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# Challenges in using Geographic Information Systems (GIS) to Understand and Control Crime in Nigeria

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***Abstract:*** *Nigeria is experiencing a dull moment due to high level of insecurity that ravage the country. Criminal activities are believed to constitute a significant proportion to this increased insecurity situation. While, advanced strategies in GIS such as crime analyses are available and can have great potential for impacting a department's efficiency in crime reduction and professionalism, today relevant officials in most crime departments in Nigeria may or may not have the necessary skills to engage in computerized crime mapping. In this paper, the aim is to explore how the technology of GIS is being used in crime control research, identify the challenges of this technology in relation to crime control in Nigeria and finally design strategic measures to overcome obstacles.*

***Keywords:*** *GIS; Crime Analysis; Crime Mapping; Security.*

## I. Introduction

**Background**

The level of insecurity in Nigeria is very pathetic, pervasive and vulnerable to the progress of development in the country. A former American secretary of defence, Robert McNamara, clearly stated that security is development and development is security. This means that without security there cannot be any meaningful development. This is absolutely true since security is an all-encompassing phenomenon and of benefit to individual, entities, communities and even nations. In Nigeria, the importance attached to security could be vividly observed as enshrined in the nation's constitution of 1999; section 14 (2) (b)which stated that "The security and welfare of people shall be the primary purpose of government" Therefore, it is the responsibility of government to safeguard the lives, property, and welfare of Nigerians against both internal and external aggression (Leadership, Friday, 01/02/2013).

To be able to tackle security challenges, nations established the armed forces, police, security agenciesand other Para-military forces. However, there has been an increase of insecurity especially in Nigeria with the police and the judiciary been blamed for the increased in crime rate.Many challenges that the police is faced with are; beenunder-equipped to deal with the high incidence of crimes across the country,mobility, non-availability of computers, Internet facilities and uniforms and several factors which makes the typical Nigerian police station one of the most uninspiring places to work(Punch, 01/08/2013 ). The police force can arrest the whole neighbourhood in trying to solve the theft of a car. Annoyingly, the Nigerian police are still far from great advantages of scientific innovation in the world of crime prevention and control (Punchmobile, Wednesday, 17/04/13 and BusinessDay's, Friday 11/01/2013).

There has been an increase in crime rate in Nigeria just like some part of the world which include kidnapping, rape, car snatching, arm robbery, burglary, oil bunkeryetc. Many factors could be responsible for a particular crime and also, some crime may be more prominent at a particular location and time, andevery crime relate to a location such as it's an address, street, ZIP Code, district, region etc.Johnson(200) stated that the traditional and age-old system of intelligence and criminal record maintenance has failed to live up to the equirements of the existing crime scenario since it neither provide accurate, reliable and comprehensive data round the clock nor does it help in trend prediction and decision support which results in lower productivity and ineffective utilization of manpower.

Due to increasing number on crime rates this has raised the need to find new ways to handle information about criminality to better understand its causes, local, regional and national security authorities turned to new decision support tools such as Geographic Information Systems (GIS) and other information technologies to help them in finding better solutions(Ferreira et al. 2012). The stated thatcrime mapping and spatial analysis plays a crucial role in defining new forms of representation and visualization to better understand crime and to respond adequately to the problem of criminality**.**Geographic Information System (GIS) uses geography and computer-generated maps as an interface for integrating and accessing massive amounts of

location-based information which allows the police personnel to plan effectively for emergency response, determine mitigation priorities, analyse historical events, and predict future events Johnson (200).

Despise these advanced strategies in GIS such as crime analyses which have great potential for impacting a department's efficiency, crime reduction, and professionalism, today relevant officials in most crime departments in Nigeria may or may not have the necessary skills to engage in computerized crime mapping (Sever et al., 2008). This makes the systemmore shambolic and in a chaotic state.The goal of this paper is to explore how the recent technology of GIS is being used for crime control research, identify the challenges of this technology in Nigeria and finally design strategic measures to overcome obstacles.

## II. GIS In Crime Control And Research

To discuss this more effectively, the GIS/ crime literature has been divided into five categories as thus:

### 1. Mapping Crime Incidence

Basically, crime incidents can be mapped by identifying hot spots or through cluster detection. Hot spot as described by Anselin (2000) "is a location or small area within an identifiable boundary with a concentration of criminal incidents" This is however limited to our understanding of why crime isconcentrated in a given location. This is because pattern need to be assessed in such a way that to understandwhether it reflects true clusters or outliers. Other methods and techniques include thematic mapping, locationQuotients, mode and fuzzy mode, nearest neighbour, hierarchical clustering, spatial and temporal analysis ofcrime, K-means clustering, local indicators of spatial association, and kernel density smoothing (Wilson, 2011).

**Mapping of relationships between crime incidence and other potentially related variables:**

The ultimate aim of any crime mapping is to understand the pattern and related factors attached to crimes scene,such activities are geospatial phenomena, they must be interpreted and analysed in relation to situational factors. Crime is usually concentrated around crime opportunities and other environmental features that facilitate criminal activity. The purpose of crime analysis is to identify and describe these crime patterns. Thus, environmental criminology is a branch of criminological theory that can guide crime analysis and crime prevention efforts. The goal of environmental criminology is to understand the various aspects of a criminal event in order to identify patterns of behaviours and environmental factors that create opportunities for crime (Philips and Lee 2011).

Considering environmental factors, it is possible to predict the future criminal trends and therefore adopt necessary measures to prevent the occurrence (Shillingford and Groussman, 2013). In this angle, a law enforcement agency can control crime in two ways; reducing and investigating crime. This is quite advantageous because the law enforcement agency has few resources such as patrol cars and man power availability. In this manner, GIS acts as an effective tool which can allow the realisation of this objective.

The mapping of 'hot spots' in relation to factors such as population density, average income can tell whether the hot spots in low income means that the offender may be committing the crime because of poverty, in this case providing employment to the people of effected area may lead to decrease in crime. If the hot spot is located near the abandoned buildings then increase of patrol near these building will decrease the crime in the area. The hot spot identification using GIS helps the law enforcing agencies to effectively use their resources. The analysis also helps them to take prevention action of serial crime such as murder, since the behaviour of the offender is likely to choose its next target in a manner that has correlation with the previous ones. This approach is known as pattern matching and it gives the law enforcing agencies some awareness about the next move and hence the law enforcing has a chance to nab the serial crime offender and hence prevent the offender from committing the next crime. The second way in which the law enforcement agency can control crime is by investigating crime. This can be figure out using previous records.

**Using innovative methods of collecting data**

Data is one of the most important components of GIS. The nations data base in which the whole population data of citizens and foreigners is captured can be made available to police and other security agencies. The use of remotely sensed images such as IKONOS, Quick Bird, and SPOT can provide a strong basis for generating maps. The use of Global Positioning System (GPS) is one of the modern techniques to establish control points to site police station or locate criminal activity in the neighbourhood. However, police records arefundamental instrument of data collection. In the advance nations of the world, police used GIS to trace calls origin from 911 using crime management system. This help them to an established system that geo-code addresses to tackle criminality.

**2. GIS Software Being Used**

**ArcGIS/MapInfo:**
This software is provided by the ESRI, one of the standard industries in providing effective and relevant software toGIusers. It has many extensions that can perform crime analysis in many ways. ArcGIS provides a tool for measuring the mean nearest neighbour distance for point patterns, kernel density, spatial autocorrelation, and identifying hot spots among others.

**Crimestat:**
Crimestat is a spatial statistics program developed to be used in crime mapping and related problems. It can be used for spatial description, spatial autocorrelation, and spatial modelling (such as interpolation, journey-to-crime, time-space analysis). The CrimeStat program was developed by Levine under research grants from the Mapping and Analysis Program (MAPS) of the National Institute of Justice (NIJ), a research agency of the U.S. Department of Justice. The NIJ is the sole distributor of CrimeStat and makes it available for free to analysts, researchers, educators, and students. The program can be access at: http://www.ojp.usdoj.gov/nij/maps or http://www.icpsr.umich.edu/crimestat

**Stac**:
The Spatial and Temporal Analysis of Crime program (STAC) is a DOS-based program developed by the Statistical Analysis Center of the Illinois Criminal Justice Information Authority to help police departments analyse the distribution of crime incidents, and has been enhanced by the contributions of a network of users. Many crime incidents tend to cluster in small concentrations (called "hot spot areas"), and the program was designed to identify these (Levine 2007).

**Hawaii Pointstat:**
This is special software for point pattern analysis and description spatial distribution of phenomena including crime.The program takes as input a list of locations, definedby either latitude and longitudes or projectedX-Y coordinates. Hawaii Pointstat was developed by Levine at the University of Hawaii mainly to analyse the spatial distribution of motor vehicle accidents. However, it can be used to compare different types of distribution such as crime incident locations with motor vehicle accident (Levine 2007).

**Others:**
Include Geoda (for aerial unit analysis of similar and dissimilar clusters), Head bang (for point pattern analysis with a directional component), and Satscan (point pattern analysis with a time component), R-Language (with various packages designed mainly to perform crime analysis) etc.

## 3. Limitations In Using GIS For Crime Research And Control

The following constitute great limitations to the use of GIS for crime research and control.

**Lack of qualified staff:**
Indeed, this is one of the most notable problems and limitation in the use of GIS technology. GIS is relatively new technology within high concentration of experts around US and Europe. This is because GIS hardware and software are usually produced in those nations. In contrast to this, only very few people can use GIS software elsewhereeg in Nigeria. This means that staff with GIS training and skills are in high demand in many areas of the world.

**Data limitation:**
This is one of the biggest problems confronting GIS users not only in developing countries but also inthe developed nations of the world. Getting the required data set in digital format is still a problem. In fact even where it is available, security and confidentiality issues continue to delay this process. This slow down the rate at which crime analysis could be understood.

**Financial implications of hardware and software:**
Hardware and software used for GIS crime data collection, mapping and analysis is very costly. For instance, the cost of ArcGIS licence software may be up to $ 2500 from ESRI. This makes it difficult for many people to learn the software because they cannot afford to buy it. However, there are quite a number of softwares that are used for crime analysis which can be obtain from different web sites for free (e.g. crimestat, R-Language).

**Decision-makers do not understand its application**:

Decision and policy makersare not deeply aware of the GIS potentialities. Many of them do not understand what it does and what it could do, so policy formulations and financial support become an impediment to the development of GIS. Thus, there is the strong need for GIS practitioners to sell out this development to decision makers to remove this barrier.

Lack of skills and training to perform spatial analysis:Spatial analysis is a key process in the use of GIS. Longley et al, (2011) add that "spatial analysis is the Cruz of GIS, the mean of adding value to geographic data and turning data in to useful information" The use of existing software to perform spatial statistics, modelling and description is not well understood by many GIS users.

## 4. Challenges In Using GIS For Crime Control In Nigeria

Nigeria is still lagging behind in the development and utilisation of information technology. Inadequate and poor infrastructural facilities coupled with a poor maintenance culture and low level funding have greatly contributed to this (Yusuf 2004).

**Data Problems:**

Data is the most important components of GIS and is seriously lacking in Nigeria. Even the population census data is not comprehensive and updated. What one can get at the smallest unit is the local government population data. Many houses were not geo-referenced in relation to their location and socio-economic data. The Nigeria Postal Service (NIPOST) is not doing much in providing housing addresses. The Nigerian Federal Survey is not proactive to this development. Imagine, most of the existing copies of the Nigeria 1:50,000 topographic map series, which is the most commonly used map in the country, were produced more than three decades ago (Uluocha 1997). The Nigeria space technology agencies are not doing much to ensure availability and accessibility of remotely sensed data. In spite of the launch of Nigeria-Sat2 and Nigeria-sat-X in 2011, the country is still faced with serious challenges in acquiring geospatial data. On the other hand, the police management information system is inefficient and has not embrace modern crime control techniques in data gathering process.The police in Nigeria do not record the spatial locations of crime scene which would have helped in spatial analysis and in the identification of hot spots and also do not have a biometric data base for criminal. Sometime even ex-convict could join the police since they can't conduct a background check on the intending recruits

**Computer hardware:**

Availability and affordability of computer hardware is not very promising in Nigeria. Although, there is growing interest in the use of computer nowadays, quite a number of staff are still illiterate in the use of computer and even the educated one are indifferent to the use of modern technique(GIS) in crime control since such technologies are not available. Most police department doesn't have computer with which they can install GIS software to learn and control crime in Nigeria.

**GIS software**: In addition to GIS software being very costly, many staff in the relevant authority in crime control department are very unaware of what the software can do. So, GIS operations cannot be used in crime related analysis. This makes it difficult for criminal behaviour to be fully understood.

**Training on how to use the software:** Training in the use of GIS software is not quite novel. This is due to insufficient number of professional couple with poor computer literacy and lack of commitment on the parts of crime agencies. What do you expect about the training on how to use the software?

**Low level of Awareness:** In many parts of the world especially in Nigeria, the level of awareness in regard to the use of GIS technology is relatively low compared to advanced nations. Many officials, politicians, academicians and decision- makers in most government departments are unaware of what GIS does and what it could do. Therefore, this means that there is very low degree of adoption and implementation of the technology throughout the country.

**Others:** This include lack of efficient power supply to run the hardware's, internet connectivity to enable real time information sharing or tracking of crime etc.

## 5. Strategies To Overcome Obstacles In Nigeria

Some suggested strategies to overcome the obstacles discussed above include the following. However, some of these obstacles have no instant and easy solutions. They require a concerted effort, timely and dedicated funding.

**Data:** One way of approaching data problem is to make relevant organisationsvery functional and efficient. The Nigerian Postal Service (NIPOST), National Population Commission, Nigerian Federal Survey and National Space Technology Agencies need to be proactive in providing enormous data for use not only in crime control related issues but also in all the facets of human endeavour. In the UK, the ordinance survey (OS) is the Great Britain's national mapping agency, providing the most accurate and up-to-date geographic data, relied on by government, business and individual. While the Royal Mail, is the UK's postal agency with over 350 years of operational history. Thus, royal mail suppliers the address in the database in the form of PAF (Postal Address File), OS simply attaches a GPS point to the address. Today, Britain has Ordinance Survey's Master Map Address Layer 2 database. This is the Britain's most complete, comprehensive and reliable national dataset of addresses and building and their precise locations. This is classical example of how institutions in Nigeria can work together towards a common goal. The Nigerian mapping agency supposed to be the equivalence UK's OS while NIPOST is the Nigerian equivalence of UK's Royal Mail. The data derived out of this can be used not only for the police but also banks, insurance company, utilities, emergency services and hospitals among others (Ajala 2013).

**Increased level of awareness:**

In Nigeria, GIS professionals (many of them trained outside the country) have not done enoughin selling their applications to decision makers, and even when the awareness is brought to the policy makers, there interest mostly on the financial gain rather than how it will be used to help the public. GIS higher education itself started in 1996 with pioneering efforts of the department of geography; University of Ibadan(Yusuf, 2004). To bridge this gap, placing GIS in a sustainability education is a key to unlocking this barrier.Thus, geospatial thinking can be incorporated in to sustainability curriculum (in primary, secondary and tertiary education) using GIS. The student can explore sustainability issues using GIS through spatial distribution, spatial interactions, spatial relationships, spatial comparisons and temporal relationships (Hwang, 2013). Therefore, professionals with vast experience and skills could be available to indulgecriminal investigations and other socioeconomic development related issues

**The police force:**

The police force constitutes the nerve centre in crime control and prevention. Therefore, they need to develop some Geographic Information Systems (GIS) capacityto deal with crime related behaviour. This cans bedone in three ways:

1. To develop enormous **database** from past and present (police information management system) records of criminal activitiesconcerning, armed robberies (street armed robberies and commercial), homicides, rapes, burglary (homes and commercial), theft etc.
2. To establish GIS departments in all the police divisions of the federation of Nigeria. One way of approaching this is by providing adequate infrastructural facilities to trained staff to be able to use GIS software. This will create an abundant opportunity to use the latest mapping technology and equipment in powerful ways to assist public safety issues in the communities. For example, the remarkable extension of the sophisticated city-wide CCTV (Closed Circuit TV) system within the UK and current shift towards the digital systems based on algorithmic monitoring and linked to sophisticated data bases of recorded crime and criminals. In US, shift towards electronics tagging of offenders and use of cellular radio systems for surveillance (Graham 2013).
3. Dedicated Funding is critical to realisation of this dream. However, although, according to Business Day's analysis of the proposed 2013 budget, the Police Formation and Commands has an allocation of N311 billion ($1.997 billion), a greater of it goes to payment of salaries. Therefore, there is the need for fund foundation in each state of the country to at least set the stage by providing neighbourhood database. A typical example is Lagos State Security Trust Fund (LSSTF) and the integrated neighbourhood-level database for the city of Boston(funded by The Boston Foundation)

**Academicians:**

In the field of crime and GIS, academiciansscan help to increase level of awareness through computer mapping technology related researches. Thus, this can help to move criminal justice policy and research in a direction that places increasing emphasis in understanding crime, control and prevention.

**The private organisations:**

Private organisations as part of their social responsibility can contribute in crime control mechanism to augment the shortfall from the site of government in ensuring adequate security in the country. The efforts of

CLEEN FOUNDATION in partnership with Lagos State Security Trust Fund (LSSTF) by training and donating GIS equipment to some police station divisions in Lagos, is worthy of emulation.

## III. Conclusion

The limitations chronicles in this discourse are not hurdles to be jumped up and does not mean that GIS should not be used in controlling and understanding crime in Nigeria. Rather, focussing on suggested strategies can wipe out serious impediments for many crime prevention and control programs. Hence, criminal agencies need to be proactive to embrace some spatial analyses (Geographic Information Systems) capacityto deal with criminal behaviour and related issues. However, the proper implementation is really far from simple; it requires timely and dedicated funding to make it more robust. The attitude of the police in embracing modern technology in controlling and fighting crime most change; the police need to start employing more graduate into the force to enhance easy training and transition from tradition method of crime control to the modern.

## References


[1]. Ajala, I. (2013, May 20). National address gazeteer of Nigeria- An aid to national development and a100 million missed business opportunities for Nigerian postal agency & office of the surveyor general of Nigeria . Lagos, Nigeria.

[2]. Balogun, O. Y., & Uluocha , N. O. (1998). Fundemental issues in sustainable GIS implementation in Nigeria. In O. Y. Balogun, & N. O. Uluocha, Cartography and challenges of the 21st century in Nigeria. Nigerian Cartographic Association .

[3]. BusinessDay. (2013, January 11). Reforming the police. Nigeria.

[4]. Craglia, M., Haining , R., & Wiles, P. (2000). A Comparative Evaluation of Approaches to Urban Crime Pattern Analysis. Urban studies, 711–729.

[5]. Ferreira, J, João, P and Martins, J.(2012) "GIS for Crime Analysis - Geography for Predictive Models" The Electronic Journal Information Systems Evaluation Volume 15 Issue 1 2012, (pp36 -49), available online at www.ejise.com

[6]. Fotheringham, S. A., & Zhan, B. F. (1996). A Comparison of Three Exploratory Methods for. Geographical analysis, 3.

[7]. Graham, S. (2013, july 12). Surveillant simulation and city: GIS and Urban Panopticism. Newcastle, Upon Tyne, England.

[8]. Hirschfield , A., Brown , P., & Todd, P. (1995). GIS and the analysis of spatially-referenced crime data:Experiences in Merseyside, U.K. International Journal of Geographical Information Systems, 191-210.

[9]. Hwang, S. (2013). Placing GIS in sustainability education. Journal of Geography in Higher Education.

[10]. Leadership. (2013, February 01). Nigeria's security challenges: The way forward. Nigeria.

[11]. Levine, N. (1996). Spatial Statistics and GIS: Software Tools to Quantify Spatial Patterns. Journal of the American Planning Association, 381-391.

[12]. Levine, N. (2006). Crime Mapping and the Crimestat Program. Geographical analysis, 41–56.

[13]. Longley , P. A., Goodchild, M. F., Maguire, D. J., & Rhind, D. W. (2011). Geographical Information Systems and Science. U.S.A: John Wileys and Sons.

[14]. Pattavina , A., Pierce , G., & Saiz, A. (2002). Urban Neighborhood Information Systems: Crime Prevention and Control Applications. Journal of Urban Technology, 37-56.

[15]. Phillips , P., & Ickja, L. (2011). Crime analysis through spatial areal aggregated. Geoinformatica, 49–74.

[16]. Punchmobile. (2013, April 17). Re: Crime and punishment in Nigeria . Nigeria.

[17]. Rogerson, P., & Sun, Y. (2001). Spatial monitoring of geographic patterns: an application to crime analysis. Computers, environment and urban systems, 539-556.

[18]. Sever , B., Garcia , V., & Tsiandi, A. (2008). Municipal police departments' attention to crime analysis: essential or impractical? Police Practice and Research: An, 323-340.

[19]. Uloucha, N. O. (1997). The develpoment and application of Geographical Information Systems (GIS) for property tax administration : Experiences from Nigeria. Computers in Urban planning and Urban Management.

[20]. Wilson, R. E. (2012, April 15). Mapping & analysis for public safety program. U.S.A.

[21]. Yusuf, R. (2013, July 10). GIS Higher education development in Nigeria: The Example of the GIS programme, The University of Ibadan. Ibadan, Oyo, Nigeria.

[22]. http://www.punchng.com/feature/no-computers-no-uniforms-sorry-state-of-nigeria-police/

[23]. Johnson C.P. (2000) Crime Mapping and Analysis Using GIS,Geomatics 2000: Conference on Geomatics in Electronic Governance, January 2000, Pune, Geomatics Group, C-DAC, Pune University Campus, Pune 411007.