NIGERIA SMART CITY INITIATIVES (NSCI) the GEOSPATIAL PERSPECTIVES

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SUMMARY

The Nigeria Smart City Initiative acronym NSCI was launched in Abuja, Nigeria on 8 [th] August, 2017. The summit was to initiate sound actionable strategies for transforming Nigerian major urban centers from traditional dysfunctional cities to modern, efficient, responsive ones capable of satisfying the needs of present and future generation of Nigerians. NSCI would rely heavily on application of ICT and other smart technologies in the operations and management of those cities.

A city can be termed smart when it is able to effectively link sensors and software to generate and manage information that improves efficiency in decision making and in arriving at smart solutions to every day issues. However, smart city is not predicated solely on ICT but also on robust geospatial technologies, human and socio-cultural environment among other interactive platforms. Every object is location based and in that wise location is a primary attribute of city and the citizens and also the heart of ICT and Internet of Things (IoT). Geospatial technologies that are capable of continuously providing accurate, concise, timely and relevant location information are among the primary tools on which smart solutions and smart management of cities are based. This brings to fore the involvement of Surveyors who are the professional producers and managers of geospatial information.

The presentation outlines place of surveyors in the Nigeria government desire for transforming our major urban centres into functional, responsive, interactive and resilient municipalities. This is planned to be achieved through city upgrade and renewal, massive PPP investment on infrastructure, citizen capacity development and strategic action plans for migrating from traditional analogue ways of doing things to applications of ICT and Internet of Things in decision making processes and the management of cities. The overall objective of NSCI is to improve the living standard of Nigerian citizens and enhance the city environment at sustainable levels.

It is pertinent that this presentation also evaluates the capacity and preparedness of Nigerian surveyors to provide the needed qualitative geospatial information capable of driving the NSCI and smart municipalities. Appropriate recommendations shall be made to empower surveyors to meet up with the challenges and take their rightful place as the engine rooms of NSCI.

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1.   THE SMART CITIES

Two major disruptions that characterise and shape the 21st century is unprecedented exponential growth in population of cities and sheer physical sizes of cities and generation of large volume of data and fast processing of information. This is often called the digital era or the fourth industrial revolution 4IR. The recent rapid urbanization is occasioned by substantial migration of population towards cities and urban conurbations in pursuit of perceived limitless opportunities offered by the city and the attraction of its lures. Today it is estimated that 51 percent of the world population live in cities. This trend is bound to explode further as it is estimated that by 2050 world population will hit over 9 billion people with 80 per cent of them living in cities. Nigeria together with China and India are estimated to account for 37 per cent of this projected growth. Nigeria alone is projected to have 212 million urban dwellers by the middle of the century (World Urbanization Trends 2014, New York City). This geometrical growth in population of urbanite and the sheer physical size of cities pose greatest challenges for policy maker, city managers and the citizens living in them. Globally cities are said to disproportionately consume about 80 per cent of physical and social resources. The consumption continues to grow in the face of fixed or dwindling resources. It is apparent that urgent strategies must be evolved to provide solutions to the complex demand of the city.

Challenges in provision of social amenities such as basic education and health care delivery, waste management systems, urban transport system, supply of portable water, combating environmental and ecological hazards, security (combating terrorism, violent crimes, traffic in human beings, drugs and child abuse etc), alleviating urban economic contradictions and social segregations, slum upgrade and many topical urban issues exerts pressure on the administration and management of cities. The pressure increases with fresh addition of each new individual to the city population. This scenario led United Nations to tag cities as the greatest challenges facing mankind since we became social.[1] In spite of these challenges cities however provide unlimited opportunities for administrators to leverage on large population as a source for economic growth, for national development and for innovations that brings improved living condition of the citizenry.

Faced with these, challenges city administrators evolve multifaceted approaches and action plans to solve the problems and in some cases turn the problems into opportunities, as in waste to wealth in refuse management. Various initiatives are rolled out at local, such as Nigeria Smart City Initiative, at regional levels such as Africa Smart Cities and at international level like New Urban Agenda, (NUA), Cities Alliance (CA), and Global Cities etc. Global policies such as SDG and MDG address these concerns. All the 8 goals of MDG and the 17 goals and 169 targets of SDG are relevant in providing solution to multiple challenges posed by rapid urbanisation. Smart cities initiative is a generic approach to city management. Urban management and planning policies such as eco-cities, sustainable cities,

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resilient cities, future cities, safe cities initiatives etc all find their expression under smart cities solutions.

A smart city is an urban area that has effectively integrated its human, physical and digital environments into its workflow in such a seamless and systematic manner as to provide intelligent solutions to everyday challenges posed by the city. The goal of a smart city is provision of efficient, affordable and faster services that improves the living conditions of the citizens and adds value to the environment at sustainable levels. City managers have leveraged on opportunities offered by ICT and IoT which in recent years seen massive growth to integrate these three domains find quick and effective solutions to complex demands of the city. Efficient management of city assets and liabilities, its infrastructure and resource, evaluation of its present and future is a complex process which requires large volume of relevant data and right amount of information at the right time.

The fourth industrial revolution, or the current digital era provides limitless volume of information for decision making by urban managers and city dwellers. 95 per cent of the data in the world today is generated in only last two years. The global daily output of data has risen to estimated 2.5 quintillion bytes. [2] (bbc.com). There are   more than 3.7 billion internet population which has seen a growth of 75 per cent since 2016. Data generated in the last 10 years is far exceeds the sum of data generated in the entire history of mankind and all these can be accessed by a click of a bottom.

This large volume information, generally called big data, allows urban managers to access, analyse and understand factors that shape the city landscape and interactive relationships among them. It also allows them to select best suitable models that provide workable and inclusive solutions to the problems of the city. As any city is organic there for information about the city must be on continuous uninterrupted stream if the information shall be of much value for decision making. Urban administrators and managers emplace data collecting sensors at every nook and corner of the urban conurbation and in the peri-urban areas to provide the required seamless information. The devises and sensors stream live information and form part of important landscape of any smart city. Network of internet of thing (IoT) provide the required interconnectivity among the sensors so that they work as a system. The urban management, the devises, IoT together with data processors form part of the urban workflow which provides intelligent solution around problems of the city and quest raised by citizens. The aim is primarily meant to provide the citizens better living conditions and city visitors comfortable stay in the city and for the city to be more flexible, resilient and liveable at efficient and sustainable levels.

2.   CONCEPT OF SMART CITY AND WHAT DISTINGUISHES SMART CITY FROM TRADITIONAL CITY

A smart city is generally construed by the purpose for which adaptation of smart technologies in management of cities are meant to serve. In many developing countries such as Africa, smart cities concept is seen as leapfrogging in technology in order to match rapid pace of urbanisation with provision of relevant urban infrastructures needed by the citizens. The aim is to improve the general environment and open up new economic opportunities for the populace arising from provision of qualitative basic urban services such as good roads, efficient communication system, secured environment, portable drinking water etc. In developing countries the view is mostly for maintenance and optimization of such urban

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infrastructures so that they can be made more affordable, efficient and sustainable. Generally whether in developing or developed countries for a city to qualify as smart, it must be focused on people, processes and technologies in its form and function to distinguish it from a normal traditional city. It requires application of ICT in workflow of the city; functional and sustainable master plan; strong democratic institutions; and educated, responsive computer literate population.

A traditional cities management and administration are usually manual, analogue and tedious; decisions are based on inaccurate and insufficient data; dissemination of information is slow and ineffective and interaction between the city administration and citizen is minimal and physical. In smart cities information from all domains, administrative, economic, social, physical, political, environmental, infrastructural, cultural etc are electronically collected and correlated and displayed in digital platforms of multiple subsystems such that citizens can access specific, accurate and comprehensive information about the city and services it offers. Smart cities offer greater satisfaction for citizens and enhancement of living environment. In smart city residents and visitors should ideally be assured the following services
- efficient multi-model transportation, education, health care, electricity supply, portable clean water and affordable housing delivery
- smart solutions to everyday issues
- resilient, friendly, transparent and strong institutions and governance
- liveable and secured environment
- short time response to citizens demand especially in emergency situations
- sharing information and interaction among citizens, city management and administrators
- democratic decision in matters that affects the city and its citizens

Two sectorial examples can help us distinguish between services in smart city and traditional city. In traditional city commuting is usually uncertain, time consuming, costly and many cases insecure for visitor. In smart city, simple click on city map on an android handset or a device the user is electronically supplied with real - time information about his destination, route options, directions, means of transportation and expected time of arrival to the destination. The citizen gives and receives feedback to the system. In taking advantage of smart technologies a simple domestic smoke detector (sensor) can be linked to the IoT. In the event of fire outbreak the sensor automatically relays signals to fire department and geospatial intelligence directs officers to the affected address. This mutual, systematic and reciprocal relationship between people, sensors, software, geo- spatial intelligence and internet of things and the city workflow is the lifeline of any smart city

It follows that for a city to be smart, the political, economic, social, technological, environmental and legal (PESTEL) frameworks must be conditioned right and work in mutual reinforcement with each other for the successful operation of the city. There shall be
- Enough budgetary provisions for the smart city and political will to execute it
- Real time interactive digital maps
- Broadband internet services
- Computer literate population
- Transparent democratic governance
- Competitive free market economy
- Freedom of information
- Functional infrastructure – roads, schools, hospitals, power supply etc

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- Strong institutions – security, judicial, regulatory agencies
- PPP investment and management of the city
- Responsive and interactive citizenry and
- Basic purchasing power – ability to purchase smart devices/android phone and run it etc

These are some key issues on which the NSCI can be premised, and which can also be used to evaluate the feasibility and workability and sustainability of the initiative.

3. BENEFITS WHEN CITIES GO SMART

Citizens benefit immensely when smart technologies are used in the operation and management of the city. The advantages of smart management in the economies, governance and societal wellbeing are endless; few of them are in the following areas.

3.1 Wealth Creation Improved economic status

Smart cities support national economy by creating new businesses and customers. Smart transportation technologies such as traffic navigation, goods and vehicles tracking systems, intelligent traffic management, automatic ticketing systems, smart parking etc generate wealth, increase government revenue, save man hours and improved the quality of lives of citizens. A study conducted by a research group Alpha Beta (supported by Google) and presented in October 2017 on Economic Impact of Geospatial Services in Nigeria indicated that digital maps reduced travel time of Nigerians by about 8% and saves over Naira 190b annually. Nigerians, the study found, value digital maps at an average of N22,131 per year per user which translates to N1781billion per year for all users in the country.

3.2 Improved Security

Smart technologies such as licence plate recognition, RFID, gunshot detectors, body and vehicular cameras give law enforcement edge while on duty and enables quick response to emergency situations

3.3 Informed decision making in the management of city - big data analytics enables policy makers, city managers and citizens to access, analyse and utilise massive amount of information relevant to particular issues of interest. This brings about efficiency and efficacy in decisions making processes particularly in matters relating to governance, management and investment. Lives of citizens is improved by cutting running costs and better services delivery

3.4 Participatory governance of the city improves public service delivery- Collaboration tools, modern and intuitive websites, mobile applications, self-service portals, and convenient online accounts makes city life easier, cheaper and less costly. Government websites and portals, performance dashboards and platforms, social media and live- streaming enables faster, easier and usually reliable two ways communication between government and citizens thus improving governance and service delivery to the citizens

3.5 Efficient use of public utilities

Smart technologies are usually applied for efficient distribution and management of natural and social services. Smart conservation techniques are used to monitor and reduce inadvertent wastages of water, electricity, gas etc. Smart sensors allows cities to monitor spatial distribution of services and to channel such services where most needed. With smart technology is useful in predictive analytics to identify areas of weaknesses and leaks in pipelines, roads, bridge, dams and other urban infrastructure and fix the weak or damaged sections in short time thus eliminating or reducing expensive cost of repairs.

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3.6 Transference and good governance
Application of smart technologies in the administration and management of cities improves transferency in the way city projects are planned, evaluated and costed. Online information on city revenues, taxes, budget, procurement processes, performance dashboards and geospatial information services enables quantification and verification of any project that city management lays claim to. These in the end reduces incidences of sharp practices in public service

4   CONCEPT OF NIGERIA SMART CITY INITIATIVE
The Nigeria Smart City Summit which gave birth to The Nigeria Smart City Initiative acronym NSCI was held in Abuja, Nigeria on 8th August, 2017 under the auspices of the Federal Ministry of Communication in collaboration with AFRITEX Initiative. The weeklong summit dwelled on how to initiate sound and practical strategies for transformation of Nigerian cities from their traditional form and functions into modernised, efficient, responsive cities capable of satisfying the aspirations of the citizens now and in any foreseeable future.
Like the case of many developing countries NSCI plans to heavily rely on application of ICT and smart technologies in the administration, development and management of Nigerian cities with the view to achieve better connectivity in transport sector, secured environment, decent affordable housing, efficient sanitary and waste disposal system, urban regeneration and upgrade in the cities. The Initiative intends to cover more than 50 percent of all Nigerian cities.1 (National Information Technology Development Agency, NITDA). This may seem overambitious for a country bedevilled with various human capacity, capital and infrastructural sectors challenges to transform above 380 mostly traditional and largely malfunctioning urban centres within the very short time span as was envisaged by the NCSI.
DRIVERS OF NCSI
The drivers of the initiative are however confident the objectives are achievable. The Federal Government of Nigeria (FGN) is committed to provision of the required infrastructures and application of smart concepts to transform its urban areas into functional, safe, serene and responsive cities capable of satisfying the demand of the city dwellers at sustainable levels. This reliance on ICT for national physical development planning is also meant to leapfrog the country to a position of technology hub in African sub region.
There are many programs and policy guidelines put in by the government that provide added impetus to for the eventual successful implementation of the NSCI. The Initiative itself is comprehensive and inclusive; Ministries, Departments and Agencies of FGN, States and Local Government Areas, private sector participants, professional associations and NGOs keyed in into the project. Prior to the debut of NSCI there exist array of interventions that rely on ICT and smart technologies in for improved governance, economic and physical development plans and management of resource in the country. These interventions, many of which are replicated in the secondary and tertiary levels of government, reinforce and provide the enabling environment for realization of the objectives of NSCI, among them are
- e - governance it is mandatory for all MDAs in the country to embrace e-governance in the conduct of their statutory functions. There is common network and information platform the Galaxy Backbone. The government e-learning platform for public servants Public Service Learning Management System (PSLMS) aims to build smart public servants for the country. The Government Integrated Financial Management Information System, (GIFMIS) Treasury

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Single Accounts, Integrated Payroll and Personnel Information System (IPPIS) e-payment system and the drive towards cashless economy in the financial sector of the country means that most of the business of government are now conducted online and this enhances the economic capacity and growth potentialities of the cities and the urban centres

- The Nigeria ICT Roadmap 2017 -2020 A compendium aimed at transforming the Nigerian economic, social, political and interactive environment to be fully ICT compliant and information driven by the year 2020

- National Board for Technology Incubation (NBTI) and Technology Hubs is a government based support program meant to aid entrepreneurs particularly start ups to develop new technology firms in Nigeria. Ten Technology Incubation Centres are spread over the country. There are more than 50 registered technology hubs training and developing capacity of millions of young Nigerian entrepreneurs in ICT and computer applications, programming, analytics etc

- Nigerian Digital Literacy Council created for the development of guidelines and standards for the actualization of improving the digital literacy of Nigerians so that they can continue to be active players in the global information driven environment

- National Information Technology Agency (NITDA) the agency is charged with the responsibility for enforcement of compliance with Public Information Access (PIA) protocol. The PIA oversees the way and manner in which internet service is provided in public places or in areas where the public have unrestricted access. The government plans to provide free internet service in many public areas in the country.

- Other institutional support include robust training institutions such as the Africa Regional Institute for Geospatial Information Science and Technology AFRIGIST, National Space Research and Development Agency (NSRDA), Federal School of Surveying FSS and hundreds of polytechnics and universities offering courses of training that develops the capacity and manpower need for the realization of Nigeria Smart Cities Initiative

- The Nigerian government continue to sustain funding and investment in GNSS infrastructures such as CORS and earth observation satellites. There is a network of many active CORS strategically located across the country and which continue to stream data to providers and users of spatial information in the country. Data from the 2.5 meter resolution EOS Nigeria Sat – 2   is sufficient for supervision and monitoring of many physical development sectors.

- Private participation in provision of enabling environment for NCS is appreciable. In 2013 Google Maps introduced turn – by- turn navigation for subscribers of Google Map for Mobile. Real traffic updates was introduced in 2015 to aid commuters navigate busy traffic conditions and in July 2017 Google Map debut Street View in Nigeria for over 10,000 kilometres of road networks particularly in Lagos. The project is being extended to many urban centres in the country.

5.   THE GEOSPATIAL PERSPECTIVES OF NSCI

NCS must be predicated on integration of people, process and technology to take the cities out of their state of dysfunction. These presupposes a sound ICT and smart technologies and their application on management of Nigerian cities, smart educated and responsive citizens and sound geospatial information framework that serves as the life wire and engine room of the

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administration and management of the city. In this then comes the role Nigerian Surveys shall play as principal partners in the emergence and running of the NCS projects.

5.1. Delimitation of city and its levels of administrative boundaries

For a city to be smart it must be not only legally, politically and administratively defined but it must be spatially delimited and clearly defined in such physical expression that no one is in doubt as to where the city begins and ends. It is impossible to administer and manage an entity whose size and extent is not clearly ambiguous as is the case of many Nigerian traditional cities and States. For effective administration and enforcement, for revenue generation and collection purposes, and the purposes of general plan of the city the extent, shape, size and neighbourhood of the city and its wards must be spatially defined.

5.2. Provision of the base maps

For the realization of the dream of Nigerian cities to be smart, the national base maps must be updated to such a state that they can provide useful and reliable information for effective and timely decision making. Many Nigerian cities and States do not have updated and functional base maps. The national topographical map series which many city administrators and other users rely for information were produced in the 1960s, the city maps and township sheets do not fare any better. They are aged, outdated and mutilated and have little or no utility value outside historical reference. The Nigerian Constitution reserves the right for generation of coordinates and trigonometrical, cadastral and topographic surveys to Surveyors.

5.3. Positioning and Monitoring of Smart Sensors and their Masts

Data capturing and streaming sensors and hardware are integral part of the city landscape. For effective administration of the city such sensors shall be spatially distributed in such a number and location that they cover the whole city in their network. The sensors and their masts shall be constantly maintain the sensors and their mast against horizontal or vertical displacements that may hamper their ability to capture and stream data in the areas they are placed.

5.4. Real Time Mapping

Effectiveness in the functions of smart city cannot go beyond the accuracy and currency of its digital maps and the timely deployment of location information to citizens and the urban managers. Effective decision making in city administration and routine activities in the city such as smart urban commuting and navigation, monitoring and surveillance of flashpoints in combating crime, reports and updates; and rapid responses to emergency situations are mostly anchored on streaming of real time, current and accurate spatial information. For implementation of NSC the city maps must be transformed into digital format constantly updated and stream online for various users of the maps and urban managers.

5.5. Mapping and Management of Infrastructure

For effective management of the city and its services it is necessary that the city infrastructure must be accurately mapped and located both absolutely and its spatial relationships with other complementary structures depicted. This calls for effective planning of smart cities to ensure that citizens easily access required services in short spatial and temporal distance particularly in times of emergencies. Predictive analysis and modelling is indispensible for planning, construction, monitoring and management of city infrastructures.

5.6. Geospatial Information User Education

City managers, administrators and citizens need to be educated on the services available from geospatial information and how to access such services. Knowledge of ICT and computer literacy do not translate into capability to access and manipulate information on maps for the

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purposes of decision making processes. Many computer literate populace do not the utility value of digital maps for say physical planning purposes, revenue generation, valuation, navigation, route analysis, location sharing, smart parking and other options like Google map search. Nigerian Geomatics and Geospatial experts must carry public awareness campaigns for key policy makers and other stakeholders for derivation of full benefits of digital maps as afforded by smart cities.

5.7. Geospatial Information is the key factor in any decisions making

Accurate spatial information is the critical factor in any policy and decision making whether on individual, collective or governance basis. The science of where is the beginning of good planning. Sound developmental, political, economic, social and environmental policies for any city or region can only stand when the physical components of the region are clearly defined and understood.

6. RECOMMENDATIONS

6.1 Cities are the biggest consumers of resources and smart cities require massive budgetary provisions and investment in infrastructures particularly digital maps, roads, health, education, ICT, electricity and internet service. Government need to continuously sustain the level of investment of infrastructure to achieve the desire

6.2. Smart city is about people, processes and technology. The Government at all levels and other development partners need to engage more in human capacity development if the economic and social benefit of the smart cities would be realised

6.3. The many agencies involve in the development, deployment, management and regulation of smart technologies and ICT in Nigeria need to be streamlined and centralised to eliminate duplication, conflicts and waste of resources

6.4. The need to involve more Private Partnership Participation in the provision of physical and social infrastructure cannot be overemphasized. Government should provide the enabling environmnent for PPP in provision of roads and metro rail lines transportation, in urban water schemes etc

6.5. Surveyors need to be trained to build their capacity to cope up with the challenges and demand of the emergent smart cities. The Mandatory Professional Development Courses should be more rigorous, purpose built and tailored to face the current challenges.

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