

Analysis Of The Determinants Of Demand For Portable Water And Sanitation In Nasarawa State, Nigeria

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Abstract: Access to safe water and sanitation are essentials elements of human development and poverty reduction in society. This study examined the analysis of determinant of demand for portable water and sanitation in Nasarawa state. The study utilizes primary data generated through the administration of questionnaire to the respondents in the study area that comprises of six local government areas, which are Nasarawa Egon and Akwanga from Nasarawa north senatorial district, Lafia and Doma from Nasarawa south senatorial district, Keffi and Karu from Nasarawa west senatorial district the population of the study is 1,038,572 and sample size of 400. The study used Taro Yamane sampling techniques and the model for the study is multinomial logit model and estimation technique is systematic random sampling and SPSS statistical package. The results of the major findings demonstrate or reveals that income of household head, location and ownership of dwelling unit are major determinants of demand for portable water in Nasarawa state. The findings also reveal that household size and gender averagely determine the household demand for portable water in Nasarawa state, while the level of education exerted the least impact on demand for portable water in Nasarawa state. The study therefore, concludes that income of household head, location of a household head and ownership dwelling unit are major determinants of demand portable water in Nasarawa state. The study recommended among other that the government should as a matter of urgency, extends the provision of pipe borne water to rural areas to improve rural dwellers chance of having access to portable water.

Keywords: Portable water, Sanitation, Determinants and Households

I. INTRODUCTION

Access to safe water and sanitary means of waste disposal are universal needs and indeed basic human rights. Besides, they are essential elements of human development and poverty alleviation and constitute necessary component of primary health care. Hence, provision of adequate sanitation services, safe water supply, and hygiene education represents an effective health intervention that reduces the mortality caused by diarrheal disease by an average of 65% and the related

morbidity by 26% UNICEF (2015). Contrary to this, inadequate sanitation, poor hygiene and unclean water result not only in more sickness and death, but also in higher health costs, lower productivity, lower school enrollment and retention rates of girls and perhaps most importantly the denial of the rights of people to live with dignity.

Availability of water has been identified as the key to the survival of all civilization that is why the international drinking water supply and other international declaration has recognized that access to water is a fundamental human right,

and has the most obvious and direct benefits in reducing mortality and mobility (WHO, 1980). An increased demand for water resources resulting from increases in populations. Despite the exhaustive efforts of many institutions at the national and international levels, around 1.3 billion people in the developing world lack access to adequate quantity of clean water and approximately three billion people are without adequate means of waste disposal (Bosch et.al., 2011). According to Brocklehurst (2014), in the last 50 years, the world's urban population has increased fourfold, and now around 50% of the world's population lives in urban centers. While urban populations grew rapidly, expansion of water supply and sanitation services did not. Spending on water supply and sanitation has not kept pace with growth, and there are dramatic differences in infrastructure expenditure between cities in low-income and high-income countries.

The provision of clean drinking water is a fundamental requirement for human consumption to reduce waterborne diseases and promote economic and social development (Vammen, 2012). Realizing the critical importance of supplying potable water, over the last decade many rural water supply programmes were implemented throughout the developing world (Otti, 2012). Despite this, in 2008, an estimated 141 million urbanites and 743 million rural dwellers continued to rely on unimproved sources for their daily drinking water needs (United Nations, 2011). This indicates worldwide, 84 percent of the people who have limited access to drinking water supplies live in rural areas. Even where rural supply systems are developed, many are in disrepair or not functioning properly (RWSN, 2012). Unsustainable water points deprive people of intended health and livelihood benefits, (Shaw, 2012). Besides, the poor management of water and sanitation resources are the impediment to achieving the Millennium Development Goals (MDGs) (Otti, 2012). Studies show that rural water supply programmes in developing countries have frequently failed to deliver benefits to society over the long term, mainly because of the approach used. For example, according to Garriga and Pdrez-Foguet (2008), the emphasis has been on the- fast production of new schemes while sidestepping post-construction support.

Poor access to portable water supply as well as accessibility to adequate sanitation can result to variety of societal health problems and can result to disease outbreak. According to the report of Nasarawa State Ministry of Health, the unavailability of safe drinking water in most rural locations in Nasarawa state is one of the main causes of diarrhea among children under the age of five (NMH, 2016). The negative health impact of contaminated water is exacerbated because more than 90 percent of households consume this water untreated. Previous empirical studies such as the one by Amadi et al., (2016) also show that access to improved water is an important contributor to improved child health and mortality reduction. In Nasarawa state, the problem of drinking water supply is further compounded by physical distance and the spending on water supply and sanitation has not kept pace with growth as a result there are dramatic differences in infrastructure expenditure between areas of low and high income in the state.

STATEMENT OF THE PROBLEM

Since the creation of Nasarawa State in 1996, the management of public water supply in the state has been the responsibility of the Nasarawa State Water Board (NSWB) while recently, the issue of sanitation is within the purview of State ministry of Health and State ministry of environment and natural resources. Although, NSWB supply pipe borne water across major cities of the State, it does not have the capacity to meet up with the demand for portable water in the entire state, there is still gap, thereby leading to seeking alternative by citizens. Similarly, in terms of sanitation, there is deficits in the state of sanitation in the state is still largely in deficits as many communities are still littered with open waste disposal and open defecation is visible even along major roads.

The Nassarawa State government have for several years through different policies sort to reduce the challenges of portable in the state as well as the issue of sanitation. There are several laws against open defecation, improper waste disposal, violation of sanitation rules e.t.c., when caught, violators risk being fined or even jail terms depending on the severity of their offences. Other measures by state government include the constant funding of the NSWB, expansion and extension areas of coverage in terms of water supply, constant renovation and construction of new drainage system across the state. As part of effort by the state government to ensure proper sanitation in Nassarawa state, the state governor Abdullahi Sule in August 2019 re-lunched the monthly state-wide sanitation exercise in the state and even promised to reward the cleanest Local Government Area. These and many more have not been able to ensure adequate portable water demand or supply in the state and neither has it ensured proper sanitation capable of lifting the state to be among the cleanest state in Nigeria and the world or has it brought portable water and sanitation close to those who really wish to demand for it.

The effort by the state to attain portable water sufficiency and sanitation have not yielded the desired fruit partly because the drive on the part of the government tend to reduce as every policy commenced, in other words he zeal to follow up all policies through is not there. Also, it is partly due to the non-compliance nature of the people of the state in most cases. Both government and individuals have great roles to play to ensure the achievements of the overall goals. In spite of these challenges or shortcomings, there are several people within the state who still demands portable water and proper sanitation services in the state while others cannot. It is against these backdrops that this study seeks to analyse the determinants of the demands for portable water and sanitation in Nassarawa State by answering the following questions:

- ✓ What are the determinants of demand for portable water in Nasarawa state?
- ✓ What are the determinants of demand for sanitation in Nasarawa state?
- ✓ What is the current level of portable water supply and sanitation in Nasarawa State?
- ✓ What is the current level of consumption of portable water in Nasarawa state?

RESEARCH HYPOTHESES

In line with the research questions above, the following research hypotheses are to be tested:

Ho1: There is no significant demand for portable water in Nasarawa State.

Ho2: There is no significant demand for sanitation in Nasarawa State.

Ho3: There is no significant supply of portable water and sanitation in Nasarawa state.

Ho4: there is no consumption of portable water in Nasarawa state

II. LITERATURE REVIEW AND THEORETICAL FRAMEWORK

DEMAND FOR WATER

According to World Bank (2009) sees demand for water as clear, colorless, odorless liquid that is essential for plant and animals life constitutes, in impure form, rain, oceans, rivers, lakes, etc. it is a neutral substance, an effective solvent for many compounds, and is used as a standard for many physical properties. Davis, (2003) sees water demand as the measure of total amount of water used by customers within the water system. That there are several things that can influence the amount of water demanded on your system. One of the most important job of a water system is to continually meet this demand without interruption, it is very difficult to precisely assess the availability of water demanded by the public since there are many factors affecting water consumption which include; domestic water demand, industrial water demand, institutional and commercial water demand, demand for public use, fire demand, water required to compensate losses in waste and theft.

Within recent decades, there have been efforts to increase provision of domestic water for both rural and urban homes. However, portable water is still not readily available to many, especially those in the rural areas. Furthermore, the availability of portable water varies greatly; while some people pay very dearly for domestic water, others have easy access to adequate clean water and sanitation due to their location and social status in society (Hunter et al., 2009). Provision of clean domestic water for both rural and urban dwellers should be seen as a necessity by policy makers.

However, this is not the case in developing nations where rural dwellers are neglected whenever water supply schemes are contemplated. As domestic water need is increasing by the day, potable water is a must for every household and community. Just as population is increasing and towns are expanding, the demand for potable water in both quantity and quality is equally on the increase (Adeoye et al., 2013). The number of people who rely on the Earth's limited fresh water reserves is increasing every day. In fact, a scarcity of clean, fresh water is one of the world's most pressing environmental problems.

As the saying goes, water is life and its importance in the life of man, animals and plants cannot be overemphasized. However, the task of meeting domestic water needs in rural

and urban areas in most developing countries, particularly in Nigeria, is enormous and falls mainly to women and children. Households also spend considerable time and effort fetching water from sources such as rivers, streams, ponds, wells and boreholes. In most cases, these sources of water may be one or two kilometres away from home, and may also be polluted (Arms, 2008).

CONCEPT OF PORTABLE WATER

Portable water is water substance that is free from impurities, pathogenic organisms, and other harmful elements which is without taste or odour, aesthetically appealing and socially acceptable for human consumption (UMES, 2008). Alaba (2011), refers to portable water as simply well treated water, safe for drinking, considering its physical, chemical and microbiological properties. Aalaa (2010), defined portable water as water that is considered safe to drink. It has been either treated cleaned or filtered and meets your local established or drinking water standards. The Joint monitoring programme for Water Supply and Sanitation set up by the World Health Organization (WHO,2012), and United Nations Children's Fund (UNICEF,2015), defined safe drinking water as "water with microbial, chemical and physical characteristics that meets WHO guidelines or national standards on drinking water quality. "The guide lines include an assessment of the health risks presented by the various microbial, chemical, radiological and physical constituents that may be present in drinking-water.

Adequate and safe water supply lies at the heart of development whether it is urban or rural. Water supply and sanitation development of any nation are continuing long-term process which requires careful planning and implementation geared towards achieving improved conditions of life (Babalola, 2005). There are still at least 1.1 billion people across the world that does not have access to safe drinking water (MacDonald, 2013). Many of these people live in rural areas and are among the poorest and most vulnerable to be found anywhere in the world. In sub-Saharan Africa, 300 million people have no access to safe water supplies – approximately 80% live in rural areas. Therefore, significantly increasing the coverage of water supply in Africa is fundamental to achieving many of the internationally agreed Sustainable Development Goals (SDGs).

On the contrary, inadequate safe water supply may be as a result of certain constraints which otherwise obstruct the creation of access to adequate potable drinking water. According to Ashingyu and Agbochenu (2007) inadequate safe water supply made people resort to fetching water from polluted water sources. A polluted water server as sources of infective agents that can transmit contagious diseases (UMES, 2008) United Nations (2010) contended that consumption of polluted water precipitates water borne diseases. The UN maintained that the problem of water supply and sanitation in developing countries rest on factors such as poor funding, lack of private sector participation, faulty implementation of water supply and sanitation in urban and rural areas.

CONCEPT OF SANITATION

World bank, (2009) refers to sanitation as public conditions related to clean drinking water and adequate treatment and disposal of human excreta and sewage. (WHO,2012), sanitation generally refers to the provision of facilities and services for the safe disposal of human urine and feces. It also refers to the maintenance of hygiene conditions, through services such as garbage collection and wastewater.

UNHSDP (2013) asserted that people give attention to water supply more than sanitation during planning, whereas both elements are essential to life. The layman understanding of sanitation refers to the provision of toilets. But in the actual sense, the word sanitation is wider in scope. Sanitation involves a process of disposing human and animal excreta, domestic and industrial wastes to final disposal sites. Furthermore, sanitation embodied community and environmental hygiene; if these are unsound, mere provision of potable water supply and sanitation facilities like latrines, refuse pits, and sewage systems cannot solve the problem of lack of safe water supply and sanitation. Sanitation in essence involves a process of hygiene behaviour in the home, community, school and work environment. These can be achieved through health education of the public about the importance of adopting sanitary facilities and services as the whole thing boils down to behaviour change, or behaviour modification where such behaviour is in conflict with socially acceptable sanitation standards.

According to Lucas and Gilles (2006) in their study agree that poor sanitation gives rise to a number of health consequences. UN (2010) stated that lack of excreta disposal; improper drainage and inadequate hygiene in a community contribute to morbidity and mortality. The ultimate goal of sanitation; according to WHO (2010) is to ensure that measures are designed for the prevention of diseases and promotion of health. According to UNICEF (2008) programme guideline, sanitation reduces environmental health risks through appropriate measures for safe disposal of human excreta, vector control; personal food and environmental hygiene. Allen and Graham (2012) conceptualized sanitation as the maintenance or improvement of sanitary conditions to promote hygiene and to prevent diseases. According to Robinson and Davidson (2006), sanitation refers to measures taken to promote and to preserve public health.

DETERMINANTS OF DEMAND FOR PORTABLE WATER

The demand for portable water is fast outpacing its availability for consumption and the supply of domestic water is seriously constrained by the rising population (Udoh and Etim, 2007). On account of this, the price of water, of whatever grade, increases daily and, this is not helped by commercial water vendors who adopt arbitrary pricing of the product. In line with the ongoing, different household demands for a particular source of water and this calls for the need to know what enforces their decision. Judging from these challenges and the dynamics of demand for portable, we need to examine those factors that determine the demand for portable water by households.

According to Aho, Akpen and Ivue (2016), many factors determine the demand for water by every household. The presence of household facilities such as low flush toilets, dishwashers and washing machines has been identified as influencing water consumption. The findings from Aho et al, (2016) revealed that among several factors considered in their study as the determinant of demand for water, only factors like the level of education, gender, kitchen type, number of cars as well as a source of water were positive and significant.

According to the study conducted by Dagnev (2012), the level of income, employment status of the head of the family, owning of the house in which the family reside, monthly expenditures and educational status of the household head are major determinant for the demand for portable water. It is necessary to point out that the proxy for portable water used in the study is pipe borne water.

The stability of the national government, the strength of government institutions at all levels, and the extent to which government services have reached all areas of the country are important (Bossert, 1990) in Ng'ethe (2012). The commitment of the national government to the democratic process and decentralization of water supply and sanitation projects makes a significant difference. This commitment is achieved through the governance type in place. To be effective, any interventions to improve water and sanitation resources in developing countries must be context-specific, meaning that among other considerations, the governance of the region and country must be taken into account (Lenton et al., 2005) as cited in Ng'ethe (2012).

According to Ng'ethe (2012), poor accessibility of potable water is an issue of poverty. Unwholesome water and lack of sanitation are the destiny of poor people across the world. One in five people in the developing world lack access to sufficient clean water. In addition, the poor pay more. A recent report by the United Nations Development Programme shows that people in the slums of developing countries typically pay 5-10 times more per unit of water than do people with access to piped water (UNDP, 2006). In summary, according to Ng'ethe (2012) two major factors determines the demand for portable water and sanitation by household: they are the National Government's commitment to infrastructural development and the level of income or economic status of the household.

From the study by Rauf et al (2015) which seeks to examine the determinant of household choice of drinking water source, it is also gathered that several factors are responsible for the choice water source by household. These factors include; Location of household, i.e. either in urban area or rural area, level of education of household head, Income level of household head, Household size and Distance between household and portable water source. In their study, the water sources categorized as portable water include hand pump water source, motor pumped water source, tap water and bottled water. From the various studies reviewed, there are several factors that have been revealed to be responsible for the determining household's demand for portable, they are summarized below:

- ✓ Location of household, i.e. either in urban area or rural area
- ✓ Level of education of household head

- ✓ Income level of household head
- ✓ Household size
- ✓ Distance between household and portable water source
- ✓ National Government's commitment to infrastructural development
- ✓ Employment status of the head of the family
- ✓ Owning of the house in which the family reside
- ✓ Monthly expenditures
- ✓ Gender
- ✓ Kitchen type
- ✓ Number of cars
- ✓ Source of water

EMPIRICAL REVIEW

Several studies related to demand for portable water and sanitation were reviewed for the purpose of establishing clearer understanding of the subject matter. Emmanuel (2012) specifically assessed the Nigerian policy trend and practices in relation to water supply and sanitation coverage over the past ten decades. Using descriptive statistic and trend analysis, the study observed that the Nigerian water and sanitation policy environment has been ineffective and as such recommended that that government should practice policy continuity so as to achieve stated results. Abaje, Ati, and Ishaya (2009) examined the nature of potable water supply and demand in Jema'a Local Government Area of Kaduna State, Nigeria. Using qualitative technique to analyze the data collected, the findings revealed that at some times and locations, the value of water can be very high due to scarcity, but at other times and locations it can be very low or even free due to relatively plentiful supplies. Lawani, Ukpanukpong, Utu-Baku, Fana, Uyabeme, Ajakaye, Oresegun, Eze and Edoamodu (2014) using a cross sectional descriptive survey, examined Potable Water Supply and Sanitation Practices in Selected Public Primary Schools in Owerri North Local Government Area, Imo State, Nigeria. Adopting qualitative techniques, the results show that a good number of respondents 82.9% used borehole water, 57.7% of the pupils fetch water from community borehole behind the school, 20.9% walked 20 metres from the school to fetch water and 60.0% used water for domestic purposes; such as drinking, hand washing and cleaning. Also, lack of potable water supply and functional toilets in the schools could affect the general hygiene status of the schools and the practice of hand washing by the pupils.

Some related studies centred purely on determinant of demand for water. Ogunniyi, Sanusi, and Ezekiel (2011) examined the use of the contingent valuation method to study the determinants of rural households' willingness to pay (WTP) for safe water in Kwara State. Applying Tobit model to explain household preferences for quality and quantity of domestic water supply and derive estimates of WTP for such a service, the results confirm that household age had a negative and statistically significant impact on WTP for both quantity and quality. Income, water consumption and water source are positively associated with WTP for better quantity but with a negative sign. This implies that the more the income, water consumes, water source, the less that household would be WTP for better water quantity. Willingness to pay for improved water quality is positively related to waiting time

and education. Rural households showed a much higher WTP for better water quantity than for improved water quality. There is therefore scope to improve water service levels in the study area. Bello and Tuna (2014) evaluated and assessed the main sources of water and the various factors that affect potable water demand and supply in Kano State. Analysing the collected data using quantitative statistical techniques revealed that the water supply in Kano state do not meet the demand due to some problems such as insufficient number of water treatment plant, power failure and shortage of fund and so on. The study suggested solution to the identified shortcoming in water supply in the state.

The study by Chia, Ijir, Iwar and Ndulue (2014) investigated the various sources of water available in Makurdi metropolis, the state capital of Benue State, its distribution across the various wards, its availability and frequency using both primary and secondary sources of data. The study employed descriptive statistical technique to analyze the data and revealed that 53.7% of all the respondents had running public taps in their homes while 46.3% do not have such facilities at home and of those that had running taps at home indicates that only 23.8% of them had water running more than three times in a week. Also, about 45.4% of the respondents only had water occasionally and 18.8% had water once a week. The remaining 15% had water running in their taps two to three times in a week. More so, this study shows how sufficient and adequate is water supply from Water Board. The study therefore suggests some solutions in which if properly implemented will help to a greater extent in solving the problem of water supply in area.

Similarly, the study by Ezekiel, and Dominic (2015) examined the relationship between domestic water sources, demand and associated problems in the context of a rapidly increasing household population in Nassarawa Eggon town, Nasarawa State, Nigeria. The data for the study were generated using a questionnaire survey and analysed using descriptive statistics in the form of frequencies and percentages. The study revealed that the major sources of water in the area are hand-dug wells and streams, with no pipe-borne water. Also, the study by Aho, Akpen and Ivue (2016) examined the determinants of residential per capita water demand of Makurdi metropolis. The study revealed that the level of education, gender, kitchen type, number of cars, and well as a source were positively significant in determining per capita water demand of household while, household size and number of children below 6 years influence the per capita water demand negatively. The studies reviewed above have been able to expose the various relationships that have been established between sanitation and portable water as well as the various factors responsible for the choices made by each household. It will be pertinent to point out that these studies not only differ in nature, scope and methodology, they also differ in findings and the recommendations with very few studies sharing similar views.

Studies conducted solely on sanitation shows that governments role towards sanitation of environment can be achieved through policy formulation, sensitization and monitoring. Obilom (2013) evaluated the role of Anambra State Environmental Sanitation Authority (ASESA) in the disposal of refuse in Enugu and Onitsha urban. Survey

research design was utilized. Using simple percentage and mean score to analyse the data collected, result of the study showed that the objectives of ASESAs were moderately achieved. Similarly, Olukanni, Azuh, George, Ajayi and Emenike (2016) carried out a study titled “the relevance of policy and practice on sanitation effort in developing nations: the experience of a semi-urban city in South-West Nigeria”. Using qualitative techniques in data collection and analysis, the Statistical Package for Social Sciences (SPSS) results showed that there is no connection between institutional policies and the people's sanitation practices in the communities and more so, the management practices in most communities expose the inhabitants to unnecessary health risks. The study recommended that in addition to legislation and policy formulation on sanitation, there is need for sensitizing the general public and raising their awareness level on environmental risks associated with poor sanitation practices.

Related studies outside the shores of Nigeria which were reviewed in this study indicated similar results to the studies conducted in Nigeria. Ahmad, Ali, Mirza and Lotia (2016) analyzed the household demand for water in a major industrial city in Pakistan to develop a better understanding of water use in a developing country, as well as to consider the implications of the findings in effective water pricing and behavioral incentives. The study findings also suggest that non-pricing instruments, such as water saving campaigns may be helpful in driving efficient use of water in rapidly growing cities in the developing world. In a related study, Amponsah, Aidam, and Senadza (2009) employed Multinomial Logistic (MNL) regression model to analyze the factors influencing the sources of drinking water. Rural residents are less likely to have access to piped water in their residence and that income increases access to piped water in residence. The study by Kassa (2017) evaluated water pressure map and demand using Shambu town of Western Oromia in Ethiopia as a case study. Using descriptive technique to analyze the data collected, the results showed that the water pressure were not feasible enough to provide adequate water and thereby recommended improvement in the water supply by expanding distribution network to meet up with the water demand.

THEORETICAL FRAMEWORK

For the purpose of this study, among all the theories reviewed, the study adopts the Slutsky demand theory. This was developed by Slutsky in 1942. Thus, the Slutsky demand theory was considered appropriate as the theoretical framework of the study since it decomposes the impact on the demand for a good into two different effects, namely substitution effect and income effect. According to Slutsky (1942), changes in demand arising from a price change are always the sum of a pure substitution effect and an income effect. He asserted that, if, at the new prices, less income is needed to buy the original bundle then “real income” has increased, while if, at the new prices, more income is needed to buy the original bundle then “real income” has decreased.

The Slutsky demand theory decomposes the impact on the demand for a good into two different effects, namely substitution effect and income effect. The substitution effect

considers the impact on demand for a good (say, good Y) of an increase in the price of such good holding utility constant. If the price of a good goes up holding utility constant, income must increase in order to prevent real income deterioration. In other words, the consumer is compensated for the increase in price. The effect of the price change on product demand, then, is only through the change in relative prices and not through the effective loss in real income. On the other hand, income effect considers the impact on demand for good Y of an increase in price through the effective drop in real income. The Slutsky demand theory can be expressed algebraically using the Slutsky demand equation which is specified as follows:

$$\frac{\partial Y^*}{\partial P_j} = \frac{\partial Y^*_H}{\partial P_j} - \frac{\partial Y^*}{\partial I} Y^* \quad (1)$$

Where ∂ is first-order derivative (change) symbol; Y^* is the optimal value of good Y ; Y^*_H is the optimal value of the Hicksian (compensated) demand for good Y ; P_j is the price of good Y ; and I is income. There are two terms on the right-hand side of equation (1): $\frac{\partial Y^*_H}{\partial P_j}$ and $-\frac{\partial Y^*}{\partial I} Y^*$. The first of these is called the substitution effect. The second is called the income effect. The first term of the income effect is the effect of a naira loss in income on demand for good Y : $-\frac{\partial Y^*}{\partial I}$. The second term is then equal to the amount of lost naira from the price change (which is equal to the amount of the good being purchased). The significance of this theory to this study is based on the fact that the theory is anchored on the two major determinants of consumer behavior towards demand for goods and service which are prices and income.

III. METHODOLOGY

The study employed both qualitative and quantitative methodology in sourcing, collecting and analysing the data collected for this study. The study employed the use of questionnaire as the instrument of data collection and Taro Yamane sampling technique to determine the sample size from the population. The estimation of the Logit model was carried out by utilizing the maximum likelihood (ML) estimation technique through Statistical Package for Social Sciences (SPSS) software.

MODEL SPECIFICATION

The model for this study is adapted from work of Nauges and Whittington (2010) which utilizes the Logit regression model which belongs to the families of qualitative (binary choice) response model where the dependent variable takes on dummy values of 0 and 1 with 0 indicating absence of an attribute or a factor while 1 implies presence of such attribute/factor. The explanatory variables in the Logit model could be exclusively qualitative or quantitative, or admixture of both (Gujarati, 2009). The Logit model for the study is specified as follows:

$$\frac{P_i}{(1 - P_i)} = \beta_0 + \beta_1 INC_i + \beta_2 HS_i + \beta_3 LOC_i + \beta_4 EDU_i + \beta_5 OWN_i + \beta_6 GNDR_i + \varepsilon_i \quad (2)$$

Where: $\frac{(P_i)}{(1-P_i)}$ is the dependent variable which is the probability of a household using portable water or not (simply denoted as L_i); i represents number of households; the independent variables (INC, HS, LOC, EDU, OWN and GNDR) are quantitative variables: $\beta_0, \beta_1, \beta_2, \beta_3, \beta_4, \beta_5$ and β_6 are the parameters of the model to be estimated; and ϵ is the error term.

Where:

L: P=1: If households consume portable water; P=0: If otherwise

INC: Monthly Income of Household head

HS: Household size

LOC: Location of Household (Rural or Urban)

EDU: Educational level of Household Head

OWN: Ownership of dwelling unit

GNDR: Gender of Household Head.

APRIORI EXPECTATION

$$\beta_1, \beta_3, \beta_4, \text{ and } \beta_5 > 0; \beta_2 \text{ and } \beta_6 < 0$$

MEASUREMENT OF VARIABLES

This section handles the way the variables have been classified and measured owing to the fact that the study has make use of primary data. The variables have been measured as shown in table 1 below:

S/NO	VARIABLES	MEASUREMENT	EXPECTED SIGN
1.	L	P = 1; If household consume portable water; P = 0 if otherwise	
2.	INC	Income of Household (Measure in Naira)	+
3.	HS	Household size (Measured in numbers)	-
4.	LOC	Location (1; if urban, 0; if otherwise)	+
5.	EDU	Education (1; if Post-Secondary, 0 if otherwise)	+
6.	OWN	Ownership of dwelling unit (1; if household head own the dwelling unit, 0; if otherwise)	+
7.	GNDR	Gender of Household head (1; if female, 0; if male)	-

Source: Author

Table 1: Measurement of Variables

From table 1 above, L represents the probability that a household consume portable water or not. In the coding of the primary data collected from the field, "1" is used to represent the outcome that a household consume portable water and "0" if otherwise.

INC represents income of household and numbers 1 – 5 is used to represent the five categories of income level; Below N20,000, N20,000 – N40,000, N41,000 – N60,000, N61,000 – N80,000 and N81,000 and above.

HS represents household size of the respondents and it is measured in numbers depending on the number specified by the respondents.

LOC represents location of the respondents, either rural or urban. This measured by "1" if respondent(s) resides in urban area and "0" if otherwise.

EDU represents the level of education of respondents, "1" if respondent possesses post-secondary education and "0" if otherwise.

OWN represents the house ownership status of the respondents, i.e. if respondent owns the house, they presently dwell in. If respondents own their dwelling unit, it is measured as "1", but if they not own their dwelling unit, it is measured as "0".

GNDR represents the gender of the household head of the respondents, if the sex of the household head is female; it is measured as "1" and "0" if male.

REGRESSION OF THE RESULTS

This section handles the analysis of the logistic regression results obtained using Statistical Package for Social Sciences (SPSS 20). Below is the summary of the results:

Determinants of Portable Water	Coefficients	P-Value	Odd Ratio
INC	0.892	0.000	2.439
HS	0.008	0.850	1.008
LOC	0.720	0.003	2.055
EDU	-0.096	0.691	0.908
OWN	1.060	0.000	2.887
GNDR	0.018	0.948	1.018
Constant	-2.624	0.000	0.073
Cox & Snell R Square		0.216	
Nagelkerke R Square		0.288	

Source: Computed by Author using SPSS, 20

Table 2: Results of the Logistic Regression

From table 2 above, the odd ratio of 2.4 for income shows that the income of a household heads is more than 2 times more likely to determine the choice of portable drinking water in Nassarawa State. In other words, as household income increases by 1, the probability of the household choosing portable drinking water increases by 2.439 times. In this regard, the probability of a household with high income choosing portable water is 70.92%.

Similarly, with an odd ratio of 1.008 for household size, it implies that the size of a household is less likely to determine a household's choice of portable drinking water in Nassarawa State. In other words, a one-unit increase in the number of people per household makes slightly more than a proportional

increase in the likelihood of household choosing portable water. From this result, the probability of a household with high household size choosing portable water is 50.20%. This implies that there is significant demand for portable water in Nasarawa state.

Location has an odd ratio of 2.055 indicating that the location of the household (rural or urban) is more than 2 times more likely to determine the choice of portable drinking in Nassarawa State within the period this study was conducted. When the probability is taken, the chance of a household located in urban areas choosing portable water is given as 67.27%. This implies that there is significant supply of portable water and in Nasarawa state.

The odd ratio for education is given as 0.908 which implies that as the educational status of a household head increases by 1, the probability of the household head choosing portable water drinking water increases by 0.908 times. In other words, educational qualification is 0.908 times more likely to determine a household's choice of drinking water in Nassarawa State. From the result above, the probability of a household head with post-secondary education choosing portable water is obtained as 47.58%. This implies that no significant demand for portale water in Nasarawa state.

Ownership of dwelling unit has an odd ratio of 2.887. This implies that household heads who own their residence units more than 2 times more likely to choose portable drinking water over other sources of water. In other words, as ownership of dwelling unit increases by 1, the probability of the household choosing portable water drinking water increases by 2.887 times. From this result, the probability of a household head who owns their dwelling unit choosing portable water is 74.27%. This implies that there is significant demand for portable water in Nasarawa state.

The odd ratio for gender is 1.018 indicating that the gender of a household head is slightly more than 1 times more likely to determine the choice of drinking water. In other words, if this variable "gender" increases by one, the probability of a household choosing a portable drinking water over other sources of water increases by 1.018. The probability of a female household head choosing portable water is 50.45%. This implies that there is significant consumption of portable water in Nasarawa state.

IV. CONCLUSION AND RECOMMENDATIONS

CONCLUSION

The finding revealed that income of a household head, location of a household (urban or Rural) and ownership of dwelling unit and gender of household head are major determinants of demand for portable water while level of education of household head and household size are less likely to determine demand for portable water with level of education of household head being the least significant. In other words, household head with high income tends to demand for portable water over than household head with lesser income. Similarly, households located in urban areas demand more portable water than households located in rural areas. In the same vein, household heads that live in their own

houses have a higher chance of demanding for portable water than those who live otherwise. The study concluded income of a household head, location of a household and ownership of dwelling unit and gender of household head have significant impact on the demand for portable water. The study concluded that people who reside in the urban area have more access to good sanitation and that the income of the household head is also a major determinant of the demand for sanitation. Finally, the study revealed that there are no sufficient waste disposal facilities and public toilet in public places which adversely affects the sanitation. In general, the determinant of demand for sanitation is basically location and income level of the household heads.

RECOMMENDATIONS

Based on the analysis carried out on this study and the findings that emanated from it, the study advanced the following recommendations:

The government should as a matter of urgency, extends the provision of pipe borne water to rural areas to improve rural dwellers' chance of having access to portable water.

The Government should also provide quality and sufficient sanitary facilities like public waste disposal facilities, public toilets and good drainage system in both rural and urban centres to improve the sanitation of residences.

Policies like subsidizing connection costs and supplying credit facilities for connection payment could enable household heads to get piped connection, although the capacity of the piped water system would need to be adequate so that this would not increase the number of days in which household heads experience a service scramble.

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