



Analysis Of Crime Pattern Using Spatial Methods In Selected Areas Of Katsina State

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ABSTRACT

Crime has no universal definition. This is as a result of changes in social, political, psychological and economic conditions. The study investigates and predict the crime pattern using Geostatistical methods in selected areas of Katsina State. Secondary data from reported crimes of Katsina State Police Command Consisting of various crimes was used for the study. The methods applied for this research were descriptive and Ordinary Kriging Model to test the fitted Variogram Model and Spatial dependencies of variables examined. The results shows that the highest cause of insecurity is unemployment, followed by poverty and illiteracy. The crimes pattern shows that there is possibility of the increase in crimes rates in some of the study areas and chance of occurrence of crimes in the nearby villages of the hot spot areas.

Keywords: Spatial Analysis, Crimes , Ordinary Kriging Model, Variogram Model

INTRODUCTION

Crime has no universal definition. This is as a result of changes in social, political, psychological and economic conditions. An act may be a crime in one society, but not in another (Danbazau, 2007). For example, prostitution, adultery and homosexuality between consenting adults have been wholly or partially removed from the criminal law in USA but are considered as crimes in Muslim communities such as Saudi Arabia and others (Feldman, 1997). The high crime rate in any nation is major sources of insecurity and fear to the public welfare and morals of its citizens. Crimes are the most common social issues nowadays, affecting the economic growth, quality of life and economy of any country.

Crime also takes place in areas where there are high population densities, swift changes in social environments and poor living conditions. For instance, many immigrants in urban areas experience new urban life where relationship is based on momentary, superficial and impersonal interactions. This then produce anonymity among urban dwellers, diabolical socio-economic, high cost of living and socially disorganized, thereby turning some to steal, rob, become drunkards, drug pushers and prostitutes to make ends meet. This idea is supported by Soh, who states that “secondary relations eventually lead to family breakup, alcoholism, crime, and other negative aspects of urban life”. One of the highest crime rates in the world are found in Nigeria (Nigeria crime 2011). Crime patterns are analyzed in terms of their socio-demographic, temporal and spatial qualities, and may be represented visually using graphs, tables and maps (Wang and Brown 2011). Results drawn from the International Crime Victim Survey show that high crime rates is a statistically normal characteristic of nations all over the world (Zhou and Zhang, 2008). The diverse differences in geographical areas in terms of population density, demographic characteristics, natural vegetation, location and socio-economic characteristics has rendered crime rate unevenly distributed globally. The report of international crime victim survey (ICVS) has confirmed the situation. The report which was conducted on six major world region including Africa, Asia, central and eastern Europe, Latin America, and western Europe for the 1989 – 1996 period as shown that more than

half of the urban respondents reported being victim at least once regardless of what part of the world they inhabit (Ackerman and Murray, 2004).

Over the decades the rate of crimes in Nigeria was continuously increasing where several studies on crimes rates have been carried out both in rural and urban areas but little has been achieved to curtail the dangers of crimes committed. However, the Nigerian Police Force and other law enforcement agency boosted more effort to fight crime with the help of more perfect and sophisticated weapons. This has led to the formation of various vigilante groups, to combat crimes in some parts of the country (Fajemirokun, Adewale, Idowu, Oyewusi, & Maiyegun, 2006). (Gulumbe, Dikko, & Bello, 2012). Used crime dataset in Katsina state which consists of the average of eight major crimes reported to the police from 2006–2008. Principal component analysis (PCA) and Correlation analysis were employed to explain the correlation between the crimes and to determine the distribution of the crimes over the local government of the state. The finding has shown a positive correlation between robbery, theft and vehicle theft. The PCA has suggested that, retaining four components that explain about 79% percent of the total variability of the data set (Khalid, Shoaib, & Qian, 2017). They conducted a research in the city of Faisalabad Pakistan, evaluated and generated hotspot of crime. The finding shows that, the street crimes are strongly concentrated in the central part of the city whereas the results manifested that, the functional nature of different urban land use affects the frequency of crime event. They finally concluded that, the hotspot analysis has real potential, impacting the police patrolling protocols. (Gimenez, Alejandro, Caplan, & Grant, 2018). They conducted a study to identify a Risky places for violent crime victimization in Bogota, Colombia, the three forms of crime are (i.e. Homicide, assault and theft). The finding shows that, the poorest areas in the city are most spatially vulnerable to Homicide and assaults. However, thefts were more prevalent near the city Centre, where economic activity is carried out. (Matijosaitiene, Zhao, Jaume, Gilkey, 2019). They applied crime prediction method using land-use data with the help of machine learning algorithms. The finding shows that, the crime prediction identified the exact hours of crime occurring using hotspot analysis and logistic regression to determine the precise time of the next crime but the prediction results can be enhanced using advanced methods of machine learning. (Volasik, 2018). Conducted a study to determine the application of Risk Terrain Modeling to predict gang assault and gang Homicide. The results indicated that, the places spatially vulnerable to experiencing a gang assault are in close proximity to where gang members are observed loitering by police and metro rail stops while also contending with residential concentration of local gang members. However, the findings indicated that areas most at risk of experiencing a gang Homicide cope with residential concentration of local gang members and gang -set space (i.e. Gang hangouts).

Crime-solving is a complex task that requires human efforts and intelligence for the processing of criminal data. The causes of crime are multiple and could be traced to bio-genetic factors, such as genetic mutation and heredity, psychological factors, such as personality disorders and sociological factors, such as learning and environment. Gupta, R., Rajitha, K., Basu, S. & Mittal, S.K. (2012) conducted a study on crime analysis in Jhunjhuna district of Rajasthan, India and demonstrated that capability of kriging as well as weighted overlay analysis for identifying crime patterns by integrating socio-economic factor in Geographical Information System domain. The finding shows that, the Socio factors have a positive correlation with different types of crime.

Crime and victimization has grave consequences for the citizens and society. Individual and societal hopes for democracy, development, human rights, high standard of living are weakened by high level of criminal victimization. Crime news is on the increase on the Nigeria news headlines. Local, national and international media stations report crime about Katsina State and recently it has extended to blogs. It can be deduced that crime rate in Katsina state needs serious attention by everybody in the community.

Katsina State is one of the States in the North West that is presently affected by banditry, cattle rustling and kidnapping which started in 2011 This affects mainly the eight frontline Local Government Areas (LGAs) namely Jibia, Batsari, Safana, Danmusa, Kankara, Faskari, Dandume and Sabua (dailytrust, 2021). The Katsina state government signed into law the security challenges containment order with a

view to closing some of the security gaps in the state and arrest the wave of banditry in the state on August 31st 2021.

The Katsina state government signed into law the security challenges containment order (SCCO) with a view to closing some of the security gaps in the state and arrest the wave of banditry in the state on August 31st 2021. The security challenges containment order (SCCO) are a set of extraordinary measures that led to shutting down of telecommunication services and some weekly markets, travel restrictions and commercial activities as well as mining introduced in August/September 2021 (BSCL, 2021). According to Beacon Security Consulting Limited (2021), the actions were introduced at the appeal of the Federal Government of Nigeria and the security forces in the North West in states of Zamfara, Kaduna, Katsina and Sokoto.

Objectives of the Study

The aim of this research is to analyze the crime scenes using special technique in the selected towns (Hot Spots) in the local governments of Katsina State. This aim will be achieved through the following objectives:

1. To identify locations of major crimes activities in the study areas.
2. To identify socio-economic variables influencing the crimes rate in the study area
3. To predict crime scenes areas using prediction techniques.

MATERIALS AND METHODS

Study Area

The study area will consist of crime Hot Spots areas which include Safana, Batsari, Danmusa, Jibia , Kurfi, Dandume, Kankara and Faskari local government areas of Katsina state.

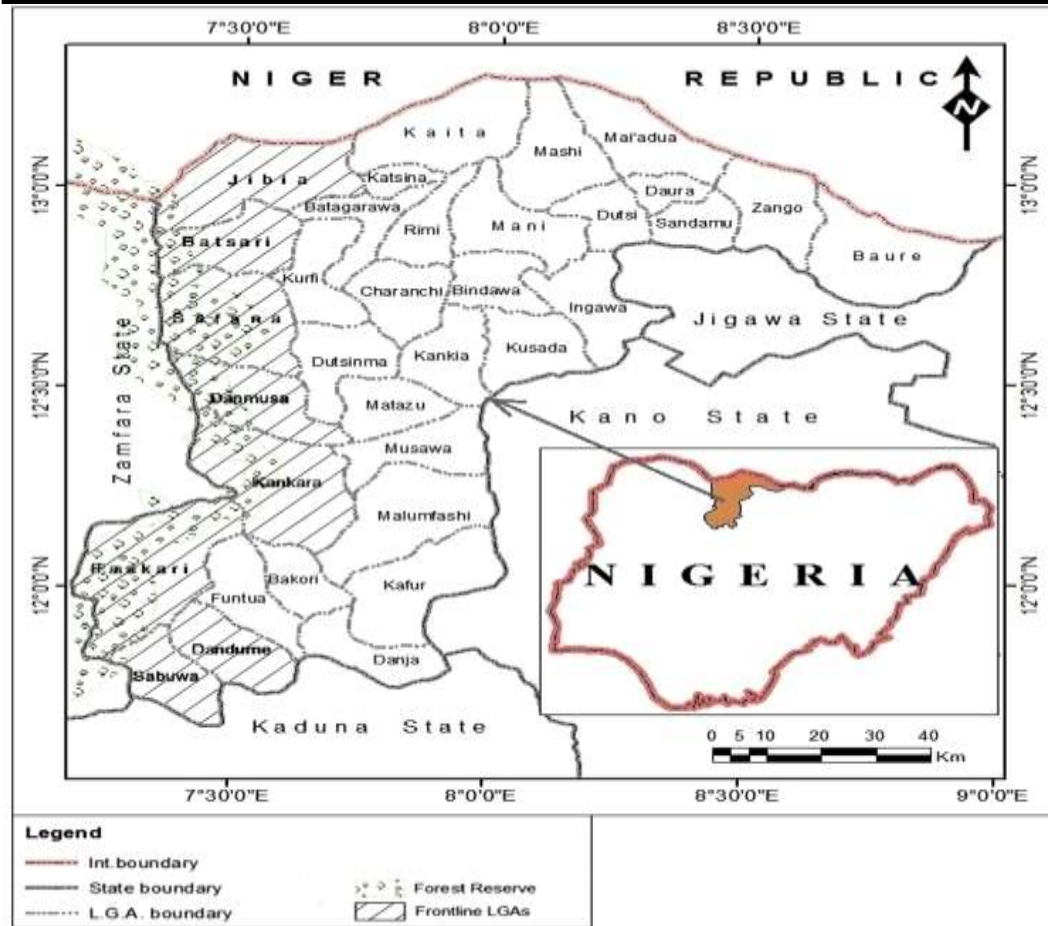


Fig 1: Map of Katsina State Showing the Front Line Local Govt. Areas
 Source:- National Aeronautic and Space Administration Spot Image 2022

The study is based on secondary and primary data. The survey method include administration of a questionnaire on target respondents (including the victims). These respondents would be selected through multi-stage sampling procedure. Multistage sampling technique would be used to select respondents to quantitative questions and simple random sampling for the rural communities of the study areas. The study analyzed the data using descriptive statistics and Geo-spatial technology.

Ordinary Kriging

Ordinary Kriging is the basic form of interpolation that measures the values by linear combination using variogram to determine the weight of data and describe the spatial correlation, developed by the French mathematician Georges Matheron 1960.

The variogram was used to describe the spatial correlation between the stations and determine the weight and also used to calculate the covariance and the covariance used to calculate the weight base on distance.

$Z(x_i)$ is the estimated variable which has the variogram/autovariogram $\gamma(h)$. The variogram can be estimated by;

$$\gamma(h) = \frac{1}{2n(h)} \sum_{i=1}^{n(h)} [(z(x_i + h) - z(x_i))^2] \quad (3.1)$$

$z(x + h) - z(x)$ is defined as the variance of increments, and h is the spatial lag between two locations (Lam, 1983). The variance $\gamma(h)$ is a function of lag h between two observations $Z(x_i)$, $Z(x_i + h)$ of attribute Z , $n(h)$ is the number of observed data pairs with the lag h ; $z(x_i)$ and $z(x_i + h)$ are two measured values at locations x_i and $(x_i + h)$ respectively. (Webster and Oliver, 2007).

To predict the value $Z(x_0)$ using the known values $Z(x_i) = \{Z(X_1), Z(X_2), Z(X_3)\}$ the prediction is of the form.

$$\hat{z}(x_0) = \sum_{i=1}^n \omega_i^{ok} z(x_i) \quad (3.2)$$

Where $\hat{z}(x_0)$ is the estimate variable of Z , (Rainfall in the study) at a target position x_0 ; ω_i^{ok} indicate kriging weight link with the sample location x_i , n is the number of sampled points and

$\omega_i^{ok} = (\omega_1^{ok}, \omega_2^{ok}, \omega_3^{ok})$ are the interpolation weights with an assumed constant mean value μ^{ok} . In order to obtain the unbiased result, $\omega_i^{ok} = (\omega_1^{ok} + \omega_2^{ok} + \omega_3^{ok}) = 1$ to ensure the unbiased condition of the linear predictor $\hat{Z}(x_0)$.

RESULTS

Table 1: Causes of crimes in the study area

	Frequency	Percent	Valid Percent	Cumulative Percent
Poverty	74	25.0	25.0	25.0
Unemployment	118	40.0	40.0	65.0
Valid Illiteracy	71	24.0	24.0	89.0
Others	33	11.0	11.0	100.0
Total	296	100.0	100.0	

Table 2 indicate that highest cause of insecurity is unemployment (40%) the second is poverty (25%) followed by illiteracy (24%) and lastly others factors that lead to the security challenge represented (11%).

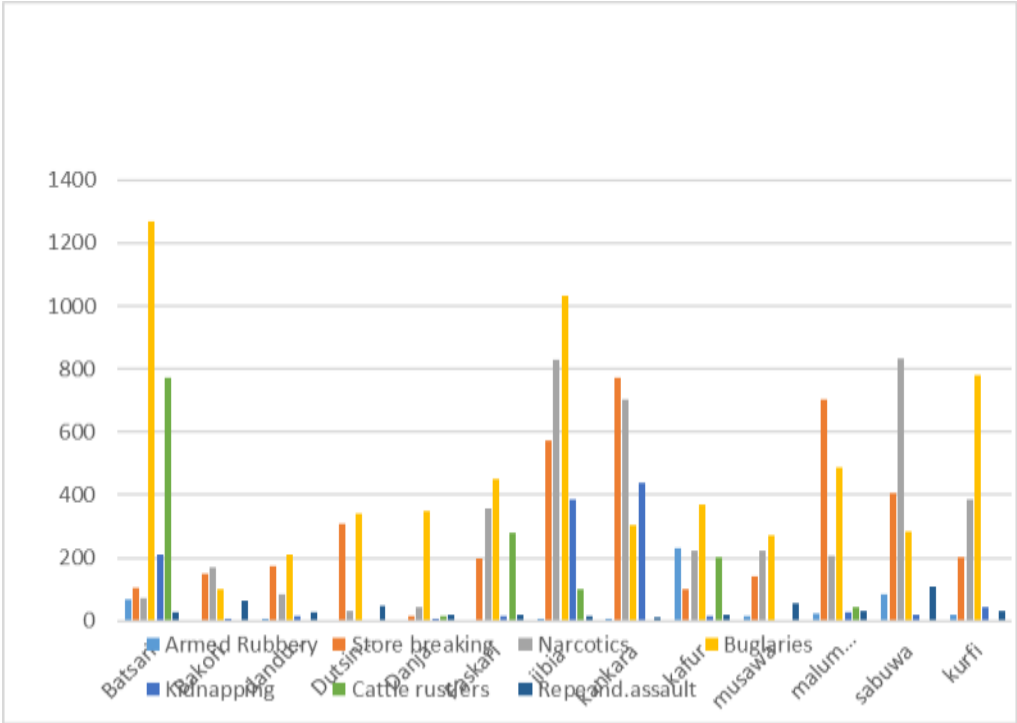


Fig.1 showing the distribution of various crimes in the study area.

Fig 1 indicating the distribution of crimes in the study area which shows that burglary occurs mostly followed by store breaking, kidnapping, cattle rustling and rape.

Experimental variogram and fitted variogram model

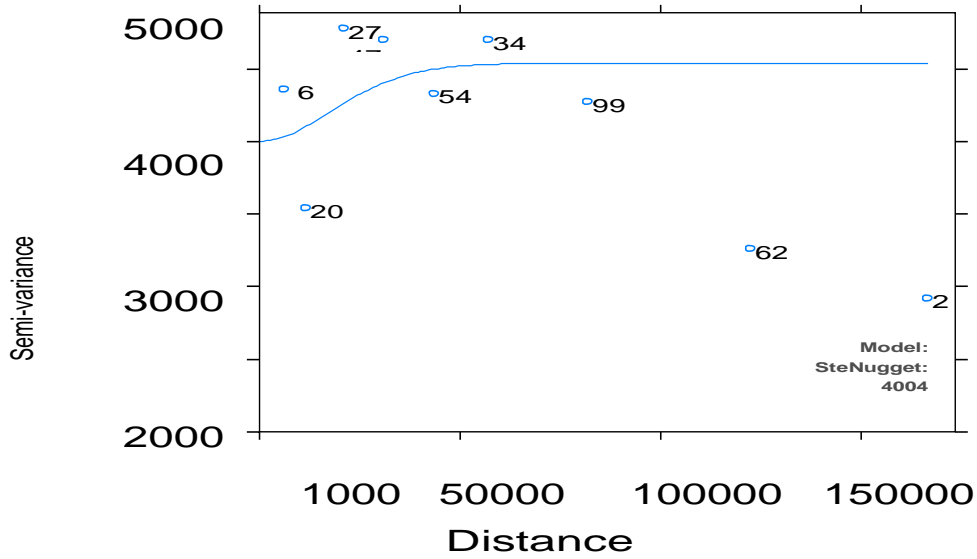


Fig. 2 The experimental and Fitted Variogram of Crimes rate



Kriging prediction

[481.8,495.6]
 (494.6,508.4)
 (506.4,521.2)
 (521.2,534)
 (533,546.8)
 (544.8,559.6)
 (558.6,572.4)



Kriging standard error

[77.21,77.59]
 (79.59,78.97)
 (80.97,80.35)
 (81.35,81.73)
 (82.73,83.11)
 (83.11,84.5)
 (84.5,85.88)

From Figure above, the Variogram model shows that there is spatial autocorrelation of the examined variables. However, the spatial prediction of crime rate shows that, the crimes rate will be increase in Faskari, Jibia, Batsari, Danmusa and Safana Local Government Areas.

DISCUSSION OF FINDINGS

It was discovered that the major causes of security challenges are unemployment (40%) the second is poverty (25%) followed by illiteracy (24%) and lastly others factors that lead to the security challenge represented (11%). The experimental Variogram of crimes rate in the selected Areas indicated that, there is spatial autocorrelation of all examined variables. It also observed that, the areas likely to experience the increase rates of crimes are Kankara, Faskari, Safana, Jibia and Danmusa, this is because of the forest situated in their areas which help the criminals to commit a crime and hide easily. It also observed from the prediction results that there is a chance of occurrence of crimes in the nearby villages.

CONCLUSIONS AND RECOMMENDATIONS

The study concluded that the highest cause of insecurity is unemployment, followed by poverty and illiteracy. The study also concludes that there is possibility of the increase rates of crimes in some of the study areas and chance of occurrence of crimes in the nearby villages of the hot spot areas.

Recommendations

1. Youth and Women should be given trainings on various entrepreneurial skills for self - reliance and source of livelihood.
2. Rehabilitation Centers should be encourage to help in shaping the Internally Displaced Persons affected by the shock of the insurgency.
3. The strategy of intelligence gathering and surveillance to predict potential crime should be emphasize.

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