

CHALLENGES OF GEOGRAPHIC INFORMATION SYSTEMS (GIS) IN CONTROLLING 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 Geographic Information Systems (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

Introduction

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 defense, 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 agencies and 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; been under-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 neighborhood 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 (Punch mobile, Wednesday, 17/04/15 and Business Days, Friday 11/01/2016).

There has been an increase in crime rate in Nigeria just like some part of the world which includes kidnapping, rape, car snatching, arm robbery, burglary, oil bunker etc. Many factors could be responsible for a particular crime and also, some crime may be more prominent at a particular location and time, and every 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 requirements 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 that crime 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, analyze historical events, and predict future events Johnson (200).

Despite these advanced strategies in GIS such as crime analyses which have great potential for impacting a departments 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 system more 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.

GIS In Crime Control and Research

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

Mapping Crime Incidence

Basically, crime incidents can be mapped by identifying hot spots or through cluster detection. Hot spot as described by Anselin (2014) “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 is concentrated in a given location. This is because pattern need to be assessed in such a way that to understand whether it reflects true clusters or outliers. Other methods and techniques include thematic mapping, location Quotients, mode and fuzzy mode, nearest neighbor, hierarchical clustering, spatial and temporal analysis of crime, 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 analyzed 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 behaviors 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 (Shilling ford and Grouss man, 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 realization 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 neighborhood. However, police records are fundamental 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.

GIS Software Being Used

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

Crime stat:

Crime stat 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 modeling (such as interpolation, journey- to-crime, time-space analysis). The Crime Stat 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 Crime Stat 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>

Spatial and Temporal Analysis of Crime program (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 analyze 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 Point stat:

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, defined by either latitude and longitudes or projected X-Y coordinates. Hawaii Point stat was developed by Levine at the University of Hawaii mainly to analyze 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).

Limitations in Using GIS for Crime Research and Control in Nigeria

The following constitute great limitations to the use of GIS for crime research and control in Nigeria:

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 elsewhere eg in Nigeria. This means that staffs 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 in the 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 license 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 software's that are used for crime analysis which can be obtain from different web sites for free (e.g. crime stat, R-Language).

Decision-makers do not understand its application: Decision and policy makers are 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, modeling and description is not well understood by many GIS users.

Challenges in Using GIS for Crime Control in Nigeria

Nigeria is still lagging behind in the development and utilization 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.

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 organizations very 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 endeavor. 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 Ordnance 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 enough in 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 indulge criminal investigations and other socioeconomic development related issues

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, focusing 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) capacity to 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.

Recommendation

Base on the findings of this research, the following recommendations were made: The police force constitutes the nerve centre in crime control and prevention. Therefore, the need to develop some Geographic Information Systems (GIS) capacity to deal with crime related behaviour is highly recommended, and this can be achieved through:

1. To develop enormous database from past and present (police information management system) records of criminal activities concerning, 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.
3. Government should provide adequate founding in order to realize this dream therefore; there is the need for fund foundation in each state of the country to at least set the stage by providing neighborhood database. A typical example is Lagos State Security Trust Fund (LSSTF).

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