International Journal of Innovation and Research in Educational Sciences
Volume 4, Issue 4, ISSN (Online): 2349–5219

The use of Geospatial Technology for Managing Elections in Nigeria: Issues and Challenges

Omoleke Muslim Esq[1*] and Maduekwe, Nnamdi Ifeanyi[2]
[1]Independent National Electoral Commission (INEC) Abuja, Nigeria.
[2]National Population Commission (NpopC) Osogbo, Osun State, Nigeria.
*Corresponding author email id: omolekeolujide@yahoo.com

Date of publication (dd/mm/yyyy): 19/08/2017

Abstract **– This paper examined the role of geospatial technologies in the management of elections in Nigeria with a view to identifying these technologies and evaluates the extent of using them in electoral process in the country. The research work, relies on secondary data. Literature by experts in the field of geospatial technology was consulted while journals and internet search formed the bulk of the reference made. It was revealed that though Geospatial technology is useful in various human endeavor, the use of the technologies in Nigeria context is limited. The paper concluded that efforts should be made to harness these technologies such as GIS, GPS and Remote Sensing and deploy such in the conduct of elections for more effective and efficient delivery of service. The interacting challenges militating against the use of the technologies need to be addressed.**

Keywords **– Election, Geospatial Technology, Election Management, Nigeria.**

I. Introduction

According to [1], it is a common knowledge that the elections conducted in Nigeria from 1960-2007 faced various challenges ranging from ballot stuffing, manipulation of result sheets, illegal creation of polling units and a host of others. Electoral bodies in Nigeria had deployed technology in the management of electoral processes. The areas where technology can improve electoral process include but not restricted to the following: delimitation of constituencies, voter registration, voting which include accreditation, balloting, sorting, counting and transmission of results.

II. Electoral Profile and Elections Management in Nigeria

In terms of population, Nigeria is the largest democracy in Africa and the third in the world after The United States of America and India with about 70 million registered voters. Table I show that the country has about 9000 Registration Area (RAs) or electoral wards and 120,000 polling units (PUs). Some PUs have several voting points designed to decongest polling units with over 750 voters. Estimated population of the country is >180 million, voting age (18 years+) population 99 million and verified registered voters is > 68.8 million [2], [3], [4]. This translates to mean values of 20,000 persons/electoral ward, 7648 registered voters/electoral ward and 458 voters/polling units. Apart from the RAs and PUs, the country's electoral administration hierarchy also includes 774 Local Government Areas (LGAs), 360 Federal Constituencies, 91 Senatorial zones and 36 +1 states. There are also sub national electoral structures like State Constituencies and Councillorship Units located at the States and LGAs respectively.

Currently, the country's elections management institution is the Independent National Electoral Commission (INEC). INEC's role is complemented at the state level by the State Independent Electoral Commissions (SIEC). However, the management of elections in Nigeria dates back to the Colonial times. Up to 1992, most of the elections conducted were carried out using the traditional approach. The registration of voters was manual which led to challenges with Voters Registers, while the conduct of elections was by traditional ballot paper. With the advent of Dr. Abel Guobadia, digitalization of Voters Registers was introduced. Improvement in the digitalization took place under the leadership of Professor Maurice Iwu. Under Professor Attahiru Jega, more technological innovations were introduced to the electoral system. An example is introduction of a smart card reader device to enhance the integrity of the voting process.

Apart from the computerization or digitalization of voting components and processes other technologies can be employed to enhance the entire election management chain. For example geospatial technologies (GSTs) can be used for effective election management. GSTs can provide a basis for a scientific delimitation of electoral wards, constituencies, location of polling stations as well as assist in sorting out issues that are related to the conduct of elections [5]. Incidentally, the last time the country witnessed delimitation of constituencies was in 1996. This underlines the necessity of another delimitation exercise. Similarly, the creation of additional polling units is long overdue in Nigeria, as most of the polling units are over congested, especially in urban areas.

The Independent National Electoral Commission (INEC) attempted to use Geographical Information Systems to commence delineation of constituencies and spatial distribution of polling units. This however was hampered by numerous challenges such as limited funding, inadequate technical experts and so on (Table I). This emphasizes the need to appraise the prospects as well as the underlying issues and challenges confronting the application of GSTs to elections management in the country.

As a result of the above, the objectives of this paper include:

(a) To identify various Geospatial technologies that can be used to manage elections in Nigeria.
(b) Examine the role of these technologies in the management of elections in Nigeria.
(c) Identify the issues and challenges that could militate

against the application of these technologies.

III. METHODS

The paper applied an electoral systems specific GST search criteria to web based and hard literature sources to collect information on the application of GST to election. The search criteria relate to each of the three objectives of the paper. The procedure yielded information for the characterization of GSTs, description of their application to election management in Nigeria including a situation analysis showing the current status, prospect and challenges of the application.

Table I. Key Electoral Statistics for Nigeria

Electoral Hierarchy	Value	Electoral Demographics	Value
National	1	National Population (2016 Estimate):	180,000,000
States	37	Estimated Voting Age (18 years +) Population: ***	99,000,000
Senatorial Zones	91	Verified Number of Registered Voters: ****	68,833,000
Federal Constituencies	360	Mean Population/ Ward:	20,000
LGAs	774	Mean Estimated Population/Ward:	11,000
		Mean Registered Voters/ Ward:	7,648
Registration Areas/Wards *	9,000	Mean Polling Units/Electoral Ward:	17
Polling Units**	150,000	Mean Registered Voters/Polling Unit:	458

*[2] **[3] ***55% of National Population **** [4]

IV. GSTS: CHARACTERISTICS AND APPLICATION TO ELECTION MANAGEMENT

Geospatial Technology (GST) has been applied in several sectors of the economy such as transportation, construction, banking and finance, natural resources management, elections, weather forecast, research, monitoring and evaluation, social networking, tourism, shopping and a host of others. Given the characteristics of the electoral operations, it is obvious that geospatial technology can play an important role in the management of elections. Specifically, the technology can provide location-specific information for the management of electoral processes.

Geospatial technologies comprise three main systems namely: Geographic Information System (GIS), Global Positioning and Navigation System (GPNS) and Remote Sensing (RS) (Fig. I). GST can ensure optimal location of polling stations and clear demarcation of catchment areas, and rationalized route planning for conduct of polls. GST enhances the chances of having a real time view of election results.

GIS can be described as a general purpose computer based information system for handling geographical data in digital form in order to capture, store, manipulate, analyze and display diverse set of spatial or geo-referenced data [6]. GIS as a type of geospatial technology (Fig. I) are multi component computer based information systems comprising hardware, software, System-ware and People-ware for the collection, collation, storage, analysis, and display of spatial or spatially relevant information. GIS includes single user interfaces and organizationally integrated enterprise systems. GIS include spatial data bases of digital maps which store information on various phenomenon and their locations. GIS is one of the most efficient tools for development of any kind of decision support system. Apart from being user-friendly, providing visual access and display, it also features data collection, processing, archiving, analysis and presentation capabilities.

GIS have been identified as one of the 21st century tools for communication, information processing and research enhancing abilities in investigating, evaluating, integrating, creating and analyzing issues and information at various locations.

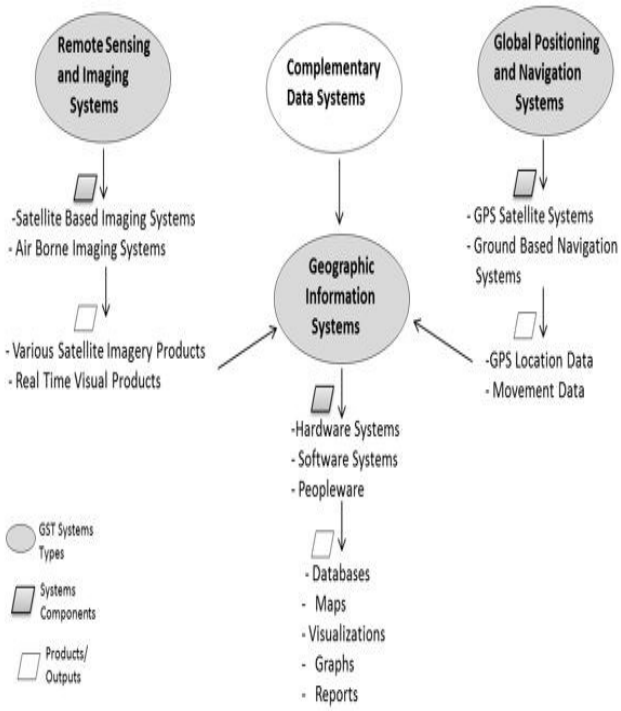

Fig. I. System Types, Components, Linkages and Products of Geospatial Technologies

Global Positioning and Navigation System (GPNS) is a composite system comprising the Global Navigation Satellite System (GNSS) and the complementary Ground Based Navigation System (GBNS) used in navigation and the determination of positions of objects. The Global Positioning System (GPS) is the best known satellite based system for determining the

Remote Sensing (RS) systems are mostly satellite based devices for the continuous collection of data on earth surface features and activities. The best known products of RS systems are imagery of different types and resolution. Data collected through GPNS, RS and other sources can be held, integrated and managed in databases included within a GIS.

V. Imperatives of Geospatial Technology in the Nigerian Election Management System (EMS)

Some electoral, geospatial and administrative realities predispose Nigeria to a strong need of geospatial technologies for management of elections. These include:

i) Strong and persistent challenges on the integrity of the country's electoral process underlining the need to foster credible and acceptable elections in the country [7].
ii) A large landmass (over 920, 000Km^2), with various types of geo-ecological terrain posing various challenges to elections and election administration in the country.
iii) A three tier Federal Structure comprising a Federal Administration, 36 states and federal capital territory and 774 Local Government Areas necessitating a multi-tier (geographical and organizational) electoral administrative structure in the country.
iv) Over 120,000 polling units and 9000 electoral wards geographically distributed over the country. This indicates the need for accurate and verifiable geo-location of each center and optimal ward delineation and boundary demarcation.

GST has robust capabilities to provide data and systems management functionalities to meet these challenges and enhance the quality of the electoral process as well as the credibility of elections in the country.

VI. Situation Analysis of the Application of GSTs to Election Management in Nigeria

Given the diversity of GST functionality and applicability and the situation in other developing countries, the current level of application of the technology for elections management in Nigeria is limited (Table I). However, there is definite evidence of some application of GST to election management in the country. For example, in a bid to obtain accurate data on the existence and location of all polling centers in the country INEC implemented a project to spatially locate and map (through GPS) all polling centers in the country. The project involved the collection of GPS based location data on all polling centers. Similarly and according to [8], it also involved the development of a Polling Unit (PU) geo-database and GIS for the country's electoral system incorporating spatial queries/ search/ selection as well as display and mapping functionalities.

There is also evidence that INEC awarded a contract for the mapping of all electoral constituencies and wards to accurately locate, delineate and map all electoral wards in the country [9]. Currently, INEC in partnership with the National Population Commission is implementing a High Resolution Satellite image based mapping of electoral wards. This is part of a GST based delineation of census enumeration units applying high resolution image datasets, and GPS and GIS. The project will achieve an integrated multi-level spatial database and GIS. The GIS will encompass various functionalities enhancing the capacity of GST and EMS in the country, including the capacity to display ward level population and electoral data and maps [10].

VII. Issues and Challenges Arising from the use of GSTs

It has already been noted that the level of application of GST to Nigerian EMS is below the potentials of the technology to positively impact on the country's electoral process [11]. This situation arises from a number of issues/challenges confronting the application of GST to elections in Nigeria (Table II). Some of these challenges are fundamental and linked to the lack of understanding and mistrust of sophisticated technologies [12]. Others are linked to the lack of technological capacity. Nigeria, like many African countries, is a technological laggard with undeveloped capability to take advantage of sophisticated technologies like GST. The country through its space program has made forays into high tech areas like satellite technology and the attendant ICT infrastructure which are major GST platforms. However, this effort is still very nascent. Thus, the impact of the Nigerian Satellite (Nigeria-Sat) program on the country's social, economic and political processes is very limited. Lack of sustainable internal technology capacity for robust GST deployment for elections is reflected in limited manpower for software and hardware development and maintenance. This results in the outsourcing of election GST development programs with implications on the cost, manpower development and sustainability.

Table II: Situation Analysis of the Application of Geospatial Technology in the Nigerian Electoral Management System

GST Type	Product/ Functionalities	Status	Prospects	Challenges
Remote Sensing	Satellite Imagery Based Wards Demarcation	Some evidence of Application-in collaboration with other Government Agencies	High potential for application of High Resolution imagery to ward area demarcation and mapping.	-High Cost of Image Datasets -Possible challenges with inadequate personnel -Challenges with implementation of relevant regulation
	Real time/Near Real time satellite Monitoring of electoral Activities	No evidence of application	High prospect of use in election situations monitoring	-Subject to space Limitations in the country's space technology
GPNS	GPS based mapping of Polling Centers	Applied in Mapping of Polling Units in 2007	Can be used to update data on inventory and location of PUs	-Cost Challenges -Terrain Challenges
	Tracking of election materials	No evidence of application	Prospects of being used for tracking and monitoring of electoral materials	-Cost of installing monitoring systems -Infrastructural and communications network limitations

GST Type	Product/ Functionalities	Status	Prospects	Challenges
GIS	Election Decision Support/Management	Some evidence of application	More robust/regular application	-Financial challenge -Weak National ICT Infrastructure to Support Integrated Multi-Level Decision Support Platform
	Spatial Database Development	Some evidence of Previous Application in 2007	Opportunities for more Robust and up to Date Electoral Data base Development	- Cost of Spatial data Collection, Processing and Data base Maintenance
	Mapping	No Published evidence	High Opportunities for Application in Electoral Ward Mapping and updating	- Cost of Map Production

The situation is not helped by the high cost and financial implications of the deployment of the GST technologies. GPS and Satellite technology and products are high cost products. The result is a high cost outlay for effective development or acquisition and deployment especially given the large landmass and diverse terrain of a country like Nigeria. The situation is worsened by the current recession in the country, the depreciation of the local currency and dwindling financial allocation for election management. The situation is further complicated by a weak power and communications infrastructure in the country. GSTs especially their applications to distributed operations like elections are strongly dependent on a robust and functional power and telecommunication infrastructure. Nigeria's power supply situation remains epileptic. The penetration of the country's communications network has improved substantially since the introduction of the GSM platform. However, many areas remain uncovered by GSM and the services are often weak and epileptic in areas that are covered by networks.

Apart from this infrastructural and manpower weaknesses some regulatory and operational challenges impinge on the use of GST in the Nigerian EMS. One is weaknesses in the application of regulations for the delimitation of constituency [13]. Though INEC has a constitutional mandate to carry out periodic reviews of constituencies this has not been implemented faithfully limiting opportunities for the application and updating of GSTs in the electoral system.

VIII. Findings

The paper revealed that;

1. Nigerian Elections Management System (EMS) has high potentials for the application of various types of GSTs.
2. GSTs have not been extensively used in the conduct of elections in Nigeria.
3. GSTs are capital intensive. There is a need for a strong political will to mobilize adequate financial resources for GST implementation in the EMS.
4. Similarly, weak ICT and power infrastructures pose serious constraints to the application of GSTs in the EMS.

IX. Recommendations

1. All arms of the government, particularly the Legislative Arm, should be prepared to make relevant laws to facilitate the application of GSTs in the delin--eation of constituencies.
2. Robust Power and ICT infrastructure development is needed to ensure effective deployment of the technologies.
3. Strategies for developing relevant technical manpower need to be implemented by INEC for effective GST adoption and use in the elections management system.

X. Conclusion

The paper concludes that geospatial technologies can enhance the conduct of elections in Nigeria. However the current level of application GSTs is inadequate. This is due to a number of challenges and limitations. Thus there is a need for policies and strategies to ensure the adoption and deployment of various GSTs in the country's EMS.

References

[1] Okonjo, I.M. (1974): British Administration in Nigeria, 1900-1950: A Nigerian view. New York. NOK Publisher.
[2] INEC (2015): Information Kit for the 2015 Elections, Abuja: INEC.
[3] Daniel Soni (2014): 2015: INEC creates more 30,027 polling units the Vanguard, August 20, 2014 http://www.vanguardngr.com/2014/08/2015-inec-creates-30027-polling-units/
[4] Nwafor, Chidi (2015): Publication of the Register of Voters for the 2015 General Elections, Abuja; INEC.
[5] Oledzki, J.R. (2004). Geoinformatrics: An Integrated spatial tool, Miscellanea Geographica Warszawa, pp. 323-331 (http://www.wgsr.uw.edu.pl/pub/uploads/mcg04/35oledzki.pdf)
[6] Longley, et al (2004): Geographic Information System and Sciences, 2nd ED., Wiley, Chichester.
[7] Nwanegbo, Jaja C. (2015): Electoral process and Micro Level Rigging in 2915 General Elections in Anambra West and Awka North Local Government Area of Anambra State, Paper submitted to the Two – Day National Conference on – The 2015 General Elections in Nigeria: The Real Issues, June 17 – 18, 2015 by the Electoral Institute (TEI), of the Independent National Electoral Commission (INEC).
[8] ESRI (2007): Nigerian Voting System Modernized Accessed from www.esri.com/news/arcnews/summer07articles/nigerian-voting.html 15/06/16.
[9] Point Blank (2013): Delineation Exercise: INEC Awards Contract for Map of Registration Areas, from www.pointblanknews.com/.../delimitation -exercise-inec-awards-contract-for-map-of-registr Accessed on 18/06/17
[10] National Population Commission (2016): Draft EAD Manual for the 2017 National Population and Housing Census, Abuja: National Population Commission.
[11] Udoh Joseph C. (2014) Electoral Mapping and Mass Media: Can Nigeria Learn from USA?. Journal of Educational and Social Research MCSER Publishing, Rome-Italy, Vol. 4 No. 1.
[12] K linkenberg (2008): Geospatial Technologies and the Geogra--phies of hope and fear, Annals of the Association of American Geographers, Volume 97, 2007 – Issue 2.INEC Bulletin, August 2014.

[13] EU Elections Observation Mission (2015): Final Report Federal Republic of Nigeria, General Elections.
[14] 28 March 2015, -11 April 2015.

AUTHORS' PROFILES

Dr (Barr) Omoleke Muslim was born in Ikire, Irewole Local Government Area of Osun State, Nigeria. He attended Ife City College between 1976 and 1980 where he obtained his West African school certificate with division one. He later proceeded to the university of Ife between 1981 and 1985 and came out with B. Sc Education/Economics. He also acquired the following qualifications from the same university: Master of Business Administration (MBA) in 1995, Master of Philosophy (M. Phil) in Management and Accounting in 2001 and a Doctor of Philosophy degree in Technology Management (Ph. D) in 2010. Because of his flair for academics, Dr. Omoleke went back to read Law at the same university and got his LLB in 2002. He also read Master degree in Law (LLM) with Specialization in criminology and Penology. Furthermore, he attended the Nigerian Law School, Abuja and was called to the Nigerian Bar in 2004. Dr. Omoleke works with the Independent National Electoral Commission as a Director of Administration/ Administrative Secretary. He has attended both Local and International Conferences and written many published articles in Local and International Journals.

Dr. Maduekwe, Nnamdi Ifeanyi holds of a PhD in Geography from the Obafemi University (OAU), Ile-Ife, Nigeria. His first degree was obtained in the same field from the University of Nigeria, Nsukka. He also has an MSc in Technology Management and Post graduate Diploma (PGD) in Financial Management. He has another PGD in Geo-information Production and man--agement from the Regional Center for Training in Aerospace Science (RECTAS). Dr. Maduekwe's research interests are in socio-ecological systems structures, dynamics and sustainability. He models interacting social and environmental dynamics. He is also interested in data systems especially geo-informatics and National Statistical Systems. He has researched and published on the Nigerian Civil Registration and Vital Statistics (CRVS). He has been teaching CRVS to university MPH students for seven years. email id: nnam6p@yahoo.com