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RESEARCH ARTICLE

AN ASSESSEMENT OF SPATIAL DISTRIBUTION PATTERN OF SECURITY OFFICES IN SULEJA LGA, NIGER STATE. A GIS-BASED APPROACH

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ABSTRACT

Security challenges have dominated the discourse on the development and peaceful co-existence of any urban centre in recent times. Adequate security personnel are paramount to curbing the rate of crime. However, provision of office space is critical to their effective and efficient control of crime rate. Therefore, the study worked on an assessment of spatial pattern of security offices in Suleja LGA, Niger state, A GIS-based approach. The study identifies the spatial location of security office and examined the distribution pattern of the security offices in the study area. The study adopted GIS and statistical methods to assess the spatial distribution pattern of security offices in Suleja LGA, Niger state. The pattern of security offices distribution was determine with use of High/low clustering (Gestis-Ord General G) tool in ArcMap and ANN(average nearest neighborhood) analysis.The result of the study indicates that the area has a total number of thirty-seven (37) security offices. Findings indicate that average nearest neighbour ratio is 0.846369, has a critical value of -1.79 and P-value of 0.074 as a test of significant. Therefore, the spatial pattern of distribution of security offices in Suleja was clustered. Also, observed General G value was 0.048287 while the expected General G was 0.001094 with a test of statistic; P-value of 0.016427 and a Z-score: 2.399294 which shows that the clustering pattern is high in the study area. The study recommended more security offices should be established in the area to reduce crime incidence. This is because areas with low security offices in the study area had mostly high crime incidences compared to areas with more security offices. Equally, urban development authorities and all stakeholders in urban development should randomly include spaces for locating security offices in the urban plan of any emerging urban centre.

KEYWORDS

Crime, Security, Office, Incidences, Clustered, GIS

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Introduction

The absence of adequate infrastructure and the need for improve standard of living have encouraged out-migration from rural areas to several urban centres. In most developing countries particularly Nigeria, in-migration to this urban centre have been noticed. Expectedly, as urbanization continues to take the centre stage with most migrants not experiencing new life and standard of living; crime and insecurity begins to dominate the urban setting.

Crime /insecurity remain one of the major problems of urban areas. Adebayo, (2019) asserted that insecurity compromises safety of lives and properties; threatens the quality of life, desecrates human rights, destabilises social and economic milieu and thwart sustainable development. Molloy & Card, (2016)defines crime as a "legal wrong, the remedy for which is a punishment of the offenders at the instance of the state". Apparently, crime may be regarded as an act that has negative impact on the public and the state.

Generally, crime can be classified as crime against persons and the public. Crime against persons refers to rape, kidnapping, murder, man slaughter and assault. Others include child stealing, slave trade, burglary, forgery, arson, cheating/fraud, armed robbery, house breaking among several others. Also, crime against the public refers to bribery/corruption, forgery of currency, gambling, breach of peace, perjury etc.

In Nigeria several security organisation existed namely Nigerian Police Force, The Civil Defense Corps, Vigilantes, and Peace Corps among others. These security organisations are to ensure that adequate security is being provided in and around the communities or urban centres. As such, the location of the offices of these security organizations is essential for effective and proper protection of life and property.

Several studies on crime/insecurity and the location of security offices are found in literature. Ajala & Owabumoye, (2018) studied Influence of police stations' location on crime incidence in developing countries like Nigeria. The study applies the use of (GIS) techniques. The study reveals increase incidence of crime as distance to police stations increases as a result of reduction of police coverage. Equally the study shows the clustering of police stations. The study concludes that the pattern of crime in the study area is a function of the pattern of the distribution of the police stations.

Ikharo & Ikharo (2019) worked on Locational Analysis of Police Stations in Bauchi Metropolis Using GIS Systems. The study adopted the use of GPS to take coordinates of police stations and the use of interviews including documented data. Analysis of the data was the use of simple ratio, nearest neighbour analysis and buffer zones classification. The study reveals 898:1 population to police ratio in the study area. The study recommends increase in the police work force in other to curb crime in the area. Bitrus, Dankani & Emmanuel (2020) examined a spatio-temporal study of accessibility of police services and facilities in Sagbama LGA, Bayelsa State, Nigeria. The study adopted geospatial techniques to get the geographical coordinates of police facilities using GPS. The data was discussed using descriptive statistics, NNA and buffer operation to determine the extent of police facilities. The result of the study indicates presence of six (60 police station, police-population ration reducing between 2014 to 2018, NNA9nearest neighbour analysis) indicating dispersed point pattern at 0.01% significance level. The study recommends reduction of police personal to political office holders and more recruitment to the police to be embarked upon.

Mafumbabetic, Chivhenge, Museva, Zingi & Ndongwe (2019) studied mapping the spatial variations in crime in rural Zimbabwe using geographic information systems. The study adopted the use of GPS (Global positioning systems) to collect data and conducted interviews. Moran-I was used to determine crime clustering and crime hotspots was determine using Gertis-Ord statistics. The study reveals crime densities of 4.6, low crime densities of 1.15, high-high crime clusters around wards 11, 15 and 30, crime hotspots around ward 11, 12, 15 and 30. The study recommends beat patrol to combat crime.

More so, Khan & Talukder (2021) looked at spatial distribution of crime in Bagladesh: An analysis. The study adopted the use of GIS based mapping of crime areas in Bangladesh. Online sources were adequately utilised in the study and the temporal scope of the study was 2016-2018. Eight ranges/zones were purposively selected for the study. Descriptive statistics was used to analyse the

data collected. The study reveals increase in crime incidence during the period under study. The study recommends police collaboration with social institutions to curb incidences of crime and the introduction of close circuits' camera (CCC) in crime prevention. Above all, Badru, Akintuyi & Wunude(2019) examined mapping of prevalence and distribution of crime within university of Lagos, Nigeria using geographic information system. The study adopted GIS to map, classify security posts, determine spatial and temporal pattern of crime. Results of the study reveals eighty-one (81) security posts and 2012 crime occurrence between 2012-2015. The study recommends the use of GIS for locating security posts and increased security personnal to control crime rate within the university.

Despite, the various review of literature on crime and security facilities done; none has assessed the spatial distribution pattern of security offices in Suleja LGA, Niger State, Nigeria: A GIS- based approach. The study intends to add to the body of knowledge.

STUDY AREA

Suleja Local Government Area in Niger state has an area of 136.33 km^2 and lies between latitude 9º 6' 13.8" and 9º 17'49.35" north of the equator and longitude 7º 6' 58.6" and 7º 12' 18.41" east of Greenwich Meridians. Suleja Local Government Area is bounded with Gurara to the North-West, Tafa to the East in Niger State and Gwagwalada, Zuba to the south, in Federal Capital Territory (Fig.1.1) (Aminu and Niranjan, 2013). Suleja city within the Local Government Area has ten (10) ward namely; Bagama A, Bagama B, Magajiya, Iku South I, Iku South II, Hashimi A, Hashimi B, Maje, KurminSarki and Wambai.

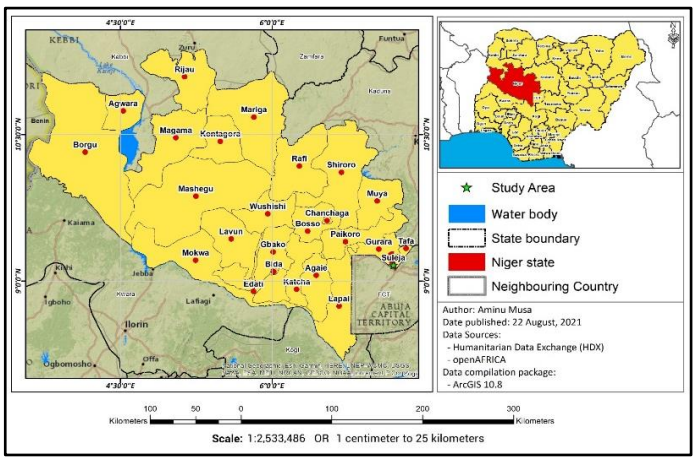


Fig.1.1: Nigeria showing Niger state

Source: Author's Lab Work (2021)

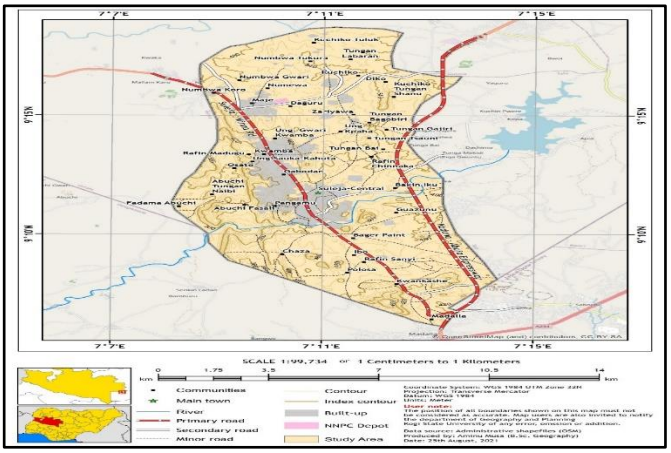


Fig.1.2: Study Area

Source: Author's Lab Work (2021)

The geology of Suleja is made up of two major rock formation namely sedimentary (Bida basin) and basement complex rocks. Sandstone and alluvial deposits, particularly along the Niger valley and in most parts of Niger state characterised sedimentary rocks to the south. This sub area also contains the extensive flood plains of the River Niger and this has made the state to be one of the largest and most fertile agricultural lands in the country (Areo, Arinola, & Adesina, 2019). Migmatites, gneisses, schists, migmatite-gneiss and granite make up the basement complex rock of the Birnin-Gwari Schist and Kushaka Formation (Akano, Idris-Nda & Waziri, 2016).

The dry and wet season makes up of the Suleja climate condition.. Relative humidity is 72% in rainy season and quite low in dry season. August and July always have the highest downpour of rain while the mean annual rainfall is about 428.83mm of rain and approximately 30 rainy days. The month of March always have the highest amount of temperature of about 31°C and lowest in August at about 26°C due to the frequency of rainfall (Yahaya & Odekunle, 2019). Suleja is found within the Southern Guinea Savanna vegetation which consists of thick grassland and shrubs. Notable trees in this area are Mahogany, Iroko, Obeche, Locust Bean, Shea Butter trees, Palm trees and generally having light vegetation sparsely populated by trees of moderate height and sizes (Akano et al, 2016). However, the impacts of intense cultivation, soil erosion and urbanization have drastically affected the vegetation cover of the area. Also the weathered remains of the varied basement complex rocks formed the major

soil parent material in the study area. The major soils are categorized as Ferric Luvisols, Ferric Acrisols and Ferric Cambisols(Ojanuga, 2006).

Suleja Local Government Area is dominated by residential, educational, agricultural, commercial and recreational land uses. Apparently, Suleja Local Government has a population of 216,578 and a land mass area of 118,910 Sq.km with 2,142 Density/Square kilometres (Niger State Bureau of Statistics, 2012). Mat making, dyeing, farming, cotton weaving are the major traditional primary activities. In addition, secondary and tertiary economic activities are also carried out.

Methodology

Data Collection and Analysis

Data on the absolute location and attribute data of various security offices (Police stations, police outpost, vigilante offices and others) were collected with the use of hand-held GPS (76CSx Garmin) set to an accuracy of ±3 m and set to a Coordinate reference System of WGS 1984. The GPS was position close to each of the office buildings or premises to collect their absolute coordinates (X, Y).During the spatial data acquisition, the attribute data of each of the security offices were also captured in a structured table against the point identification number. The entities of interest for the security offices were name of security office, address and coordinate. Thereafter, the spatial statistic toolbox in ArcMap was used to assess the average nearest neighbourhood (NNA) analysis tool which was used to explain degree of regularity, randomness or clustering. Also, high/low clustering (Gestis-Ord General G) tool in ArcMapwas used. Data were analyzed using descriptive statistics such as tables and maps to indicate and symbolize outcome of the findings.

Results and Discussion

To Identify the Spatial Location and distribution pattern of security offices in the study area

Data was collected in other to identify the spatial location and determine the pattern of security offices in the study area.

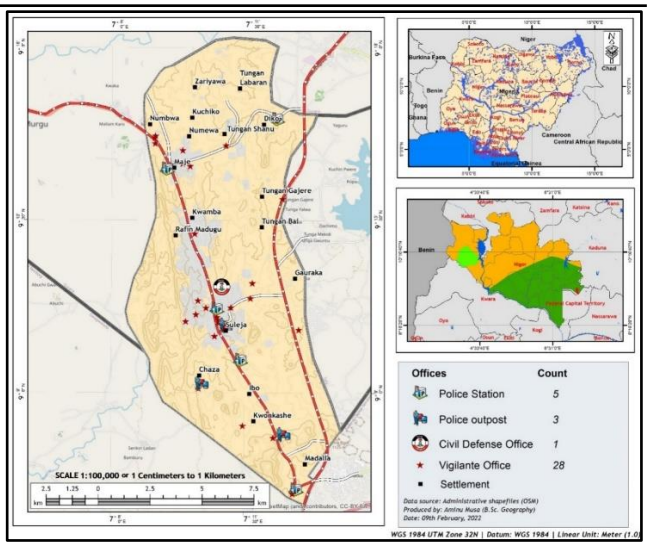


Fig 1.3: Distribution of Security offices in Suleja

Source: Author's lab work, 2021

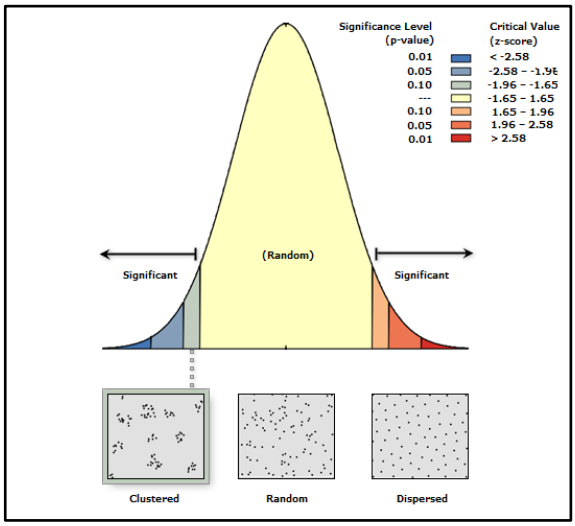
Table 1: Spatial Distribution of Security offices in Suleja

Community	Civil Defence	Police Outpost	Police Station	Vigilante	Total
Chaza	0 (0.0%)	1(2.7%)	0(0.0%)	1(2.7%)	2(5.4%)
Diko	0 (0.0%)	0 (0.0%)	1(2.7%)	1(2.7%)	2(5.4%)
Emirate	0 (0.0%)	0 (0.0%)	0 (0.0%)	1(2.7%)	1(2.7%)
Gauraka	0 (0.0%)	0 (0.0%)	0 (0.0%)	1(2.7%)	1(2.7%)
IBB Market	0 (0.0%)	0 (0.0%)	0 (0.0%)	1(2.7%)	1(2.7%)
KwambaAntena	0 (0.0%)	0 (0.0%)	0 (0.0%)	1(2.7%)	1(2.7%)
Kwankwashe	0 (0.0%)	1(2.7%)	0 (0.0%)	1(2.7%)	2(5.4%)
Madalla	0 (0.0%)	1(2.7%)	1(2.7%)	1(2.7%)	2(5.4%)
Maje	0 (0.0%)	0 (0.0%)	1(2.7%)	5 (13.5%)	6 (16.2%)
NumbwaGwari	0 (0.0%)	0 (0.0%)	0 (0.0%)	2(5.4%)	2(5.4%)
NumbwaKoro	0 (0.0%)	0 (0.0%)	0 (0.0%)	1(2.7%)	1(2.7%)
Pangamu	0 (0.0%)	0 (0.0%)	0 (0.0%)	2(5.4%)	2(5.4%)
RafinSanyi	0 (0.0%)	0 (0.0%)	0 (0.0%)	1(2.7%)	1(2.7%)
Second gate	0 (0.0%)	0 (0.0%)	0 (0.0%)	2(5.4%)	2(5.4%)
Suleja	1(2.7%)	1(2.7%)	2(5.4%)	6 (16.2%)	10 (27.0%)
TunganGajiri	0 (0.0%)	0 (0.0%)	0 (0.0%)	1(2.7%)	1(2.7%)
Total	**1(2.7%)**	**3 (8.1%)**	**5 (13.5%)**	**28 (75.7%)**	**37 (100.0%)**

Source: Author, 2021

Fig.1.3 indicates the spatial location and distribution of the security office. It was observed that there is high concentration of these offices in the central part of the

area as shown from the number of offices in Table 1, with very few located around the outward which can be



attributed to the presence of commercial activities mostly in the central area and the need for effective security coverage. Thus, the area has a total number of thirty-seven (37) security offices. Among which the CBD (Suleja) has ten10 (27%) security office, 2 (5.4%) Police Division Headquarter (A&B) and 6 (16.2%) vigilante officesincluding their Headquarter. While a total of 6 (16.2%) security offices are located up north of the study area with 1(2.7%) Police station with Madalla having 2(5.4%) the remaining are police outpost and vigilante offices sited outside the central part (Chaza, Kwankwashe, Madalla. Gauraka and Numbwa,)etc. The implication of this finding is that the rate of crime will be high in the areas not within the central business centre. And invariably become breeding ground for criminals in the long run.

Spatial distribution pattern of security offices

The distribution pattern of security offfices in the study area was conducted with the aid of the average nearest neighborhood and High/low clustering (Gestis-Ord General G) tool in ArcMap. Results generated are shown in Table 2, Fig.1.4 and Fig.1.5.

Table 2: Security Offices Average Nearest Neighbor Summary

PARAMETER	VALUE
Observed Mean Distance:	721.7083 Meters
Expected Mean Distance:	852.7109 Meters
Nearest Neighbour Ratio:	0.846369
Distance Method:	EUCLIDEAN
z-score:	-1.787763
p-value:	0.073814

Fig 1.4: Security Offices Average Nearest Neighbor report

Source: Author's GIS Report

The result of the finding indicates that the average nearest neighbour ratio is 0.846369. This falls within the Cluster – random zone (observed mean distance divided by the expected mean distance), with a critical value of -1.79 and a test of significant: P-value of 0.074 as indicated in Table 2. The result of the breakdown shows that the spatial pattern of distribution of security location in Suleja was clustered *(Fig.1.4)* and with the z-score of -1.79, there is less than 10% likelihood that this clustered pattern could be the result of random chance. In other words we are 90% confidence of rejecting the null hypothesis which state that the distribution is random. The degree of clustering was measured using the Getis-Ord General G statistical tools and a result was generated. This result corroborates with the finding of Badru, Akintunji, Omoniyesha & Wunule in their study mapping the prevalence and distribution of crime within university of Lagos using Geographic Information System that given the Z- score of -3.64125643921, there is less than 1% likelihood that this clustered pattern could be the results of random chance. Equally, the clustered pattern is expected as crime in most urban centres is usually concentrated within the central business district (CBD).

Table 3: Getis-Ord General G statistical result of Security Offices

PARAMETER	VALUE
Observed General G:	0.048287
Expected General G:	0.020589
Z-score:	2.399294
P-value:	0.016427

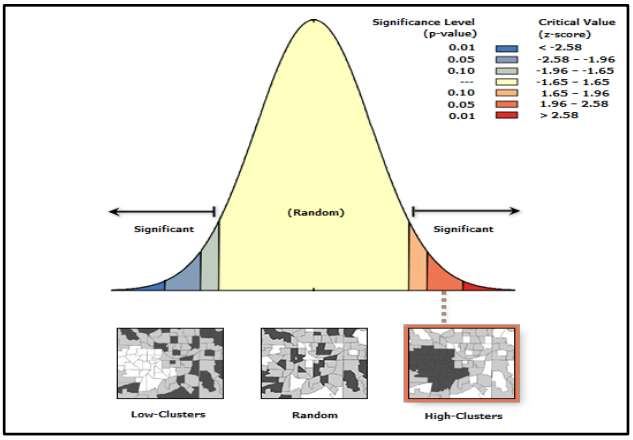


Fig 1.5: Gestis-Ord General G

*S*ource: Author's GIS Report

Result generated from the Fig.1.5 indicates that the observe General G value was 0.048287 while the expected General G was 0.001094 with a test of statistic; P-value of 0.016427 and a Z-score: 2.399294 which shows that the clustering pattern is high in the study area. There is a less than 5% likelihood that this high-clustered pattern could be the result of random chance which implies we are 95% confidence of rejecting the null hypothesis of random clustering.

The clustering pattern reveals that the offices are not evenly distributed over space. This is attributed to the concentration of the population in the central place area of the study area. The implication of this finding is that they is lack of adequate spatial planning and regulatory standard in the location of these offices. Therefore, high impact of crime in areas outside the CBD.

Conclusion

It is imperative to note that crime and insecurity will remain a major problem in towns and cites given the extent of urban poverty. Importantly, security organizations that are saddled with the responsibility of protecting life and propereties deserve condicive office in other to operate effectively. However, the distribution of available security offices indicates uneven distribution of the security offices. As such, areas with inadequate security offices is prone to more crime activities and invarably increasing the level of insecurity. Likewise, more security offices should be established in the area to reduce crime incidence. This is because areas with low security offices in the study area had mostly high crime incidences compared to areas with more security offices. Finally, stakeholders in urban planning should include location of security offices in their plan as part of national security strategies to curb crime.

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