability and transparency in the administration of local governments would be a mirage. Agwor (2015) was of the opinion that the battle to save Nigeria is beyond mere anti-corruption slogans but we should emphasize that corporate or socio-political leadership is a call to service, and should be purely regarded and treated as such, especially in the new democratic dispensation.

Nchuchuwe and Ojo (2017) found in their study on Lagos state that the digitization of the tax system in Lagos has made it very easy and more convenient for tax payers to pay their taxes and has further increased tax payers' accessibility to their tax records. It further emphasized that the digitization of the tax system has enabled the Lagos government to maintain control of its tax offices amongst many other benefits such as reduction of nonchalant attitude of tax payers to their tax obligations to the state and general noncompliance. This study concluded that it is evident that all problems and loopholes bedeviling tax administration in Lagos state could be fixed through e-taxation.

Efficient and effective tax administration is crucial for the development of any government. It boosts revenue generation, financial accountability and discipline; hence, the Lagos state government should be committed towards sustaining digitization of not just is tax administration, but all aspects of governance and public service delivery. This study revealed that there is a steady, but certain progress in the digitization of the tax system in the state and with consistency of policymaking and implementation, Lagos state would be a model state for all other states in Nigeria to learn from in terms of improving service delivery through e-governance.

The study recommended the following for further improvement in the digitization of the tax system in Lagos state:

A conscious effort should be made to enhance the effectiveness of revenue officers of the state. Cognizant effort should be taken to constantly train and retrain the tax revenue officers in the latest ICT innovations to boost their morale and enhance their ability to deliver quality services. To further strengthen the gains of the digitized tax system, the government should take advantage of the ever-changing world of mobile phone technology. LIRS should liaise with software developers to design Smartphone apps where tax payers can sign in with their Tax Identification Numbers (TINs), create accounts and pay their taxes, as well partake in self-assessment e-forms. In addition to computerizing the database for tax administration in the state, the Lagos state government should adopt online cloud data storage where tax information of Lagos residents are stored, processed and retrieved in a secured online database.

Attributes of a Smart Governance

- 1) A smart city practices accountability, responsiveness, and transparency (ART) in its governance.
- 2) A smart city uses big data, spatial decision support systems and related geospatial technologies in urban and city regional governance.
- 3) A smart city constantly innovates e-governance for the benefit of all its residents.
- 4) A smart city constantly improves its ability to deliver public services efficiently and effectively.
- 5) A smart city utilizes creative urban and regional planning with focus on the integration of economic, social, and environmental dimensions of urban development.
- 6) A smart city practices E-Democracy to achieve better development outcomes for all.

4.5 *Smart City Economy*

A smart city is driven by innovation and supported by universities that focus on cutting-edge research, not only for science, industry and business but also for cultural heritage, architecture, planning, development, and the like. A smart city's inhabitants strive for sustainable natural resource management and understand that without this its economy will not function indefinitely. The following are attributes expected to be evident in an economy to be regarded as a smart economy.

- 1) A smart city highly values creativity and welcomes new ideas.
- 2) A smart city has enlightened entrepreneurial leadership.
- 3) A smart city offers its citizens diverse economic opportunities.
- 4) A smart city knows that all economics works at the local level.
- 5) A smart city is prepared for the challenges posed by and opportunities of economic globalization.
- 6) A smart city experiments, supports, and promotes sharing economy.
- 7) A smart city thinks locally, acts regionally, and competes globally.
- 8) A smart city insists on balanced and sustainable economic development (growth).
- 9) A smart city is a destination that people want to visit (tourism).
- 10) A smart city has high flexibility of labour market.

5.0 Conclusion and Recommendations

This study assessed the current position of Lagos State in relation to smart city indicators. It was deduced that the state is yet to measure up with international best practices model of a smart city. However the state has made some remarkable efforts to improve on economy, governance, health, education and environment towards achieving a sustainable smart city. In order for Lagos State to improve on her smart city initiatives, the following recommendations were made;

Smart mobility

Smart mobility solutions aim at reducing congestion and fostering faster, greener and cheaper transportation options. They vary from solutions that optimize the current transportation system to solutions that create whole new transportation systems, based on a different paradigm. Some suggested solutions that can be adopted to enhance smart mobility include; smart parking, personalized transport information and smart traffic control

Smart Safety

Physical safety is a critical hygiene factor for thriving economies and happy people. New technologies can improve public safety and save lives. Some of the ways to achieve smart safety includes; smart street lighting, drones for risk assessment, data-based crime prevention programs, predictive policing and emergency apps

Smart Energy

Smart energy that aims at greener energy generation, lower energy consumption, an energy consumption pattern with flattened peaks, and a resilient distribution grid should be adopted. In addition distributed generation with renewable sources, Smart grids and in a smart metering can enhance sustainability of smart energy.

Smart Health

The health services can be enhanced by embracing the use of Artificial intelligence supports the doctors and application of Robotics in 'cure' and 'care'

Smart Education

Smart cities require smart people. Education is critical for development of talent that is motivated and enabled to drive innovation. New technologies will improve quality of education. Smart education can be achieved through digitization of education, adaptive learning & counseling, unbundling of education, personalization of education and lifelong learning

Smart Construction

Innovative construction techniques must be adopted in a smart city. This can be achieved through the following;

- Advanced Construction Materials and Machinery
- Concrete Admixture for Moist Content which is a product that prevents moisture from going through concrete surfaces and as a result eradicates failures in flooring
- Concrete optimizer is a system that measures information from the inside of a truck mixer drum and sends it to technicians and operators to check on the quality of the concrete.
- Improved Construction Processes
- Wireless monitoring of infrastructure

Smart Governance

Smart cities require a smart government. A smart government uses the disruptive potential of technology and data to innovate in all parts of the value chain: Analysis, Policy-making, planning, execution, enforcement, distributed government and online public services

5.1 References

Aboullaev, A. (2014). *Smart Cities Global Initiative 2014*. World Smart Cities Award

Agwor T.C. (2015). Promoting Transparency & Accountability for Sustainable Democracy in Nigeria. *Research Journal of Finance and Accounting* 6(6): 208 – 214.

Adebara, O., Adebara, I., Raji, O., Emmanuel, G., and Onigbogii, O. (2017). Knowledge, Attitude and Willingness to Use mHealth Technology among Doctors at a Semi Urban Tertiary

Hospital in Nigeria. *Journal of Advances in Medicine and Medical Research*. 22(8): 1-10, 2017; Article no.JAMMR.33232

Chourabi, H., Nam, T., Walker, S., Gil-Garcia, J. R., Mellouli, S., Nahon, K., and Scholl, H. J. (2012). *Understanding smart cities: An integrative framework*. Paper presented at the System Science (HICSS), 2012 45th Hawaii International Conference on System Sciences

Caragliu, A., Del Bo, & Nijkamp, P. (2011). Smart cities in Europe, *Journal of Urban Technology*, Vol. 18, No. 2, April 2011, pp.65- 82

Cisco (2014). *Smart City Readiness: Understanding the Issues to Accelerate the Journey*. Smart Cities Council

Deakin, M., & Al Waer, H. (2011). From intelligent to smart cities. *Intelligent Buildings International journal*, 3(3), 140-152

Deloitte (2015). *Smart Cities; How rapid advances in technology are reshaping our economy and society Version 1.0, November 2015*

Egresi, I. (2017). Tourist satisfaction with shopping experience based on reviews on trip advisor. *Journal of Tourism Research*, Vol. 65, no.3, Pp. 330-345

EU-European Parliament (2014), “*Mapping Smart Cities in EU*”, available at: [www.europarl.eu/RegData/etudes/etudes/join/2014/507480/IPOL-ITRE_ET\(2014\)507480_EN.pdf](http://www.europarl.eu/RegData/etudes/etudes/join/2014/507480/IPOL-ITRE_ET(2014)507480_EN.pdf) (accessed 25 June 2015)

European Commission (2013a). *Call - Smart Cities and Communities*. Smart Cities and Communities solutions integrating energy, transport, ICT sectors through lighthouse (large scale demonstration - first of the kind) projects. European Commission

Falconer, G., & Mitchell, S. (2012). *Smart City Framework: A Systematic Process for Enabling Smart+Connected Communities*. Cisco

Giffinger, R., Fertner, C., Kramar, H., Kalasek, R., Pichler-Milanovi, N., & Meijers, E. (2007). *Smart Cities: Ranking of European Medium-Sized Cities*. Vienna, Austria: Centre of Regional

Science (SRF), Vienna University of Technology. Available at http://www.smartcities.eu/download/smart_cities_final_report.pdf.

Giffinger, R., & Gudrun, H. (2010). *Smart cities ranking: An effective instrument for the positioning of cities? ACE: Architecture, City and Environment*, 4(12), 7-25. Available at http://upcommons.upc.edu/revistes/bitstream/2099/8550/7/A_CE_12_SA_10.pdf.

Hafedh (2012). Understanding Smart Cities: An Integrative Framework, *45th Hawaii International Conference on System Sciences*

Hall, P. (2000). Creative cities and economic development. *Urban Studies*, 37(4), 633-649.

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

IBM. (2010). *Smarter Thinking for a Smarter Planet*. Available at http://www.ibm.com/smarterplanet/global/files/us_en_us_loud_ibmlbn0041_transtasman_book.pdf

Intercessional Panel of the United Nations Commission on Science and Technology for Development (CSTD) (2016). Contribution of the Federal Republic of Nigeria to the CSTD 2015-16 priority theme on 'Smart Cities and Infrastructure'. Held in Budapest, Hungary, 11-13 January 2016

Lagos Population. (2017). Retrieved 2018-07-04, from <http://worldpopulationreview.com//>

Lee J., & Hancock M. (2012). Toward a framework for Smart Cities: A Comparison of Seoul, San Francisco and Amsterdam. *Research Paper, Yonsei University and Stanford University*

Lee, Y. (2013). *Ubiquitous (Smart) City*. Proceedings of EU Parliament Seminar on Smart (Ubiquitous) City Consortium, p.3.

Leem, Y., & Yigitcanlar, T. (2008). *Towards ubiquitous city: Concept, planning, and experiences in the Republic of Korea*. In T. Yigitcanlar, K. Velibeyoglu & S. Baum (Eds.), *Knowledge-Based Urban Development: Planning and Applications in the Information Era* (pp. 148- 169). Hershey, PA: IGI Global

Maccani, G., Donnellan, B., & Helfert, M. (2014). *Action Design Research in Practice: The Case of Smart Cities Advancing the Impact of Design Science: Moving from Theory to Practice* (pp. 132-147): Springer.

Mendoza G., Okoko L., Morgan G., Konopka S. (2011) *MHealth compendium: African strategies for health project, management sciences for health*. Arlington, A. 2013;2:1- 80.

Menninga, H., Nijkamp, P., Noll, M., & Polt, W. (2011). *Joint Programming Initiative Strategic Research Framework*. Urban Europe

Monzon, A. (2015). *Smart Cities Concept and Challenges: Bases for the Assessment of Smart City Projects. Smart cities; Green technologies and Intelligent-transport system*. Proceedings of 4th International Conference, SMART GREENS, 2015 and 1st International Conference, VEHTS 2015, Lisbon, Portugal, May 20 – 22, 2015: Springer

Nam, T., and Pardo, T. (2011) *Conceptualizing smart city with dimensions of technology, people, and institutions*. Proceedings of the 12th Annual International Digital Government Research Conference on Digital Government Innovation in Challenging Times - dg.o '11, page 282, 2011

National League of Cities (2016). *Trends in Smart City Development: Case Studies and Recommendations*

Neirotti, P., De Marco, A., Cagliano, A. C., Mangano, G., & Scorrano, F. (2014). *Current trends in Smart City initiatives: Some stylised facts*. Cities, 38, 25-36

Nchuchuwe, F.F., & Ojo, A.D. (2016). *Interrogating the application of e-governance for service delivery in the local government of Nigeria: A study of Ojo and Alimosho local government areas, Lagos state*. Covenant University Conference Proceedings on e-Governance in Nigeria. 268-299

Nwogwugwu, N., and Etareri, C.F. (2015). Accountability and transparency in local Government administration in Nigeria during the fourth republic. *The International Journal of Humanities and Social Studies* 3(7): 453 – 460.

Ojo, A., Curry, E., & Janowski, T. (2014). *Designing Next Generation Smart City Initiatives- Harnessing Findings and Lessons From A Study Of Ten Smart City Programs*

Osain, M. (2011). *The Nigerian health care system: Need for integrating adequate medical intelligence and surveillance systems*. J Pharm Bioallied Sci. 2011 Oct-Dec; 3(4): 470–478. doi: [10.4103/0975-7406.90100](https://doi.org/10.4103/0975-7406.90100)

Quality of Life Index Comparison Table (2018). Retrieved July 2, 2018, from <http://www.numbeo.com>

Setis-Eu. (2012). setis.ec.europa.eu/implementation/technology-roadmap/

Traffic Comparison Index Comparison Table (2018). Retrieved July 2, 2018, from <http://www.numbeo.com>

Wang H., Liu J. (2009) *Mobile phone based health care technology: Recent patents in Biomedical Engineering*. 2009;2:15-21.

West, D. (2012) *How mobile devices are transforming healthcare*. Issues in Technology Innovation. 2012;18:1-14

World Health Organization (2011). *mHealth: New Horizons for Health through Mobile Technologies*. Global Observatory for eHealth Series. 2011;3:1-111