



SOCIO-ECONOMIC CHARACTERISTICS OF RESIDENTS IN CORRELATION TO GROUNDWATER SOURCE IN IKENNE LOCAL GOVERNMENT AREA, OGUN STATE, NIGERIA

A. A. Adewunmi¹ and O. P. Akinpelu^{2*}

¹Gateway (ICT) Polytechnic Saapade, Remo North, Ogun State, Nigeria

²Department of Urban and Regional Planning, Bells University of Technology, Ota, Nigeria

*Corresponding author's email address:

opakinpelu@bellsuniversity.edu.ng

ARTICLE INFORMATION

Submitted 18 August, 2023
Revised 3 Sept, 2023
Accepted 10 Sept, 2023

Keywords:

Correlates
Groundwater
Residents
socio-economic
characteristics
water sources

ABSTRACT

The study examines the residents' socio-economic characteristics as correlates of groundwater source in Ikenne Local Government Area, Ogun State, Nigeria. The objectives addressed in this study are analysis of the socio-economic characteristics of the residents; sources of groundwater; and relationship between residents' socio-economic attributes and groundwater source in the study area. A total of two hundred and seventy-two (272) respondents across all the six political wards of Iperu and Ilisan, were administered using questionnaires. Data collected were analysed using frequency distribution, percentage, ANOVA (it is used to establish if there is significance different between variable), Correlation and Regression. The study revealed that there is no significant difference in socioeconomic background of the residents ($p > 0.05$) except for educational attainment. It was found that correlation exists between groundwater source and marital status, education, income and occupation with exception of gender. Regression results established that 82 % of variability in groundwater source is predicted by residents' socioeconomic characteristics. It could be concluded that socioeconomic background of the residents significantly influences their source of groundwater. It is therefore imperative that governments at all levels need to come up with policies and programmes that will enhance peoples' socioeconomic status, thereby enhancing their ability to provide an improved water source.

1.0 Introduction

Water is one of the essentials of life, needed by all categories of people irrespective of their socioeconomic background. Water by its nature is transparent, tasteless, odourless, and colourless liquid, which is the main constituent of earth's hydrosphere and the fluids of most living organisms. However, the sources of water vary across the globe. The sources are classified into two which are surface and ground-water (Okeola *et al.*, 2010) It is on record that Nigeria water capacity for surface and groundwater running to billion cubic metres (Federal Ministry of Water Resources and Rural Development, 2011). According to Nickson *et al.* (2005) groundwater is the most reliable and most extensive storage of freshwater on earth which is used by one-third of the entire world's population for drinking purposes. Earlier work of Hill (2004) reported that more than one quarter of the world population depends on groundwater for drinking and other basic needs. Okelola *et al.* (2010) further noted that water from borehole is more reliable for human consumption compared to the one from well.

It is projected that by the year 2050, more than half of the world's population will live under moderate water stress, with 80 % of these located in developing regions (Schlosser *et al.*, 2014). Record shows that of global population using improved drinking water sources stood at 91 % in 2015, while 785 million people still lacked basic water services in 2017 (UN, 2019). As defined by World Health Organization, an improved drinking water is a water source that by nature of its construction adequately protects the water from outside contamination such as public stand pipe, borehole, protected dug well, protected spring (WHO, 2012). It is observed that inaccessibility to improved water source has resulted to an increase in consumption of contaminated or polluted water (WHO, 2012; Ologbushere *et al.*, 2016; Beshiru *et al.*, 2018) with potential detriment to public health.

Groundwater occupies the entire underground soil layer with about 30.1 % of the global fresh water and that many people have been satisfying their water need through the exploitation of groundwater for various uses (Ocheri *et al.*, 2014). As a result, people depend mostly on groundwater resources due to the fact that it is less contaminated and useful for all purposes. Nevertheless, overdependence results in too much pressure on the existing groundwater resources. Piscopo (2001) identified certain factors that contribute to the decline in groundwater quality and its reduction, which are drawing of water for industrial and agricultural activities as a result of increase in population and low rejuvenation.

Access to improved water source enhances peoples' healthy living. To a large extent, accessibility to improved water source might be influenced by peoples' socioeconomic status. This assertion is corroborated by Morakinyo *et al.* (2015). They established that there is a positive relationship between the educational attainment of the household head and the likelihood of having access to improved drinking water sources. In addition, findings of Shewayinet *et al.* (2021) showed that educational status and source of income of the household head significantly determine the type of water source to be used. It further stated that accessibility to improved water source was 86.2 % increased for government employed compared to agriculture income household. Abubakah (2019) in his research work showed that factors associated with improved household water sources included place of residence, education, wealth status, ethnicity, gender, access to electricity and water collection time. A study conducted in Eswatini, South Africa, found that rich households have better access to resources and therefore have the better financial capacity to afford access to improved water sources (Irianti *et al.*, 2016).

It is believed that inadequate public water supply is a general problem in most urban areas in Nigeria. This might be responsible for why most urban dwellers device convenient means of water source through groundwater, such as well and boreholes. Though there are studies on groundwater source (Shewayinet *et al.*, 2021; Abubakah 2019; Irianti *et al.*, 2016), however, study that have investigated socioeconomic characteristics as a predictor of residents groundwater source is scanty in literature. In view of the foregoing, the study examined the residents' socio-economic characteristics as determinants of groundwater source in Ikenne Local Government Area, Ogun State, Nigeria. This is with a view to establish whether there is a relationship between socioeconomic attributes of residents and groundwater sources; and to determine percentage contribution of the socioeconomic background to variability in groundwater source in the study area.

2. Materials and Methods

Ikenne, one of the twenty local government areas in Ogun State, Nigeria, is geographically located on Longitude 60°51'57"N or 6.86580 and Latitude 30°42'55"E or 3.71520 (Figure 1a and 1b). Ikenne Local Government Area (LGA) has its headquarters seated in Ikenne with about 144 square kilometers in size. The Local Government Area, is bounded in the west by Obafemi Owode Local Government Area, in the south by Sagamu Local Government Area,

in the east by Odogbolu Local Government Area and in the north by Remo North Local Government Area. Being suburban, it consists of four (4) major towns. These are Iperu, Ilishan/Irolu, Ogere, and Ikenne Township.

The climate and geographical location of the local government area is known to support several economic activities such as agriculture, industrial and commercial activities. The sources of water supply to the people of Ikenne LGA include pipe-borne water, borehole, and deep well. The Local Government is located along the transitional forest zone of southern Nigeria and guinea savannah of the country. There are some rivers that exist in the study area like Uren River at Ikenne and Ogun River at Ogere. The Local Government area has major road bypassing between Iperu and Ogere town and also between Ikenne and Ilisan town. These towns are also interlinked or connected together with distributor road. The major occupation of the people in the study area is farming and trading. This is due to the favourable rainforest weather. Their engagement in farming activities is as a result of the good nature of soil which supports agriculture at both subsistence and mechanized levels.

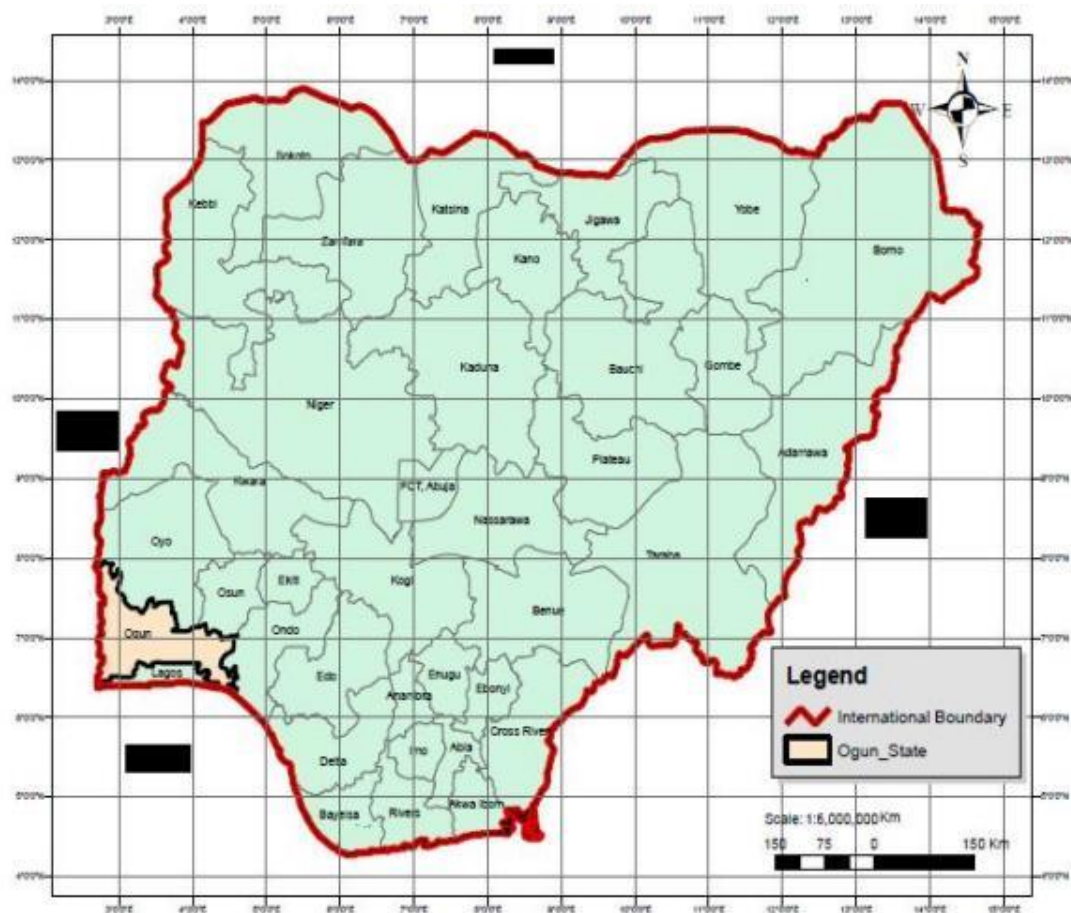


Figure 1a: Ogun State in the context of Nigeria
Source: Department of Surveying and Geoinformatics, Ilaro (2022).

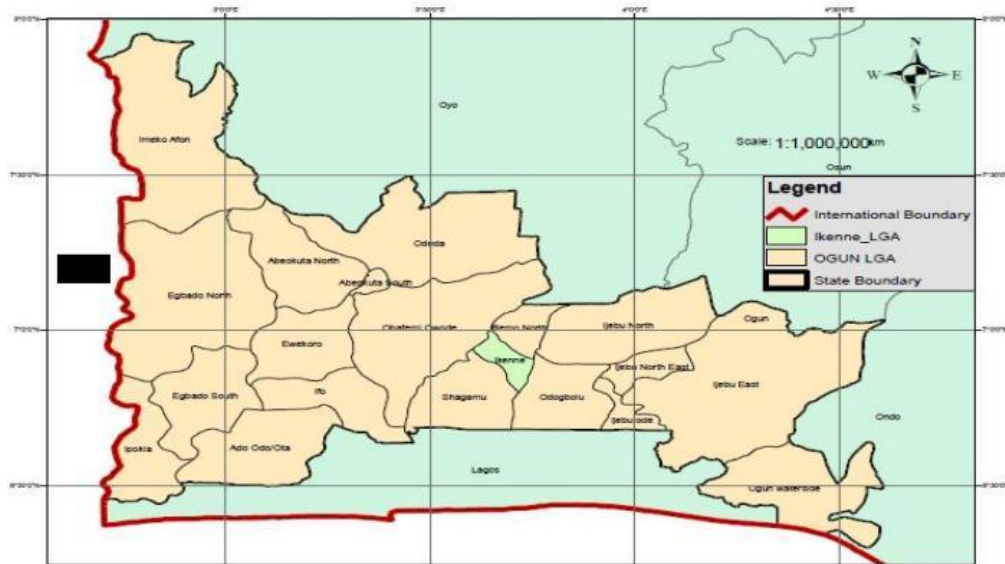


Figure 1b: Ikenne Local Government in the context of Ogun State
Source: Department of Surveying and Geoinformatics, Ilaro 2022.

The research used primary and secondary data. The primary data were sourced from the field through administration of closed-ended questionnaire to the residents, while secondary data were obtained from the data that have been already collected and readily available, including census data and maps. The questionnaire was based on socio-economic attributes of the residents as well as information about groundwater sources.

In the administration of the questionnaire to the target respondents, random and systematic sampling techniques were employed. For the household survey, samples were selected using the sample size determination equation of Cochran (1977) presented as Equation 1. The study used a single proportion formula, 95 % confidence interval, the marginal error of 5 %, and the non-response rate of 10 %, total population of 6,813.

$$n = \frac{Z^2(1 - P)}{d^2(N - 1) + Z^2P(1 - P)} \quad (1)$$

Where, Z = 95 % confidence limit (z-value at $\alpha = 0.05$ is 1.96); N = Number of houses in Iperu and Ilisan town = 6813; p = 0.5; 1-p = 0.5; D = Marginal error or degree of accuracy = 0.05; n = 272. Out of a total number of 272 sample size distributed among the six (6) political wards only 165 questionnaires were retrieved. Percentage, frequency distribution, ANOVA, (Analysis of Variance), correlation and regression were used to analyze the socio-economic attributes of the residents and groundwater sources. Thus, regression equation is expressed as:

$$Y = b_0 + \mu_1 + \mu_2 + \mu_3 + \mu_4 + \mu_5 \quad (2)$$

Where; Y = Groundwater source

b_0 = Constant

μ_1 = Gender

μ_2 = Marital status

μ_3 = Education

μ_4 = Income

μ_5 = Occupation

3. Results and Discussion

Table I presents the socioeconomic background of the residents across different wards of the study area. Data used in this study were obtained from field survey conducted in 2022, unless otherwise stated.

3.1 Socioeconomic Characteristic of Residents

Findings on socioeconomic characteristics such as gender, marital status, educational status, average income and occupation of the respondents are presented below.

Table I: Socio-economic Characteristics of the Residents

| Parameter | Iperu Ward I n (%) | Iperu Ward II n (%) | Iperu Ward III n (%) | Ilisan Ward I n (%) | Ilisan Ward II n (%) | Ilisan/Irolu Ward III n (%) | Total n (%) |
|---------------------------|-----------------------|------------------------|-------------------------|------------------------|-------------------------|--------------------------------|------------------|
| Gender | | | | | | | |
| Male | 31 (75.6) | 17 (53.1) | 14 (66.7) | 15 (57.7) | 15 (57.7) | 13 (68.4) | 105 (63.6) |
| Female | 10 (24.4) | 15 (46.9) | 7 (33.3) | 11 (42.3) | 11 (42.3) | 6 (31.6) | 60 (36.4) |
| Marital status | | | | | | | |
| Single | 8 (19.5) | 4 (12.5) | 2 (9.5) | 3 (11.5) | 3 (11.5) | 3 (15.8) | 23 (13.9) |
| Married | 31 (75.6) | 25 (78.7) | 15 (71.4) | 22 (84.6) | 19 (73.1) | 15 (78.9) | 127 (77.0) |
| Widow/(ed) | 2 (4.9) | 3 (9.4) | 3 (14.3) | 0 (0.0) | 4 (15.4) | 1 (5.3) | 13 (7.9) |
| Separated | 0 (0.0) | 0 (0.0) | 1 (4.8) | 1 (3.8) | 0 (0.0) | 0 (0.0) | 2 (1.2) |
| Educational Status | | | | | | | |
| Illiterate | 1 (2.4) | 14 (43.8) | 4 (19.0) | 1 (3.8) | 3 (11.5) | 11 (57.9) | 34 (20.6) |
| Primary | 1 (2.4) | 3 (9.4) | 0 (0.0) | 1 (0.0) | 0 (0.0) | 0 (0.0) | 4 (2.4) |
| Secondary | 13 (31.7) | 4 (12.5) | 5 (23.8) | 5 (30.8) | 3 (11.5) | 1 (5.3) | 34 (20.6) |
| ND/NCE | 16 (39.0) | 3 (9.4) | 5 (23.8) | 6 (23.1) | 3 (11.5) | 3 (15.8) | 36 (21.8) |
| HND/BSc | 9 (22.0) | 2 (6.2) | 6 (28.6) | 8 (30.8) | 13 (50.0) | 3 (15.8) | 41 (24.9) |
| PGD | 1 (2.4) | 6 (18.8) | 1 (4.8) | 3 (11.5) | 2 (7.7) | 0 (0.0) | 14 (8.5) |
| Others | 0 (0.0) | 0 (0.0) | 0 (0.0) | 0 (0.0) | 2 (7.7) | 0 (0.0) | 2 (1.2) |
| Income | | | | | | | |
| <₦30,000 | 9 (22.0) | 6 (18.8) | 9 (42.9) | 5 (19.2) | 5 (19.2) | 5 (26.3) | 39 (23.7) |
| 30000-59999 | 6 (14.6) | 17 (53.1) | 5 (23.8) | 6 (23.1) | 6 (23.1) | 8 (42.1) | 48 (29.1) |
| 60000-89999 | 8 (19.5) | 2 (6.3) | 3 (14.3) | 3 (11.5) | 3 (11.5) | 4 (21.1) | 23 (13.9) |
| 90000-119999 | 13 (31.7) | 5 (15.6) | 2 (9.5) | 7 (26.9) | 8 (30.8) | 2 (10.5) | 37 (22.4) |
| >119999 | 5 (12.2) | 2 (6.2) | 2 (9.5) | 5 (19.2) | 4 (15.4) | 0 (0.0) | 18 (10.9) |
| Occupation | | | | | | | |
| Farming | 2 (4.9) | 8 (25.0) | 2 (9.5) | 0 (0.0) | 1 (3.8) | 4 (21.1) | 17 (10.3) |
| Trading | 19 (46.3) | 10 (31.2) | 7 (33.3) | 11 (42.3) | 6 (23.1) | 6 (31.6) | 59 (35.8) |
| Civil Servant | 11 (26.8) | 9 (28.1) | 6 (28.6) | 5 (19.2) | 14 (53.8) | 6 (31.6) | 51 (30.9) |
| Artisan | 6 (14.6) | 5 (15.6) | 2 (9.5) | 5 (19.2) | 2 (7.7) | 1 (5.3) | 21 (12.7) |
| Professional | 1 (2.4) | 0 (0.0) | 1 (4.8) | 4 (15.4) | 0 (0.0) | 2 (10.5) | 8 (4.8) |
| Others | 2 (4.9) | 0 (0.0) | 3 (14.3) | 1 (3.8) | 3 (11.5) | 0 (0.0) | 9 (5.5) |
| Total | 41 (24.8) | 32 (19.4) | 21 (12.7) | 26 (15.8) | 26 (15.8) | 19 (11.5) | 165 (100) |

Overall findings on the gender of the respondents show that the proportion of male was higher than their female counterparts. While male accounted for 63.6 %, female recorded 36.4 %. On the basis of each ward, the results from Iperu ward I reveal that male constituted 75.6%, while female was 24.4 %. The proportion of male and female in Iperu ward II was 53.1 % and 46.9 % respectively. It was found that the percentage of male to female in Iperu ward III was 66.7 % and 33.3% respectively. The same proportion of male and female was recorded in Ilisan ward I and ward II. While male accounted 57.7 %, female constituted 42.3 %. In Ilisan-Irolu ward III the percentage of male and female was 68.4 % and 31.6 % respectively. It could be inferred that both gender was well represented; however, the proportion of male was a little bit more than their female counterparts. The ANOVA analysis shows that statistically significant difference does not exist between genders of

respondents across the wards, as F value is 1.021 at $p > 0.05$. Although the ANOVA, result does not show a significant different, however, there is a wide margin between the overall proportion of female to male. It may be deduced that male is more responsive to female regarding the issue of groundwater source in the study area.

The analysis of the marital status of the respondents is presented in Table I. It was found in Iperu ward I that single, married, and widow constituted 19.5 %, 75.6 % and 4.9 % respectively. Findings from Pieris ward II show that 12.5 % was single, 78.1 % was married, while widow or widower accounted for 9.4 %. Similarly, married recorded the highest percentage (71.4 %) in Iperu ward III. Single widow/widower and separated constituted 9.5 %, 14.3 % and 4.8 % respectively. Furthermore, the respective percentage of single married, and separated in Ilisan ward I are 11.5 %, 84.6 % and 3.8 %. Nothing was recorded for widow or widower. It was found that single accounted for 11.5 %, married constituted 73.1 % and widow or widower recorded 15.4 % in Ilisan ward II. Like other wards, married respondents accounted for highest (78.9 %) in Ilisan-Irolu ward III. The proportions of other marital status are 15.8 %, 5.3 % for single and widow/ widower respectively. Aggregately, married respondents have the highest percentage (77 %). Single constituted 15.8 %, while widow or widower accounted for 7.9 %, separated has the least percentage (1.2 %). ANOVA results show that there is no statistically significant difference in the marital status of the respondents across sampled wards as F value of the computed ANOVA is 0.302 at $p > 0.05$.

In aggregate, findings on educational status of the respondents reveal that those that had tertiary education such as National Diploma or National Certificate in Education, Higher National Diploma or University Degree and Post-graduate degree constituted the highest (55.2 %). Other educational status is no formal education (20.6 %), primary education (2.4 %) and secondary education (20.6 %). Other educational attainments accounted for 1.2 %. The computed ANOVA ($F = 5.899$ and $p < 0.05$) established that there is a statistical significant difference in the educational status of the respondents across the surveyed wards. Expectedly, wards having respondents with high educational attainment supposed to be more concerned with issue of good quality drinking water. This has been earlier posited by (Abubakah, 2019) that the educational status of a person to a large extent affects his/her standard of living, level of exposure and attitude.

The information on the income distribution showed that majority earned above the minimum wage (₦30,000) in Nigeria. The percentage of respondents earning above minimum wage was 76.3 %. Those who earned below were 23.7 %. However, the computed ANOVA established that there is no significant difference in the income distribution of respondents across sampled wards with $F = 2.412$ and $p > 0.05$. The result implies that most of the respondents are middle income earners.

The result presented showed that 35.8 % of respondents engaged in trading and 30.9 % worked in civil service. While those that engaged in farming represented 10.3 %; artisans (welder, furniture, mechanics, and others) constituted 12.7 %. The percentage of professionals was 4.8 %, while others who engaged in other occupations recorded 5.5 %. However, there is no statistical significant difference in the occupational status of the respondents across the surveyed wards with ANOVA results of $F = 2.548$ and $p > 0.05$. It implies that there is a level of commonality in the occupational distribution of the respondents across the surveyed wards.

3.2 Sources of Groundwater

Findings on sources of groundwater in the study area show that most (70.3 %) of the respondents sourced water from borehole (Table 2). However, those who sourced water from dug well are 22.4%, while only 2.4% sourced water from both dug well and borehole.

Table 2: Respondents' Ground-water Source

| Ward | Source of Ground water | | | Total (%) |
|---------------------|------------------------|--------------|---------------------|-----------|
| | Well (%) | Borehole (%) | Well & Borehole (%) | |
| Iperu Ward I | 3 (7.3) | 37 (90.2) | 1 (2.4) | 41 (100) |
| Iperu Ward II | 12 (37.5) | 18 (56.2) | 2 (6.2) | 32 (100) |
| Iperu Ward III | 3 (14.3) | 17 (81.0) | 1 (4.8) | 21 (100) |
| Ilisan Ward IV | 8 (30.8) | 12 (46.2) | 6 (23.1) | 26 (100) |
| Ilisan Ward V | 2 (7.7) | 23 (88.5) | 1 (3.8) | 26 (100) |
| Ilisan/IroluWard VI | 9 (47.4) | 9 (47.4) | 1 (5.3) | 19 (100) |
| Total | 37 (22.4) | 116 (70.3) | 12 (7.3) | 165 (100) |

The results revealed that residents in the study area relied more on water obtained from borehole, probably because of the fact that the source is considered to be more reliable than dug well. Although, Nickson *et al.* (2005) asserted that groundwater is the most reliable and most extensive storage of fresh-water on earth which is used by one-third of the entire world's population for drinking purposes. However, Okelola *et al.* (2010) further noted that water from borehole is more reliable for human consumption compared to the one from well.

3.3 Respondents' Proximity to Groundwater

It was found that majority (78.2 %) of the respondents were close to the source of groundwater, while 21.8 % was far from the source of groundwater. The findings indicate that groundwater; especially borehole is more accessible to the respondents in the study (Table 3).

Table 3: Nearness of Water Source to Respondents

| Ward | Closeness of Water Source | | Total (%) |
|----------------------|---------------------------|-----------|-----------|
| | Yes (%) | No (%) | |
| Iperu Ward I | 40 (97.6) | 1 (2.4) | 41 (100) |
| Iperu Ward II | 17 (53.1) | 15 (46.9) | 32 (100) |
| Iperu Ward III | 17 (81.0) | 4 (19.0) | 21 (100) |
| Ilisan Ward IV | 22 (84.6) | 4 (7.6) | 26 (100) |
| Ilisan Ward V | 23 (88.5) | 3 (11.5) | 26 (100) |
| Ilisan/Irolu Ward VI | 10 (52.6) | 9 (47.4) | 19 (100) |
| Total | 129 (78.2) | 34 (21.8) | 165 (100) |

It could be deduced that the distribution of boreholes in the study area is fairly even. Even distribution of utility such as boreholes tends to enhance accessibility. Studies have shown that lack of access to improved water source has resulted to an increase in consumption of contaminated or polluted water (WHO, 2012; Ologbushere *et al.* 2016; Beshiru *et al.* 2018) with potential detriment to public health.

3.4 Uses of Groundwater

The predominant use of groundwater as found from the study is domestic purpose, such as cooking, washing and drinking (Table 4). The proportion of respondents that used groundwater for domestic purpose accounted for 92.7 % out of the total. As shown in the table, the percentage of the respondents that used groundwater for industrial purpose constituted 2.9 %, whereas those that used it for other purposes such as farming accounted for 4.9 %.

Table 4: Ground-water Usage

| Ward | Uses of Ground water | | | Total (%) |
|----------------------|----------------------|----------------|------------|-----------|
| | Domestic (%) | Industrial (%) | Others (%) | |
| Iperu Ward I | 39 (95.1) | 2 (4.9) | 0 (0.0) | 41 (100) |
| Iperu Ward II | 31 (96.9) | 0 (0.0) | 1 (3.1) | 32 (100) |
| Iperu Ward III | 19 (90.5) | 0 (0.0) | 2 (9.5) | 21 (100) |
| Ilisan Ward IV | 22 (84.6) | 2 (7.7) | 2 (7.7) | 26 (100) |
| Ilisan Ward V | 25 (96.2) | 0 (0.0) | 1 (3.8) | 26 (100) |
| Ilisan/Irolu Ward VI | 17 (89.5) | 2 (10.5) | 0 (0.0) | 19 (100) |
| Total | 153 (92.7) | 4 (2.4) | 8 (4.9) | 165 (100) |

The findings reveal that the respondents relied more on groundwater to meet their daily domestic water needs. Earlier study by Hill (2004) found that more than one quarter of the world population depends on groundwater for drinking and other basic needs.

3.5 Correlation and Regression Analyses of Respondents' Groundwater Source and Socioeconomic characteristics

The results of correlation analysis presented in Table 5 show that there is no relationship between the gender of the respondents and their source of groundwater ($r = -0.058$). It implies that gender is not a determinant of where respondents source for their groundwater. The result of analysis on groundwater and marital status shows that significant relationship exists between the two variables ($r = 0.514$). This means that respondents with a spouse or partner are more concerned about where they source for their groundwater than a home with no spouse or partner.

Table 5: Correlation Analysis of Respondents' Groundwater Source and Socioeconomic Attribute

| Parameter | Groundwater source | Gender | Marital status | Education | Income | Occupation |
|--------------------|--------------------|--------|----------------|-----------|--------|------------|
| Groundwater source | 1.000 | | | | | |
| Gender | -0.058 | 1.000 | | | | |
| Marital status | 0.514 | -0.005 | 1.000 | | | |
| Education | 0.670 | -0.025 | 0.549 | 1.000 | | |
| Income | 0.557 | -0.060 | 0.636 | 0.811 | 1.000 | |
| Occupation | 0.604 | -0.013 | 0.588 | 0.846 | 0.837 | 1.000 |

Correlation analysis between groundwater source and occupation reveal that a relationship exists between the two variables ($r = 0.604$). This implies that residents with better occupation can afford to source for groundwater that is reliable and/or of better quality. The study found a relationship between educational status and groundwater source. This is corroborated by the work of Morakinyo *et al.* (2015), where they found that positive relationship exists between educational attainment of household and access to improved drinking water sources. It was also established in the study that income correlates positively with groundwater source. This is in agreement with the study of Shewayine *et al.* (2021). They also observed in their work that there is a connection between income and household source of water.

On the other hand, the regression analysis was done on five (5) variables that were correlated with groundwater source. When gender was input as a predictor of groundwater source, which is considered as a simple correlation between groundwater source and gender, the value of R obtained is 0.058. The value of R^2 is 0.3364, which shows that gender can account for 33 % of the variation in groundwater source. This means that 66.4 % of the variation in groundwater remains unaccounted for (Table 6).

Table 6: Predictors of Groundwater Source

| Model | R | R Square | Adjusted R Square | Std. Error of the Estimate | R Square Change | Change Statistics | | | |
|-------|-------------------|----------|-------------------|----------------------------|-----------------|-------------------|-----|-----|---------------|
| | | | | | | F Change | df1 | df2 | Sig. F Change |
| 1 | .058 ^a | .336 | -.003 | .61793 | .003 | .545 | 1 | 163 | .462 |
| 2 | .702 ^b | .493 | .477 | .44642 | .489 | 38.327 | 4 | 159 | .000 |

a. Predictors: (Constant), gender

b. Predictors (Constant), gender, marital status, education, income, occupation

c. Dependent Variable: water source

However, when the other four predictors are included (marital status, education, income and occupation), this value increases to .493 or 49.3% of the variance in groundwater source, which is significant with F value of 38.327 and $p < 0.005$. If gender account for 33%, then marital status, education, income and occupation must account for an additional 49%, which means that addition of the four predictors increase the ability of the model to predict the residents' variation in groundwater source. The five variables analysed can be used to predict up to 82% of residents' groundwater source in the study area. However, there is 18% of the variation in groundwater not accounted for. This might be subject of further study. The study conducted by Abubakah (2019) found that education, gender and wealth status among others were determinants of improved household water source. This is in line with the outcome of current findings that residents' socioeconomic background contributes significantly to their source of groundwater.

4. Conclusion

The finding of the study showed that residents depended more on borehole as a source of groundwater. Also, regression analysis established that socio economic characteristics of the residents are strong factors in predicting residents' groundwater source. Hence, governments and corporate organisations should give priority to borehole drilling, especially in areas where people rely more on well water as part of their social responsibilities. In the provision of boreholes more attention is expected to be given to wards where residents were either low- or medium-income earners. The fact that potable water is important for healthy living and the need for people to have access to it as recognised by United Nations Sustainable Development Goals (No. 6), thus, water sources that is reliable should be made more accessible to people. Therefore, the study recommends that governments at all levels should embark on drilling of boreholes such that it will be easily accessible to people. It is equally important for governments and corporate organisations to embark on awareness campaigns on the need for people to desist from sourcing for water from unreliable sources because of inherent health problems that can lead to diseases and even death.

References

- Abubakah, IR. 2019. Factors influencing household access to drinking water in Nigeria. *Utilities Policy*, 58: 40-51.
- Agbadi, PE., Darkwah, PL. and Kenney, AC. 2019. A multilevel analysis of regressors of access to improved drinking water and sanitation facilities in Ghana. *Journal of Environmental and Public Health*, 20: 11-23
- Akpabio, IB, Ati, OF, and Iniobon, EA. 2013. Water for cities in Nigeria: The governance dimension. *Mediterranean Journal of Social Sciences*, 40 (4): 297-309.
- Ashraf, MA., Maah, MJ., Yusoff, I. and Mehmood, K. 2010. Effects of Polluted Water Irrigation on Environment and Health of People in Jamber, District Kasur, Pakistan. *International Journal of Basic & Applied Sciences*, 10 (3): 37-57.

Bos, R., Alves D., Latorre, C., Macleod, N., Payen, G., Roaf, V. and Rouse, M. 2016. Manual on the human rights to safe drinking water and sanitation for practitioners. London, UK: IWA Publishing London, www.iwapublishing.com

Beshiru, A., Okareh, OT., Chigor, VN. and Igbinosa, EO. 2018. Assessment of water quality of rivers that serve as water sources for drinking and domestic functions in rural and pre-urban communities in Edo North, Nigeria. Environmental Monitoring and Assessment, 190: 387-398.

Calow, RC., Alan, MM., Alan, LN. and Nick, RS. 2011. Groundwater security and drought in Africa. linking availability, access and demand, groundwater, The Groundwater Association Journal, 48 (2): 246-256.

Calixto, OJ. and Anaya, JM. 2014. Socio-economic status: The relationship with health and autoimmune diseases. Autoimmunity Reviews, 13(6); 641-654.

Chapra, SC. 1997. Surface water quality modelling, McGraw-Hill, New York, 844-856

Cochran, WG. 1977. Sampling Technique. 3rd ed. John Wiley & Sons. New York

David, SG. and Thomas, OS. 2011. The environmental impact of groundwater exploitation in African grassland. Examples and a case study from Kalahari Region. Science direct, Department of Geography, University of Sheffield, United Kingdom, S102tn, [Http://Books.Google.Co.Ke/Books](http://Books.Google.Co.Ke/Books), pp. 225-235

Dickerson, DL., Penick, JE., Dawkins, KR. and Van, SM. 2007. Groundwater in Science Education. Journal of Science Teacher Education, 18 (1): 45-61.

Efunshile, AM., Ezeanosike, O., Nwangwu, CC., Konig, B., Jokelainen, P. and Robertson, LJ. 2019. Apparent overuse of antibiotics in the management of watery diarrhoea in children in Abakaliki, Nigeria. BMC Infectious Diseases, 19: 275. <https://doi.org/10.1186/s12879-019-3899-1>

Federal Ministry of Water Resources and Rural Development, 2011. www.waterresources.gov.ng

Galobardes, BM., Shaw, DA., Lawlor, JW., Lynch, JP. and Smith, GD. 2006. Indicators of socioeconomic position (part 1). Journal of Epidemiology & Community Health, 60 (1): 7–12.

Henry, GJ. and Heinke, GW. 2005. Environmental Science and Engineering, Second edition Prentice-Hall of India Private Limited, New Delhi, pp. 33-45.

Hemmig, C. 2015. What development? Poverty and the struggle to survive in the Fuuta Tooro Region of Southern Mauritania, The Ohio State University, United States of America.

Hill, MK. 2004. Understanding environmental pollution, 2nd ed. Cambridge University Press, United Kingdom.

Hounslow, A. 2018. Water quality data: Analysis and interpretation; CRC Press: Boca Raton, FL, USA, New York, Washington. www.crcpress.com

Irianti, S. and Prasetyoputra, P. 2007. Analysis of the 2007 Indonesia family life survey. Cogent Medicine, 3 (1): 115-143.

Sasimartoyo, TP. 2007. Determinants of Household drinking –water source in Indonesia: Analysis of the 2007 Indonesia family life survey. Cogent Medicine, 3 (1): 192-195.

Kausar, S., Maann, AA., Zafar, I., Ali, T. and Kanwal, A. 2009. Household Characteristic Affecting Drinking Water Quality and Human Health. *Pakistan Journal of Agricultural Sciences*, 46 (3): 192-195.

Morakinyo, OM., Adebowale, SA. and Oloruntoba, EO. 2015. Wealth status and sex differential of household head: implication for source of drinking water in Nigeria. *Archives of Public Health*, 73(1): 58-73.

Nickson, RT., McArthur, JM., Shrestha, B., Kyaw-Nyint, TO. and Lowry, D. 2005. Arsenic and other drinking water quality issues, Muzaffargarh District, Pakistan. *Applied Geochemistry*, 20: 55–68. <https://doi.org/10.1016/j.apgeochem.2004.06.004>

Ocheri, M., Odoma, L. and Umar, N. 2014. Groundwater quality in Nigerian urban areas: A review. *Global Journal of Science and Frontier Research*, 14(3): 1-9.

Okeola, FO., Kolawole, OD. and Ameen, OM. 2010. Comparative study of physico-chemical parameters of water from a river and its surrounding wells for possible interactive effect. *Advances in Environmental Biology*, 4(3): 336-344.

Ologbushere, OA., Aluyi, HSA., Ogofure, AG., Beshiru, A. and Omeje, FI. 2016. Physico-chemical and microbiological profile of bacterial and fungal isolates of Ikpoba River in Benin City: Public health implications. *African Journal of Environmental Science and Technology*, 10(3): 67–76.

Olugbamila, OB., Adeyinka, SA., Odunsi, OM., Olowoyo, SA., Isola, OL. and Adanlawo, TD. 2020. Community participation in the provision of environmental sanitation infrastructure in Akure, Nigeria *Environmental & Socio-economic Studies*, 8(3): 48-59.

Orewole, MO., Mkaide, OW., Adekalu, K. and Shittu, KA. 2007. Chemical examination of piped water supply of Ile –Ife in South West Nigeria. *Iran Journal of Environmental Health Science and Engineering*, 4(1): 51-56.

Pawari, M.J. and Gavande, SM. 2015. Assessment of Water Quality Parameters: A review, *International Journal of Science and Research (IJSR)*, 4(7): 85-97.

Piscopo, G. 2001. Groundwater vulnerability map, explanatory notes, Castlereagh Catchment, NSW. Department of Land and Water Conservation, Australia, Found at: http://www.dlwc.nsw.gov.au/care/water/roundwater/reports/pdfs/castlereagh_map_notes.pdf

Schlosser, A., Strzepek, K. and Gao, X. and Fant, C., Blanc, E., Paltsev, S., Jacoby, H., Reilly, J. and Gueneau, A. 2014. The future of global waters: An integrated assessment, *Earth's Future*, 2(8): 341-361.

Smith, JH., Mill, T., Mabey, PC., Bomberger, TW., Chou, DG. and Herdry, W. 1997. Laboratory Protocols for evaluating the fate of organic chemicals in air and water. US Environmental Protection Agency, Athens GA EPA 600/3-82-0220.

UNICEF and World Health Organization 2012. Progress on drinking water and sanitation, UNICEF and WHO, New York, NY, USA, <https://sdgs.un.org/>

United Nations 2019. The sustainable development goals report, United Nations< New York, NY, USA, <http://sdgs.u.org/>

World Bank 2019. The World Bank Eswatini water supply and sanitation access project (P166697): Project Information Document (PID), World Bank, Washington DC, USA. <http://www.worldbank.org/projects>

World Health Organization 2012. Diarrhoeal Diseases. WHO, Geneva. Switzerland http://www.who.int/vaccine_research/documents/DiarrhoealDiseases20091122.pdf

World Health Organization and United Nations Children's Fund 2017. Progress on Drinking Water and Sanitation: 2017 Update and SDG Baselines, World Health Organization and United Nations Children's Fund, Geneva, Switzerland. <http://apps.who.int/iris/handle/10665/258617>