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Spatial Distribution of Crime in Akure, Nigeria: The GIS Perspectives

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Abstract

Criminal behaviour is a fact of life in every community, to some extent it can be checked, restrained and bridled. An up-to-date data is needed on crime for proper management; it is only in a GIS environment this can be done effectively. This study therefore, utilized the GIS technology to access the spatial distribution of crime in selected communities in Akure. The socio economic characteristics of respondents in the study area were also examined through the administration of a structured questionnaire to 250 respondents that constitute 1.1% of the total population in the selected communities due to homogenous characteristics. Data from the questionnaire were transformed, coded and processed with SPSS to establish relationship between the variables and exported to ArcMAP GIS software to create attribute table for the crime data. A Geo-database design consisting of database development, data manipulation and data storage and retrieval was used as a repository for acquired data and information. Empirical analysis shows that over 60% are not employed by government while the average monthly income is less than ₦18,000.00. GIS analysis shows that theft and battery are the major crimes and these are mostly concentrated in areas with poor building conditions. The

paper recommends proper housing and layout designs for urban communities in order to expose criminals and enhance living conditions of the people.

Keywords: Crime, Crime Hotspots, Spatial distribution of crime, Sustainable Living, GIS and Akure.

1. Introduction:

Crime news is on the increase on the Nigeria news headlines. Local, national and international media stations report crime about Nigeria and recently it has extended to blogs. It can be deduced that crime rate in Nigeria needs serious attention by everybody in the community (Olutola, 2011). For urban security and public safety, crime control is not as adequate as crime prevention, much of Nigeria Police Force effort is exercised in responding after crime has taken place, and the police do not have enough resources to intervene in many crime situation, most times they complain about fuel consequently, the crime will eventually be committed (Balogun, Okeke and Chukwukere, 2014). As a result of current security challenges facing the country the Nigeria police force spent over 600 million for the procurement and maintenance of foreign dogs in the last few years (Ikenna, 2016). The hasty increment in police operating budget and expenditure is as a result of rising crime challenges in our communities.

Under reporting of crime incidents is a serious challenge many police departments have been facing (Rick, 2011). Consequently, the police departments are restricted to crime reported and recorded only and crime is widespread than those reported or recorded by the police. Victims and witnesses of a crime may not report the incident to the police for a variety of different reasons. Those affected by a crime may be too scared to come forward and to report it, fearing potential retaliation for their actions. Others may feel that certain crimes, such as vandalism or petty theft, are not of a serious enough to merit being reported to the police (Lockyer, 2013). Others may simply wish not to be associated with a crime, or prefer to avoid going through the hassle of filing a formal police report.

The routine activities theory of Cohen and Felson (1979) adopts the belief that for a crime to occur there must be convergence in space and time of likely offenders, suitable targets and the absence of capable guardians, which is more likely to occur in high density

neighbourhood (Cohen, Lawrence and Marcus, 1979). Incessant criminal activities in a community could undermine property values, lead to displacement, break social and economic ties, loss of lives and victimization (Buck, 1991).

The traditional method of crime detection, monitoring, and management has failed to be fully effective in curbing the present crime scenario (Gupta, 2012). In traditional approach of curbing crime, little effort is given to the exact location and timing of the criminal act. There has been a growing recognition by researchers and policy-makers, that many of the existing traditional responses to crime and victimization are ineffective (Vallée, 2001). It is evident that if crime has to be mitigated traditional method of mitigation should be discouraged. Crime however, can be and have been prepared for, responded to using geo-spatial technology in advanced countries (Shillingford, Groussman, 1999). Official crime reports only capture a fraction of all criminal activities that actually occur and under reporting of crime remains prevalent (Rick, 2011). Consequently, it was noted that criminal statistics are not accurate and therefore official statistical analysis of crime is a problem that must be solved so as to have full understanding about patterns of criminality.

Crime mapping identifies high-crime neighbourhoods, where risk of victimization is relatively high, where residents have great difficulty exerting social controls, it identifies concentrations of crime, determines the causes of these concentrations, and then implement responses to reduce these concentrations. Much of what is called crime analysis is dedicated to locating neighbourhoods with high concentrations of crime and much of crime mapping is devoted to their detection (Buck, 1991), knowing that improved public safety from crimes in the future is a function of what we can learn from the crimes of today.

This research intends to identify concentrations of individual events that may indicate series of related crimes and to observe neighbourhoods and neighbourhood clusters with high crime rate and try to link these to underlying social conditions in the study area. Therefore this paper assesses the spatial patterns of crime in Akure using Geo-spatial technique in order to achieving urban security and safety.

2. Review of Literature:

Urban security and public safety through crime prevention is an ancient concept. Crime prevention has evolved significantly over the last 30 years (Gabor, 2011). However, even in

the more distant past, most people routinely practiced some forms of crime prevention in their daily lives, from avoiding dimly lit streets and tough-looking neighborhood youth to locking the doors of homes and protecting the cash earned at work (Gabor, 2011). Crime Prevention has been described as "any initiative or policy which reduces, avoids or eliminates victimization by crime or violence. It includes governmental and non-governmental initiatives to reduce fear of crime as well as lessen the impact of crime on victims" (Institute for the Prevention of Crime, 2010).

Brantingham and Faust (1976) proposed that crime prevention should be classified in a similar manner to models of disease prevention adopted by the public health field. However, the model was classified into primary, secondary, and tertiary prevention (Brantingham and Faust, 1976).

Primary prevention refers to those measures that improve the physical environment and social conditions in a way that discourage the general population from engaging in crime. Secondary prevention refers to strategies used to identify and intervene in the lives of individuals or groups that are more vulnerable to be involved in crime. Tertiary prevention refers to all those strategies put in place to discourage convicted offenders from returning to their previous form of behaviour (Brantingham and Faust, 1976). However, in Nigeria Efforts to discourage, disable, incapacitate, and reform offenders are especially insignificant.

2.1 The UN Guidelines for urban security and public safety through Crime Prevention

In 2002, the United Nations drafted the following resolution for urban security and public safety in an attempt to achieve safer cities devoid of crime and opined that "There is clear evidence that well-planned crime prevention strategies not only prevent crime and victimization, but also promote community safety and contribute to the sustainable development of countries. Effective, responsible crime prevention enhances the quality of life of all citizens". The guidelines state that, governments should facilitate knowledge-based crime prevention by: providing the information necessary for communities to deal with crime problems; supporting the generation of practically applicable knowledge that is scientifically reliable and valid; disseminating that knowledge to researchers, policy makers, educators, and the wider community; applying this knowledge in replicating successful interventions and developing new initiatives (United Nations, 2002).

2.2 Some Concepts of Crime Prevention:

2.2.1 The Concept of Crime Analysis Process

Crime analysis is an investigative tool, defined as 'the set of systematic, analytical processes that provide timely, pertinent information about crime patterns and crime-trend correlations It uses crime data and police reports to study crime problems, including the characteristics of crime scenes, offenders and victims. Crime patterns are analysed in terms of their socio-demographic, temporal and spatial qualities, and may be represented visually using graphs, tables and maps. Using these findings, crime analysts provide tactical advice to police on criminal investigations, deployment of resources, planning, evaluation and crime prevention. (Richard and Lorraine, 2011).

Crime analysis helps to understand the occurrence of a crime and it is a significant practice to law enforcement. It includes the collection and analysis of data relating to a criminal occurrence, culprit and victim, and develops information of use for crime prevention and detection activities (Chi, Pun-chung and Edward, 2005). Crime analysis is defined as a set of systematic, analytical processes aimed at providing well timed and appropriate information corresponding to crime patterns and trend correlations to help operational and administrative personnel in planning the distribution of resources for averting and subduing of criminal activities, aids to conduct investigative process, and increasing arrest of offenders and the clearance of outstanding investigation (Gottlieb, Arenberg and Singh, 1994). Therefore, the basic goal of crime analysis is to identify and produce the information required for making relevant decisions in distributing an appropriate quantity of resources to mitigate and control crimes. In addition, crime analysis can be used to appraise the effectiveness of crime prevention programmes, develop strategies through research and help determine or define a problem (Canter, 2000). It can also inform policy and decision makers about the existing or anticipated consequences of interventions, polices, or working procedures (Boba, 2001). Therefore, crime analysis aims at identifying patterns and trends of a crime while the former aims at examining the association and identification of criminals with any criminal activity.

2.2.2 Geo-spatial Technologies and Crime Analysis

Geo-spatial technology can be defined as technology relating to the collection or processing of data that is associated with location (Ahmadi, 2003). Geo-spatial technology is of great value mapping, analysing and providing real solution to crime globally. It has become a potent crime prevention and investigation tool for mapping and analysing crime patterns (Shillingford and Groussman, 1999). Geo-spatial technology for urban security and public

safety provides decision makers with spatial consciousness of risks and vulnerabilities corresponding with a crime incident as well as the incident's scale and magnitude. These new knowledge supply decision makers with a superior and more useful opportunity to distribute resources more effectively and efficiently to mitigate further crime incident escalation.

Integration of Geo-spatial technology for urban security and public safety has been adopted in several areas such as: crime analysis and density reporting, strategic maps for tactical operation, proximity alerting for everyone within a particular miles of an incident, predictive crime risk modelling based on historical and real-time data and situational awareness of the event. In developed nations geo-spatial technologies have been successfully integrated for urban security and public safety through: (i) Resource Tracking: It helps law enforcers to track both the location of the vehicle and the individual after leaving the vehicle. Resource tracking is vital for safety of lives and properties; Video Surveillance Integration: The private sector, which owns 80 percent of the infrastructure in the United States, has employed video surveillance systems to monitor, detect and observe key areas to prevent or respond to threats such as encroachment and infringement into sensitive areas. With video surveillance, a person in a central location can monitor different areas without being physically present; Intelligence and Analysis: security agencies in the United States make use of geo-spatial technology to procure more intelligence data and analytical systems at all levels of government. Many public safety agencies use GIS geo-database management systems as their repository for intelligence data. Their main focus is better community protection from crime occurrences through better resource deployment planning.

2.2.3 Crime Analysis Using Geographic Information Systems (GIS)

The earliest application of GIS in crime analysis was conducted by Pauly, Finch and McEwen in 1967 (Weisburd and McEwen, 1998). They used mainframe computers and punch cards to produce black and white shaded Choropleth maps from a line printer outlining the distribution of a type of crime in St. Louis. This pioneering work conducted by St. Louis Police Department was done with the intention of establishing a Resource Allocation Research Unit to improve the efficiency of patrol operations (Harries, 1999). Without doubts, these maps proved to be pragmatic in their use and soon they were observed to possess a great deal of potential for understanding spatial distribution of criminal activities and for assisting the management in better distribution of police resources in high crime areas. Further research was able to mark the boundaries on these maps and since then maps could be

used for crime mapping purpose. Notwithstanding, the system developed in this way was basically an informative crime mapping system that produced maps of crime distribution and yet it was still lacking analytical capability (Chi, Pun-chung and Edward, 2005).

Early GIS efforts were restricted by the limitations of older computer systems lacking memory and speed. Meanwhile, the invention of micro-computers in the late 1970's, faster speed of processing power of micro-computer in the 1980's (Boba, 2001), larger storage and networking capability of micro-computers in the 1990's (Rich, 1999) together with sophisticated mapping software has meant that adopting GIS in crime mapping on desktop computer has created an epoch of the history of crime mapping. It became an affordable analytical device, it also provides user-friendly operations in handling complicated queries, higher compatibility in data exchanging (Weisburd and McEwen, 1998) and better connectivity in sharing of crime information with other agencies (Vann and Garson, 2003). Mapping crime data is a scientific process and without explicit theory in crime analysis, the value of crime assessment can only rely on the expertise of the analyst's personal understanding of relations between crime and space (Eck, 1998). To buttress the fact, Jane Jacobs in her book "the death and life of great America cities" proposed that there exist a relationship between crime and the physical environment (Jacobs,1961). However, criminological theories of crime and places have been developed along with the growth of computer technology and practical experiences have been shared and integrated crime mapping into law enforcement operations. Crime mapping has become a well-established discipline of science in crime prevention.

In 1997, the National Institute of Justice (NIJ) determined to create its Crime Mapping Research Centre (CMRC) in the United States to strengthen the use of analytic mapping in research and practice (Travis, 1998). In 1998, Vice President of the United States of America, Al Gore established a Task Force on Crime Mapping and Data-Driven Management to augment the efforts of the Clinton-Gore Administration to reduce and prevent crime (Rich 1999). Quoted from a book "Mapping out Crime" published by the United States Department of Justice in 1999, Gore appraised the use of crime mapping that "Maps can represent every dimension of a community. They can show how healthy a community's children are, where social services are most needed and most effective, and ways to protect the safety of each citizen. Innovative communities are using maps to mobilise resources to solve their toughest problem." The use Geo-spatial technology in crime mapping once again has been proven to

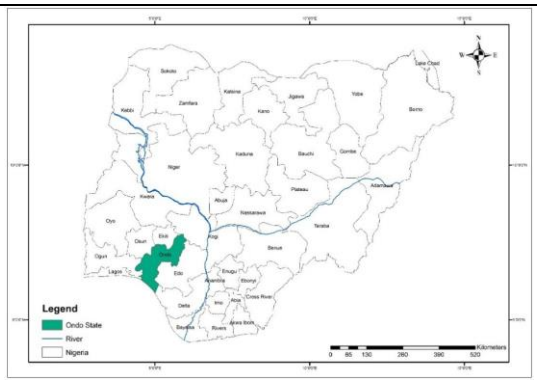
provide the communities with a new approach in targeting crime so as to ensure public safety and urban security.

3. Materials and methods:

3.1 Research Locale:

The study area is Akure metropolis in Akure South Local Government Area of Ondo State, Nigeria. Figure 1 shows the study area in its national, regional and local settings. Akure has a population of 484,798 (NPC, 2006), with most of the inhabitants belonging to the *Yoruba* ethnic extraction. The geographic extent of the study area is within the coordinate 4.363689 to the west, 6.065289 to the East, 7.746367 to the North and 5.798803 to the South. It lies between the latitudes 7 °15'0"N and longitudes 5 °11'42" E (WGS. 1984). Akure is situated within a 48 kilometer radius to major towns in Ondo State, viz: Ondo to the South; Owo to the East; and Iju/ItaOgbolu to the North. The easy access and geographical centrality of Akure to these towns have enhanced the growth prospects of the city.

Akure Local Government Area, where the study area is located, has an area of 331 sq.km and population of 353,211 (NPC, 2006). The study area has witnessed rapid population growth as a result of influx; Okoko (2002) asserted that, this influx was necessitated by the development attracted to the state capital. With the presence of government seat in Akure, job opportunities, provision of community facilities such as roads, water etc. and social facilities such as hospitals, schools, markets etc. precipitated the migration of youths from the surrounding towns and settlements for job opportunities among others, leading to increase in population.



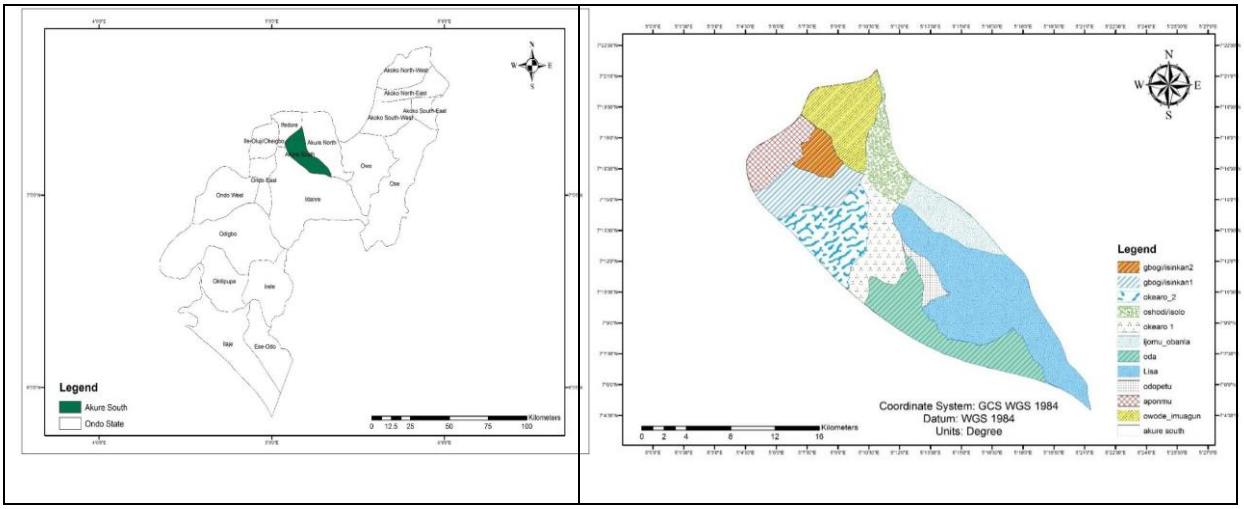


Figure 1: Akure in its National, Regional and Local Settings

Source: Ministry of Surveys, Abuja (Digitized in ArcMap, 2016 by the Authors)

3.2 The database:

This paper examines some relevant socioeconomic characteristics of respondents such as the sex, age, household size, occupation and average income and social crime distribution in two political residential wards in Akure Metropolis. The wards include Oke-Aro and Osodi-Isolo with 12,601 and 10,171 building populations respectively. About 1.1% of the total number of buildings (250 buildings) in the study area was purposively selected as the sample size due to homogenous characteristics. Household heads were randomly interviewed through the instrumentality of a structured questionnaire. The two wards covered almost the geographical centre of the city where crime hotspots are concentrated. The simple random sampling technique was adopted in the administration of questionnaires to respondents.

4. Data Analysis and Discussion of Results:

4.1 Socio-Economic Characteristics of Respondents:

About 14.0% of respondents are within the age bracket of 18-30years; while 27.6%, 40.8% and 17.0% are in the age group of 31-45, 46-59 and above 60 years respectively (Table 1). It is evident that over 80% of respondents are youths and young adults. Literature confirms that youths are much involved in criminal events and adults are more likely to be victims of property crime (Brad and Steven 2005). This shows that the study area is an appropriate choice for this study. Table 1 also shows that about 41.6% of respondents are single, 42.0%

are married while; 3.2% and 13.2% of respondents are divorced and widowed respectively. The high proportion of single and married signifies tendency for more marriages and high rate of proliferation. Marriage may lead to pressure to earn higher incomes including illegal sources if their legitimate options are limited (United States Department of Health and Human Services, 2009). Furthermore, over 50% of respondents are illiterate (Table 1), this high proportion of illiteracy could result in larger family sizes, poverty, poor health and meagre economic life which are all catalysts to crime proliferation.

In addition, an individual's educational status places constraints on his or her choice of housing, place of residence and access to jobs (Brad and Steven, 2005). Therefore, education perpetuates the values of society, acculturates the people to serve their communities, and promotes the virtues of hard work and honesty (Usher, 1997). Hence, Education may affect the decision to engage in criminal activities (Paolo and Daniel, 2006). In the study area 42.8% of the respondents were self-employed; students constituted about 24.8% of the respondents (Table 1). It is therefore evident that the community are predominated with people that are self-employed. This trend increases opportunities of the population earning illegal income (Ehrlich, 1973).

Table 1: Socio-Economic Characteristics of Respondents, *N=250*

Variable	Frequency	Percent
Age		
18–30 years	35	14.0
31–45 years	69	27.6
46–59 years	102	40.8
60 years and above	44	17.6
Marital Status		
Single	104	41.6
Married	105	42.0
Divorced	8	3.2
Widow/widower	33	13.2
Level of Education		
Illiterate	129	51.6
Adult Education	8	3.2

Primary	8	3.2
Secondary	40	16.0
Tertiary	65	26.0
Employment Status		
Student	62	24.8
Unemployed	8	3.2
Self-Employed	107	42.8
Private company Employed	33	13.2
Government-Employed	40	16.0
Length of Stay (in years)		
Less than 5	19	7.6
5-10	42	16.8
11-15	16	6.4
16-20	55	22.0
Above 20 years	118	47.2
Average Monthly Income in Nigerian Naira (₦)		
Above 75,000.00		
60,001.00-75,000.00	17	6.8
45,001.00-60,000.00	45	18.0
18,001.00-45,000.00	50	20.0
Below 18,000.00	35	14.0
	103	41.2

Source: Authors' Fieldwork, 2016

Over 75% of respondents have stayed in the study area for over 10 years. These sets of people would be well equipped with adequate information on crime activities in the selected communities, hence validating the source of data for this study. Analysis of the income of respondents shows that over 40.0% earn below the national minimum wage of N18,000 per month. The community could therefore be adjudged poor. This trend will obviously have a significant impact on the quality of life and tendency to commit crime.

4.2 GIS Analysis:

Geo-Spatial technology was employed to analyze and present the spatial pattern of the most frequent crimes (such as robbery, stealing, shoplifting etc.) in the study area. The coordinates of crime hotspots were acquired using the Global Positioning System (GPS). The coordinates were exported to GIS environment in ARCMAP. The relationship between all the sample points was examined and was used to produce a continuous surface of crime concentration using Kernel Density tool in ARCMAP.

4.2.1 Robbery Points and Crime Hotspots in Oshodi-Isolo:

Figures 5a and 5b show results of GIS analysis of robbery points and crime hotspots in Oshodi-Isolo residential community respectively. From the Figures, it is evident that robbery is predominant in the southern, eastern and western part of Isolo-Oshodi. The affected streets in this community are: Owode, Adeniyan, Oke-Lisa, Ayetoro, Oke-Ijebu and Adejuyigbe. This implies that, the above named streets are more vulnerable to robbery. Paradoxically, streets that are vulnerable to crime exhibit certain characteristics such as poor housing condition, poor environmental sanitation, old and derelict buildings, and poverty among others. Generally, the communities are not planned; the neighbourhoods are accessible from all fronts with poor road system and overcrowded households. These characteristics encourage criminal activities to strive in the study area.

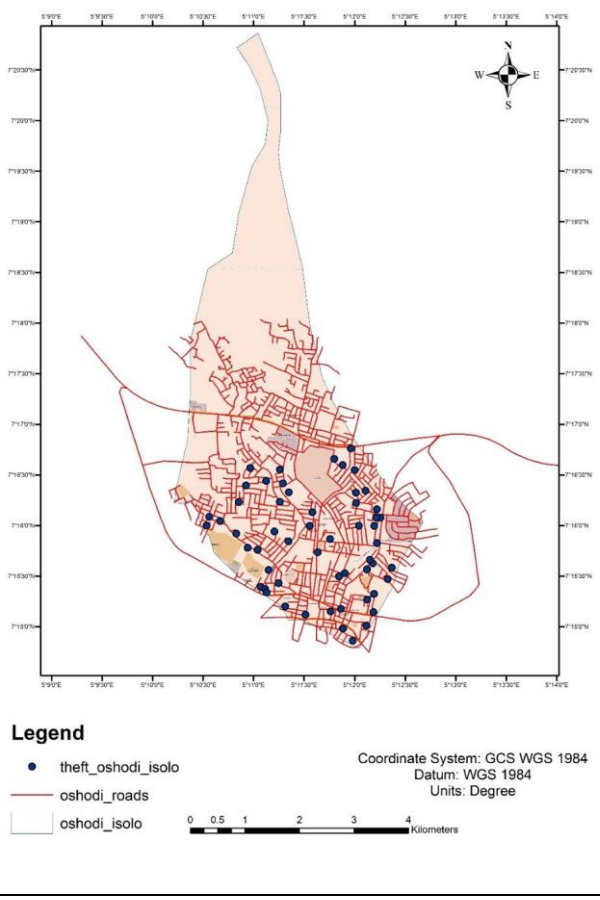


Figure 5a: Robbery points in Oshodi-Isolo

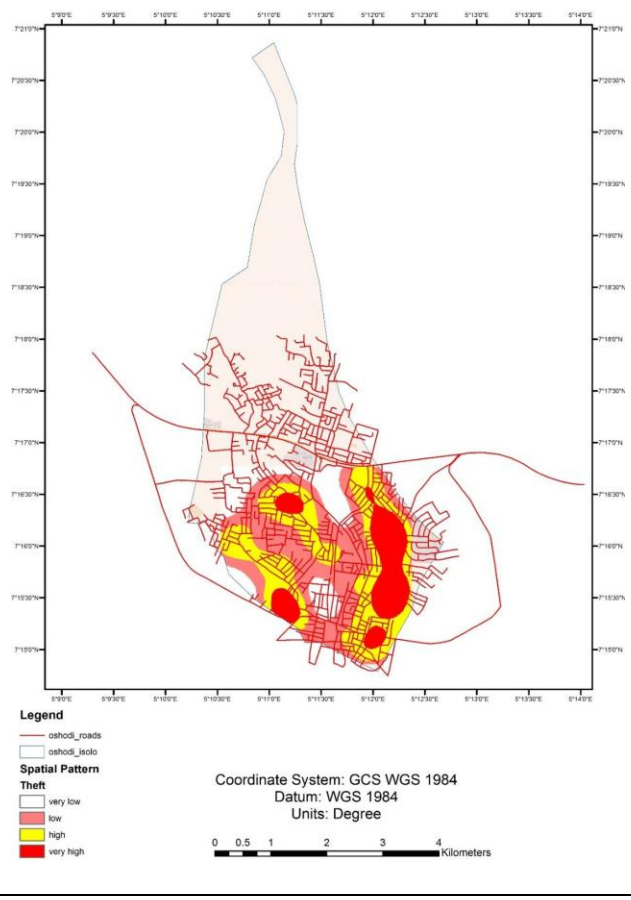


Figure 5b: Robbery Hotspots in Oshodi-Isolo

Source: Authors' Fieldwork, 2016.

4.2.2 Battery Points and Hotspots in Oke-Aro:

Battery is a crime of attacking somebody or something physically and violently causing injuries or damages (Hornby, 2005). In Oke-Aro community, battery points are found at community roundabouts, bars/club houses, motor parks, restaurants, artisans' workshops and lottery shops among others. The hotspots refer to the concentration of these points with their effects spreading over a particular land area, such as streets or group of streets in a neighbourhood. Figures 6a and 6b show the battery points and consequent hotspots in Oke-Aro community. From the figures, it is obvious that battery hotspots are found across the northern part of the community. The crime pattern ranges from very high to high, low and very low as shown in red, pink, yellow and white colours respectively. The crime is very high and high where there is incessant occurrence especially at community centres, while it becomes low and very low as one moves from the core to the periphery. This output is useful

at policing neighbourhoods and strategizing at checkmating crime and criminals in residential communities.

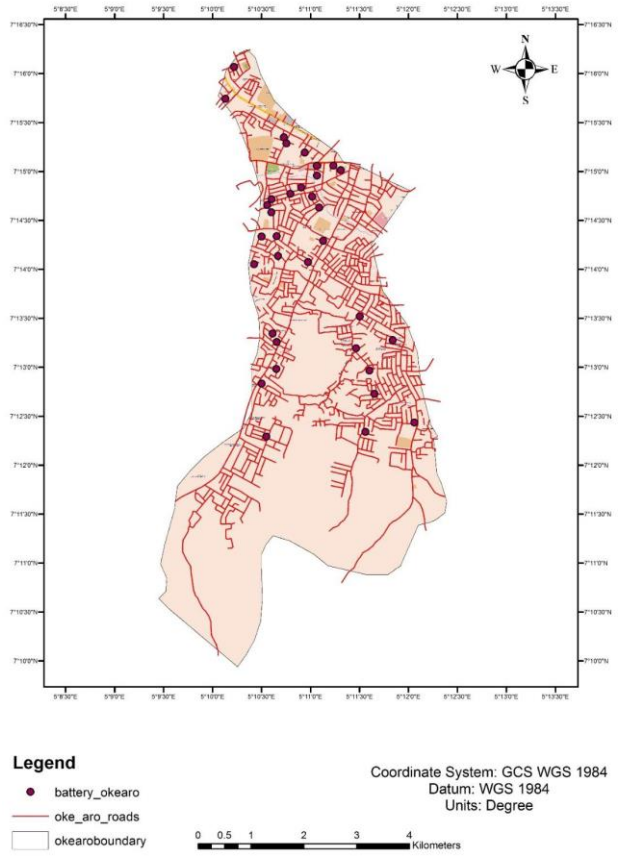


Figure 6a: Battery points in Oke-Aro

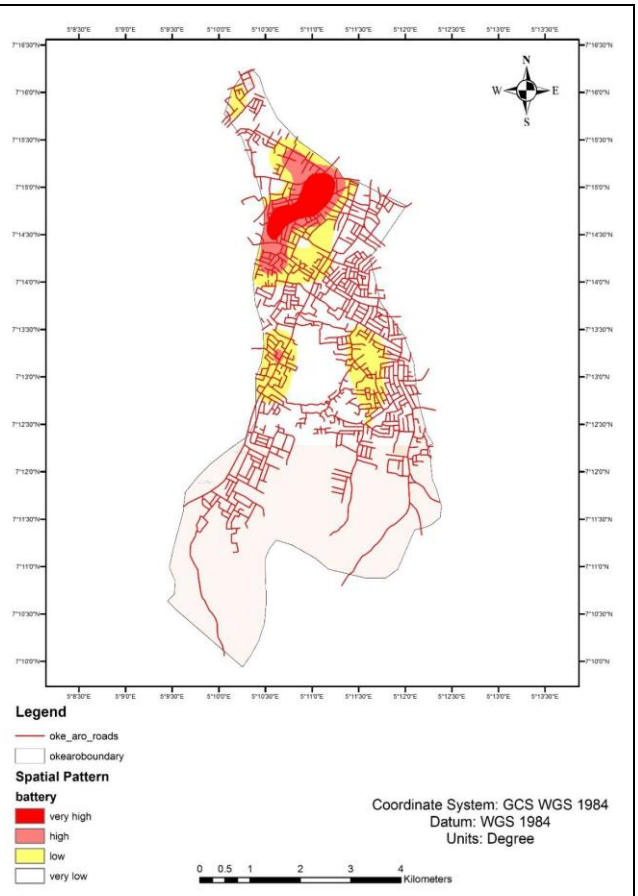


Figure 6b: Battery Hotspots in Oke-Aro

5. Conclusion

Empirical analysis shows that the population in the study area is active, and mostly youths hence are much involved in criminal events while the adults are more likely to be victims of property crime which makes the choice of this study appropriate. Most respondents are married with a high number of households implying more pressure to earn higher incomes including illegal sources if their legitimate options are limited, which could consequently lead to more criminal tendencies among the residents. Generally, the majority of respondents could be adjudged poor and illiterate as a considerable percentage of them earn below the national minimum wage of ₦18, 000 per month with low education level respectively. Residents are therefore practically unable to seek better housing conditions due to poverty and decide towards engaging in criminal activities due to illiteracy. GIS analysis on the

spatial distribution of crime in the selected communities show that crime hotspots are characterized by poor housing condition, poor sanitation and other slum conditions. Based on empirical analysis report, the State government should collaborate with private individuals and organizations to build residents' income capacity through workshops and seminars. The state government urban renewal programme should also be extended to the selected communities to repair poor roads and facelift old and derelict buildings harbouring criminals. The study also canvasses for infrastructure provision such as roads, street lights, drainages and sanitation facilities among others. Finally, the Nigeria government should make GIS related resources available to the Nigeria Police Force (NPF) so as to incorporate geo-spatial technology into crime control and public safety operations and; acquire technical know-how on how to apply geo-spatial technology for developing predictive crime models and resources deployment.

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