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Socio-Economic and Spatial Determinants of Housholds' Water Accessibility in Lokoja, Nigeria

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ABSTRACT

Access to adequate water is a major challenge facing many households in Nigeria especially In Lokoja, which has the largest burden of morbidity and mortality. Previous studies on water accessibility focused on quality, without considering the pattern of urban households' access to water based on geographic location and household socio-economic characteristics. Therefore, this study investigated socio-economic and spatial determinants of households' access to safe water in Lokoja, Nigeria with a view to developing practical and policy guidelines that will enhance access to safe drinking water. Cross-sectional design was adopted. A semi-structured questionnaire was administered to 350 household heads in the six residential zones across Lokoja as identified in the Lokoja Urban Master Plan. This was obtained using Taro Yamane sample size calculator based on the 2025 population projection of 58,219 households. The data were analyesed using descriptive and inferential statistics at $p \leq 0.05$. Male-head households constituted 57.6%. Households sourced water from boreholes (64.5%), tube-well (11.5%) hand-dug well (28.9%), rain harvesting (2.7%) and stream (0.10%). About 59% households had optimal access to water, 26.9% intermediate access and 14.4% has basic access, while pipe-borne water was not functional. There is association between Socio-economic characteristics of households and access to safe water R^2=0.54. The results obtained indicate that households has varied degree of water accessibility across residential zones in Lokoja. To achieve equitable access to safe water, restoration of public water reservoir system, provision of motorised and hand-pumped boreholes especially low ad medium density area were recommended among others.

Keywords: Access to safe water, Accessibility, Lokoja Water Supply

INTRODUCTION

In 2010, the United Nations General Assembly officially recognised the availability of clean and sufficient water, as well as proper sanitation, as an essential human right. It urged all nations to intensify their actions to guarantee affordable, dependable, and safe water services for everyone (United Nations, 2010). Approximately 489 million people around the world still lacked improved water sources as of 2020, and about 122 million relied directly on untreated surface water. The problem is regarded as most critical in sub-Saharan Africa, where inadequate water, sanitation, and hygiene (WASH) services are linked to persistently high disease and mortality rates.

The World Health Organisation (2019) reports that unsafe WASH conditions account for about 60% of diarrhoeal deaths in children. To build human resources, preserve public health, and keep children safe, it is important to have constant accessibility to safe water and good sanitation facilities. These systems also help the economy flourish in a way that is good for the environment. Despite this importance, numerous rural and urban areas in developing countries — Nigeria included — still face challenges in securing safe and sufficient drinking water.

Many urban settlements have developed without adequate consideration for wastewater management and this has increased the vulnerability of groundwater resources to contamination. UN-Water/Africa classifies Sub-Saharan Africa as water-deficient, suggesting a lack of access to reliable water for consumption. In several

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nations in this part of Africa, pipe-borne water delivery service is disrupted; households are either without water or have access to water for a restricted number of hours each day.

As global monitoring of water access advances under the Sustainable Development Goals (SDGs) framework, there is growing recognition of the need to understand the complex social and economic dynamics that shape access, usage patterns, and lived experiences. Such insight is crucial for promoting equity in policy interventions and ensuring that water supply initiatives deliver meaningful benefits. Lokoja is a confluence city to two major rivers in Africa, river Niger and Benue yet the households could not have access to safe water. In 2007, The Greater Lokoja water supply scheme was awarded to the Chinese Geo- Construction Company at the rate of $83, 000, 000, 00 through counterpart funding with the Word Bank and Kogi State Government. The water project was to supply 10 million gallons water per day to Grater Lokoja. The water scheme was in operational between 2011-2017. Relevant questions raised in this study include the following: So then what are the sources of water supply in Lokoja/? What is the spatial distribution of households' access to water supply in Lokoja? What is the association between socio-economic characteristics of households and access to safe water? Against this background this study seeks to examine socio-economic and spatial determinant of access to safe water in Lokoja

LITERATURE REVIEW

Conceptual clarification

Accessibility

Accessibility is defined as the quality of being at hand when needed, or as the degree of which a product, device, or service and commodity is available to as many as possible. Accessibility can also be viewed as the ability to access and benefit from some system or entity. However, this concept is applicable to the study because access to water is essential to the health and wealth of a nation. From the foregoing, a conceptual framework for this study is therefore given below in a pictorial model in Figure 1.

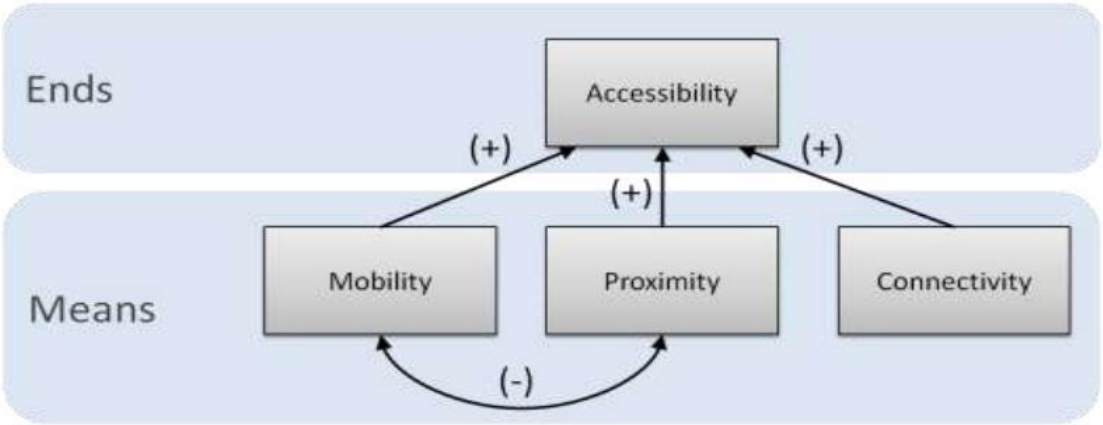

Figure 1. Conceptual model

Source: Extracted from Levine, Grengs and Shen, 2009

mobility

Mobility refers to the ability to move between any two points in space, it involve the movement of people, information, materials and goods. A growing number of people move as a result of competition for scarce resources and economic hardship. When there is drought and scarcity human and animals are forced to move from area of deficit to abundance. For instance, Women in developing countries walk an average of 6 kilometers per day to collect drinking water, in Cameroun they spend an average of 6 hours per day while in Kenya, and about four hours is spent in dry season and two hours in wet season (National Institute of Statistics, Cameroun (NISC), 2004).

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Proximity

Accessibility means aggregate nearness whereas the Advanced English Dictionary defines proximity as nearness and it is often quantifying with the world close. Put another way, accessibility is the synonym of proximity. Living in household with access to proximate water source has several benefits; private well or in - house tap water may be of higher quality than water from community sources, close water source reduces the need for lengthy storage, and also limit bacteria growth, this can also free mothers from water fetching so that they can devote more time for child care. According to United Nation Programme Fund (2001) water points should be sufficiently close to household with a maximum distance of 500metres. According to UN General Comment No. 15 (para. 16), every household, school, and workplace should have access to sufficient, safe, and acceptable water either on-site or in close proximity. The World Health Organisation (WHO) and UNICEF (2000) recommend that water collection points be located within one kilometre of the home and that the total collection time should not exceed 30 minutes Table1. However, the United Nations Office of the High Commissioner for Human Rights (UN OHCHR, 2010) reports that women in many African regions travel an average of six kilometres daily to fetch water, revealing a persistent gender gap in access and the physical burden associated with water collection.

Table 1: World Health Organisation (WHO) water accessibility indicators.

Travel distance to collect water	**(WHO) standard**	**Average time spent to collect water**	**WHO**
Water supply through multiple taps continuously < 100m	(optima access)	Water supplied through multiple taps within continuously five minutes	Optima access.
101-200m	One tap or within 100m (intermediate access)	5 minutes to 30 minutes	Intermediate access.
201-500m 500-1000m	Between 100 and 1000m(basic access)	30 minutes to 2 hours	Basic access.
1.1-2km (1.5km) 7.2km (3km)	More than 1000m (no access)	30 minutes to 2 hours 2-4 hours 4 hours.	No access.

Source: WHO (2004)

Connectivity

In-house connection is ultimately the goal of every individuals and population at large, this is because water will always be available with good quality and quantity. Improved drinking water source includes household water connection located inside the house and other improved water sources such as public taps or standpipes, tube wells or boreholes, protected dug wells, protected springs and rain water collection, (WHO/UNICEF JMP, 2004). To ensure safety of drinking water supplies within the building system, plumbing practices must prevent the introduction of hazards to health and this can be achieved by ensuring that; pipes carrying either water or waste are water tight, cross connection between drinking water supply and waste water removal system do not occur, water is discharged without contaminating drinking water and plumbing system function efficiently.

Water Accessibility and scarcity

Access to water is defined as a condition of uninterrupted contact and use of water for different purposes, and it can be in terms of quality and cost of getting water for various uses (Ifabiyi & Ogunbode, 2014). Water scarcity can be defined as the lack of access to potable water (Ifabiyi, 2011). On the other hand, it is attributed to a

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changing climate and population growth (Seckler et al., 1998). In addition, the water available to meet human demand and to each person can serve as a measure of scarcity (Rijsberman, 2006). Access to safe drinking water has improved over the last decades in almost every part of the world, but approximately one billion people still lack access to safe water and over 2.5 billion lack accesses to adequate sanitation, (Oriola et al. (2017) stated that the Sahel and Sahara are severely affected. This is because they are areas of the globe where adequate water supply in quantity and quality is a major problem. There are two main types of water scarcity namely; physical and economical scarcity (Seckler et al., 1998). Physical scarcity means that physical access to water is limited, it occurs when the demand for water outstrip supply; its implications include severe environmental degradation, declining aquifer, and unequal water distribution (Food and Agricultural Organization, 2012). Economic water scarcity on the other hand is when a population does not have the necessary monetary means to utilize an adequate source of water. It is also known as the lack of investment and proper management to meet the demand of people who are not financially buoyant to use existing water sources (FAO, 2012). According to WHO (2002), most of the people in sub-Saharan Africa are suffering from economic water scarcity. Economic accessibility refers to the affordability of water services, ensuring that the cost of obtaining safe and adequate water does not compromise individuals' ability to meet other basic needs. Water should be available at a price that is affordable to all, particularly low-income and marginalised populations. UN General Comment No. 15 (para. 12) stresses that payment for water services must be based on the principle of equity, taking into account both social and economic conditions. In line with this, the World Health Organisation (WHO, **2022)** advocates for progressive tariff systems and targeted subsidies that protect the poor while maintaining financial sustainability of water utilities.

Methods and Study Area

Lokoja is presently the administrative capital of Kogi State (Figure1.1), the city is located on the intersection point of Longitude 7º 49'E and Latitude 6º 44'N East of the Greenwich Meridian (Figure1.2). It is bounded on the north by river Niger and to the west by wooded hill Mount Patti and to the south by Ajaokuta. Lokoja occupies an area of about 29,833km². It lies on the right-hand side of kilometre seventy-six of the Okene-Abuja Road. (Ifatimehin et al., 2014). Lokoja town is the confluence of Rivers Niger and Benue. Due to its strategic location as a confluence city. Water Supply takes it raw water from this river. The River Niger, which meets the River Benue at Lokoja, is one of Nigeria's most significant river systems, with an estimated average flow rate of 137.9 km² per year (Ifatimehin et al., 2014). During the rainy season, its water level typically rises to 8–10 metres above sea level, while in the dry season, it falls to around 3–5 metres. The Greater Lokoja Waterworks relies on the River Niger and its extensive floodplain, which also supports year-round agricultural activities. In addition to this main drainage system, the Ganaja Stream also flows into the River Niger, contributing to local hydrology.

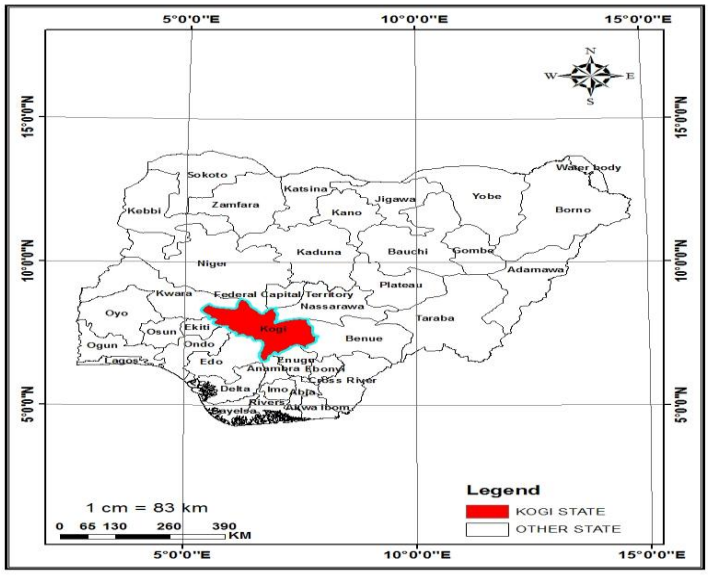

Figure 2.1: Kogi State in the Context of Nigeria

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Source: Department of Geography, Prince Abubakar Audu University, Anyigba, 2023

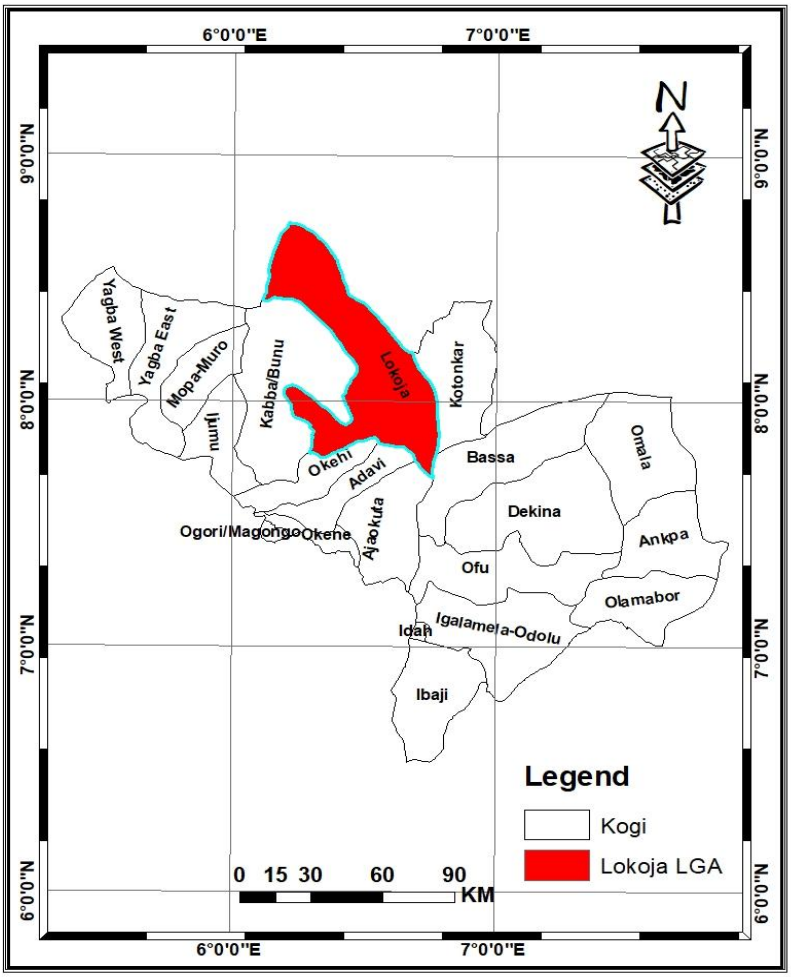

Fig. 2.2 Map showing Lokoja in the context of Kogi State

Source: Department of Geography, Prince Abubakar Audu University, Anyingba

Cross sectional survey research design was adapted for the study. Primary and secondary data were used for the study. Primary data were sourced through the use of questionnaire. The sample size of 350 households were drawn from the population of 58,219 households using multi-stage sampling technique. At the first stage, Lokoja was stratified into six zones for ease of data capturing. At the second stage, localities with population of over 10,000 persons (Urban localities benchmark as identified by Olatubara (2004) were identified in the study area with the aids of National population figure 2006 projected to 2023. At the last stage, a random choice of 'n' number of households corresponding to 0.006% of the total number of households was selected randomly. O.006% of the total number of households was selected for the study owing to the fact that 95% of the studies reviewed on household's access to water and sanitation had a sample size between 100 and 150 resulting from the use of 0.006% of the sample frame. Within each community, separate but proportional samples were drawn using the number of households and number of communities Table 2. This gave a total of 350 households. Accordingly, 350 copies of the survey questionnaire were administered on households in the selected communities.

Data collected were analyse using both descriptive and inferential statistics for this study. Simple percentages combined with tables, charts and figures were used to analyse the collected data. The Multivariate statistics used is the Multinomial logistic model which was employed to capture the relationship between the socio-economic characteristics of households and their access to safe water. In this study, each of the identified socio economic characteristics was selected as the dependent variables. Five sets of variables are the predictor, these are: households income, level of education, location of property, religion and households' size. There are eleven categories form these set of predictors. Educational background as an independent variable is with four categories

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of no formal education, primary, secondary and tertiary. Similarly occupation is categorised into four farming, artisan, trading, and civil service while households' size is also with three categories of small, medium, and large.

Table 2: Sample Frame and Size

Zones	Number of Households	Sample size (0.006%)
Zone1	9572	58
Zone2	4693	28
Zone3	6,371	38
Zone4	17,127	103
Zone5	13,028	78
Zone6	7, 428	45
Total	58,219	350

Source: Computed from the Record of National Population Census, 2006 and Report for Lokoja Metropolis Enumeration (2026).

RESULTS AND DISCUSSION

Educational Status, Occupation, and Households' Income

Table 4 shows the literacy level of respondents. About 53.6% of the respondents had tertiary education, while 30.8% constituted secondary school certificate holders. Only about 4.5% of the respondents claimed that they had no formal education. It is expected that formal education enhanced the respondents understanding of Households water Accessibility.

With regard to the respondents' occupation, Table 5 also reveals that 28.2% are either self- employed or artisans while 41.2% are civil servants. Traders account for 17.9% while only3.3% claimed to be unemployed. This trend shows a diversity in the livelihood activities of the study area and it is not unexpected of an urban area.

Responses of respondents on the household income are presented in the same table. It is revealed that 13.2% of the respondents earned below ₦50,000.00 per month while 11.6% claimed that they earned between ₦50,000 and ₦100,000.00 in a month. Also while 46.2% earned between ₦100,000 and ₦150,000.00 monthly. About 8.2% of the household sampled earned above ₦200,000 monthly. This implies that a low percentage of the household were self-employed and traders and they were able to provide sustainable income for their households. Furthermore, this result connotes that households were empowered to pay for water utility rate or bill if services were provided regularly by Greater Lokoja Water-Supply.

Table 3: Educational Status, Occupation and Household Income

Variables	No of Respondents	Percentage
A, Educational Status		
No formal education	6	4.5
Primary	39	11.1
Secondary	109	30.8
Tertiary	189	53.6
B. Occupation		

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Self-employed/artisan	98	28.2
Civil servant	144	41.3
Trader	60	17.1
Unemployed	46	13.3
C. Household income		
<50,000	49	13.6
50,000-100,000	42	11.6
100,001-150,000	165	46.6
150,001-200,000	74	20.6
>200,001	32	8.5
	350	**100**

Source: Field survey, 2025

Households' sources of water in Lokoja

The result of the collective analysis of the 873 household heads obtained shows borehole, tube-well and hand-dug well were the main sources of water in the study. In addition, no zone had access to pipe borne-water as at the time of the study. Field investigation indicated that tube-well were motorised and well design by well-lining, head well cover and concretised floor around them while hand-dug well were deficient by head wells and use of bucket that was attached to a rope as a fetcher.

The study revealed in fig. 3 that zone 1 which comprises Cantonment, Cemetery, New Lay-out and Old-market about 60.2% households' sampled sourced their water from bore-holes; while 11.2% have access to tube-well, about 31.3.2% have access to Hand dug-well while 01 household which accounted for 1.4% claimed to source their water supply from rain harvesting.

Zone 2 comprises of Galilee, Kabawa and New Market which are the core areas of the city. About 58.2% sampled households have access to boreholes while 10.5% have access to tube-well. Furthermore, 38.4% claimed to source their water supply from hand-dug well. Rain-harvesting and stream accounted for 1.6% and 2.6% respectively.

Zone 3 which comprises of Army signal, Lokongoma phase 1, phase 2 and Secretariat Housing Estate. About 63.7% sampled households have access to bore-holes while 17.2% sourced their water from tub-well. Similarly, about 20.5% source their water supply from Hand dug-well while 01 households which accounted for 0.99% claimed to source their water through rain-harvesting.

Zone 4 comprises Adankolo, Gadumo, 200 units, 500 units and Ganaja. Out of the 257 households sampled, about 66.5% have access to bore-holes while 18.5% source their water supply from tube-well, 13.3% source water from Hand dug-well. Furthermore, 0.69% source their water from rain-harvesting while and 1.06% sampled households claimed to source their water from river/stream.

Households' water accessibility in Zone 5 which comprises of crusher, Sarkin Noma and Felele, about 56.5% sampled households have access to borehole water while 14.3% sampled households source their water from tube-well. Similarly 33.7% claimed to sourced their water supply from Hand dug-well while 2.3% source their water through rain-harvesting

Access to water in zone 6 which comprises Army Barracks. Otokiti and zango Daji. About 64.3% have access to bore-hole water while 10.4% have access to tube-well for their water supply. Similarly, about 33.1% claimed to source their water supply from hand-dug well and a paltry number of 0.2% claimed to source their water

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supply from rain-harvesting. The result of this study were corroborated by the findings of Adekola (2018) that typical urban area in the Southwestern Nigeria do not have access to Pipe-borne water supply but source water through supplies from underground resources include the hand dug wells and drilled boreholes.

Borehole account for highly significant source of about 64.6% of the total households sampled in the study due to the fact that most of the households have resorted to the drilling of well and boreholes in order to offset the huge short fall in water supply as observed (Tomilayo & Sannin, 2013) . The finding also reveals that tube-well and hand-dug well account for about 28% and 18.9% respectively of the sampled households. However, the disadvantage is that most of the wells in the study area usually run dry during dry season. This is corroborated with the studies which opined that almost all groundwater sources are major source of water in home during the dry season when the resources is scarce (Musa&Fumen, 2013; Kolawole & Afolayan, 2017)

Meanwhile others such as stream and river and rain accounted 0.9 and 2.4 respectively this is because some of the households in the study area are located in Town.

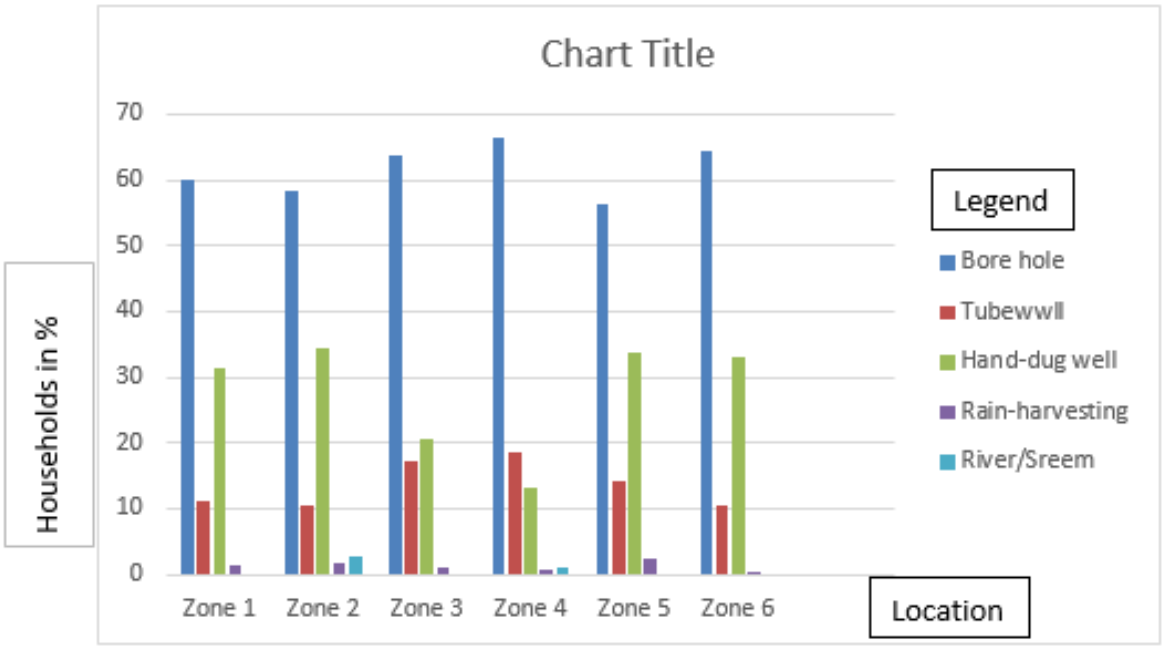

Figure 3 Households' Sources of Water

Association between Access to safe water and socio-economic attributes of households

The study also investigate the association between households' characteristic and access to improved sources of water in residential density areas. Regression analysis was carried out at (0.000) significant level. There were five independent variables, these include: Households income, level of education, occupation, location of property and religion. The correlation coefficient were weak to moderate, Residential density (R=0.540) and level of education (R=0.479) were most strongly related to the dependent variable (Table 5)

Table 5: Correlations coefficients among socio-economic factors and access to safe water.

Variable	R	P
Religion	0.017	0.307
Occupation	0.188	<0.001
Households' size	0.347	<0.001
Income	0.252	<0.001

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Education	0.479	<0.001
Residential density	0.540	<0.001

Source: Field survey, 2026

Results of the multivariate regression analysis are presented in Table 6, the results revealed that all the socio-economic variable with the exception of religion were significantly associated with access to improved sources of water. Households' level of education, location of property and household income demonstrated the greatest explanatory capacity. Combination of all the independent variables cumulatively explained 54% (R^2=0.54) of the variance in access to improved sources of water in the study area. Therefore, we accept H^1 at 0.00 level of significance which states that there is an association between socio economic characteristics of households and access to safe water. The findings is in agreement with Dare (2014) who argued that socio economic characteristics of household influence access to water supply and willingness to pay. Similarly, Akoteyon (2018) corroborated it that access to safe water is influence by location of property.

Table 6 Standardised Regression Coefficients on the Relationship among Socio-economic Factors and Access to Improved Water Source

Predictor	R^2	B	P
Religion	0.540	0.034	0.239
Occupation		0.148	<0.001
Household size		0.116	<0.001
Income per month		0.208	<0.001
Level of Education		0.485	<0.001
Residential density		0.476	<0.001

Source: Field survey, 2026

Households' Water Accessibility

a. Access to Safe Water in Terms of Distance

Distance is a critical indicator for assessing access to water supply. Findings from Table 7 reveal that approximately 58.7% of households travel less than 5 minutes to access water in the study area. This is regarded as optimal access, supply of water through multiple taps within the house this imply average quantity exceed 100 liters per person per day; households cleaning is also assured. While 26.9% cover distances between 5-30 minutes to water point.

This is regarded as intermediate access; likely volume of water collected 50 liters per person per day public health risk from poor hygiene may be compromise and bathing may occurs off-plot. Additionally, 14.4% of the sampled households travel between 30minute to 1 hour to fetch water; average quantity unlikely to exceed 20 liters per person per day. Public health risk from poor hygiene may be comptomise during outbreak and bathing may occur off-plot (WHO/UNICEF (2004).

These results suggest that although a significant proportion of residents in Lokoja have access to boreholes, tube wells, or hand-dug wells capable of meeting their water needs, distance still poses a substantial barrier to achieving equitable access to improved water sources. The persistence of this challenge underscores the need for spatially inclusive planning and investment in water infrastructure to reduce travel distance and enhance accessibility across all residential areas.

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Table 7. Household's Access to water in Terms of Distance in the Area.

Zone	<50m	50-100m	101-200m	200-500m
Zone 1	63%	6.9%	3.5%	
Zone 2	60%	30%	11.4%	1.7%
Zone 3	77%	16.6%	5.2%	
Zone 4	61.4%	24.9%	13.6%	
Zone 5	44.1%	8.2%	18%	6.62%
Zone 6	55.8%	30.6%	4.5%	9%
Total	58.7%	26.9%	12.4%	4.0%

Source: Field survey 2025

b. Access to safe water in terms of Time

Distance is an important parameter for measuring water access, the duration required to gather water is contingent upon its quality and quantity. This is due to the fact that water sourced from an in-house tap or borehole is purer than that received from a remote stream. The findings presented in Table 8 indicates that 58.7% of the surveyed households accessed water under 5 minutes, while around 26.9.7% used 5-30 minutes in pursuit of water. Furthermore, about 14.4% sampled households spent 30minutes to - 1hour in search of water. This implies that 58.7% sampled households have optimal access while 26.9% sampled households have intermediate access, and 14.4% sampled households have basic access. (WHO/UNICEF, 2004). Multiple sources of water are noticeable in the study area.

Table 8 Household Access to water in Terms of Time taken.

Zones	< 5 minutes	5-30 minutes	30-1 hours	1 hour and above.
Zone 1	63%	6.9%	30.5%	
Zone 2	60%	30%	11.4%	
Zone 3	77%	16.6%	5.2%	
Zone 4	61.4%	24.9%	13.6%	
Zone 5	44%	28.2%	21%	
Zone 6	55.8%	30.6%	4.5%	
Total	58.7%	26.9%	14.4%	

Source: Field survey 2026.

SUMMARY, CONCLUSION AND RECOMMENDATIONS

Summary

The socio-economic characteristics of households were analysed in this study in order to understand households' water accessibility and factors that account for variance in access to water sources. The study reveals that underground water is the major source of water in the study area. Interns of specific sources, borehole accounted for about 61.5% average sampled households source of water supply while Tube-well accounted for 11.5%. In addition, 28.4% average sampled households sourced their water from hand-dug well. Rain-harvesting

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accounted for 0.28% of the households' sampled source of water supply and a paltry sum of 0.25% of households sampled, claimed to source their water supply from stream/river. The study also note that 58.7% of the sampled households traveled a distance less than 5 minutes to water source (optimal access to water supply) while about 26.9% sampled households traveled a distance of 50-100 meter to source for water (Intermediate access to water supply); about 14.4% sampled households traveled a distance more 30 minutes to 1 hour to source for water (Basic access) at the time of writing this report none of the two government water schemes in Greater Lokoja is functioning.

The model summary of the regression analysis performed to assess the contribution of each socio-economic characteristics of households on the overall access to safe drinking water shows that the R^2 value is 0.540, implying that 54% of the variability in the dependent variable is explained by the independent variable. However, the correlation coefficient were weak to moderate. Residential density (0.540) and level of education (0.4979) were most strongly related to the dependent variable.

Conclusion

Access to safe water is a fundamental human right just like food, but it should available at the right place, in term of quality and quantity. This study assessed socio-economic spatial determinant of households' water accessibility in Lokoja, Nigeria, with a view to evolving practical policy recommendations to improve households' water accessibility. Findings reveal that Households has varying degree of access to safe water supply in the area. Underground water is the primary source in the research locations. All sampled households use either a borehole, tube well, or hand-dug well as their households' source of water. Meanwhile, there is no evidence that households that source their water from a stream or a hand-dug well treat such water before consumption.

The socio-economic characteristics of households play a crucial role in determining access to improved sources of water supply. Variables such as household income, educational attainment, occupation, and property location jointly account for approximately 54% of the variance in access to improved water sources. The findings reveal that many households in the study has varying degree of access to safe water. Consequently, the following recommendations were made

Recommendations .

1. It is recommended that Motorised and hand-pump boreholes should be provided in every 500 meter service radius especially in low ad medium density areas
2. Indigenous communities, borehole management committee together with the ministry of Health personnel should monitor anthropogenic activities near the boreholes and the hand-dug wells.
3. The government should restore the public water reservoir system, which distributes water via pipes to various households around the community

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