



## ABSTRACT

This study investigated effects of socio-economic characteristics on domestic water demand in Yelwa area of Bauchi metropolis. A random sampling technique was used for the study. Three hundred and sixty-five (365) copies of questionnaire were administered and used for collection of data in the study area. The study found out that majority of the respondents were male with 71% and also the study found out that 68% of the respondents are married which shows that there is a need for provision of more water facilities because they demand more water

# EFFECTS OF SOCIO-ECONOMIC CHARACTERISTICS ON DOMESTIC WATER DEMAND IN YELWA AREA OF BAUCHI METROPOLIS

SUNDAY THOMAS; UZOAMAKA OKOYE;  
NAFISAT ABDULRAHMAN LAWAL; & ZUBAIRU  
ABUBAKAR GHANI

Department of Urban and Regional Planning, Faculty of Environmental Technology, Abubakar Tafawa Balewa University Bauchi

## Introduction

Water is essential to human life. Domestic water demand varies widely from place to place as higher standards of living, changes in lifestyle and socio-economic activities rise, (Istifanus, 2017). The term “domestic water demand” is usually taken to mean the amount of water required for various domestic purposes which may include water for drinking, food preparation and cooking washing cloth and utensils, house cleaning and polishing vegetable gardening, livestock watering and other uses, (Amin, 2017).

Water demand for domestic purposes are often in the form of drinking; preparation of food as well as cooking; dish washing, household laundry; cleaning the house and polishing vegetable gardening; rearing of domestic livestock among other uses, Bada, *et.al* (2021). Consequently, the amount of water demand by a household is greatly determined by the size of the family or the household size, the nature of water consuming appliances that are being utilized within the household and the amount of income earned by the household, David (2007).

Globally the extensive demand for domestic water has increased which is not balanced with the supply as a result of higher standards of living, changes in lifestyle and socio-economic activities which resulted to increase in continuous for the supply (Al-Amin, 2011). Domestic water demand varies from one community to another also higher standards of living are changing water patterns which are



due to their large number. Again majority of people in the study area are Christians with 64% even though the Muslims that occupy 36% demands more water for spiritual cleansing that is ablutions. In terms of employment, majority of the population are employed in the public sector which shows that they demand more water than those not employed and the self-employed because of the increase in domestic activities. Those that live in room and parlor occupies large population with 46% and therefore demand more water because of their size and require more attention in term of provision of domestic water facilities.

**Key words:** Domestic, Water, Demand, Characteristics, Socio-Economic.

reflected mainly in increased domestic water demand especially for personal hygiene, (Istifanus, 2017).

In developed countries like Spain, Carbella and Pujol (2009), found out that the domestic water demand includes water for bathing, cooking, clothes washing, toilet flushing. In Los Angeles, U.S.A, Mini, (2013), found out that the domestic water demand includes water for bathing, toilet flushing, cloth washing, dish washing and landscape greening. In India, Shaban and Sharma (2007) found out that the domestic water demand includes water for bathing which consumes the highest amount of water with about 28% of total consumption, toilets 20%, washing clothes 18.6% and washing utensil 16.3%. In Melbourne Australia, an average family domestic water demands 19% of their total water for flushing toilets and 35% for garden and lawn watering; 26% in bathroom, 15% laundry, kitchen 4%, 1% drinking, (Abrashinsky, 2004).

In developing countries, Ali and Terfa (2010), found out that in Nakemate town Ethiopia the domestic water demand includes water for drinking and cooking where they stood at 12.5 liters per day as the largest users, followed by utensils cleaning, bathing, cloth washing, house cleaning and gardening, toilet and others. Ayanshola and Salami (2010) found out the pattern of domestic water demand in Ilorin includes water for cooking laundry, dish washing, toilet flushing. Kagu *et al.*, (2013), showed that the patterns of domestic water demand in Maiduguri which includes bathing, washing, food preparation and others. Uzoamaka (2010) in a study of Qualitative Analysis of Drinking Water in Enugu urban areas found the pattern of domestic water demand includes bathing, cooking, cloth washing, dish washing, and toilet flushing. In Bauchi, Istifanus (2017) found out the pattern of water demand in

the domestic sector which includes water for bathing, cooking, car wash, drinking, washing clothes, washing dishes and other socio-cultural activities.

There is a wide variation in domestic water demand for instance; (Shaban & Sharna, 2007) reported water demand variations among 7 major cities in India. The highest was in Kolkata (116 l/p/c/d), Mumbai (90 l/p/c/d), Madurai (88 l/p/c/d) while Kampur (77 l/p/c/d). In the United States household per capita domestic water demand range from 200 l/p/c/d in Wisconsin to 80 l/p/c/d in Idaho (Donnelly & Coolley, 2015). Abrashinsky, (2004), reported 156 l/p/c/d in Australia, In Nigerian urban centers per capita domestic water demand in Ilorin is 86.22 l/p/c/d (Ayanshola *et al.*, 2010) and in Maiduguri 100 l/p/c/d, Kagu, *et al.* (2013).



In the whole of the Bauchi metropolis, there are total of 28,475, 489 liters of water demand per day for domestic activities. In the low density 5,994,132 liters (21%) of water demand while in the medium and high density areas, there is 10,157,615 (36%) and 12,323,742 liters (43%) of water demand respectively daily, (Istifanus, 2019). The quantity of domestic water demand varies within densities and at household level 878 l/p/c/d, 439 l/p/c/d and 458 l/p/c/d is used in the low, medium and high of density areas respectively. On per capita basis the average domestic water demand in Bauchi is 102 l/p/c/d, 71 l/p/c/d and 57 l/p/c/d in the low, medium and high density areas respectively, (Istifanus, 2017) of which Yelwa as part of the medium density occupies 10,157,615 (36%) with 439 l/p/c/d.

Despite this domestic water demands, the World Health Organization (WHO, 2009) and Nigeria National Water Policy (NWP, 2004) recommends 120 l/p/c/d to maintain healthy living conditions in urban centers. The study area is among those where there is domestic water demand where both men and women spend a lot of their time in search for alternative water. This research intends to determine the domestic water demand in Yelwa area of Bauchi metropolis with a view of identifying alternative water sources and the challenges faced as a result of the domestic water demand.

## **LITERATURE REVIEW**

### **Socio-Economic Characteristics and Domestic Water Demand**

Domestic water is defined as water demand for drinking, bathing washing cloths and dishes flushing toilet and landscaping, (Donnelly. & Cooley, 2015). A number of factors determine the type of activity and quantity of water demand in the domestic domain. It is certain that societies are going to have to confront, among other things, demographic transitions, geographical shift of population, technological advancement, growing globalization, degradation of the environment and emergence of water scarcities. Indeed, rapid growth in population, economic development and changes in life style have been responsible for the rapid growth in water demand in many developing countries in the face of shrinking supplies due to over-exploitation and pollution, (Shaban & Sharma, 2007). There are many factors that contribute to the total water demand at household level. Arbues, et al 2013 examined the main issues in literature on domestic water demand. They analyzed several tariffs and their objectives and identified water price, income or household composition as crucial determinants of residential water demand. Other researchers found out that the rate of water demand depends on the socio-economic standard of the people, the level of education and development, the nature of prevailing climate and hygiene characteristics of the people. Other factors include water use appliance and geographical location, Lu, (2007). The list of factors keeps increasing as society transits from one level of development to another. The relationship between factors and quantity of domestic water demand has been of interest to scholars of domestic water demand for a long time.

### **Domestic Water Demand in some selected Nigerian cities.**

In most Nigeria, urban centers the main source of water are rivers, boreholes, wells and springs, (Istifanus & Bwala, 2019). In Lagos water supply comes mainly from the Ogun and Iju River, and the supply is 210 million liters per day while the demand for domestic water is 540 million liters per day



giving a deficit of 330 million liters per day, (Lagos State Water Board, LSWB, 2015). In Enugu Uzoamaka (2010) noted that the major source of public water supply was the Ajali water scheme commissioned in 1985 to provide water to about 3.3 million inhabitants of Enugu urban and according to her, for the five years (2002 – 2007) the inhabitants experienced acute water shortage. In Owerri city Nigeria, Onyenechere & Osuji (2012) reported that River Otamiri water facility that is supposed to supply 66 million litres of water currently supplies 12 million litres of water a day, leaving a deficit of 54 million litres a day. In Osiele, 78.8 % of the households' fetched water from hand operated wells and 21.2 % from boreholes and motorized wells (Oluyigbe & Fasakin, 2010; Amori & Makinde, 2012; Ezenwaji, et al, 2014 & Ojo, 2014).

In Zaria public water supply to the town is 35,000 m<sup>3</sup> (35 million litres) per day while the demand for domestic water stands at 85,000 m<sup>3</sup> (85 million litres) which his gives a shortage of 50,000 m<sup>3</sup> (50 million litres) of water a day, (Kaduna State Water Board KSWB, 2010). In Kano metropolis the total for water is 550 million litres per day while the supply is 200 million litres per day, with a deficit of 350 million litres per day, thus satisfying only 36 % of domestic need. (Kano State Water Board, KNSWB, 2011).

In Bauchi main sources of water supply are the Gubi water scheme at Gubi Dam, the supply to Bauchi is 13,388,535 litres while the is 66,700,000 litres, (Bauchi State Water Board, 2015). The water supply schemes are operated and maintained entirely by the Bauchi State Water Board (BSWB, 2015). The supply in the study area Yelwa is a scheme based on 4 boreholes, a 108,000 litres surface steel tank and an elevated steel tank with capacity of 80,000 litres to serve the areas and details of how they work and who is in charge are not quite clear (SUWASA, 2012). Rafin Zurfi: - has a scheme which depends on 4 boreholes, 80,000 litres overhead tank, a 108, 000 litres surface steel tank. Yelwa Kagadama – Tsakani – Lushi scheme: - This system has one overhead tank 108,000 litres at Yelwa Kagadama, another similar capacity at Tsakani and a pumping station at Lushi. It also has a 220,000 litres surface steel tank and an overhead tank in Lushi now incorporated in the scheme.

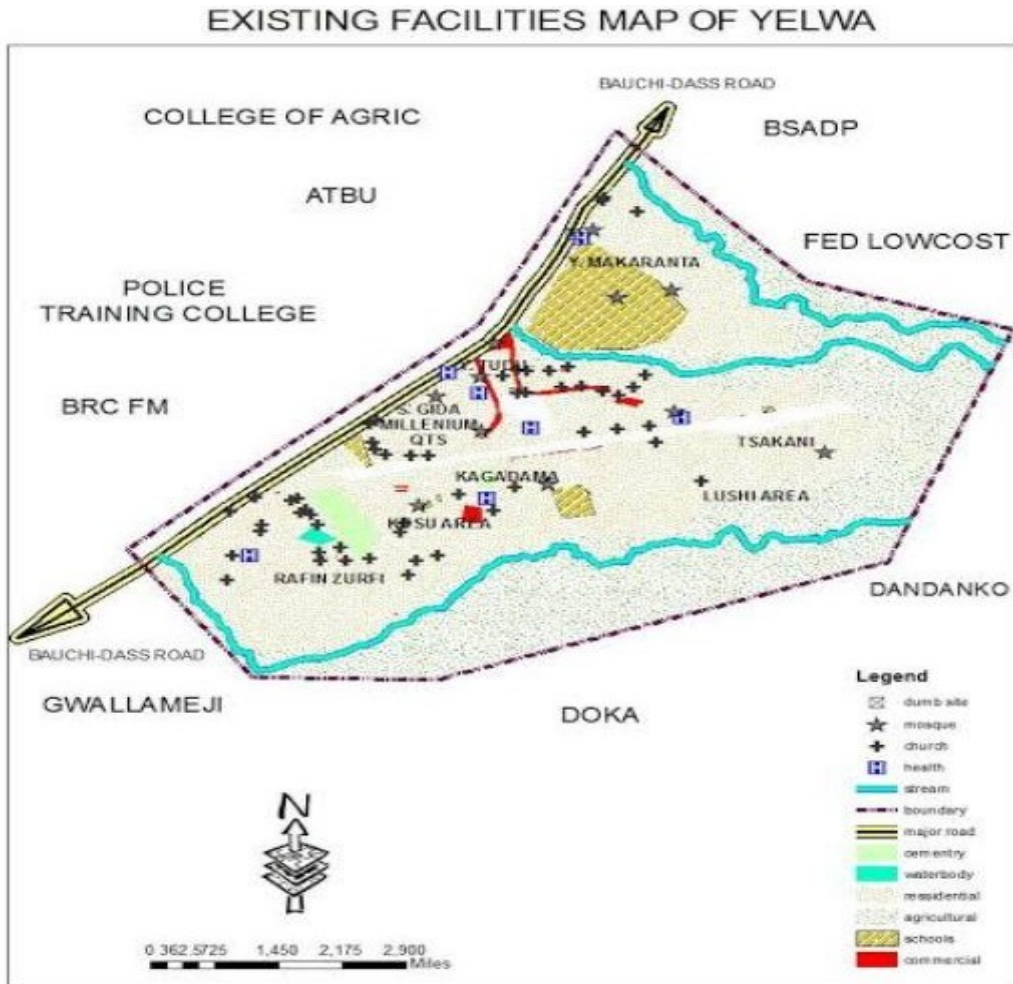
## **METHODOLOGY**

### **Location of the Study Area**

Yelwa area is one of the largest settlements in Bauchi town, located south of the metropolis along Dass to Tafawa Balewa road. The early settlers were Gerawa and Fulani who settled for cattle rearing and farming purposes. The founder Nde Waziri said to have migrated from Inkil a surb of Bauchi town in 1966. He is Ngas by tribe that is why the central settlement of the area is described as Ngas ward literally called “Angwan Ngas”. Because of its vast land, it is described as institutional land use where many institutions are located today these include: General Hassan Usman Katsina Unity College; Bauchi College of Agriculture; Federal Polytechnic Bauchi; Abubakar Tafawa Balewa University Yelwa Campus, and Police Training School. Yelwa sector is made of ethnic diversity that include but not limited to the following tribes: Hausa-fulani; Sayawa; Jarawa; Ngas; Tangle-waja; Igbo; Yoruba; and other minority tribes. Yelwa area of Bauchi metropolis comprises of Tudu, Makaranta, Laborer, Kagadama, Tsakani, Lushi, Rafin-zurfi, Birshin Gandu, and Gwalameji neighborhoods, Dukku (2018) and is one of the largest settlements in Bauchi metropolis, located south of the metropolis along Dass road. The physical terrain is characterized by marshy and dry land. The structure of the settlement is compacted of poor quality urban design and streetscape

that are narrow mostly less than 2.0 meters wide with many structures constructed on and under utility lines.

Map 1. Yelwa area of Bauchi Metropolis



**Population and Economic Activities**

The population of the study area, according to the 2006 population census, the result stood at sixty-six thousand, three hundred and eighty-two (66,382) persons, (NPC, 2006). Agricultural practices for production of both food and cash crops have captured the life of the inhabitants of the study area. The ethnic groups in the area include Hausa-fulani, Sayawa, Jarawa, Ngas, Tanglewaja, Igbo, Yoruba, and other tribes. The area is mostly predominantly dominated by students of Abubakar Tafawa Balewa University, Federal Polytechnic and other institutions of higher learning within the metropolis. Dukku, (2018)

**Climate and Rainfall**

The climatic condition of the study area can be as: Temperature ranges from high (maximum) to low (minimum) in every month within a year. These will be determined either by a raining or dry season. The mean daily maximum high of temperature range is 36.6°C in April and it



decreases to 28.2°C in August. While the mean daily minimum range of temperature range is about 13.3°C in December to about 22.1°C in April and May. Bauchi experience it is raining season right from mid-June to mid - October, with August recording the highest amount of rainfall of 340 mm. the total mean annual rainfall stands at 1,091.4 mm (BASG, 2012). There are two major seasons in Bauchi i.e. rainy and dry seasons. The rainy season months are May to September, when humidity ranges from about 37% to 68%. The onset of the rains has been often in March and they end virtually October while the dry season starts from November to May (Musa, Hashim & Reba, 2017).

### Research Design

The research design refers to the overall strategy that you choose to integrate the different components of the study in a coherent and logical way, thereby, ensuring you will effectively address the research problem; it constitutes the blueprint for the collection, measurement, and analysis of data, Vaus, (2006). The researcher therefore intends to adopt quantitative research because it is used in obtaining information concerning the current status of the phenomena and to describe "what exists" with respect to variables or conditions in a situation and descriptive research is often used as a pre-cursor to more quantitative research designs with the general overview giving some valuable pointers as to what variables are worth testing quantitatively. The choice of this research design was considered appropriate because of its advantage of identifying attributes of a large population from a group of individuals

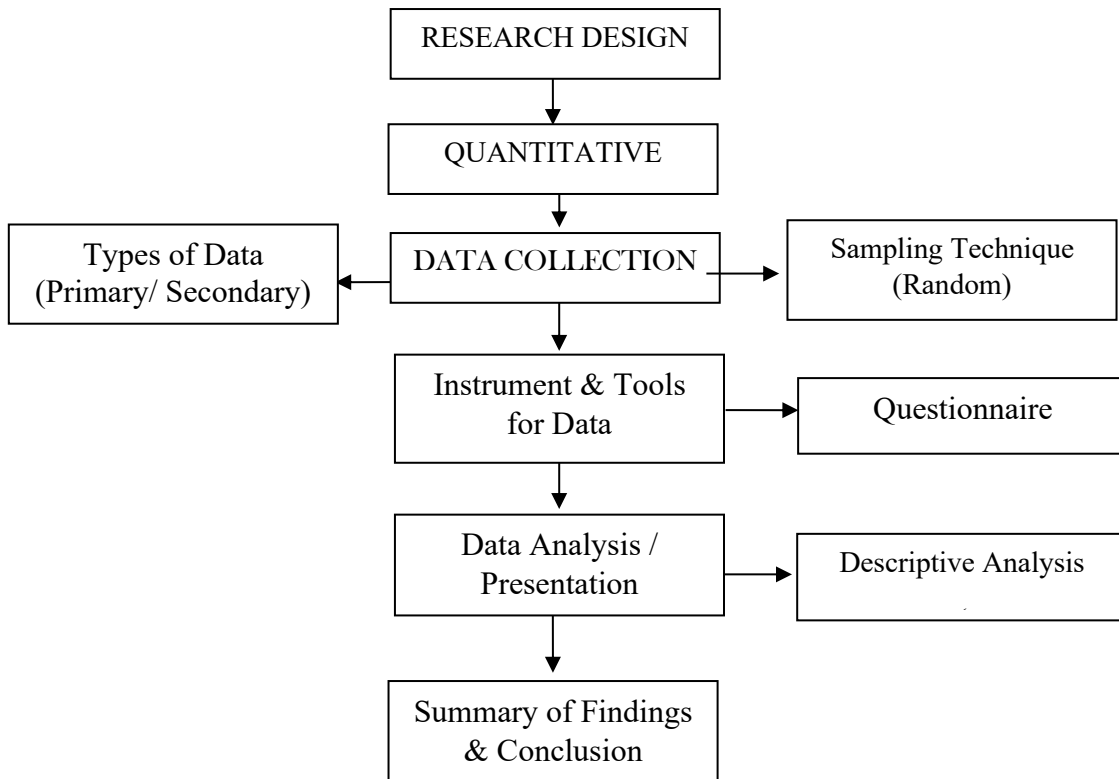


Fig. 1 Research Design  
Source: Author, 2022.



### Population of the Study

Population of a study is a total of items about which information is desired or a group of persons, aggregate items or things the researcher is interested in getting information from (Kabir, 2016). Therefore, target audience of the study is the household heads in Yelwa area who must have stayed for long and have knowledge on the water issues in the area and also the management of Bauchi State Urban Water and Sewerage Corporation (BSUWSC) on the other hand on the issues of water supply. The major languages commonly spoken in the area are: Hausa-Fulani, Sayawa, Jarawa, Ngas, Tangle-Waja, Igbo, Yoruba and other tribes.

### Sampling Design

Sample design refers to the plans and methods to be followed in selecting sample from the target population and the estimation technique formula for computing the sample statistics (Kabir, 2016). Random sampling design will be adopted for the research and the population of the study area is sixty-six thousand, three hundred and eighty-two (66,382) persons based on an annual urban growth rate of 2.55% (NPC, 2006 projected).

### Sample Size

The sample size of a study can be obtained using a census for a small population, imitating a sample size of similar studies, using published sample size determination tables and applying formula to calculate sample size, (Israel, 1992). The Krejcie and Morgan (1970) method of determining sample size will be used where 381 questionnaires will be set as the number of questionnaires for a population of fifty thousand to seventy-four thousand (50, 000 – 74, 000) of population (**see table 1**). The questionnaire will be designed to collate respondent's socio economic data and response on domestic water.

**Table 1: Methods of Determining Sampling Size**

| <i>N</i> | <i>S</i> | <i>N</i> | <i>S</i> | <i>N</i> | <i>S</i> |
|----------|----------|----------|----------|----------|----------|
| 10       | 10       | 220      | 140      | 1200     | 291      |
| 15       | 14       | 230      | 144      | 1300     | 297      |
| 20       | 19       | 240      | 148      | 1400     | 302      |
| 25       | 24       | 250      | 152      | 1500     | 306      |
| 30       | 28       | 260      | 155      | 1600     | 310      |
| 35       | 32       | 270      | 159      | 1700     | 313      |
| 40       | 36       | 280      | 162      | 1800     | 317      |
| 45       | 40       | 290      | 165      | 1900     | 320      |
| 50       | 44       | 300      | 169      | 2000     | 322      |
| 55       | 48       | 320      | 175      | 2200     | 327      |
| 60       | 52       | 340      | 181      | 2400     | 331      |
| 65       | 56       | 360      | 186      | 2600     | 335      |
| 70       | 59       | 380      | 191      | 2800     | 338      |
| 75       | 63       | 400      | 196      | 3000     | 341      |
| 80       | 66       | 420      | 201      | 3500     | 346      |
| 85       | 70       | 440      | 205      | 4000     | 351      |
| 90       | 73       | 460      | 210      | 4500     | 354      |



|     |     |      |     |        |     |
|-----|-----|------|-----|--------|-----|
| 100 | 80  | 500  | 217 | 6000   | 361 |
| 110 | 86  | 550  | 226 | 7000   | 364 |
| 120 | 92  | 600  | 234 | 8000   | 367 |
| 130 | 97  | 650  | 242 | 9000   | 368 |
| 140 | 103 | 700  | 248 | 10000  | 370 |
| 150 | 108 | 750  | 254 | 15000  | 375 |
| 160 | 113 | 800  | 260 | 20000  | 377 |
| 170 | 118 | 850  | 265 | 30000  | 379 |
| 180 | 123 | 900  | 269 | 40000  | 380 |
| 190 | 127 | 950  | 274 | 50000  | 381 |
| 200 | 132 | 1000 | 278 | 75000  | 382 |
| 210 | 136 | 1100 | 285 | 100000 | 384 |

Note.— $N$  is population size.  $S$  is sample size.

Source: Krejcie & Morgan, 1970

### Sampling Techniques

A sampling technique is the name or other identification of the specific process by which the entities of the sample have been selected. The researcher intends to employ the random sampling technique for the data collection because it allows all the units in the population to have an equal chance of being selected. The technique will be applied where respondents will be selected at intervals and the sampling technique will be used to select the required sample size in the study area to assess the domestic water and supply in the study area.

### Data Collection

Data collection is a methodological process of gathering and analyzing specific information to proffer solutions to relevant questions and evaluate the results. In an attempt to elicit relevant data and information for this study, two sources of data will be exploited for the collection of data and information namely;

a. **Primary source:**

These are materials of statistical investigation which will be collected by the researcher for the study. The primary data and information will be collected directly from the household heads through questionnaire in the study area.

b. **Secondary source:**

To collect secondary data and information for this study, published books, reputable journals, text, thesis/ dissertation, seminar papers and other relevant documents will be consulted to strengthen the literature review and provide helpful links to the study and the internet facilities.

### Data Collection Instrument

Data collection tools or instruments refer to the devices/instruments used to collect data, such as a paper questionnaire. The major research instrument to be used is the questionnaire. The questionnaire will be designed to obtain sufficient and relevant information from the respondents. The primary data will contain information extracted from the questionnaires in which the respondents will be required to give specific answer to a question by ticking in front of an appropriate answer. The questionnaires to be administered to the residents in the study area





contained structured questions which will be divided into sections A and B. Section A will contain demographic information of the respondents while section B will contain the water in liters per capita per day (L/P/C/D) of the respondents.

## RESULT AND DISCUSSION

### SOCIO- ECONOMIC CHARACTERISTICS OF RESPONDENTS

**Table 2: Gender Composition of the respondents in Yelwa area of Bauchi Metropolis.**

| GENDER       | FREQUENCY  | PERCENTAGE |
|--------------|------------|------------|
| MALE         | 259        | 71         |
| FEMALE       | 106        | 29         |
| <b>TOTAL</b> | <b>365</b> | <b>100</b> |

Source: Author 2023

The gender composition has influence on domestic water demand because sometimes female gender demand more water than male due to personal hygiene and domestic activities The study found out that 71 % of the respondents are male while 29% of the respondents are females.(Table 2).

**Table 3: Marital Status of the households in Yelwa area of Bauchi Metropolis.**

| MARITAL STATUS | FREQUENCY  | PERCENTAGE |
|----------------|------------|------------|
| MARRIED        | 250        | 68         |
| SINGLE         | 115        | 32         |
| <b>TOTAL</b>   | <b>365</b> | <b>100</b> |

Source: Author 2023

The marital status composition has influence on domestic water demand because married people demand more water than the unmarried because of their number in the household. The study found out that 68 % of respondents are married while 32 % are unmarried. This explains why the household sizes are relatively larger which demands more water. (Table 3).

**Table 4: Religion of the households in Yelwa area of Bauchi Metropolis.**

| RELIGION     | FREQUENCY  | PERCENTAGE |
|--------------|------------|------------|
| CHRISTIAN    | 235        | 64         |
| MUSLIM       | 130        | 36         |
| <b>TOTAL</b> | <b>365</b> | <b>100</b> |

Source: Author 2023

The study found out that 64 % of households are Christians while 36 % are Muslims. Within the study area, even though the Muslims occupies 36% but demands water most especially for prayers that is Ablution.(Table 4).



**Table 5: Employment Status of the households in Yelwa area of Bauchi Metropolis.**

| EMPLOYMENT STATUS | FREQUENCY  | PERCENTAGE |
|-------------------|------------|------------|
| EMPLOYED          | 149        | 41         |
| SELF EMPLOYED     | 124        | 34         |
| UNEMPLOYED        | 58         | 16         |
| OTHERS            | 34         | 9          |
| <b>TOTAL</b>      | <b>365</b> | <b>100</b> |

**Source:** Author 2023

The employment status of the respondents has influence on domestic water demand because those employed are saddled with more responsibilities in the household. The study found out that 41 % of the respondents are employed, 34% are self-employed, 16% are unemployed while others while includes the artisans 9%. (Table 5).

**Table 6: House Type of the households in Yelwa area of Bauchi Metropolis.**

| HOUSE TYPE     | FREQUENCY  | PERCENTAGE |
|----------------|------------|------------|
| SINGLE ROOM    | 49         | 13         |
| ROOM & PARLOUR | 167        | 46         |
| FLAT           | 149        | 41         |
| <b>TOTAL</b>   | <b>365</b> | <b>100</b> |

**Source:** Author 2023

The type of house has influence on domestic water demand those that lives in room and parlor or flat demand a lot of water most especially because of their number in the household. The study found out that 46% of residents live in room & parlor, 41 % in flats, while 13 % in single rooms. Within the study area, 87 % of the households occupy more rooms that their demands for domestic water will be high while 13% of the households with less number of rooms have less domestic water demands. (Table 6).

## **CONCLUSION AND RECOMMENDATION**

Household socio economic characteristics have profound implications for domestic water demand as demonstrated in this study. From the above discussion it is obvious that water demand exists in terms of quantity supplied and the NWP standard. For example, when people are faced with shortage of water supply from public source they have no choice but look for alternative sources such as streams, wells, boreholes and water vendors with it numerous problems. It is therefore recommended that policy makers and water supply planners should increase the quantity of water supplied to the metropolis by expanding existing water supply schemes and establish new ones through improved budgetary allocation. It is also recommended that water supply should be metered so each household can be supplied according to their need.

## **REFERENCES**

(UN), U. N. (2007). *Water and Food and Agriculture Organisation of the United Nations (FAO). Coping with Water Scarcity: Challenges of the Twenty Century.* New York.



**TIMBOU-AFRICA ACADEMIC PUBLICATIONS**  
**NOVEMBER, 2023 EDITIONS, INTERNATIONAL JOURNAL OF:**  
**SOCIAL SCIENCE RES. & ANTHROPOLOGY VOL. 15**

- (UN), U. N. (2009). *World Population Monitoring: Focusing on Population Distribution, Urbanisation, Internal Migration and Development, A Concise Report*. New York.
- (UNDP), U. N. (2006). *Human Development Report 2006: Beyond Scarcity: Poverty and the Global Water Crisis*. New York.
- Abrams, L. (1998). *Understanding Sustainability of Local Water Services*.
- Abrashinsky, N. (2004). *Domestic Use of Water. International Environmental Problems and Policy* .
- Ahmed, F. &. (1987). *A Field Study into Patterns of Domestic Water Consumption in Rural Areas of Bangladash*.
- Ahuja, R. (2010). *Research Methodology*. New Delhi: Rawat Publication.
- Ajadi, B. (1996). *Pattern of Water Supply in Ilorin City*. Ilorin.
- Ali, M. &. (2012). *State of Water Supply and Consumption in Urban Areas at Household Level, A case Study of East Wollanga Zone Ethopia. British Journal of Humanities and Social Sciences* .
- Amori, A. &. (2012). *Evaluation of Access to Public Water Supply in two major citties in Nigeria. American Journal of Environmental Engineering* , 2(6), 48-151.
- Anthonio, G. (2005). *The European Responses to the Challenge of Water and Sanitation in Developing Countries*. TRIBUNE, The Document of European Commission.
- Barney, C. (2005). *Urbanisation in Developing Countries; Current trends, future projection and key challenges for sustainability*.
- Biswan, A. (1978). *Resources and Needs, Assessment of the world water situation in as it, water demand and management proceedings*.
- Corbella, H. &. (2009). *What lies behind Domestic Water Use? A Review Essay on the Drivers of Domestic Water Consumption*.
- David, L. (1969). *International Encyclopedia of Social Science*. New York: The Macmillan Company and Free Press .
- Ezenwaji, E. ., (2014). *Optimal Allocation of Public Water Supply to the Urban Sectors of Enugu, Nigeria. A linear Programming Approach. Applied Water Science* , 4, 73-78.
- Farouk, B. (1987). *Water Quality and Uses of Some Surface Water bodies in Kano Metropolitan*. Kano.
- Foundation, H. (2005). *Water for Life; Community Water Security. An accompanying booklet on Sanitation and Cleanliness for a healthy Environment*. California: The Hesperian Foundation, Berkeley.
- Howard, G. (2003). *Arsenic Drinking Water and Health Risk. Journal of Water and Human Health* .
- Istifanus, V. (2017). *Pattern of Domestic Water Use in Bauchi Metropolis. Journal of Resources Development and Management* .
- Khadam, M. (1984). *Managing Water Demand in Developing Countries Proceeding of International Seminar on Water Revenue Management in Ilorin*.
- Mimi, Z. &. (2000). *Statistical Domestic Water Demand Model for the West Banks Water International*.
- Mini, U. (2013). *Domestic Water Use and Landscape Vegetation Dynamics in Los Angeles*. Los Angeles.
- Mulwafu, W. (2002). *Water Deman Management in Malawi; Problems and Prospect for its Promotion*.
- Musa, S. H. (2017). *Urban Growth assessment and its impact on deforestation in Bauchi metropolis Nigeria using Remote Sensing and GIS Techniques. ARPJ Journal of Engineering and Applied Sciences* , 12, (6) 22-27.



**TIMBOU-AFRICA ACADEMIC PUBLICATIONS**  
**NOVEMBER, 2023 EDITIONS, INTERNATIONAL JOURNAL OF:**  
**SOCIAL SCIENCE RES. & ANTHROPOLOGY VOL. 15**

- Obioha, E. (2008). Climate Change, Population drift and Violent Conflict over land Resources in North Eastern Nigeria. *Journal of Human Ecology* .
- Ojo, O. (2014). Availability and Use of Domestic Water in Osile areas of Ogun Nigeria. *Research Journal in Engineering and Applied Sciences* , 3(2), 104-107.
- Olujuyigbe, A. &. (2010). Willingness to pay for Improved Sustainable water supply in a medium sized city in south western Nigeria. *Current Research Journal of Social Science* , 2(2), 41-50.
- Potts, D. (2012). Whatever Happend to Africa's Rapid Urbanisation? *Africa Research Institute* .
- Richard. C & Aurthur, C. (1984). Municipal: Water Demand and Supply Oklahoma City and Tulsa Oklahoma Water Resources Board.
- Schouten, T. &. (2005). Scaling Up Rural Water Supply; A framework for achieving Sustainable Universal Coverage through Community Management. [www.scalingup.watsan.net](http://www.scalingup.watsan.net) .
- Schouten, T. (2006). Scailing Up Community Management of Rural Water Supply. Resource Centre Network for Water, Sanitation and Environmental Health. [www.iboro.ac.uk/well/links.htm](http://www.iboro.ac.uk/well/links.htm) .
- Shaban, A. &. (2007). Water Consumption Patterns in Domestic Household in Major Cities. *Journal of Economics and Political Weekly* .
- Stephenson, J. N. (2010). Population Dynamics and Climate Change: What are the Links? *Journal of Public Health* .
- Uzoamaka, C. (2010). *Qualitative Analysis of Drinking Water in Enugu Urban areas and its Implication*. Awka.
- Zhang, H. (2005). Domestic Urban Water Use, its implication for Municipal Water Supply in Beijin. *Jornal of Habitat International* .
- Zhang, H. (1999). *Nine Dungons, One River: The Role of Institutions in Developing Water*. Beijin PRC: McGill University.