

## Spatial Analysis of Factors Responsible for Spread of Crime Activities in Akure, Nigeria, Using GIS Techniques

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### Abstract

This research attempts to bridge the gap between the old and modern fashion of keeping and storing criminal data by investigating the level and spatial analysis of crime occurrence in Akure, Nigeria with a view to promoting security in the city. The responses obtained from the administered copies of the questionnaire were coded and entered into Microsoft Excel 2013 for generating spatial database and exported to Statistical Package for Social Science (SPSS) version 17 for statistical analysis. The crime data were analyzed using spatial analysis technique in ArcGIS 10, Global Mapper 13 and CrimeStat III. Overlays operations were carried out to evolve crime maps. GPS Garmin 76 was employed to obtain co-ordinates of major landmarks in the area, which comprise police stations, banks, markets, liquor stores, and places of worship among others. These were subsequently registered on the base map. The information extracted from the analyzed responses from the questionnaire and crime data were geocoded to the administered points using ArcGIS 10 for better and advanced spatial analysis, and also for hotspot and black spot analysis using Geostatistical Analyst. The study found that the main road network that traverses Akure Metropolis, provides easy access and exit to criminals, and constitutes a dominant axis of crime events as facilities located along the road usually experience armed robbery attack or burglary. Again, crime hotspots are more prevalent in the city core. In view of the efficacy of GIS technique as a tool for detecting crime pattern, occurrence and prediction, the study advocates the development of all inclusive crime database system and training of security agents in the use of information technology to improve intelligence gathering capabilities in a bid to combat crimes in Akure metropolis in particular and Nigeria in general.

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## Introduction

Crime is largely an urban phenomenon, but the specific urban area dimensions of the social processes that are connected with crime have been seriously understated in much recent criminological work (Baldwin & Bottoms, 1976). Urban crime is a composite and multi-dimensional phenomenon which includes behavioural, physiological, managerial, and spatial and other various scopes. Sutherland et al (1992) associate crime with socio-demographic factors, indicating that the rates of crime in any urban neighbourhood are highly influenced by demographic and socio-economic contexts such as income, ethnic composition, youth concentration and level of education and a host of others without any regard for the spatial configuration of the settings of crime (Reith, 1996).

The awareness that crime is not evenly distributed across cities, but often concentrated in certain areas has been the focus of crime study since 1940s, thus given prominence to environmental criminology as a field of the study of the influence of situational factors (social and physical) on crime and travel behaviour of criminals across urban neighbourhoods (Davies et al, 2007). Urban characteristics of neighbourhoods are important for crime. Particular land uses (e.g. schools, bars, stores, and abandoned buildings) have been found to attract more crime in their vicinity (Block and Block, 2000).

Research evidence suggests that both physical and social conditions of the environment may influence crime incidents and make certain neighbourhoods crime prone and others less crime prone thus generating different patterns of crime and crime analysis trend across a city (Formosa, 2010). Pattern detection occurs when offenses reported during a short period of time have common attributes, such as type of crime, modus operandi, and type of weapon used (Philip, 1999). A crime pattern could occur over a large geographic region, or it may occur in a relatively small area. A crime pattern occurring in a relatively small area is called a "hot spot" or cluster. Sherman (1995) defines a hot spot as "small places in which the occurrence of crime is so frequent that it is highly predictable, at least over a one year period".

Crime has serious negative effects on societies in both developed and developing countries of the world. Fear of victimization, loss of life and assets, drop in income, unemployment, displacements, evictions, emotional depression and diversion of investment and development funds towards security cost are all impacts of rising incidences of crime in our societies. The Nigerian Police Force operating budget between 1984 and 1988 remained in the N360 million to N380 million range, and in 1988 increased to N521 million. More notable were large capital expenditure infusions of N206 million in 1986 and N260.3 million in 1988, representing 3.5 and 2.5 percent of total federal capital expenditures in those years. An NPF study in late 1990 concluded that the force's budget must double to meet its needs. Despite huge investments in social interventions and crime prevention measures all over the world, the crime problem is still unresolved, as crime rate around the globe continues to escalate due to increasing growth in poverty and the inequality in urban neighbourhoods as manifested in the proliferation of slums and unplanned urban areas in towns and cities.

The geography of crime with its emphasis on mapping and spatial analysis has emerged in recent years as a growing area of research. Nevertheless, 'cartographic criminology' involving the production of maps indicate the distribution of crime is found not enough for the modern day crime analysis, rather, the requirements today involves the need to explore the relationship between socio-spatial phenomenon and crime pattern through a more robust spatial and statistical analysis tools present in the modern day Geographic Information System (GIS) and Remote Sensing (RS). In addition, the traditional and age-old system of intelligence and criminal record maintenance has failed to live up to the challenges of the prevailing crime scenario. Manual processes neither provide accurate, reliable and comprehensive data round the clock nor does it help in trend prediction and decision support. It also results in lower productivity and ineffective utilisation of manpower. The solution to this ever-increasing problem lies in the effective use of Information Technology of which GIS has capability for crime analysis that involves the collection and analysis of data pertaining to a criminal incident, offender, and target. Police managers

recognize that competent analysts provide important information to decision makers. One of the most important purposes of crime analysis is to identify and generate the information needed to assist in decisions regarding the deployment of police resources to prevent and suppress criminal activity. To this end, GIS is often employed to understand the geographical distribution of crime, identify crime concentrated area, or hot spots, and facilitate deployment decisions regarding the duration and dosage of intervention programs.

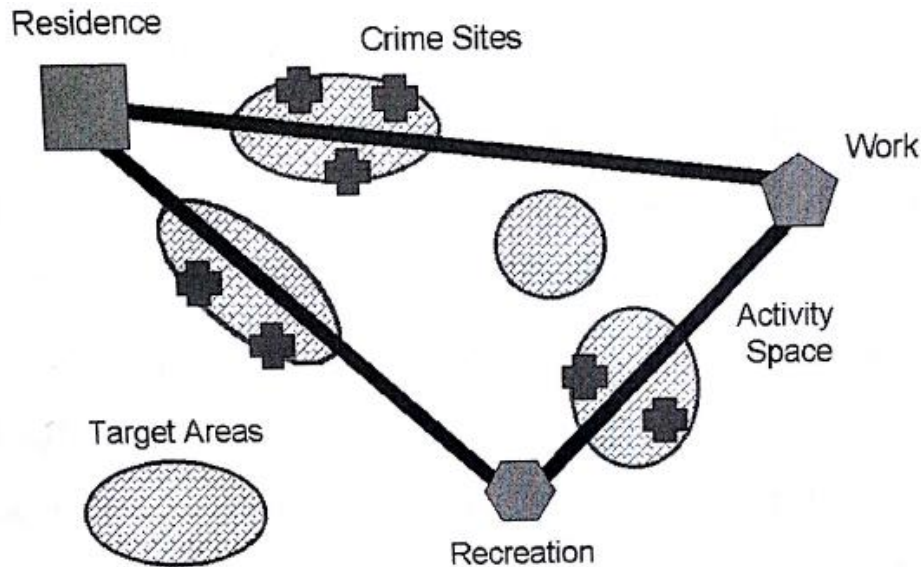
GIS functions, when combined with capabilities of location identification devices such as GPS facilitate tracking the movement of high-risk inmates or at-risk personnel throughout an area. It is more cost-effective for the crime analyst to come up with the information than for patrol officers to do it themselves (Jonson, 2000). GIS has been said to be an efficient and effective technology in policing, limited empirical assessment has been conducted. A primary reason relates to the multiplicity of functions of GIS. Garson and Vann (2001), for example, identified 21 functions, including pin mapping of crime locations, mapping hot spots, mapping crime density, creating briefing maps, mapping for decision-making, spatial tracking, resource allocation, real-time response mapping, and mapping for community policing. This study therefore utilizes GIS and remotely sensed data to determine the spread of crime activities in the Akure city core, with a view to unveiling the underlying factors that account for the prevailing crime patterns. In addition, the study uses GIS techniques to map out the crime prominent places and hotspots in the study area to facilitate community policing.

### **Conceptual Framework**

The focus of researches utilizing the spatial dimensions of crime is that human behaviour is situated in place, therefore, the location of crime must be one of the dimensions of crime analysis (Guerry, 1833; Quetelet, 1842). It is worthy of note that crime has a spatial pattern and within criminological research. Crime mapping has thus informed theory and policy about crime for almost two centuries. Nonetheless, its use has been sporadic. Each time that mapping has emerged as a crime analysis method or crime prevention tool, technological or theoretical barriers have prevented its full-scale development and application. The difficulty of matching data to maps made crime mapping an extremely time consuming and tedious activity for scholars and practitioners. The paucity of good data that could be accessed in a timely fashion often relegated mapping to an interesting but not very practical tool for crime prevention. Similarly, in periods during which the major theoretical questions that informed crime prevention research and policy had little to do with the ecology of crime, a full-scale focus on crime mapping was unlikely (Weisburd and McEwen, 1997). The role of place in crime is a factor that dictates its inherent geographical quality. This includes the dimension of crime such as legal (a law must be broken), victim (someone or something has to be target), offender (someone has to do the crime) and spatial (it has to happen at a place – somewhere, in space and time).

Brantingham and Brintingham (1984) postulated in the Crime Pattern Theory that crime is the result of people's (both offenders and potential victims) interaction and movement in the urban landscape in space or time. This is a way of explaining why crimes are committed in certain areas. Crime is not random, it is either planned or opportunistic in nature. According to the theory, crime happens when the activity space of a victim or target intersects with the activity space of an offender. Crime Pattern theory sees crime as a complex phenomenon, but, even assuming high degrees of complexity, finds discernible patterns both in criminals' events and for criminals that are scale independents. This theory has three main concepts namely, nodes, paths, and edges. A node is a term from transportation, refers to where people travel to and from, such places not only can generate crime within but also nearby. It also conveys a sense of movement and hence carries extra meaning about crime opportunities (Felson and Clarke, 1998). Paths is the linkage or the string that attaches routes between nodes, while, edge refers to the boundaries of areas where people live, work, shop or seek entertainment (Figure 1). Most importantly, crime pattern theorist and other environmental criminologist have shown that the design and management of town city, and business areas can produce major shifts in crime rates. Brantingham and Brintingham

(1991) argued that there are four dimensions to any crime. That is, for a crime to occur it must consist of four essential elements namely, the law, the offender, the target and the location. Crime pattern theory, a central component of environmental criminology, considers how people and events involved in crime move about in space and time. Block and Block (1995) pointed out that a place could be a point (such as a building or a classroom) or an area (such as a census tract or a metropolitan region). However, the former generally are regarded as places, and the latter, with their greater area, are spaces.

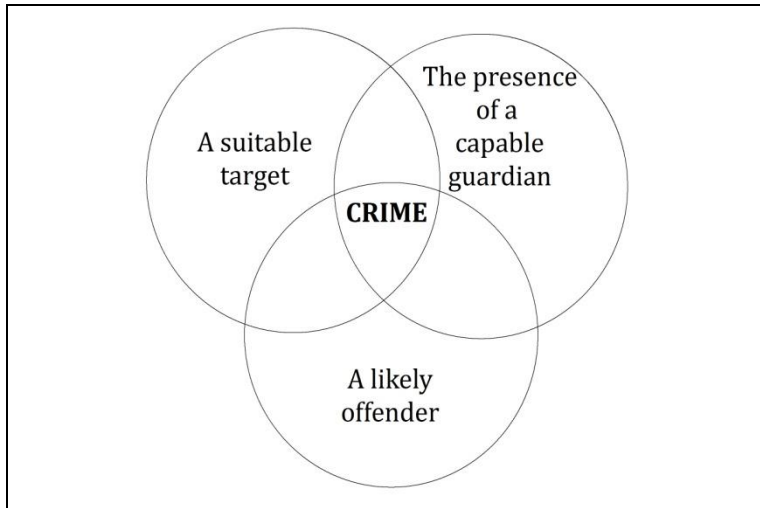


**Figure 1:** Crime site search Geography  
Source: Keppel (1989)

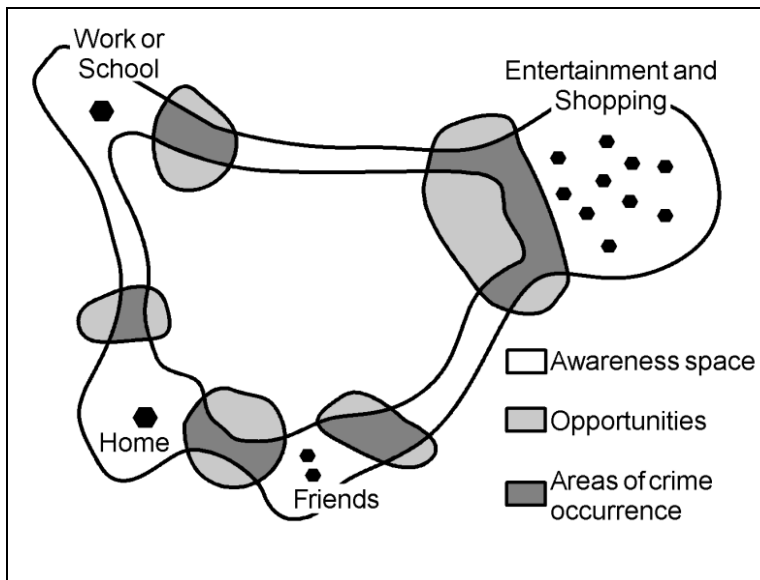
The routine activity theory was first introduced by Cohen and Felson (1979), later refined in Felson (1986, 1994), and extended to crime pattern theory in Brantingham and Brantingham (1993). This theory identifies the convergence of motivated offender, suitable target, and the absence of a capable guardians in space and time as they are engaged in their daily activities as the core elements necessary for a crime to occur. Routine activity theory premise is relatively unaffected by social causes such as poverty, inequality and unemployment. This is controversial among sociologists who believe in the social causes of crime. But several types of crime are very well explained by routine activity theory including copyright infringement, related to peer-to-peer file sharing, employee theft, and corporate crime. According to Cohen and Felson (1979), routine activity theory sought to predict changes in criminal activity through changes in the activities routinely engaged by the victims of crime. They also postulate that criminal activities are a structurally significant phenomenon, meaning that violations are neither random nor trivial events. Routine activity theory provides a macro perspective on crime in that it predicts how changes in social and economic conditions influence the overall crime and victimization rate, and at the micro perspective; they identify the role of individuals' routine activities as facilitating or hindering the convergence of offenders, targets, and capable guardians at the same time and in the same place (Figure 2). This related the pattern of offending to the everyday patterns of social interaction. Crime is therefore normal and is dependent on available opportunities to offend.

Thus, the routine activities theorists recommended a whole array of changes to reduce crime, most of them falling either under the category of "target hardening" or "increasing the guardians". These theorists suggest that neighbourhood activity patterns may increase the probability that motivates offenders will converge in time and space with suitable targets and in the absence of a capable guardian, opportunities for crime increase when neighbourhood land-use patterns are conducive to crime activity.

Routine activity theorists suggest that criminogenic land-uses influence crime in two ways: (a) by inhabiting an area's social control capacity, and (b) by attracting particular types of routine activities (Figure 3).



**Figure 2:** Awareness of Physical Convergence in time and space adapted from Brantingham and Brintingham (1981).



**Figure 3:** Awareness of Space – Routine Activities Theory adapted from Brantingham and Brintingham (1981).

The rational choice theory adopts a utilitarian belief that man is a reasoning actor who weighs means and ends, costs and benefits, and makes a rational choice; or the conscious evaluation of the utility of acting in a certain way. This perspective assumes that crime is a personal choice, the result of individual decision-making processes. This method was designed by Cornish and Clarke to assist in thinking about situational crime prevention (Clarke, 1997). This is an approach used by social scientist to understand human behaviour. This approach has been long dominant paradigm in economics, but in recent decades it has

become more widely used in other disciplines. Rational choice theory is based on the fundamentals tenets of classical criminology, which holds that people freely choose their behaviour and are motivated by the avoidance of pain and the pursuit of pleasure. The theory further emphasizes the role of enlightened self-interest in individual decision-making. In many ways, this is a pre-sociological theory, deriving from behaviourism in psychology and the homo-economic model in economics. People are viewed as adding up the benefits and costs of various courses of action. Rational choice theory had a revival in sociology in the early 1960s, under the heading of exchange theory, and by the end of the decade was having a renewed influence in criminology, first as control theory and later as routine activity theory. The tenets of this theory are based on a number of assumptions about the decision-making process and behavioural motivations. It is held that people decide to commit crime after careful consideration of the costs and benefits of behaving in a certain manner. Rational choice theory focuses on the opportunity to commit crime and how criminal choices are structured by the social environment and situational variables.

The rational choice theory's perspective of criminology expounded by Clarke and Cornish in 1985 posits that "crime is purposive behaviour designed to meet the offender's common place needs for such things as money, status, sex, excitement, and that meeting these needs involves the making of (sometimes quite rudimentary) decisions and choices, constrained as they are by limits of time and ability and the availability of relevant information's (Clarke, 1997). The central points of their theory are that human being is a rational actor, rationality involves an end/means calculation, people (freely) choose behaviour, both conforming and deviant, based on their rational calculations, the central elements of calculation involves a cost benefit analysis: Pleasure versus Pain (or hedonistic calculus), choice with all other conditions equal, will be directed towards the maximization of individual pleasure, choice can be controlled through the perception and understanding of the potential pain or punishment that will follow an act judged to be in violation of the social good, the social contact, the swiftness, severity, and certainty of punishment are the key elements in understanding a laws (this system is embodiment of the social contract).

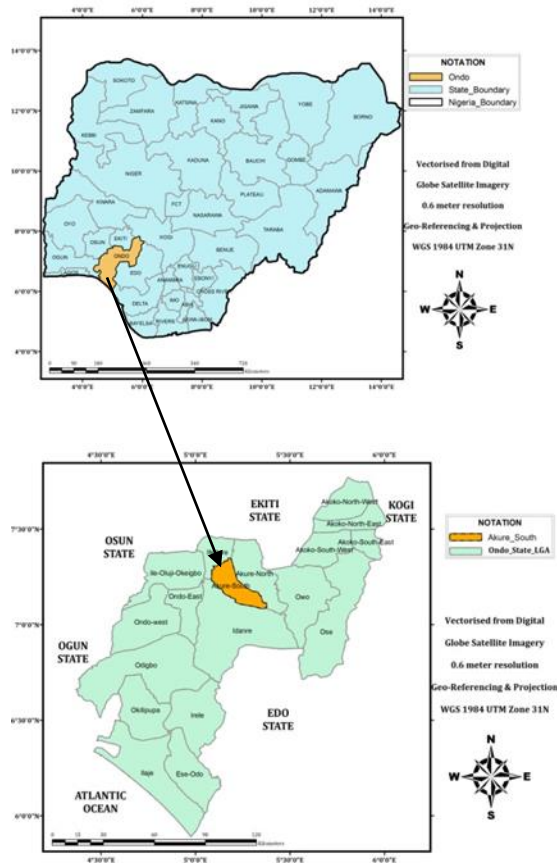
Virtually every operational activity in the police department includes spatial relationships. Traditionally, these activities have been supported by paper maps and pins. Police officers now have the ability to immediately generate maps directly relevant to the situation at hand. Police agencies collect vast amounts of data from many sources including called-for-services, arrests, first information reports and daily report. Data in this form, however, can be difficult to visualize. The same information displayed graphically provides a powerful decision making tool for investigators, supervisors, and administrators. The visual format shows relationships and patterns that are buried in the data. GIS could also be used to explore the relationship between crime and the environment (Jonson, 2000).

## **Materials and Methods**

### *Research Locale*

Akure became the Capital of Ondo State in 1976. It is situated on latitude 7<sup>0</sup>17' N and longitude 5<sup>0</sup>4' E (Figure 4). It is about 370m above the mean sea level. Akure comprises of two Local Government Areas namely Akure North and Akure South with corresponding land area coverage of 676.7km<sup>2</sup> and 318.0 km<sup>2</sup> respectively. Each of these Local Government Areas constitutes a sub-region that forms the Akure region. This region is an integral part of a larger political region called Ondo State of Nigeria (Olamiji & Olujimi 2001). 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/Ita Ogbolu to the North. The easy access and geographical centrality of Akure to these towns have enhanced the growth prospects of the city. The city connects to certain other Nigerian cities such as Ibadan, Lagos, Benin, Port Harcourt and Kaduna, Abuja. The city continues to receive influx from neighbouring towns necessitated by the development attracted to the state capital. The rapid growth of the city, particularly within the last 25 years, has made it one of the fastest growing

metropolitan areas in the South-western Nigeria. Its population has more than tripled from 157,947 in 1990 to about 500 000 in 2006 [National population Commission (NPC) reports, 2006]. 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/settlements for job opportunities among others, leading to increase in population. Consequently, there is heterogeneous massing of people and activities in the city.



**Figure 4:** Location of the Study Area in Ondo State, Nigeria

### Nature of Data

The study exploited both primary and secondary sources of data. The primary source of data involved the use of structured questionnaire to elicit socio-economic information and the factors militating against criminal operations and activities from the selected respondents in the residential and commercial buildings in the city core of Akure, amounting to 1150 buildings as obtained from the high resolution imagery through digitization. The landlords and tenants of the buildings in the city core of Akure were considered in the questionnaire administration. 10% of the residential and commercial land users within the Akure city core and its immediate environs, which include areas around the Oba’s Palace, central mosque, and the Oja Oba area were sampled for this study using stratified systematic random sampling methods due to the homogeneity of the population in area. Consequently, 115 copies of questionnaire

were administered. The secondary data utilized for achieving the set objectives of this study include information from both official and non-official documents; analogue maps of the study area; crime data in the region from the Police Headquarters Crime Report.

### **Data Analysis**

The responses obtained from the administered copies of the questionnaire were coded and entered into Microsoft Excel 2013 for the purpose of spatial database and exported to Statistical Package for Social Science (SPSS) version 17 for statistical analysis. The data were analyzed and presented by the use of simple frequency tables to explain the distribution of crime incidents in the study area and proper presentation on maps. The crime data were analyzed using spatial analysis technique in ArcGIS 10, Global Mapper 13 and CrimeStat III. Descriptive statistics – frequencies, percentages and charts were used to present data while inferential statistics – such as regressions, ANOVA, Partial and Pearson's correlation analysis were used to test for the formulated hypothesis at 0.05 level of significant. Overlays operations were carried out to evolve crime maps. GPS Garmin 76 was employed to obtain co-ordinates of major landmarks in the area, which comprise police stations, banks, markets, liquor stores, and place of worship and among others were obtained and used to register the important landmarks on the base map. The information extracted from the analyzed responses from the questionnaire and crime data were geocoded to the administered points using ArcGIS 10 for better and advanced spatial analysis, and also for hotspot and black spot analysis using Geostatistical Analyst which include Inverse Distance Weight analysis, Kriging and Cokriging.

### **Results and Discussion**

#### *Socio-economic Characteristics of the Respondents*

The results of analysis on socio-economic characteristics of the respondents were shown in Table 1. According to the table, the male respondents were 74.8% against 25.2% that were females. It suggests the predominance of male population over the females in the study area. The age distribution of the respondents revealed that 37.4% were between 18 and 25 years, 42.6% fall between 26 and 35 years, 16.5% belonged to the ages between 36 and 45 years, while the remaining 3.5% were in the age group between 46 and 55 years. The table further showed that 69.5% of the respondents were yet to get married but 31% were married and 4% were divorcees. The employment status of the respondent's showed that majority of them were self-employed with a percentage of 48.7%, followed by 33% student respondents.



**Table 1: Socio-economic Characteristics of the Respondents**

<b>Socio-economic Characteristics</b>		<b>Frequency</b>	<b>Percent</b>
<b>Sex</b>	Male	86	74.8
	Female	29	25.2
	Total	115	100.0
<b>Marital Status</b>	Single	80	69.5
	Married	31	27.0
	Divorced	4	3.5
	Total	115	100.0
<b>Age</b>	18-25 yrs	43	37.4
	26-35 yrs	49	42.6
	36-45 yrs	19	16.5
	46-55 yrs	4	3.5
	Total	115	100.0
<b>Religion</b>	Christian	97	84.3
	Muslim	18	15.7
	Total	115	100.0
<b>Duration in town</b>	Indigene	47	40.9
	Less than 5 yrs	12	10.4
	6-10 yrs	33	28.7
	11-15 yrs	9	7.8
	16-20 yrs	12	10.4
	Above 20 yrs	2	1.7
Total	115	100.0	
<b>Employment Status</b>	Unemployed	14	12.2
	Private Company	7	6.1
	Self Employed	56	48.7
	Student	38	33.0
	Total	115	100.0

Source: Authors' Fieldwork, 2013

In addition, the analysis on duration of stay as depicted by the table showed that 40.9% of the respondents were indigenes. This implies that long duration of stay is germane in account of crime history and enhances provision of reliable information regarding the occurrences of crime activity in the study area.

*Crime Occurrences and Activities*

From the table 2, the results of income analysis provide information that 35.7% of the respondents earned between ₦50,001 and ₦100,000, 29.6% of the respondents realized between ₦100,001 and ₦500,000, 27% earned below ₦50,000, 6.1% earned between ₦500,001 and ₦1,000,000, while 1.7% of the respondent earned above ₦1,000,000 on monthly basis. It suggests that income of the respondents is a pull factor that causes events to theft, shop burglary, and extortion to be paramount in such places of high income. This lends credence to Reith’s postulation in 1996 that the rates of crime in any urban neighbourhood are highly influenced by demographic and socio-economic factors such as income, ethnic composition, youth concentration and level of education. Table 3 revealed that 37.4% of the respondents believed people residing in the area committed property crimes. 19.1% was of opinion that property crimes were committed by the people outside the area and 16.5% submitted that both the inhabitants and non-residents committed property crimes. Table 4 identified the motives for committing crimes such as real need, greed and financial motive. In regards to these motives, 47% of the respondents considered all the identified motives as motivating factors for crime occurrence in the study area. Real need, greed and financial motives were identified by 7%, 17.3% and 28.7% respectively. Table 5 identified different approaches that can be adopted to curtail crime activity in the study area. These are crime prevention and law enforcement, The Judiciary Courts, social development and prison empowerment program. 41.7% of the respondents believed in the use of crime prevention and law enforcement approach. Another 25.2% considered social approach while 15.7% and 2.6% emphasized the use of the law courts and prison empowerment program for curtailing crime activity. 14.8% viewed the adoption of all the identified approaches as very necessary in curtailing crime in the study area.

**Table 2: Income analysis of the respondents**

<b>Income</b>	<b>Frequency</b>	<b>Percent</b>
Below 50000	31	27.0
50001-100000	41	35.7
100001-500000	34	29.6
500001-1000000	7	6.1
Above 1000000	2	1.7
<b>Total</b>	<b>115</b>	<b>100.0</b>

Authors’ Field Survey, 2013

**Table 3: Location of culprits of property crime**

<b>Location</b>	<b>Frequency</b>	<b>Percent</b>
People residing in the area	43	37.4
People residing outside the area	22	19.1
Both	19	16.5
No idea	31	27.0
<b>Total</b>	<b>115</b>	<b>100.0</b>

Authors’ Field Survey, 2013

**Table 4: Reasons for committing crime**

<b>Reason</b>	<b>Frequency</b>	<b>Percent</b>
Real need	8	7.0
Greed	20	17.3
Financial motive	33	28.7
All of the above	54	47.0
<b>Total</b>	<b>115</b>	<b>100.0</b>

Authors' Field Survey, 2013

**Table 5: Measures for curtailing crime**

<b>Measure</b>	<b>Frequency</b>	<b>Percent</b>
Crime prevention and law enforcement	48	41.7
The Judiciary/Courts	18	15.7
Social development	29	25.2
Prison Empowerment Program	3	2.6
All of the above	17	14.8
<b>Total</b>	<b>115</b>	<b>100.0</b>

Authors' Field Survey, 2013

Table 6 shed light on the performance of Nigeria Police Force in the area. 54.8 rated the performance to be unsatisfactory while 55.2% were satisfied with the ways the Police Force has been monitoring, preventing and stemming down crimes in the study area. It suggests that the Police has been up to the task in respect of crime prevention and law enforcement but there is still room for improvement in the area of regular patrol and prompt response to crime occurrence alert. As reflected in Table 7, the level of crime activity was considered to be high by 21.7%. 46.1% and 32.2% respondents viewed the level of crime activity as medium and low respectively. Going by the viewpoint of 53.3% and 6.7% (See Table 8) of the respondents that believed in the efficiency of the Police Force regarding the facilities in place, the position of the 78.3% respondents of moderate crimes in the area was established. Though, the adequacy of the crime preventive facilities was pinched by another 40% respondents but it is an indication that all is not well in area of crime control in the area

**Table 6: Rating police performance on crime control and management**

<b>Rating</b>	<b>Frequency</b>	<b>Percent</b>
Very good	2	1.7
Good	8	7.0
Satisfactory	42	36.5
Poor	40	34.8
Very poor	23	20.0
<b>Total</b>	<b>115</b>	<b>100.0</b>

Authors' Field Survey, 2013

**Table 7: Level of crime activity in the study area**

<b>Level</b>	<b>Frequency</b>	<b>Percent</b>
High	25	21.7
Medium	53	46.1
Low	37	32.2
<b>Total</b>	<b>115</b>	<b>100.0</b>

Authors' Field Survey, 2013

**Table 8: Rating police facilities**

<b>Rating</b>	<b>Frequency</b>	<b>Percent</b>
Very effective	1	6.7
Effective	8	53.3
Fairly effective	6	40.0
<b>Total</b>	<b>15</b>	<b>100.0</b>

Authors' Field Survey, 2013

The result of the analysis on the level of technological improvement of Nigeria Police Force (NPF) showed that 33.3% respondents observed inadequate technological improvement. Another 46.7% respondents viewed that NPF had not got a considerable technological improvement. Nevertheless, 20% respondents categorically claimed that the NPF had been equipped technologically (see Table 9). Going by the level of the criminal activity in the study area, 40% respondents agitated for establishment of high alert control unit, 13.3% respondents solicited more recruitment of manpower, 26.7% asked for power criminal justice while 20% considered all these measures holistically to reduce the influx of the criminals to the area (Table 10).

**Table 9: Rating of police’s level of technological improvement by the respondents**

<b>Rating</b>	<b>Frequency</b>	<b>Percent</b>
Lacking	5	33.3
Not lacking	3	20.0
Slightly lacking	7	46.7
<b>Total</b>	<b>15</b>	<b>100.0</b>

Authors’ Field Survey, 2013

**Table 10: Control of flux of criminal activity in the area**

<b>Control</b>	<b>Frequency</b>	<b>Percent</b>
High alert patrol unit	6	40.0
More manpower	2	13.3
Effective criminal justice	4	26.7
All of the above.	3	20.0
<b>Total</b>	<b>15</b>	<b>100.0</b>

Authors’ Field Survey, 2013

**Analysis of factors that responsible for Crime Occurrence in the Study Area**

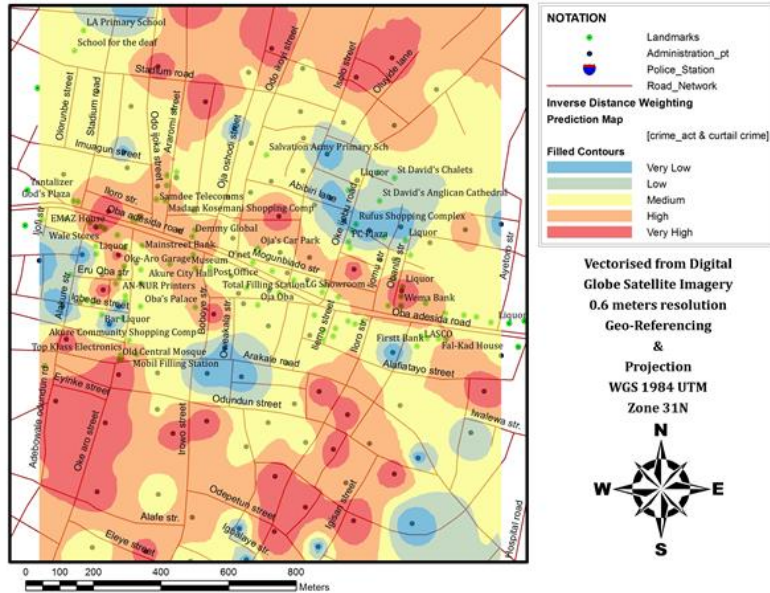
The results of the correlation analyses as shown in Table 11, revealed that there was a significant relationship between occupational status, income level and the type of criminal operations in the study area (with R value = -0.374). In addition, there was significant relationship in the variation of incidences, types and distribution of crime in urban neighbourhoods of Akure (R=0.471). Property crimes were found to be most predominant in the study area. The high level of police patrol, prompt response of police to crime report, public enlightenment on police activity and effective keeping of crime records by the police are factors that are highly correlated to crime occurrence in the study area (with R = 0.698).

**Table 11: Correlation Analysis of Crime Variables in Akure Neighbourhoods**

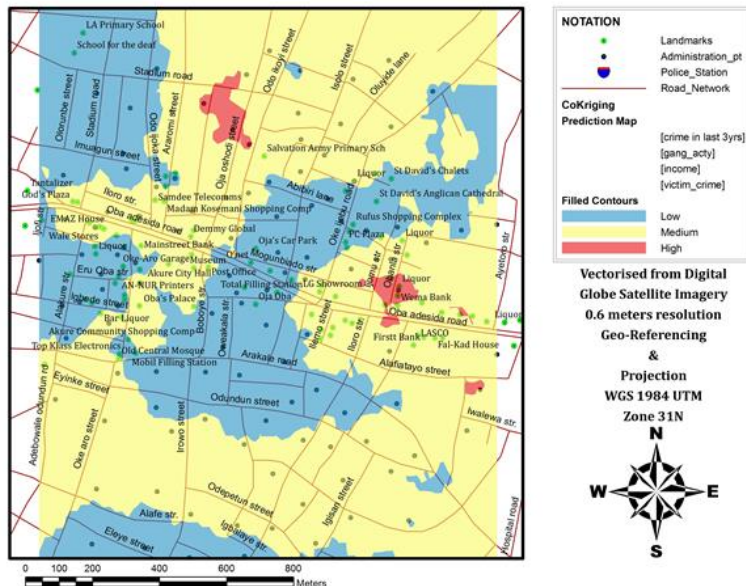
<b>Variables</b>	<b>R Value</b>	<b>P Value</b>	<b>Number of pairs in Sample</b>
Occupational status, income level and type of criminal operation	-0.374	0.000	115
Variation of incidences, types and distribution of crime in urban neighbourhoods of Akure.	0.471	0.000	115
Location of police station, crime prevention measures, security facility, gang activity and victim experience	-0.244	0.010	115
Response of police to security alert, availability of police patrol vehicle and crime workshop/seminar for police	0.698	0.006	115

Authors’ Fieldwork, 2013

Figure 5 showed the result of IDW (Inverse Distance Weight) factor analysis; the intensity of crime was on the increase along the major transport route cutting through Akure metropolis, and also to some specific areas such as Post-Office, Oke-Aro, Odo-Ikoyi and Isolo areas.. It is further noted that the occurrence of crime in the last 3yrs as a dependent variable with others as independent variables (gang activity, income, and victim of crime) shows that crime event is low in some area but on the moderate and high level in other places like around banking halls, shopping plaza and the Oja Oba market in the study area (see figure 6).



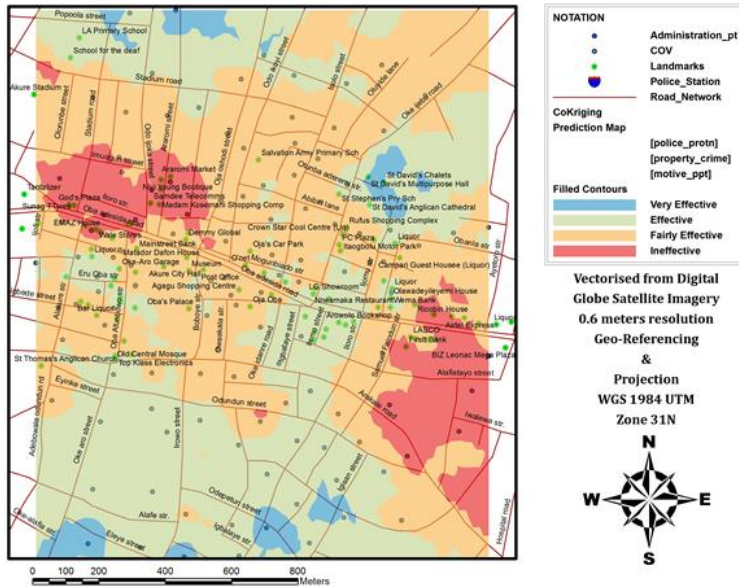
**Figure 5:** Map showing geospatial analysis of level of crime in the study area.



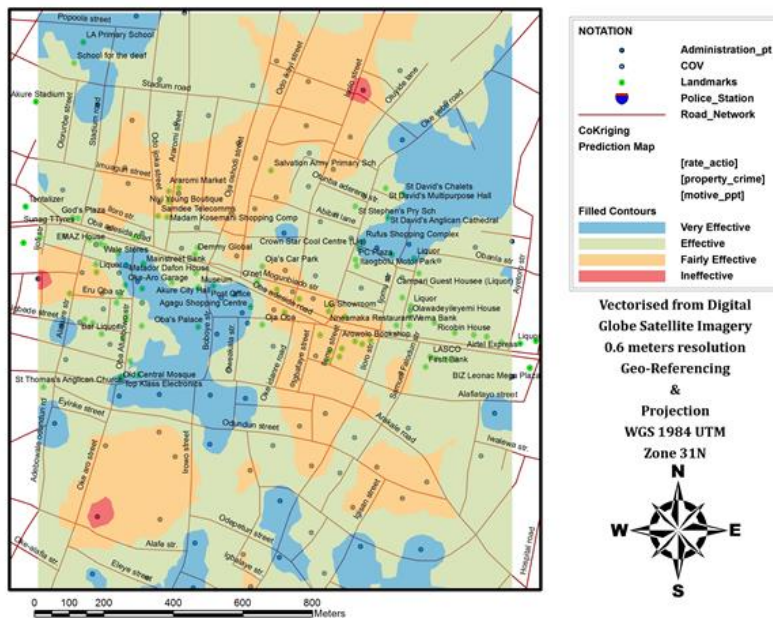
**Figure 6:** Map showing geospatial analysis of view of crime by victims in the study area.

The analysis spawned in Figure 7 shows that respondents believes that police protection with respect to crime and violent act is poor taking into consideration the affected areas in the study area. The

ineffectiveness of the police with regards to the respondents view is paramount around various strategic centre of attraction such as the God’s Plaza (Nao Supermarket), LASCO, First Bank, WEMA Bank, Ricobin House, BIZ Leonac Mega Plaza and even to some interior part of the Akure city core. Figure 8 shows that personal measures (such as target hardening, private security, vigilante etc) against crime and violent act have been found to be more effective than the police force protection against such crimes. Respondents are of the opinion that personal measure as reduced crime at a greater length.



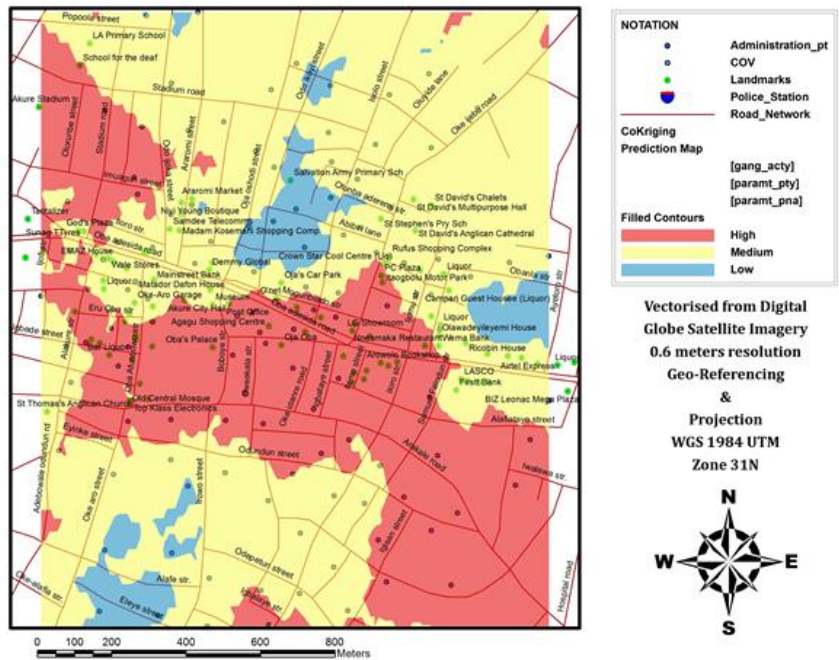
**Figure 7:** Map showing geospatial analysis of police action against crime & violent act in the study area.



**Figure 8:** Map showing geospatial analysis of personal measures against crime & violent act in the study area.



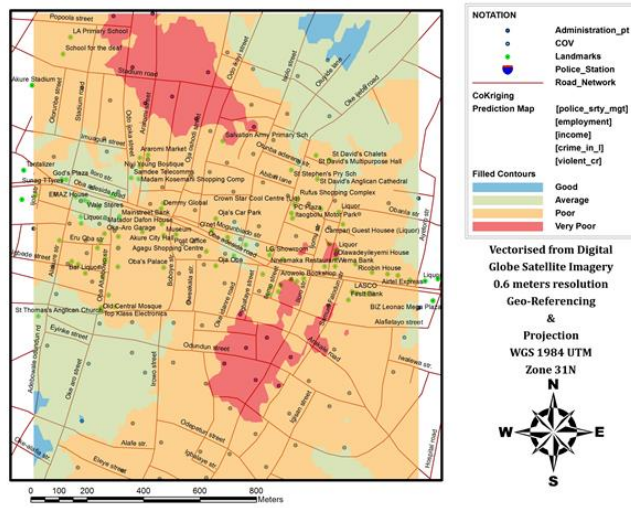
From Figure 9, the cokriging factor using the multiple datasets to investigate cross-correlation and autocorrelation, shows that analyzing of multivariable proves to be a useful way of deducing crucial factors. The combination of these variables (gang activity in the area, paramount property crime and paramount personal crime) shows that the flux of crime in the study area is at a peak level. The major event areas are carried out along the Oba Adesida road and gradually reducing to the exterior part of the Akure Metropolitan core.



**Figure 9:** Map showing geospatial analysis of gang activity with respect to paramount property & personal crime in the study area.



From Figure 10, the respondents strongly believe that police security management is on the lane of been insignificant as to the poor performance of the Nigerian Police Force (NPF) do not have sufficient manpower and combating equipment to keep the study area healthy from the unrest of crime and violent act.



**Figure 10:** Map showing geospatial analysis of police security management in the study area.

## Conclusion

The study has demonstrated the capability of GIS techniques in crime mapping and analysis and found that the road network that traverse Akure Metropolis provide easy accessibility and exits to the criminals, and has become a dominant axis of crime events as facilities located along the road have experienced armed robbery attack or burglary at one time or the other. In addition, it is revealed that income instability of a person/business is a factor of criminal occurrence which is also dependent on the security strength around such as person/business. Crime activities are more dominant in some part of the city core, indicating the crime hotspots. The study further demonstrates the efficacy of crime database system for effective combing of Akure Metropolis by the security agents through the knowledge of crime pattern and occurrence, crime prediction and commensurate measures to take in getting rid of crimes in the Akure Metropolis. The study advocates the development of all inclusive crime database system and training of security agents in the use of information technology to improve upon their intelligence gathering capabilities and pave way for the adoption of modern technology in combating crimes in the metropolis in particular and Nigeria in general.

## References

- Bladwin, J., & Bottoms, A.E. (1976). *The urban criminal*. London: Tavistock.
- Block, R.L. and C.R. Block (1995) "Space, Place, and Crime: Hot Spot Areas and Hot Places of Liquor-Related Crime," in J. Eck and D. Weisburd (eds.) *Crime and Place*, Monsey, NY: Willow Tree Press.
- Block, R.L. and C.R. Block (2000) "The Bronx and Chicago: Street Robbery in the Environs of Rapid Transit Stations," in *Analyzing Crime Patterns: Frontiers in Practice*, Mollenkopf, J. (ed.), London: Sage.
- Brantingham, P.J.; and Brantingham P.L.(ed.) (1981). *Environmental Criminology*. Beverly Hills: Sage Publication.
- Brantingham, P.L. and Brantingham P.J. (1991). *Environmental Criminology*, Sage Publication Beverly Hills, CA.
- Brantingham, P.J. and P.L. Brantingham (1984). *Patterns in Crime*. New York, NY: Macmillan.
- Brantingham, P.J. and P.L. Brantingham (1993). "Environment, Routine, and Situation: Towards a Pattern Theory Crime." In: R.V. Clarke and M. Felson (eds.) *Routine Activity and Rational Choice*. *Advances in Criminological Theory*, Vol. 5. New Brunswick, NJ: Transactions Books.
- Clarke, Roland V. (1997). Introduction. In Clarke, Roland V. (ed.). *Situational Crime Prevention: Successful Case Studies* (2nd ed.). (pp. 1-43). Albany: Harrow and Heston.
- Cofen, L.E. and Felson, M. (1979), "Social Change and Crime Rate Trends: A Routine Activity Approach", *American Sociological Review*, 44: 588-608.
- Johnson, C.P. (2000). *Crime Mapping and Analysis Using GIS*: Geomatics Group, C-DAC, Pune University Campus, Pune 411007
- Davies, M. and Mousas, J. (2007) *Homicide in Australia: 2005-2006 National Homicide Monitoring Program Annual Report*, Research and Public Policies Series No. 77. Canberra: Australian Institute of Criminology.
- Felson, M. (1986). "Routine Activities, Social Controls, Rational Decisions, and Criminal Outcomes." In: D. Cornish and R.V.G. Clarke (eds.) *The Reasoning Criminal*. New York, NY: Springer-Verlag.
- Felson, M. (1994). *Crime and Everyday Life: Insights and Implications for Society*. Thousand Oaks, CA: Pine Forge Press.
- Felson, M. and Clarke, R.V. (1998). *Opportunity Makes the Thief*. Police Research Series, Paper 98. Policing and Reducing Crime Unit, Research, Development and Statistics Directorate. London: Home Office. ([www.homeoffice.gov.uk/rds/prgpdfs/fprs98.pdf](http://www.homeoffice.gov.uk/rds/prgpdfs/fprs98.pdf))
- Garson, G. D., and Vann, I. B. (2001). *Geographic Information Systems for small and medium law enforcement jurisdictions: Strategies and effective practices*. Raleigh: North Carolina Governor's Crime Commission.
- Guerry, A.M. (1833). *Essay on the Moral Statistics of France*, (Paris: Crochard).
- Sherman, L.W. (1995). "Hot Spots of Crime and Criminal Careers of Places". Pp 35-52 in John E. Eck and David Weisburd, eds., *Crime and Place*, Crime Prevention Studies, Vol 1. Monsey, NY: Criminal Justice Press.
- Olamiju I.O. and Olujimi J.A.B (2011). Regional analysis of locations of public educational facilities in Nigeria: The akure region experience. *Journal of Geography and Regional Planning* Vol. 4(7), pp. 428-442.
- Philip, C. (1999). *Using a Geographic Information System for Tactical Crime Analysis*.
- Quetelet, M.A. (1842). *A Treatise on Man* (Edinburgh: William and Robert Chambers).
- Reith, M. (1996). The Relationship between Unemployment in Society and the Popularity of Crime Drama on TV, *Journal of Broadcasting & Electronic Media*, 40: 258-264.

- Sutherland, E. H., Cressey, D. R., & Luckenbill, D. F. (1992). *Principles of criminology*. Rowman & Littlefield.
- Sherman, L.W. (1995). Hot Spots of crime and criminal careers of places. In: J.E. Eck and D. Weisburd eds., *Crime and Place*. Monsey, NY: Criminal Justice Press; and Washington, DC: Police Executive Research Forum, pp. 35-52.
- Weisburd, D., and J.T. McEwen, eds. (1997). *Crime Mapping and Crime Prevention*. Monsey, NY: Criminal Justice Press.