



ANALYSIS OF GEO-SPATIAL DATABASE AND DISTRIBUTION OF GOVERNMENT SECONDARY SCHOOLS' USING GIS IN CHIKUN LOCAL GOVERNMENT AREA, KADUNA STATE

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ABSTRACT

Provision of education as a global social service is champion by the public sector. Where these education facilities are located influences their utilization and efficiency. Proximity to these facilities also influences decisions to seek and patronize them. The study analyzes the geo-spatial database and distribution of Government Secondary Schools, using GIS in Chikun Local Government Area. 28 Government Secondary Schools were identified. Their geographic coordinates were established by the use of GPS device and mapped out. The data generated from the field was used to create geo-database of Government Secondary Schools. From the study, 51.4% of registered students were enrolled in the Government Junior Secondary Schools cadre while 58.6% was in Government Senior Secondary Schools. 79% of the student's enrolments were concentrated in three communities. Nasarawa community was 43.3%, Sabo-Tasha community was 19.4% and Narayi community was 16.5%. These communities form part of Kaduna metropolis with evidence of high population concentration. Queries from the database show only 21.4% of the Schools were with fenced, 7.1% of the schools were with school halls, 25% of the schools were with school libraries and 14.3% of the schools were with computers. The distribution pattern was found to be appearing not different than random using the ArcGIS auto-correlation analysis tool. Government Secondary Schools in the study area appear to be poorly equipped for conducive learning experience. Therefore, the study recommends schools expansion, provision of new schools and upgrading existing schools to standard by all stakeholders.

Keywords: Geographic-coordinates, geo-database, mapping, spatial distribution, government secondary schools.

INTRODUCTION

In most of the advancing economy of the world, human resources and education is crucial for development of civilization driving economy. Nations development and civilization depends primarily on its ability to utilize her intellectual resources at their disposal (Kinda, 2017). This makes education vital and mandatory for all nations who want to attain viable economy status. Education is strongly advocated by promoters of social equality, social justice and modern day democracy; who view it as a way for advancing development at a competitive edge. It also provides opportunities to the general public and can be measured and evaluated in terms of spatial, social, political and economic dimensions (Ogunyemiet *al.*, 2014; Juneitt, 2015). Therefore, access to education is a human right issues and development programme meant for economic transformation and liberation. One thing for grab is that, the overall impact of education for national development will guarantee quantity and quality of human resources needed for the economic growth and development of any nation.

Officially, formal education occurs in schools with infrastructural facilities and friendly environment where effective learning take place between the facilitator and the target audience (Sunday and Olayiwola, 2018). But in the past, the elites in Nigeria, and other African countries has used access to education as political and economic tool to suppress and uplift a section of the population over the other (Fabiya and Ogunyemi, 2015). This is often attributed to the fact that, there exist income inequalities in most countries. It is sad to know

that same injustice on social and economic drivers is still taking place in Nigeria today. The wide array of social inequalities of education has been a debated issue within the social sciences as well as the teaching profession. Discrimination of various kinds such as religion, politics, ethnic, racial, and gender are very often the main issues of debate. However, territorial inequalities of education are discussed far less, despite the facts that these differences exist in great extremes, and attempts to resolve them have yielded very little (Healey, 2008; Humphreys and Crawford, 2014). Unless the various stakeholders are willing to accommodate the fact as promulgated by Ibara (2019) that, the overall development strategy of education in any given society depends largely on the level at which there is an equitable distribution of educational resources and opportunities to all.

In Nigeria, especially the northern region, the provision of education facilities is typically concentrated in settled centers with higher hierarchical order (Umar *et al.*, 2016). In other words, there are more educational facilities in towns and cities than in rural settlements where only elementary schools are found. Inhabitants of core urbanized areas thus have better access to education than the poor inhabitants of remote rural peripheries. These practices are against what Barro and Jongwa. (2000) emphasized on the provision of education as a social service for all around the world, placing valid demands for government and interest stakeholders to do more in this regard. Secondary education is designed for the public after elementary schooling. It begins generally at the age of eleven

to sixteen years. Some secondary education, such as vocational schooling, is terminal and prepares the student for employment upon graduation. Others lead to advanced training in colleges, universities, or technical schools. The emphasis on educational services is based on the total dependence of development and policy actualization on the level of education in our society. If educational services are not adequately provided and sustained, it leads to poor and usable information in the system but if adequately provided and sustained, it provides the citizenry with information which can be used for effective and sustainable planning and management of their resources (Ige, 2013).

Chikun Local Government Area of Kaduna State Nigeria, form part of Kaduna metropolis with it headquarters is in Kujama. It has an area of 4,666 km², and currently has a projected population of 535,727 in 2020 base on 2006 population census used as beginning (NPCN and NBS, 2016). The problem with secondary education in the study area is not limited to provision of public secondary schools only but unbalance location and equipping of these facilities. Secondary education facilities has witness much pressure in recent years due to population explosion without corresponding expansion of existing and provision of new secondary schools and planning. Unless there is a tool to help decision makers in locating of schools base on approved standardized criterion, it will be abysmal planning for balance in the education sector. This is emphasized by Murray (2002) and Gangwar (2013) that location analysis approaches which assist planning processes continue to be important in both the public and private sectors given the costs and viability implications involved. Therefore, a deliberate effort is needed to balance the disparities by means of adequate distribution of public secondary schools within the study area. The study aim is to analyze geo-spatial database and distribution of public secondary schools at local government level, using GIS capabilities and different possibilities techniques. GIS application do support timely decision making, school mapping, operations for educational planning, enforcing clear school planning policies, and finding the best locations for existing and new services, service analysis, and creation of digital database. Stakeholders in education should take advantage of GIS tool for planning and management purposes (Senapathi and Paramasivam, 2019; Burrough, 2001). The study area is imperative and provided a framework and a guide for facility planning and management.

MATERIALS AND METHODS

Materials and equipments used for this study are administrative map of Chikun local government area sourced from Kaduna state ministry of lands and survey, 76C5X Handheld GPS receiver for acquisition of geographic coordinates of public secondary schools, Laptop that houses Microsoft Excel, Words and ArcGIS 10.3, for data processing, manipulations and GIS operations, checklist of all government secondary schools sourced from the local government head office, Kujama that served as guide for ground truthing. Questionnaires were administered to all principals of public secondary schools to authenticate the information received from the local government head office such as school name, address, number of students in each school, number of schools with fenced etc., secondary data from existing literature, journals, seminar papers, reports, thesis, and conference proceedings were used to enrich the study. A combination of descriptive and GIS

analysis was employed. The coordinates and other relevant attributes generated from field survey was copied in Microsoft excel and saved as CSV (comma delimited) format. It was imported into GIS environment 'ArcGIS 10.3' using the add XY command at the tools menu. The coordinates of each school was used to determine absolute locations of public secondary schools of the study area. This was done by overlaying the coordinates of the schools on the geo-referenced digitized map by a process known as point on polygon overlay. The map overlaid with the schools coordinates formed composite maps showing the distribution of public secondary schools of the study area. A spatial database was created using ArcGIS 10.3 software based on the attribute data derived from the coordinates, questionnaires and the checklist. The database was created by adding required number of fields (columns) to the table and entering the data for each school in their corresponding records (rows) of data attributes collected. A table was created in Microsoft Excel and saved as CSV (comma delimited) format which is recognized and accepted by the ArcCatalog extension of ArcGIS. The file is imported into Arc Map environment using the add XY Command at the tools menu for analysis. Updates and changes can be effected in any school attribute as well as adding more attributes in the ArcGIS interface by an authorized ArcGIS application user. The system created allows queries and updates. For the analysis of the distribution pattern of the public secondary schools, auto-correlation analysis was used to evaluate whether the spatial patterns of schools are clustered, dispersed or random. Using the ArcGIS 10.3 spatial statistic tools: the Moran's I value, the Z score or P value was calculated to assess the index. A Moran's I value close to +1.0 indicates clustering, while a value close to -1.0 indicates dispersion.

RESULTS AND DISCUSSION

Of the 28 Government Secondary Schools examined in the study area, 13 are Government Junior Secondary Schools and 15 are of the Senior Secondary Schools cadre. They are designed to service 22 communities out of several communities. The enrolments register of students at the time of study was 43,737 (100%) with 51.4% students enrolled in the Government Junior Secondary Schools and 58.6% students enrolled in Government Senior Secondary Schools. Nasarawa, Sabon-Tasha and Narayi Government Schools constituting 79% of students' enrolment. Furthermore, Nasarawa community had the highest students' enrolment of 43.2% with Government Junior Secondary School Nasarawa 21.9% while Government Senior Secondary School Nasarawa was 21.3%. Sabon-Tasha community had student enrolment of 19.4% with Government Junior Secondary School Sabon-Tasha 10.2% while Government Senior Secondary Sabon-Tasha was 9.2%. Narayi community student's enrolment was 16.5% with Government Junior Secondary Schools Narayi 9.8% while Government senior secondary schools, Narayi had 6.7%. Base on the analysis above, it is pertinent to note that, the three communities are located in the heart of Kaduna metropolis where rural-urban migration is on an increasing rate. Another key observation during the field was that most of these schools with higher population operate two schools in a single school concept. This suggest two things, either there is no space for expansion or stakeholders not willing to site new schools in the said communities. On the other part of the analysis, Government secondary schools with student enrolment of less

than 1 or equal to 1 are mostly located in rural communities learning. Below is the database display. and are schools with the worse facilities for conducive.

Table 1: Geo-spatial database of Government secondary school, Chikun Local Government Area

OBJECTID	LATITUDE	LONGITUD	NAMES_OF_SCHO	SCH_ENR	LIBRAR	FENCE	HAL	BIO_LA	PHY_LA	CHEM_L	HM_FCON_L	COMPTI	TOILET	Shape *
1	10.593691	6.890736	GSS Baba Saura	218	0	NO	NO	NO	NO	NO	NO	NO	YES	Point
2	10.271147	7.106161	GSS Chikun	167	0	NO	NO	NO	NO	NO	NO	NO	YES	Point
3	10.368775	7.399594	GSS Kakau	377	0	NO	NO	NO	NO	NO	NO	NO	YES	Point
4	10.368775	7.399594	GSS Kakau	323	0	NO	NO	NO	NO	NO	NO	NO	YES	Point
5	10.333175	7.518947	GSS Kankomi	233	0	NO	NO	NO	NO	NO	NO	NO	YES	Point
6	10.518715	7.105977	GSS Kasaya	118	0	NO	NO	NO	NO	NO	NO	NO	YES	Point
7	10.457831	7.624297	GSS Kujama	485	0	YES	NO	NO	NO	NO	NO	NO	YES	Point
8	10.457831	7.624297	GSS Kujama	448	0	YES	NO	NO	NO	NO	NO	NO	YES	Point
9	10.383242	7.491764	GSS Kidumu	283	0	NO	NO	NO	NO	NO	NO	NO	YES	Point
10	10.469981	7.449911	GSS Narayi	41300	1	YES	NO	NO	NO	NO	NO	YES	YES	Point
11	10.469981	7.449911	GSS Narayi	3004	1	YES	NO	NO	NO	NO	NO	YES	YES	Point
12	10.480914	7.3981	GSS Nassarawa	9621	0	NO	NO	NO	NO	NO	NO	YES	YES	Point
13	10.480914	7.3981	GSS Nassarawa	9191	0	NO	NO	NO	NO	NO	NO	YES	YES	Point
14	10.400511	7.494297	GSS Rido	469	0	NO	NO	NO	NO	NO	NO	NO	YES	Point
15	10.441509	7.454191	GSS Sabon Tasha	4444	1	YES	YES	NO	NO	NO	NO	NO	YES	Point
16	10.441509	7.454191	GSS Sabon Tasha	4010	1	YES	YES	NO	NO	NO	NO	NO	YES	Point
17	10.429208	7.416811	GSS Ungwan Romi	1430	1	NO	NO	NO	NO	NO	NO	NO	YES	Point
18	10.429208	7.416811	GSS Ungwan Romi	1105	1	NO	NO	NO	NO	NO	NO	NO	YES	Point
19	10.475975	7.488456	GSS Bagado	116	0	NO	NO	NO	NO	NO	NO	NO	YES	Point
20	10.250244	7.229972	GSS Gwagwada	299	0	NO	NO	NO	NO	NO	NO	NO	YES	Point
21	10.427281	7.384458	GSS Gonin Gora	1179	0	NO	NO	NO	NO	NO	NO	NO	YES	Point
22	10.480525	7.378553	GSS Kudendan	233	1	NO	NO	NO	NO	NO	NO	NO	YES	Point
23	10.420931	7.534425	GSS Maraba Rido	311	0	NO	NO	NO	NO	NO	NO	NO	YES	Point
24	10.318756	7.387847	GSS Sabon Gayan	376	0	NO	NO	NO	NO	NO	NO	NO	YES	Point
25	10.453931	7.4775	GSS Ungwan Baro	153	0	NO	NO	NO	NO	NO	NO	NO	YES	Point
26	10.6169	7.2316	GSS Buruku	348	0	NO	NO	NO	NO	NO	NO	NO	YES	Point
27	10.282	7.412	GSS Udawa	245	0	NO	NO	NO	NO	NO	NO	NO	YES	Point
28	10.666585	6.716264	GSS Kuriga	214	0	NO	NO	NO	NO	NO	NO	NO	YES	Point

From table 1, the Geo-database created allows us to perform different queries. For example, Government Secondary Schools without fence? Government Secondary Schools without hall? Government Secondary Schools with library? Government Secondary Schools with computers? etc. Below is the pop up results generated from the database on Government Secondary Schools without fence of the study area.

Table 2: Government secondary schools without fence in Chikun LGA.

OBJECTID	LATITUDE	LONGITUD	NAMES_OF_SCHO	SCH_ENR	LIBRAR	FENCE	HAL	BIO_LA	PHY_LA	CHEM_L	HM_ECON_L	COMPIE	TOILET	Shape *
1	10.593691	6.890736	GJSS Baba Saura	218	0	NO	NO	NO	NO	NO	NO	NO	YES	Point
2	10.271147	7.106161	GJSS Chikun	167	0	NO	NO	NO	NO	NO	NO	NO	YES	Point
3	10.368775	7.399594	GJSS Kakau	377	0	NO	NO	NO	NO	NO	NO	NO	YES	Point
4	10.368775	7.399594	GSS Kakau	323	0	NO	NO	NO	NO	NO	NO	NO	YES	Point
5	10.333175	7.518947	GJSS Kankomi	233	0	NO	NO	NO	NO	NO	NO	NO	YES	Point
6	10.518715	7.105977	GJSS Kasaya	118	0	NO	NO	NO	NO	NO	NO	NO	YES	Point
9	10.383242	7.491764	GJSS Kidonu	283	0	NO	NO	NO	NO	NO	NO	NO	YES	Point
12	10.480914	7.3981	GJSS Nassarawa	9621	0	NO	NO	NO	NO	NO	NO	YES	YES	Point
13	10.480914	7.3981	GSS Nassarawa	9191	0	NO	NO	NO	NO	NO	NO	YES	YES	Point
14	10.400511	7.494297	GJSS Rido	469	0	NO	NO	NO	NO	NO	NO	NO	YES	Point
17	10.429208	7.416811	GJSS Ungwan Romi	1430	1	NO	NO	NO	NO	NO	NO	NO	YES	Point
18	10.429208	7.416811	GSS Ungwan Romi	1105	1	NO	NO	NO	NO	NO	NO	NO	YES	Point
19	10.475975	7.488456	GSS Bagado	116	0	NO	NO	NO	NO	NO	NO	NO	YES	Point
20	10.250244	7.229972	GSS Gwagwada	299	0	NO	NO	NO	NO	NO	NO	NO	YES	Point
21	10.427281	7.384458	GSS Gonin Gora	1179	0	NO	NO	NO	NO	NO	NO	NO	YES	Point
22	10.480525	7.378553	GSS Kudendan	233	1	NO	NO	NO	NO	NO	NO	NO	YES	Point
23	10.420931	7.534425	GSS Maraba Rido	311	0	NO	NO	NO	NO	NO	NO	NO	YES	Point
24	10.318756	7.387847	GSS Sabon Gayan	376	0	NO	NO	NO	NO	NO	NO	NO	YES	Point
25	10.453931	7.4775	GSS Ungwan Baro	153	0	NO	NO	NO	NO	NO	NO	NO	YES	Point
26	10.6169	7.2316	GJSS Buruku	348	0	NO	NO	NO	NO	NO	NO	NO	YES	Point
27	10.282	7.412	GSS Udawa	245	0	NO	NO	NO	NO	NO	NO	NO	YES	Point
28	10.666585	6.716264	GSS Kuriga	214	0	NO	NO	NO	NO	NO	NO	NO	YES	Point

Result from table 2 display government secondary schools without fence indicating 22 (78.6%) public secondary schools are without fence with majority of them located in the rural communities. This invariably suggest that, only 6(22.4%) of public secondary schools are with fenced and are mostly located within Kaduna metropolis.

Another query was performs on “public secondary schools with school library” in the study area. The result display indicates that, only 25% of the public secondary schools has library while 75% coexist with no libraries. This also suggests how schools reading culture is fading in our places of learning. Below is the result display.

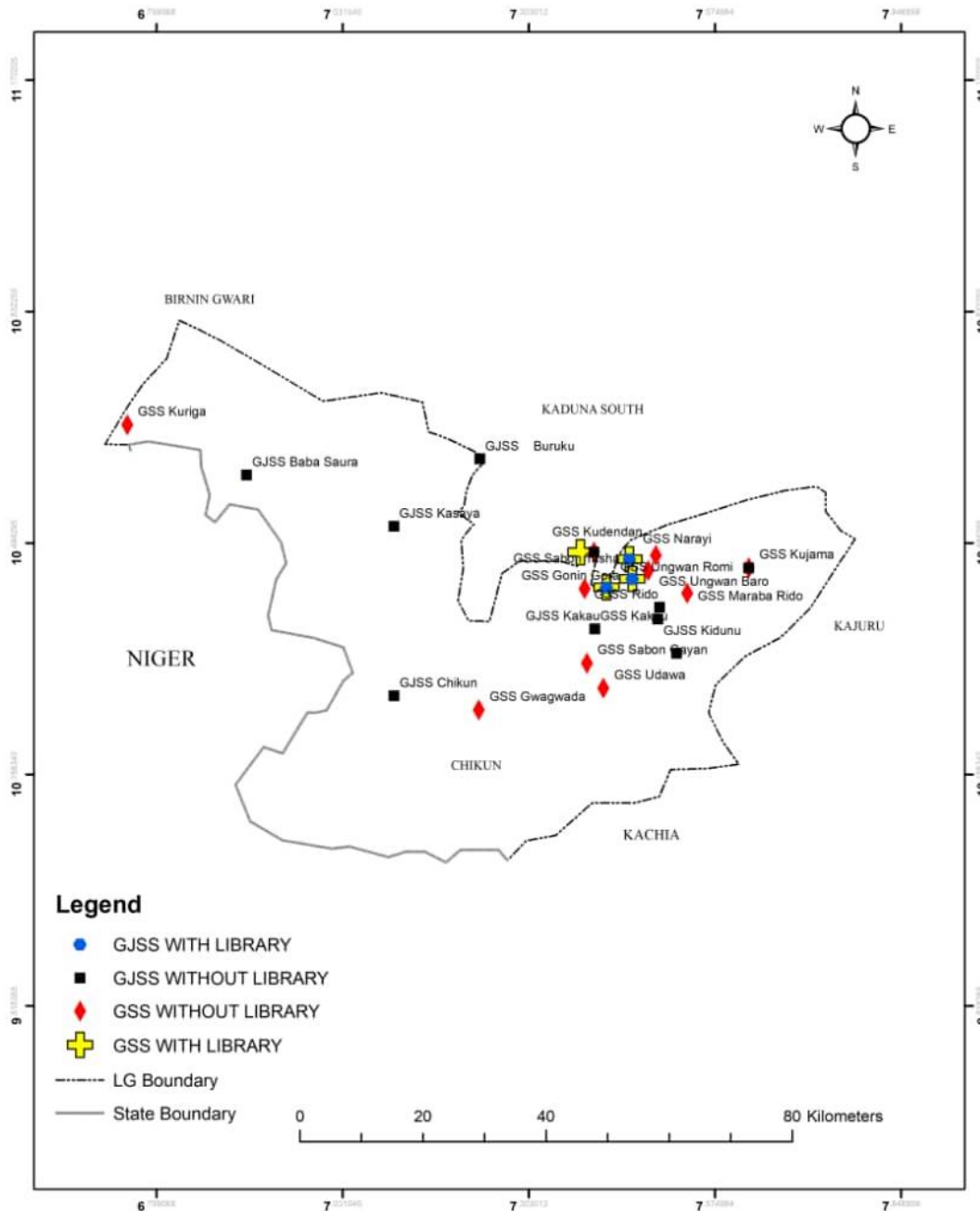
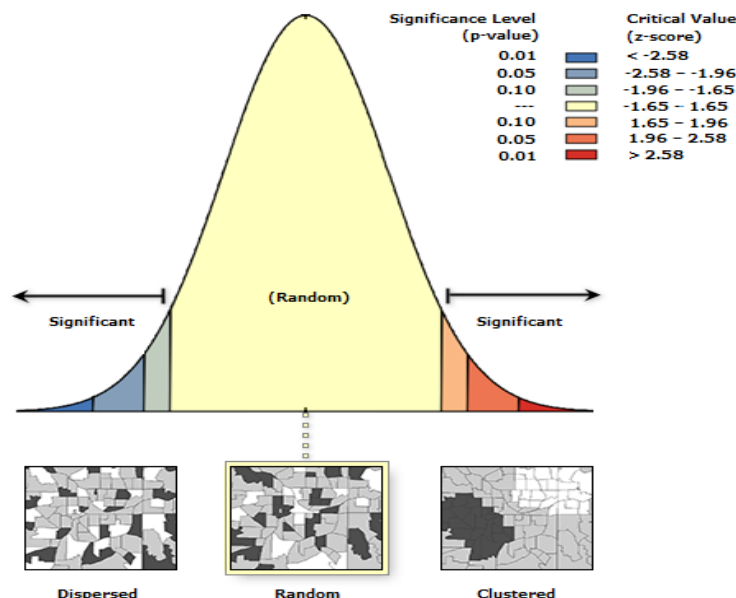


Figure 1: Government secondary schools with libraries of the study area

For the analysis of spatial pattern of public secondary schools, using the ArcGIS 10.3 auto-correlation statistical tool, the result from the report shows the following values: Moran Index value 0.337162, Z score 1.022555 and P value 0.267279. Given the Z-score value is 1.02, the pattern of distribution does not appear to be significantly different than random

The result from the report for the public secondary schools shows the following values: Moran Index value 0.337162, Z score 1.022555 and P value 0.267279. Given the z-score of 1.04, the pattern does not appear to be significantly different than random.



CONCLUSION

Finally to analyze Geo-spatial database and distribution pattern of public secondary schools using GIS in Chikun Local Government Area is imperative, considering how important GIS play in our modern world. The study was able to demonstrate the dynamic capabilities and possibilities of GIS application in spatial distribution and geo-database analysis. This work could serve as a guide for decision making, policy making, planning and implementation of different programmes within the overall educational sector. The study also revealed 28 public secondary schools in the study area, but only few was found to be equipped to guarantee sound learning environment. More so, the database created allows different queries to be generated such as government schools without fence, schools without library etc. The auto-correlation analysis also revealed that the distribution pattern of Government secondary schools is not different than random. Finally the study recommends expansion of some existing Government secondary schools and provision of additional government secondary schools especially in Kaduna metropolis. The Government should equip all government secondary schools not minding their rural locations or urban to provide sound learning atmosphere for students and teachers.

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