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CONTENTS

ASSESSMENT OF THE FACTORS AFFECTING THE SPATIAL DISTRIBUTION OF SECONDARY SCHOOLS IN SOME PARTS OF BENUE STATE, NIGERIA

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Abstract

This research studied the factors affecting the spatial distribution of secondary schools in some parts of Benue State. The objective of the study was to assess the spatial relationship that exists between relief, population, land area covered by the districts and the schools distributed in the districts. The study adopted survey, field observation and measurement to obtain the needed data. Population of 2006 census was collected and projected at 2.9% to get the current population of the study area. ArcGIS 10.1 was used to produce the relief maps of the study area and establish the relationship between relief and the schools' patterns. It was also used to compute the land area covered by the districts using digital map. Descriptive and inferential statistical techniques were employed to analyze the data. The result shows that relief is the most predominant factor affecting the spatial distribution of schools in the three Local Government Areas. A disproportionate relationship exists between population, land mass and schools. This disproportionate relationship weakens the strength for ascertaining the findings on the effects of population and landmass on spatial distribution of schools in the area. This study recommends that further research should be conducted using GIS database analysis and more robust inferential statistical techniques to validate the result and establish spatial reality of the findings.

Keywords: Determinants, Distribution, Schools, GIS, Population, Relief

Introduction

Education is seen as one of the most promising paths for individuals to realize better and more productive lives and as one of the primary drivers of national economic development (Akpan and Njokwu, 2013). Formal education has been a priority in both developed and developing countries because of its contribution to social economic development (Neema *et a,* 2019*)*. However, in developing countries, formal education faces a number of challenges that necessitate the formulation of various policies to facilitate its accessibility (Asiyanbola, 2017; Sumari et al., 2019).It is a basic human right and is indispensable for realization of other human rights as a means for accessing broader social, economic, political and cultural benefits (Aliyu, Sule and Youngu, 2012). The provision of educational facilities is crucial to bringing education to the door

steps of all (Oluwadare and Julius, 2011; Khalid and Hamdy, 2013). This explains why the United Nations' Millennium Development Goals (MDGs) of September 2000 emphasize "equal and adequate educational opportunities at all levels". Various countries of the world have their economies largely influenced by their respective educational systems.

In Chile for instance, a close relation seems to exist between the socio-economic aspect of the families and the performance of an educational centre. However, it is difficult to describe statistically and geographically the spatial distribution of educational centres, how to measure accessibility of the school population to those centres, or how to establish the degree of spatial correlation between location of educational facilities and the population strata according to their quality and level of income, respectively.

In South Africa, the Department of Public Services and Administration (DPSA, 2011/2012) reported that education facilities are well distributed and located and most children live within 5km from a school, with most having a choice of school within this distance. However, in many areas there is a distinct lack of capacity at government provided schools relative to the number of people living in that area.

In Nigeria, one of the major concerns of successive Nigeria governments since attainment of independence in 1960 is implementation of strategies for wider accessibility and reduction of inequalities in educational opportunities among the populace (Ekemode and Oduolowu, 2004). However, the growth of the educational sector is yet to be matched by real development vis-a-vis the removal of all barriers of inequality of educational opportunities among the people. Scholars like; Jonathan and Kayode (2009); Musa and Mohammed, (2012) and Aliyu, Shahidah and Aliyu (2013); and unanimously confirm that there is inequality of educational opportunities across the country. This perfectly agrees with Eze (2010), who stated that Nigeria has some unique characteristics that tend to make development difficult. According to him, industrial location policies are either formulated partially to favour certain non-economic gains or satisfy geo-political lines.

Nigeria is a demographically young nation with most of the teenagers in their secondary school age. Without adequate secondary schools in the country, majority of the young people will be unable to grow educationally and in career attainment. However, many recent studies have shown that secondary schools are inadequately supplied and unequally distributed in Nigeria (Inobeme and Ayanwole, 2009; Idowu, 2012; Musa and Mohammed, 2012; Akpan and Njokwu, 2013; Odum, 2014; Jiya, Salawu and Jibril, 2014; Olawole, Alilesere and Aguda, 2015).

This inadequacy and uneven distribution negatively affect accessibility to secondary schools in the country (Akpan and Njokwu, 2013; Aliyu, Shahidah and Aliyu, 2013; Olawole, Alilesere and Aguda, 2015). This limits the chances of some children making transition from primary school to secondary school. It also limits their ability to reach full potential thereby negatively affecting their quality of life.

Just like Eze (2010) stated, the spatial distribution of public educational facilities in Benue State has been greatly influenced by different factors. Consequently, there is high rate of inaccessibility due to increase of inequalities in educational opportunities. These inequalities arise partly because there is no policy on the spatial distribution of schools in the state. The only official guide on school establishment available in the state is minimum standards. Consequently, the urban centres are favoured by these spatial patterns of educational opportunities at the expense of their rural counterparts. However, one aspect of access to rural services that remains relatively under-researched in Nigeria is in the area of distributional pattern (Olawole *et al.* 2015).

In Benue State, available studies on the factors affecting the distribution of secondary schools are scanty. Among the many scholarly works that have been done on secondary schools in Benue state, none has either specifically addressed the spatial distribution of secondary schools in the area. This has limited the possibility of making significant and valid assessment of the determinants of the spatial patterns of schools in the area. Consequently, this study attempts to fill this gap by identifying the factors that determine the distribution of secondary schools in selected parts of Benue State, by answering the question: What are the factors that affect the spatial distribution of secondary schools in the area?

Material and Methods

The study area is Logo, Gboko and Obi Local Government Areas of Benue State which lie between Latitudes $6^0 55'54''$ and $7^0 9'34''$ North of the Equator and Longitudes $7^0 59'20''$ and $9^0 56'18''$ East of the Greenwich Meridian (Figure 1). Logo, Gboko and Obi cover land areas of about $1388.908 km^2$, $1834.403 km^2$ and $397.016 km^2$ respectively. The climate of the area in general is of the tropic wet and dry climate (Aw) according to Koppen's classification scheme.

The study adopts the survey research design. The primary sources of the data are the researcher's fieldwork using GPS to obtain schools coordinates while interviews were used to obtain attribute data from selected heads of government ministries, educational institutions and districts that were used as guides. The secondary sources of data include the Local Government Information Units, Area Education Offices, Ministry of Land and Survey and National Population Commission (NPC, 2006). The target population is all the secondary schools in the area. However, the secondary schools in the selected Local Government Areas for this study were sampled

using stratified random sampling and simple random sampling techniques. The choice of stratification for this study is in agreement with Gyuse (2005) who said that stratification will not have to be only according to numbers, it also applies to spatial association. A total of 120 secondary schools were identified and mapped in the three Local Government Areas altogether; 19 secondary schools in Logo Local Government Area, 83 secondary schools in Gboko Local government Area and 18 secondary schools in Obi Local government area.

ArcGIS 10.1 software was used to compute the total area (km²) for each district and Local Government Area (LGA) using digital map of Benue State. It was also used to produce the relief maps of the three LGAs, which were used to assess the relationship between relief and number of schools' alongside land area and population. The land area and population data generated were edited, coded and assigned unique numeric values to allow for easy handling and usage in the statistical software. The codes were entered into Statistical Package for Social Sciences (SPSS) for analysis. The analysis was carried out using regression statistics. Results of the analysis were presented in maps, tables and charts as appropriate. Regression statistical tool via SPSS 16.0 was used to examine the relationship between population, land area coverage and number of secondary schools in each Local Government Area. The relief factor was not considered in the regression analysis simply because of unavailability of quantifiable relief data.

Results
Factors that determine the distribution of secondary schools

Assessment of these schools within the districts reveals that the schools are not equally distributed in the districts of the Local government Areas. Some districts are over serviced; others are under serviced while others are completely neglected, resulting to the spatial disparity in the distribution of secondary schools among the Local Government Areas. This could be explained by certain factors. In this study, however, three factors of relief, population and land area affecting the spatial distribution of secondary schools in the three Local Government Areas, were investigated.

Factors affecting the spatial distribution of secondary schools in Logo L.G.A
Relief

The spatial visualization of these schools within the districts of Logo Local Government Area reveals that 47.4% of the schools are located on lands with average elevation and plain surfaces, 42.1% of the schools are located on positions of highest elevations while 10.5% of the schools are located on lowest elevations in the Local Government Area (Figure 2). This implies that plain lands with average elevation and flat surfaces have the highest preference for schools' location in the area. The next lands of preference for schools' location in the area are high elevated lands while the lowest elevated areas have the least preference for schools' location.
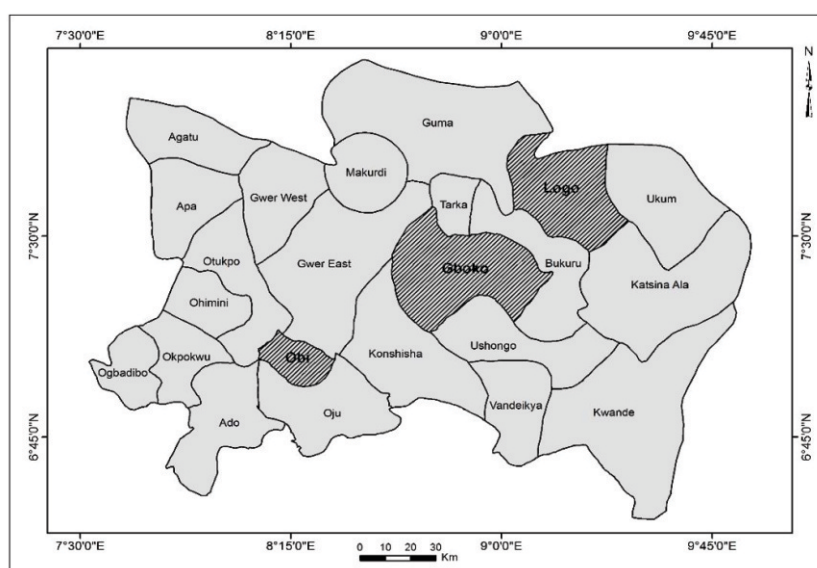
Figure 1: Benue State showing the Study Area.
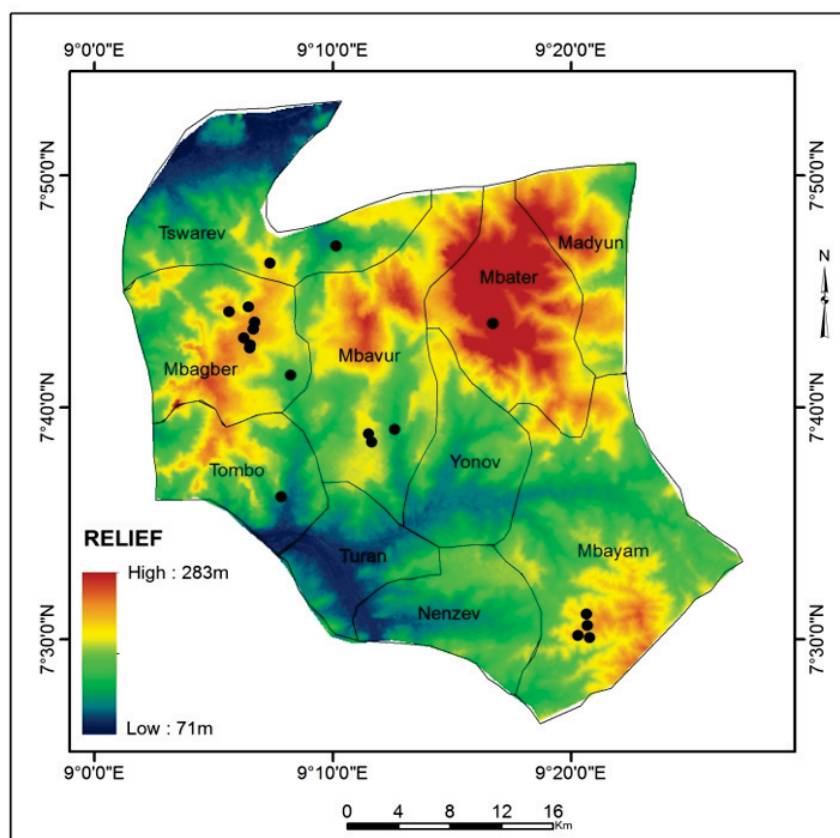Source: National Centre for Remote Sensing, Jos (2015).

Figure 2: Logo LGA showing relief and location of schools
Source: Researchers' field work

Population

In Logo Local Government Area, the districts with 16.5%, 12.3% and 8.9% of the population have 10.5%, 42.1%, and 15.7%, of the schools respectively. Conversely, the districts with 14.6% and 7.2% of the population both have 5.3% of the schools. A deviation occurs where the districts with 7.4%, 9.3%, 8.4% and 6.5% of the population all have 0% of the schools (Table 1). This trend is highly inconsistent, suggesting a weak relationship between population and schools' distribution in the area.

Land area

The district with 13.1% of the land area has 10.5% of the schools. The district with 9.8% of the land area has 42.1% of the schools. The districts with 7.4% and 10.9% of the land area both have 5.3% of the schools. All the districts with 7.2% of the land area or less have 0% of the schools (Table 1). The relationship between schools and land area is more consistent in the districts of Logo local government area.

Table 1: Relationship between schools, population and land mass in Logo LGA

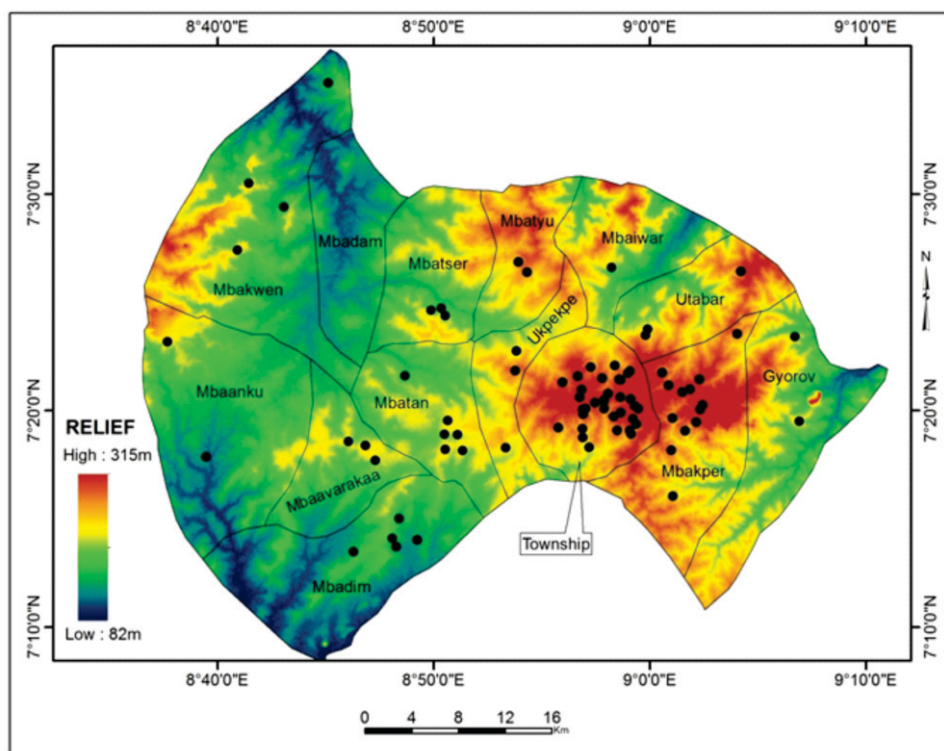| S/No	Districts	Population	Area (Km²)	No of Sch
1	Tswarev	20522	182.432	2
2	Mbagber	15257	135.998	8
3	Tombo	18166	102.755	1
4	Mbavur	11133	203.092	3
5	Mbater	8941	151.245	1
6	Yonov	9270	100.364	0
7	Turan	11522	78.040	0
8	Nenzev	10471	98.723	0
9	Madyun	8063	88.623	0
10	Mbayam	11189	274.636	4
	TOTAL	**124,534**	**1388.908**	**19**

Source: Researchers' field work

Figure 3. Gboko LGA showing relief and location of schools
Source: Researchers' field work

Factors affecting the spatial distribution of secondary schools in Gboko L.G.A

Relief

The spatial visualization of these schools within the districts of Gboko Local Government Area reveals that 53.0% of the schools are located on lands with average elevations, 42.2% of the schools are located on lands with highest elevation while 4.8% of the schools are located on lands with the lowest elevation in the Local Government Area (Figure 3). The implication is that stakeholders will prefer to locate their schools on plain lands with average elevation. Like Logo Local Government Area, the next lands of preference for schools' location in the area are lands with highest elevation while low lands with the lowest elevations have the least preference for schools' location. The fear of the choice of lands with lowest elevations could be related to the water logged nature of the lowest points in the area.

Population

In Gboko local government area, the district with 2.8% of the population has o% of the schools while the district with 2.5% of the population has 3.6% of the schools. However, the other districts with 12.3%, 4.8%, 4.2% and 4.9% of the population all have 3.6% o the schools. A close relationship exists where the districts with 37.9%, 9.4% and 4.4% of the population have 42.2%, 16.9% and 8.4% of the schools respectively. A little deviation occurs where 6.3% of the population has 6.02% of the schools (Table 2). This trend is slightly consistent.

Land area

The district with 5.6% of the land area has 0% of the schools while the districts with 4.2%, 4.8% and 5.0% of the land area all have at least 2.4% of the schools. However, there is a deviation where the districts with 12%, 8.7% and 5.5% of the land area have 2.4%, 2.4% and 1.2% of the schools respectively. Likewise, the district with 6.3% of the land area has 42.2% of the schools while those with 8.2% and 10.0% of the land area have 16.9% and 6.0% of the schools respectively (table 2). This trend is inconsistent making population the likely determinant of schools' allocation in Gboko Local Government Area.

Table 2. Relationship between schools, population and land area in Gboko LGA

S/No	District	Population	Area (Km²)	No of sch
1	Mbadim	28454	182.602	5
2	Mbakwen	25880	248.436	3
3	Mbadam	12725	102.308	0
4	Mbatser	21982	111.104	3
5	Gyorov	20016	160.017	2
6	Ukpekpe	19128	77.164	3
7	Mbatyu	21560	77.722	2
8	Mbaiwar	17082	100.406	1
9	Township	171983	115.784	35
10	Utabar	22448	90.916	3
11	Mbakper	42558	150.153	14
12	Mbaanku	18459	219.439	2
13	Mbaavarakaa	11182	87.873	3
14	Mbatan	20175	110.479	7
TOTAL		**453,632**	**1834.403**	**83**

Source: Researchers' field work
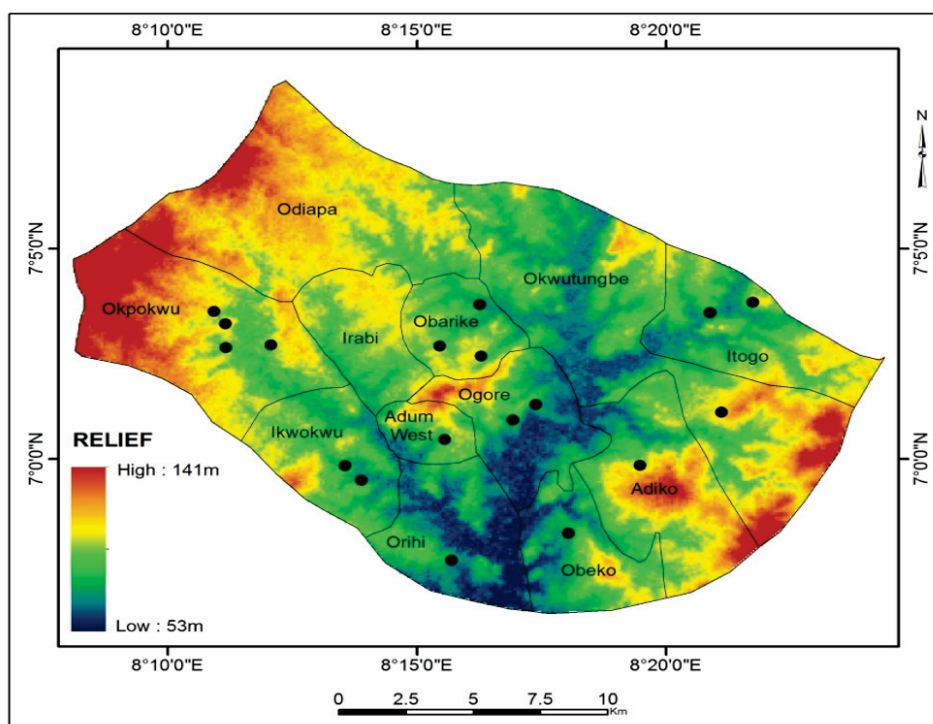
Figure 4. Obi LGA showing relief and location of schools.
Source: Researchers' field work

Factors affecting the spatial distribution of secondary schools in Obi L.G.A

Relief

The spatial visualization of these schools within the districts of Obi Local Government Area reveals that 66.7% of the schools are located on lands with average elevation in the area, 33.3% of the schools are located on lands with the lowest elevations while 0% of the schools are located on the highest elevated lands in the area (Figure 4). Eventhough the result reveals that stakeholders' have high preference for plain lands with average elevation in the area, it is not completely consistent with the situation in Logo and Gboko Local Government Areas. This may have occurred as a result of the influence of political, economic, social and other factors on the distribution of schools in the area.

Table 3: Relationship between schools, population and land area in Obi LGA

S/No	District	Population	Area (Km²)	No of Sch
1	Adiko	6033	35.872	1
2	Odiapa	9138	64.062	0
3	Okwutungbe	10953	78.646	1
4	Itogo	14187	29.419	2
5	Obarike	15371	15.367	3
6	Ogore	6082	24.265	2
7	Adum West	4089	8.345	1
8	Irabi	8204	19.886	0
9	Okpokwu	17964	48.821	4
10	Ikwokwu	11000	24.068	2
11	Orihi	7210	26.919	1
12	Obeko	6201	21.388	1
	TOTAL	116,432	397.016	18

Source: Researchers' field work

Population

In terms of population, the districts in Obi Local Government Area with 5.2%, 9.4%, 3.5%, 6.2% and 5.3% of the population all have 5.6% of the schools. The districts with 12.2%, 5.2% and 9.4% all have 11.1% of the schools. The districts with 15.5% and 13.2% of the population have 22.2% and 16.7% of the schools respectively. While the districts with 7.8% and 7.0% both have 0% of the schools (Table 3). This trend is a little bit more consistent, suggesting population as the most likely determinant of school allocation in the area.

Land area

Alternatively, in terms of land area, the districts with 9.0%, 19.8%, 2.1%, 6.8% and 5.4% of the land area all have 5.6% of the schools. Those with 7.4%, 6.1% and 6.1% of the land area all have 11.1% of the schools. Those with 12.3% and 3.9% of the land area have 22.2% and 16.7% of the schools respectively. Those with 16.15 and 5.0% of the land area both have 0% of the schools (Table 3). This trend is highly inconsistent, making land area an unlikely determinant of school allocation in Obi Local Government Area.

Regression Analysis of Population, Land Area and Secondary Schools in the Study Area

Table 4 shows that Logo Local Government Area has regression coefficients of 0.503 and 0.332 for area and population respectively. This means that area has a stronger relationship with number of secondary schools than the population. The predictive ability of population is relatively weaker (0.001) than that of area (0.16) evident in the adjusted R-square values. The goodness of fit probability plot is harmoniously less definitive (Figure 5). This situation is explicitly incorporeal probably because of the level of growth of education sector in this local government area.

Normal P-P Plot of Regression Standardized Residual
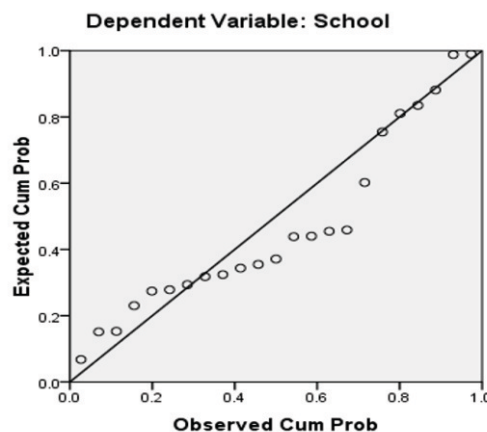
Fig. 5: Goodness of fit probability for schools, population and land area in Logo LGA

In Gboko Gocal Government Area, the relationship between the number of secondary schools and the land area is statistically very poor indicated by a very weak regression coefficient of 0.027. Population on the other hand has a strong positive relationship with the number of secondary schools in Gboko evident in the regression coefficient of 0.968 (Table 4). This shows that population is a stronger determinant of number of secondary schools in Gboko Local Government Area. The implication is that the higher

Table 4: Regression analysis of population, land area and secondary schools in the study area

L.G. A	Regression coefficients	
	Land Area and Secondary Schools	Population and Secondary Schools
Logo	0.503 (Adj. R^2 = 0.160)	0.332 (Adj R^2 = 0.001)
Gboko	0.027 (Adj. R^2 = -0.08)	0.968 (Adj R^2 = 0.933)
Obi	0.103 (Adj. R^2 = -0.08)	0.731 (Adj R^2 = 0.448)

the population, the higher the number of secondary schools. The adjusted R-Square value of 0.933 (93.3%) shows how much of the explanation in the number of secondary schools as occasioned by the number of people in the Local Government Area.

The situation in Obi Local Government Area is not unlike the one in Gboko Local Government Area. The size of the local government area has a very poor statistical relationship with the number of schools (r = 0.103). Conversely, population has a significant relationship with the number of secondary schools in the same local government area. With a regression coefficient of 0.731.This means that any unit increase in the number of people brings about a 0.73 (73%) standard increase in the number of secondary schools and vice versa. The adjusted R-square value is however not very strong statistically (0.488). This shows the extent to which the number of secondary schools in the area can be explained by the population.

Discussion

The study examined the factors affecting the distribution of secondary schools in the three senatorial zones of Benue State. This is consistent with Olawole*et al* (2015) who suggest that this pattern of distribution of secondary schools is determined by different factors other than physical distance. Three factors were considered; relief, population and land mass of the districts and Local Government Areas.

Generally, Gboko and Obi Local Government Areas have more similarities in spatial distribution of secondary schools than Logo Local Government Area. A stronger relationship is observed between relief and the spatial distribution of secondary schools in the three Local Government Areas. However, the independent assessment of the relief factor weakens the strength of the relationship. This makes uncertain the fact that relief has stronger influence on the spatial distribution of the schools than population and land mass.

 A strong relationship also exists between population and secondary schools in Gboko and Obi Local Government Areas. However, there is a disproportionate relationship between land mass and schools' distribution in Logo Local Government Area. This makes the likelihood of population been the factor predominantly determining the distribution of schools in the area not ascertained, despite the strong positive relationship between population and number of schools in the area generally. However, it is obviously indisputable that population has stronger influence on the spatial distribution of the schools than land mass.

The study further reveals that there is deficiency in the distribution of secondary schools among the districts. Some districts are over serviced; others are under serviced while others are completely neglected. This indicates that the secondary schools are inadequate and unevenly distributed among the districts. This result is in agreement with the findings of Khalid and Hamdy (2013) in Kuwait which shows uneven distribution of schools and lack of schools in many districts.

Conclusion

It is uncertain from the findings, that relief is the most predominant determinant of schools' location in the three Local Government Areas. Population is identified to be the most likely determinant of schools' distribution in Gboko and Obi Local Government Areas, while land mass seems to be the most likely determinant of schools' distribution in Logo Local Government Area. This disproportionate relationship weakens the strength for generalizing the effect of any of the factors on spatial distribution of schools in the area.

Recommendations

Based on the results of the analysis and findings of this study, it was recommended that further research should be conducted using GIS database analysis and inferential statistics techniques to establish spatial reality of the findings on population and land mass. Also, further research should be conducted to identify the effects of political, economic and social factors on the spatial distribution of secondary schools in the study area.

References

Akpan, P. E. and Njoku, E.A. (2013). Towards a Sustainable Distribution and Effective Management of Schools' Facilities in Ikot Ekpene LGA of Akwa Ibom state: A Geographic Information System Option, *Mediterranean Journal of Social Sciences*, 4(16): 77 – 84.

Aliyu, A., Shahidah, M. A., and Aliyu, R. M. (2013). Mapping and Spatial Distribution of Post Primary Schools in Yola North Local Government Area of Adamawa State, Nigeria, *International Journal of Science and Technology*, 2(5): 405 – 422.

Aliyu, Y.A., Sule, J.O., and Youngu, T.T. (2012). Application of Geospatial Information System to Assess the Effectiveness of MDG Target in Amac Metropolis – Abuja, Nigeria *Research Journal of Environment al and Earth Science*, 4(3): 248 – 254.

Asiyanbola, A. R. (2017). An Evaluation of Public Servant Awareness and Use of GIS/Remote Sensing in Africa-Nigeria, *South African Journal of Geomatics,* Vol. 7. No. 1, 349-362

Ekemode, K. O. and Oduolowu, E. (2004). Sustainable Development of the Nigeria Rural- Girl – Child: Poor Accessibility and Unequal Opportunities as Limiting Factors in Primary Education, *Journal of Academic Qualitative and Quantitative Finding in Educational Sector for Development*, 1 (01): 174- 179.

Eze, C. G. (2010). Integration of Geographic Information System in Planning and Managemaent of Industrial Development in Nigeria, FIG Congress, Sydney, Australia: 11 -16.

Gyuse, T.T. (2005). *How to Plan, Execute and Report your Research*, Selfers Education Books, Makurdi.

Idowu, I. A. (2012). Database Management and Mapping of Secondary Education Infrastructure in Sabon-Gari and Zaria Local Governments, Kaduna State, Nigeria, *Science and Technology*, 2(2):1-7.

Inobeme, J. and Ayanwole, K. A. (2009). Assessing the spatial Distribution of Government Secondary Schools in Zaria Area, Kaduna State, *The Information Manager,* 9(1): 1-9.

Jiya, S. N., Salawu, E. and Jibril, M.S. (2014). The Use of Geospatial Approach in Assessing the Impacts of Long Distance to school on Students' and Pupils of Gidan Mango/ Garatu Axis in Bosso Local Government Area of Niger State, Nigeria, *Indian Journal of Information Sciences,* 3(2): 109-113.

Jonathan, I. and Kayode, A.A (2009). Assessing the Spatial Distribution of Government Secondary Schools in Zaria Area, Kaduna State, *The Information Manager* Vol.9(1): 1 – 9.

Khalid, A. and Hamdy, I. E. (2013). GIS as an Efficient tool to Manage Educational Services and Infrastructure in Kuwait, *Journal of Geographic Information System,* 5: 75-86.

Musa, H. D. and Mohammed, B. B. (2012). Analysis of Spatial Distribution of Primary and Secondary Schools in Bida Town, Nigeria. *Abuja Journal of Geography and Development*, 3(2): 30 – 40.

National Population Commission–NPC. (2006). Federal Republic of Nigeria Official Gazette, Lagos, *The Federal Government Printers,* 24 (94): B187.

Neema, S. S, Hashir, T, Zhenfeng, S and Ernest, S. K. (2019). Geospatial Distribution and Accessibility of Primary and Secondary Schools: A Case of Abbottabad City, Pakistan. 29th International Cartographic Conference. Tokyo, Japan. International Cartographic Association.

Odum, P. O. (2014). *Geospatial Decision Support System for Universal Primary Education in Cross River State,* Unpublished M. Sc. Remote Sensing and GIS Thesis, Department of Geography, Obafemi Awolowo University, Ile Ife, Nigeria.

Ogunyemi, S.A., Muibi, K. H., Eguaroje, O. E., Fabiyi, O. O. and Halilu, A. S. (2014). A Geospatial Approach to Evaluation of Accessibility to Secondary Education Institution in Ogun State, Nigeria, *Earth and Environmental Science*, 7 (20): 1-13.

Olawole, M. O., Arilesere, O. A. and Aguda, A. S. (2015). Acccessibility to Rural Services: A GIS Based Analysis of Secondary Schools in Ife Region, Nigeria, *Nigerian Geographical Journal*, 10 (2): 110 – 125.

Oluwadare, O, I. and Julius, O. (2011). Regional Analysis of Locations of Public Educational Facilities in Nigeria: The Akure Region Experience, *Journal of Geography and Regional Planning*, 4 (7): 428- 442.

Republic of South Africa: Department of Public Service and Administratiion (2011/2012). Geographic Accessibility Study of Social Facility and Government Service Points for the Metropolitan Cities of Johannesburg and Ethekwini, Part C, Section 2, Pp1-62.

Sumari, N.S., Shao, Z., Van Genderen, J.L., Masakwa, W., Ujoh, F., Washaya, P. & Gumbo, T. (2019). Status of Geo-Informatics Education and Training in Sub-Sahara Africa: Initiatives Taken and Challenges. *Journal of Geography in Higher Education.* 2(7): 285-298

UNICEF (2012). Global Initiative on Out–of–School Children in Nigeria, http/www.unicef-irc.org. Accessed November, 18, 2015.