Journal of Science and Multidisciplinary Research
Volume 5, No. 2, 2013
ISSN: 2277-0135

# ASSESSMENT OF PIPE-BORNE WATER SUPPLY IN MALUMFASHI TOWN, KATSINA STATE AS A CHALLENGE TO RESEARCH AND INNOVATION FOR ECONOMIC DEVELOPMENT IN GLOBALIZING AFRICA

**Haruna Saleh[1] and Abdulmalik M. Sada[2]**
**[1&2]Department of Geography**
**Umaru Musa Yar`Adua University Katsina, Nigeria**
harunasaleh@gmail.com, maiwadaabdulmalik@yahoo.com

**Abstract:** An assessment of Pipe-borne Water Supply was carried out in Malumfashi Town, Katsina. Method used for investigations includes population data of the town, Independent National Electoral Commission (INEC) ward division criteria and 653 structured questionnaires survey distributed to the households among the four (4) sampling areas. Descriptive statistics and chi-square test at 0.001 significant levels were used to analyze the data. Results obtained indicate the sources of pipe-borne water supply to the study area came from Malumfashi Water Board and the supply was generally inadequate to meet the demand. Testing the relation of flow duration of tap-water at 0.001 significant levels with less and greater than 3 hours per day indicates significant spatial variations of pipe-borne water supply among the four sampling areas. Generally southern part (Ward A) receives more supply than the Northern part (Ward B). As a consequence of this you could see people of the urban area now resort to alternative sources of water supply such as hand-dug wells, water vendors among others. These predominantly unwholesome sources are variable sources of water borne-diseases. The study thus, recommends that Water Board should ensure pipe-borne water supply meets the demand and encourages private sector participation in water supply system. This would no doubt be a challenge to research and innovation for economic development in globalizing Africa.

**Keywords:** Assessment, Shortages, Spatial Variations, Pipe-Borne Water Supply

## INTRODUCTION

With the exception of air, water is the most important natural resource used by man, (Walton, 1970). The average human being has 65% of his total weight in the form of water. Man can exists for several weeks without food, but ten days is about the maximum survival period without water, and it may be less than this in certain parts of the world. Even when man has sufficient water to survive, its availability and quality have profound and continuing implication for general health and well-being. It has been estimated that about two-thirds of the population of the developing world draw untreated water from polluted sources. Diseases, which are either water-borne or water related, are endemic and affect some 500 million people each year, (Walton, 1970). As the per capita use increases due to changes in lifestyle, and as population increases as well, the proportion of water for human use is increasing. This coupled with spatial and temporal variations in water availability, means that water to produce food for human consumption, industrial processes and all the other uses is becoming scarce (Ayodele, 1975). Data from area based survey conducted in 2006 indicated that most areas of southern Nigeria especially Ibadan Peri-urban areas have no (according to Adebayo, 2007) access to portable water and therefore rely on ground water from wells, streams, rivers and rains. The study reveals that these sources of water are not adequate for human consumptions. There are unacceptable high levels of faecal coliform contamination during rainy season due to eutrophication from urban activities in the area. The situation is the same for most Nigerian urban centers.

According to Akintola and Areola (1980), water supply consists of making water available for agricultural urban use. Agricultural uses include irrigation, fives tocks, watering and farm household use. By law of supply and demand, water will be inexpensive when it is abundant and expensive when it scarce. People will use less water as it becomes more expensive. Base on these Akintola and Areola (1980) observed that the present water - demand tendencies, water distribution system will probably call for an increased investment per capita. The supply of good quality drinking water in adequate quantity and quality are vital factors in the determination of health, welfare and productivity of man. In spite of this however, the existing situation of pipe-borne water supply in most parts of the world is largely inadequate to meet ever increasing water demands of the population Biwas (1978). It was also common for piped supplies to be restricted to one part of a town, causing spatial variation of water supply. For instance, in 1937 only one third of Brad ford's population was receiving regular supplies and Water Carts still provided a door-to-door service in the less fortunate areas (Bradford Cooperation Water Departments, 1955).

This trend holds true in Malumfashi Town as well. Unfortunately, there is no any empirical information to certain the people the cause of this trend. Pipe-borne water is scarced in the area, in spite of the existing Water Board Authority. It is worse during the dry seasons. Most of the dwellers of the area draw their domestic water from wells and polluted streams, located in different locations in the area. There are long hours of dry-taps in most of the distribution areas. The existing distribution network is old. Most of the pipes were installed in 1970.The latest extensions were laid in 1983. It was in line of these, this paper aimed at assessing the pipe-borne water supply in Malumfashi Town. The aim will be achieved by the following objectives:

i. Identify the source of pipe-borne water supply
ii. Ascertain the number of households with and without taps water
iii. Examine the adequate and inadequacy of pipe-borne water supply
iv. Identify the flow duration of tap- water in less and greater than 3 hours per day
v. Examine uses of pipe-borne water
vi. Identify others sources of water supply
vii. Identify remedies to the present pipe-borne water shortages in the area.

## RESEARCH HYPOTHESIS

The research attempts to test the following hypothesis:
There are no spatial variations of flow duration of tap- water between less and greater than 3 hours per day. The hypothesis is tested at 0.001 significant levels.

## DATA AND METHOD

Two types of data for this study were collected. They are secondary and primary data. The secondary data were sourced from National Population Commission (NPC) Malumfashi office and Independent National Electoral Commission (INEC). Method used to collect secondary data includes visits to National Population Commission and Independent National Electoral Commission (INEC). The Primary data collected came from the structured questionnaires survey, which were administered to the dwellers of the study area. Methods employed in collecting Primary data include the use of sampling areas, sampling size and by administering the structured questionnaires survey. The study area is divided into strata (wards) based on the Independent National Electoral Commission (INEC) criteria and on the Population size.

On the basis of INEC, Malumfashi Town is divided into 2 wards. The first ward is situated to the South of Kano/Funtua road. The Second ward locates to the north of Kano/Funtua road. Each ward is further sub-divided into two based on Population size. This gave four (4) strata or sampling areas: A, B, C and D. The estimated population size of each area was; area 'A' was estimated at 26,160, 'B' 19,620, 'C' 13.080 and 'D' 6,450. The sum of 1% of the Population size of area A, B, C and D was considered as the sampling size for this study (Table 1.1)

Six hundred and fifty three (653) questionnaires survey were administered to the dwellers of the study area. Households are selected through systematic random sampling along streets. Every ($5^{th}$) household along some streets in each sampling division is given a questionnaire survey to fill. Each individual household's responses from the filled questionnaire survey were gathered and analyzed. Table 1.2 shows the number of traditional ward in each sampling area and the number of questionnaires distributed.

Descriptive statistics and chi-square test at 0.001 significant levels were used in analyzing the data collected. Chi-Square was used to test the data observed against the data as expected. It is mathematically expressed after David (1977) as:

$$X^2 = r \sum^k \sum (0-E)^2/E$$

Where by:
r is the number of rows, k is the number of columns, $r\sum^k\sum$ means sum of all rows and columns, 0 is the observed frequency and E is the expected frequency.

**Table 1.1: Estimated Population Size of the Sampling Areas**

| **Area** | **Population Size** | **1% of Population Figure** |
|---|---|---|
| A | 26160 | 162.6 |
| B | 19620 | 196.2 |
| C | 13080 | 130.8 |
| D | 6450 | 64.5 |
| **Total** | **65310** | **653** |

**Data Source**: NPC, Malumfashi Office, 2013

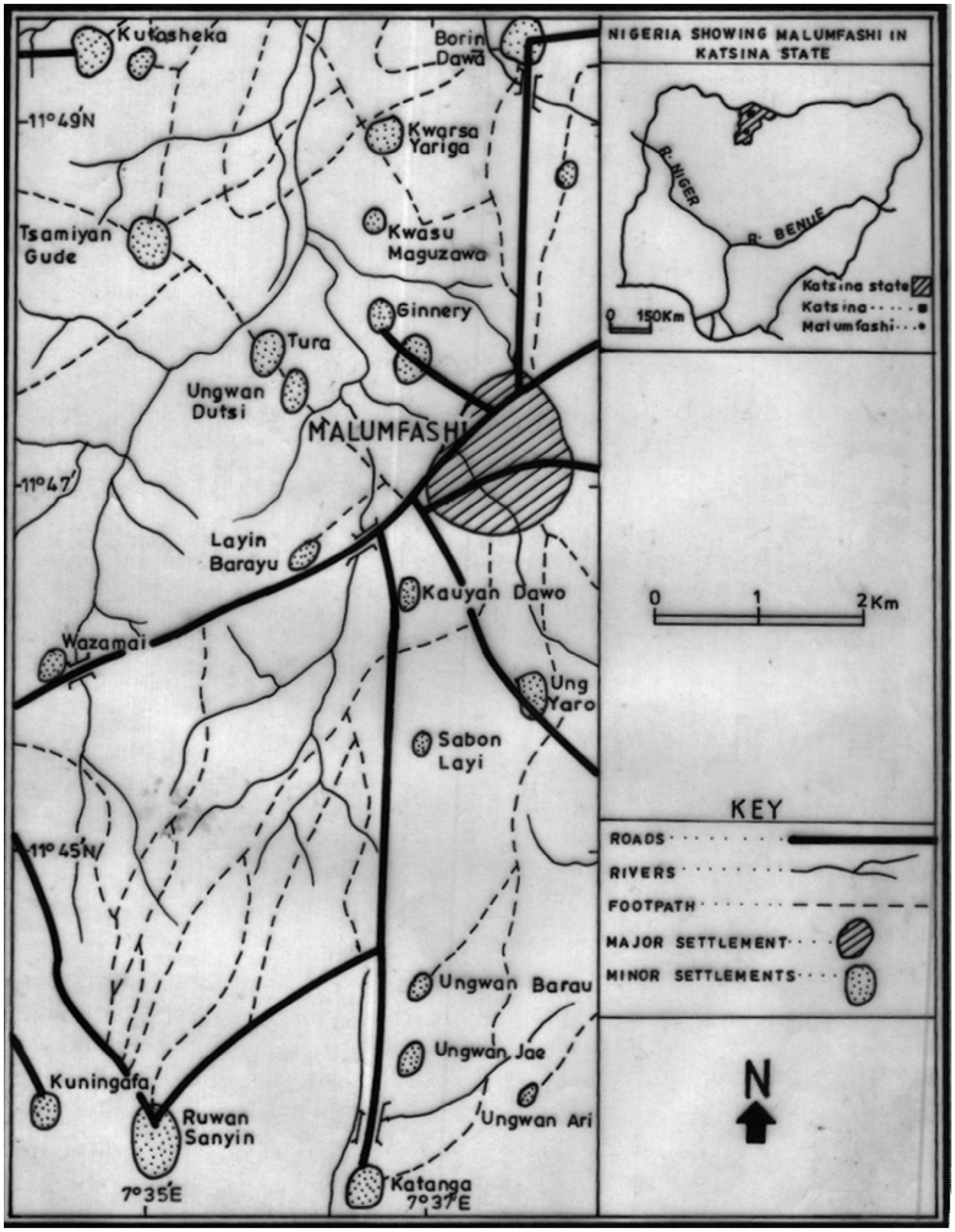
**Table 1.2: Number of Traditional Ward in the Sampling Areas And Number of Questionnaires Distributed**

| Sampling Areas | No. of Traditional Wards | No. of Questionnaires Distribution |
|---|---|---|
| Area (A) | Danrimi | 40 |
| | Unguwar Talatu | 30 |
| | Kofar fada | 45 |
| | Kofar Kudu | 26 |
| | Unguwar Minista | 30 |
| | Hayin Majema | 35 |
| | Layin Lamarudu | 30 |
| | Marmara | 25 |
| Area (B) | Gangarawa | 50 |
| | Unguwar Sodangi | 45 |
| | Unguwar Dawo | 35 |
| | Katarda | 35 |
| | Kofar Gardi | 30 |
| Area (C) | Mission | 18 |
| | Tanki | 18 |
| | Layin Shanu | 18 |
| | Tudun Bala | 20 |
| | Unguwar Mata | 18 |
| | Hayin Dam | 18 |
| | Unguwar Modibo | 20 |
| Area (D) | Fayamasa | 18 |
| | Kwata | 10 |
| | Bisije | 18 |
| | Rafin Dinya | 11 |
| | Area | 10 |
| **Total** | **25** | **653** |

**Data Source**: NPC, Malumfashi Office, 2013

## THE STUDY AREA

Malumfashi Town locates in Katsina, Nigeria. It is situated on lat. 11° 44'N, 11° 48'N, and long. 7° 34'E, 7° 38' E. It bordered with some villages, e.g. to the north it bordered with Kwarsu and Tsamiyan Gude, to the south by Kauyen-dawo, to the west with Unguwar-Dutsi, Layin Barayu and Wanzamai, to the east it is bordered by Tsaunin-Kura and Allah Madogara (Fig. 1.1). Fig.1.2 shows the study area and four (4) sampling divisions.


NIGERIA SHOWING MALUMFASHI IN KATSINA STATE
R. NIGER
R. BENUE
Katsina state
Katsina
Malumfashi
0 150Km
Kutasheka
Borin Dawa
11°49N
Kwarsa Yariga
Tsamiyan Gude
Kwasu Maguzawa
Ginnery
Tura
Ungwan Dutsi
MALUMFASHI
11°47
Layin Barayu
Kauyan Dawo
Wazamai
Ung Yaro
Sabon Layi
11°45N
Ungwan Barau
Ungwan Jae
Ungwan Ari
Kuningafa
Ruwan Sanyin
Katanga
7°35E
7°37E
0 1 2Km
KEY
ROADS
RIVERS
FOOTPATH
MAJOR SETTLEMENT
MINOR SETTLEMENTS
N

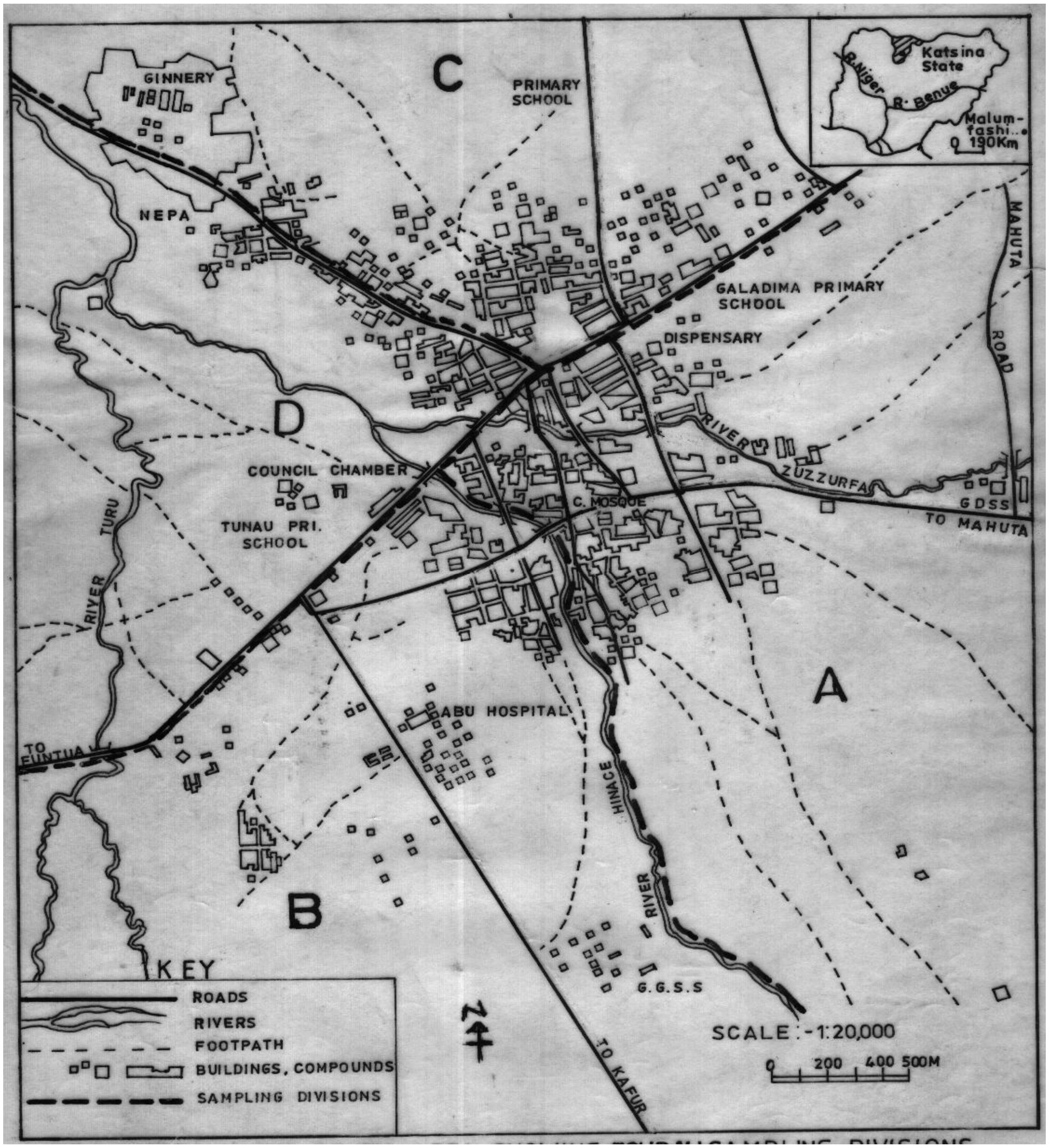



**Fig. 1.2: The Study Area and Four (4) Sampling Divisions**
**Data Source:** Malumfashi Structure Plan by Max Lock Group Nigeria, 1977

## RESULTS

Table 2.1 presented the households responses obtained from the administered questionnaires survey in the study area. In the Table out of 653 households interviewed, 235 households have tap-water. However, there are variations in the number of households with tap water among the individual sampling area. For instance, area (A) has 90 households with tap-water;

area (B) has tap-water among the individuals sampling area also varies. Area (A) has 171 households without tap-water, (B) 125, (C) 80 and (D) 42. These variations occurred because of the variations in the population density and the spatial distribution of pipeline network among the area. Two hundred and thirty five (235) households sourced their pipe-borne water from Malumfashi Water Board. But the supply is generally inadequate, because out of 235 households, 174 respondents have inadequate pipe-borne water supply.

Also from Table 2.1 out of 653 households that were interviewed, 235 households have tap-water. However, there are variations in the number of households with tap-water among the individual sampling area. For instance, area (A) has 90 households with tap-water, area (B) has 70 households with tap-water, and Area (C) has 50 and (D) has 25. The remaining 418 households are without tap-water, which also distributed among the four sampling areas. Similarly, the number of households without tap- water among the individuals sampling area also varies. Area (A) has 171 households without tap-water, (B) 125, (C) 80 and (D) 42. These variations occurred because of the differences in the population density among the area.

With regards to other sources of water supply, majority of the households interviewed sourced their domestic water from wells. From the Table 2.1, 270 households out of 418 households without tap-water sourced their domestic water from wells.

**Table 2.1: Households Responses from Questionnaires Survey**

| | Frequencies of Responses | | | | No. of |
|---|---|---|---|---|---|
| **Items of Questionnaire Survey** | **Area (A)** | **Area (B)** | **Area (C)** | **Area (D)** | **Households** |
| 1a. House-holds with taps water | 90 | 70 | 50 | 25 | 235 |
| b. Household without taps water | 171 | 125 | 80 | 42 | 418 |
| 2. Source of pipe borne water from M/fashi water- board | 90 | 70 | 50 | 35 | 235 |
| 3a. Adequate pipe-borne water supply | 27 | 21 | 8 | 5 | 61 |
| b. Inadequate pipe borne water supply | 60 | 49 | 42 | 20 | 174 |
| 4. Others source of water supply | | | | | |
| a. Source of water supply from water vendors | 29 | 35 | 7 | 17 | 88 |
| b. Source of water supply from boreholes | 42 | - | 18 | - | 60 |
| c. Source of water supply from wells | 100 | 90 | 55 | 25 | 270 |
| 5a. Flow duration of taps water in less than 3hrs/day | 40 | 30 | 30 | 28 | 128 |
| b. Flow duration of tap water in greater than 3hrs/day | 50 | 40 | 10 | 7 | 107 |
| 6. Uses of pipe borne water: | | | | | |
| a. Domestic use | 67 | 45 | 43 | 23 | 178 |
| b. Gardening use | 8 | 5 | 4 | - | 17 |
| c. Commercial use | 15 | 20 | 3 | 2 | 40 |
| 7. Remedies to present water shortages | | | | | |
| a. A net increase withdrawal | 70 | 60 | 28 | 15 | 173 |
| b. Private participation in water supply system | 61 | 45 | 30 | 8 | 144 |
| c. Drilling boreholes | 130 | 90 | 70 | 40 | 330 |
| d. Others | - | - | 2 | 4 | 6 |

**Data Source:** Questionnaire Survey, 2013

For the flow duration of tap-water, tap-water flow in the tap of 128 households in less than 3hrs/day. It also flows in the tap of 107 households in more than 3hrs/day. These have shown, there is spatial variation of water supply in the area. Reason for this is due to relief factor and variations in population density among the sampling areas. For instance, in area (A) and (B) the slope dips gently to the south causing taps- water to flow for more than 3hrs/day. In area (C) and (D), the slope dips steeply to the north causing taps-water to flow in less than 3hrs/day. It also related to the pumping time which the Water Board allocates to each area.

## TEST OF HYPOTHESIS

To further certain whether there is or no spatial variations of pipe- borne water supply in the study area, the hypothesis of the study, stated as there are no spatial variations of flow duration of tap- water between less and greater than 3 hours per day was tested at 0.001 significant levels. Table 2.1a and b illustrated the compilation of Chi-Square test for flow duration of tap-water respectively in the study area.

**Table 2.1(a): Compilation of Chi-Square Test for Flow Duration of Tap-Water/Day**

| | **Flow Duration of Tap Water/Day** | | |
|---|---|---|---|
| **Sampling Areas** | **Less than 3 Hours/Day** | **Greater than 3hrs/Day** | **No. of Respondents** |
| Area (A) | 40 (a) | 50 (b) | 90 |
| Area (B) | 30 (c) | 40 (d) | 70 |
| Area (C) | 30 (e) | 10 (f) | 40 |
| Area (D) | 25 (g) | 7 (h) | 35 |
| Total | 128 | 107 | 235 |

**Data Source:** Questionnaire Survey, 2013

**Table 2.1(b): Compilation of Chi-Square Test for Flow Duration of Tap- Water/Day Between Observed and Expected Data**

| **Cells** | **A** | **B** | **C** | **D** | **E** | **F** | **G** | **H** |
|---|---|---|---|---|---|---|---|---|
| O | 40 | 50 | 30 | 40 | 30 | 10 | 25 | 7 |
| E | 49.02 | 40.97 | 38.11 | 31.78 | 21.78 | 18.21 | 19.06 | 15.93 |
| O-E | -9.02 | 9.03 | -8.12 | 8.13 | 8.22 | -8.21 | 8.94 | -8.93 |
| $\frac{(O-E)^2}{E}$ | 1.65 | 1.99 | 1.72 | 2.07 | 3.10 | 3.70 | 4.19 | 5.00 |
| $X^2$=23.42 | 1.65 | 1.99 | 1.72 | 2.07 | 3.10 | 3.70 | 4.19 | 5.00 |

**Data Source:** Questionnaire Survey, 2013

At 0.001 significant levels with (df = 3) the tabulated is equal to 16.27. This value is less than the calculated value 23.42. The null hypothesis is therefore rejected and retained the alternative hypothesis. Meaning there are significant spatial variations of flowing duration of tap- water/day in the study area.

Inadequate pipe-borne water supply, relief factor, population growth and the nature of water supply system are the major factors responsible for these shortages and spatial variations of pipe-borne water supply in this urban area.

## REMEDIES TO THE PRESENT PIPE-BORNE WATER SUPPLY SHORTAGES

Based on Table (2.1 ), it appears majority of the dwellers of the area opt for drilling boreholes in different locations to solve the present shortages of pipe-borne water followed by a net increase of withdrawal of fresh water by the Water Board authority. Private participation in water supply system takes the third measure for tackling water shortages. This involves establishment of individual or cooperatives water supply industries to augment existing water supply system which was owned by state government. The last measure for water shortages is others. These are the respondents which opt for improvement of power supply, tackling leakage problems, enlighten people on misuses of taps water and financial assistance to the existing Water Board authority.

## SUMMARY AND RECOMMENDATIONS

The findings of this research have empirically proved there were shortages and spatial variations of pie-borne water supply, due to inadequacy of supply, relief factor, population growth and the nature of water system. It is recommended, therefore, that government should adopt immediate measures to tackle the existing problem. This by means of drilling boreholes in the different locations, increase a net withdrawal of fresh water and encourage private sector to participate in the water supply in the Town.

## REFERENCES

Adebayo, A. (2007). Adaptive Water Management System in Nigerian Peri-urban Center: A Paper Presented at 4th Annual Association of Nigerian Geographers` Conference, Held at University of Abuja, Nigeria, 15th -19th October, 2007

Ayodele, J.O (1975). Water Resources and Theirs Development in Nigeria, in: Hydrol. Sci. Bull. Pg. 20, 25i-591

Akintola and Areola (1980) Domestic Water Consumption in Urban Area, Published by Federal Department of Water Resources, Lagos, Nigeria

Biswas, A.K (1978). United Nation Conference, Summary and Main Documents, Pergamon Press Pg. 34-121.

David, E (1977.) Statistics in Geography, A Practical Approach, pg. 61-65

Walton, W.K (1970). The World of Water, Weider Feld and Nicolson, London

**Reference** to this paper should be made follows: Haruna Saleh and Abdulmalik M. Sada (2013), Assessment of Pipe-Borne Water Supply in Malumfashi Town, Katsina State as a Challenge to Research and Innovation for Economic Development in Globalizing Africa. *J. of Sciences and Multidisciplinary Research,* Vol. 5, No. 2, Pp. 84 – 92.