IOSR Journal of Mechanical and Civil Engineering (IOSR-JMCE)
e-ISSN: 2278-1684,p-ISSN: 2320-334X, Volume 13, Issue 4 Ver. III (Jul. - Aug. 2016), PP 48-53
www.iosrjournals.org

Small Town Water Supply: Situational Assessment of Shao, Kwara State, Nigeria

B. F. Sule[1], M. Agunbiade[2]. A. G. Adeogun[2] and G. Ihagh[2]
[1] *Department of Water Resources and Environmental Engineering, University of Ilorin, Ilorin, Nigeria*
[2] *Department of Civil Engineering, Kwara State University, Malete, Nigeria.*

Abstract:*Nigeria is endowed with abundant freshwater resources spreading all over the country from the coastal region to the arid zone of Lake Chad Basin. In spite of this immense water resource potential, sizable proportion of the country stillface problems of supply and distribution. A study conducted in Shao, Kwara state, Nigeria recently, showed that water is supplied once in a month and sometimes there is no supply for several months due to operational problems at the treatment plant. The supply last for only a few hours on the day of supply and water is mostly available for the community at public fetching points. The result of the study shows lack of capability by the state water agency to meet the water needs of the people despite the availability of water infrastructure (dam, treatment plant, pumping station, reservoirs) for the town and other users in the area. The authority can leverage on the high willingness to pay for the service by introducing a tariff structurebacked up e with an effective revenue collection mechanism. The revenue realised can be used to obtain materials, chemicals and parts required for the proper functioning of the water works. This will improve water production and delivery to Shao and the environs.*

I. Introduction

Water is a natural resource and a very essential constituent for human survival and continual existence. The abundant supply of treated and purified water to a community is very vital for a prosperous economy. Access to safe water supply has great influence on the health, economic productivity and quality of life of the people, as different sectors of community can have water which they need (for different purposes. Some of these uses include drinking, cooking, laundry, cleaning, swimming, firefighting, removing of waste, general sanitation, watering lawns and gardens, agricultural purpose, industrial uses, commercial uses etc. Generally, water production facilities in Nigeria rarely operate to capacity due to break down of equipment, or lack of power or fuel for pumping. The operating cost of water agencies is high as they rely on diesel generators or even build their own power plants, since power supply is erratic (World Bank, 2002). Equipment and pipes are poorly maintained, leading to intermittent supply and high levels of non-revenue water. Nigeria is among ten countries in the world that are home to two thirds of the global population without access to improved water sources and has the highest population (66 million) without improved source of drinking water in Africa (FMWR, 2013). The 60% access to improved water sources in the country is just below the Sub-Saharan Africa average of 61%. Although, there have beenreported improvements in access to improved water sources from 47% in 1990 to 60% in 2012, the rate of progress was not high enough to keep the country on-track towards achieving the MDG drinking water target of 75% by 2015.

Ishaku et al (2011) studied the dilemma of water supply in Nigeria rural communities, andthey were able to establishthat access to water supply has great influence on the health, economic productivity and quality of life of the people. But meeting this need is one of the major challenges facing the rural communities in Nigeria today. Preliminary investigation revealed that majority of the rural communities in Nigeria do not have improved water supply systems such as piped water networks or boreholes.Where such facilities exist they are either malfunctioning or completely broken down and this forces many households to rely on available sources for domestic purposes. It was concluded that over 70% of households in rural communities do not have access to improved water supply. They rely mainly on self – water supply (free source) such as rivers, perennial streams, water ponds and unprotected wells and are thus susceptible to water borne diseases such as typhoid fever, cholera, dysentery, malaria parasite etc.

II. StudyArea

The study area is located within the north central zone of Nigeria. The actual study was carried out in Shao town, Moro Local Government Area (LGA), Kwara State. Figure 1 shows the location of Shao town. The town has an average elevation of 269 meters above sea level. Moro LGA of Kwara State is made up of rural setting, where the major occupation include farming, hunting and trading, while a few people are employed in white-collar jobs or are involved in private businesses. It is a small town with a population of 6,550 based on the

census of 1991 (NPC, Ilorin). The mean annual rainfall of the area is 1200mm concentrated between the months of April and October and mean annual temperature varies between 31.5°C and 35°C.The location map of the study area is as presented in Figures 1.1 and 1.2.

Figure 1.1 Map of Nigeria showing Kwara State

Figure 1.2 Map of Kwara State showing Shao town.

III. Methodology of the Study

3.1 Data sources

A combination of both quantitative and qualitative research methods were employed in this study. The research was designed to collect information from two categories of people (water users and water providers). The water users provided primary information while the providers provided information on management and operation of water in the community. Different methods of data collection involving structured survey questionnaire; interviews and discussions with beneficiaries, technical staff members; and personal observations were employed to produce primary data. Secondary data was collected from the state water agency, theKwara State Water Corporation (KWWC), Nigerian Population Commission and Moro Local Government Council Office (Bode-Sadu).Other relevant data were obtained from existing documents and literature. In the analysis of the secondary data obtained from National Population Commission (NPC), the population for 1991 census was obtained and used to calculate the population of Shao town in 2016 using geometrical projection method.

To get information from water users, a structured questionnaire was administered in July 2015 to a total of 50 respondents. Structured questionnaires with both open and closed-ended questions were formulated to enable the respondents to express their feelings and knowledge about their access to safe water and clean water. Respondents were randomly selected within each public water point service zone and from households with tap water connection tothe houses. Household-heads or members who were involved in water collection were the main target. The questionnaire sought respondents' views regarding community accessibility to water supply, demand management strategies, the way they settle water charges and their capability to pay for the water. The end-users perspectives' regarding the underlying causes of deficiencies and inefficiencies in water supply provision to the town was considered important and was investigated. Questions covered household

characteristics, supply adequacy, other sources of water in use, how they pay for the supply and their willingness to pay for improved service.

Though the questionnaire survey was time consuming and required resources, it was used because it allowed individual respondents to express their understanding or knowledge concerning access to safe and clean water and how the management can impact the sustainability of the water schemes. Besides, the method allowed the interviewer(s) the freedom to probe, allowed flexibility in asking additional questions and to seek clarification and elaboration on the answers given. It is a method which builds confidence in the respondent when responding to questions from the researcher (Onesmo, 2006).

3.2 Data Analysis

Data collected during the questionnaire survey was analyzed using the Microsoft Excel 2007 for Windows. The questionnaires were given numbers for identification purposes. Each question was identified by a variable name and within variables there were values and value labels for identification of responses from the respondents. After coding the information from the questionnaires, a template for entering data in the computer program was created. The coded data was then entered in the Excel computer program where frequencies, multiple responses, mean, standard deviations and cross tabulations were computed during the analysis.

IV. Results and Discussion

4.1 Population and Household Structure

The 2016 projected population of Shao town using a growth rate of 3.2%and assuming geometric increase method over the 1991 estimated is 13,112. The Federal Ministry of Water Resources has stipulated an average domestic per capita consumption rate of 60 lcpd for small towns in Nigeria (FMWR, 2014). Therefore the total daily domestic water demand for Shao town is estimated as 786, 000 liters.Allowing for losses (30%), commercial and industrial uses (15%), institutional and public uses (5%), as additional requirements, then the total demand on daily basis in 2016 was estimated as 1,179,000 liters. The household structure comprise of different number of persons. The survey showed that 40% of the households had between 5 – 8 persons while 34% had between 9 -12 persons. Only 10% of the households had less than 5 persons while 16% had more than 12 persons. These results mean that for planning purposes it is safe to use an average of 8- 9 persons per household in Shao.

4.3 Household Water Use and Accessibility

The source of water to Shao town, the Nigerian Army Sobi barracks and part of Ilorin is the Sobi water works. It has a dam on Moro river and two treatment plants with a total installed capacity of 9,090 m^3/day (Ayansola, 2005, 2013). There is a storage tank in Shao connected to the network in the town. When the water works is in full production it is expected to pump water regularly for distribution within Shao.With an installed capacity of 9000 m^3/ day it is expected that the demand of 1200 m^3/day in Shao presently can be met even at 20% production rate. The majority of the respondents (74%) reported that they have access to municipal supply either in their houses or at public water taps while 26% had no access to municipal supply. In some areas in the town there is no pipe network as the network is limited in scope and areal coverage. New layouts outside the traditional and core township sections are not covered. This is because of lack of adequate planning. Sule, et al (1999) has identified the need for a master plan on water supply in Kwara state necessitated by accelerated socio – economic development and the failure of the available facilities to cope with demand. The surveyalso showed that about 92% of the respondents were without sufficient municipal water supply and only 8% of them had sufficient water supply during the hours of supply. The frequency of supply is once a month in most cases (72%), some areashave supply once in two weeks (20%) and only 8% claimed they have supply once a week. Also 26% of the respondents indicated that they have the water supply during the early hours of the day whenever there is supply, while 62% have water supply during the daytime and 12 % do have supply in the evening hours on the day of supply. The hours of supply vary from one hour to three hours with 74% of the respondent having the supply for two hours,18 % for onehour and 8 % for three hours. During these periods most respondents (92%) claimed they are able to get all the water they need for the day whenever there is municipal supply. This notwithstanding 66% of the respondents would require two additional hours of supply to meet their demands, while 28 % would need one additional hour of running water and 6 % require three more hours to balance up their daily needs.Adedayo and Ifabiyi (1999) stated that a survey in Ilorin, the Kwara state, showed that only 60.9 % of the respondents claimed to have water twice a week, 11% three times a week, while only 0.9% have water on daily basis. The situation in Shao is not therefore too different as not much improvement has taken place in the public water schemes in Kwara state in the last 10 – 15 years.

The situation above is unsatisfactory since access to safe drinking water and improved sanitation is fundamental and is considered to be vital to concerted action towards poverty reduction. An enhanced access to safe drinking water provides the deprived, especially women, an opportunity to be in command of vital aspects

of their livelihood and maximize their sense of confidence/self-esteem (Mukherjee &Wijk, 2003). Access to safe drinking water and water use practices at house hold level are determined by a combination of factors associated and intermingled to each other. The presence and absence of which greatly influence the level of access to safe drinking and the water utilization practices. Provision of improved water supply points in a community could be helpful in allowing families to get water easily for drinking, cooking and sanitation purposes (Abebe, 2012).

4.3 Other Water Sources

The respondents use other sources of water to meet their daily needs. 54% of the respondents get water from hand dug wells, 18% userain water harvesting, 16% use boreholes and 12% use river water to meet the shortfall in municipal water supply.Unreliability of water supply due to lack of regularpower and mechanical breakdown of the machines especially the breakdown of the pump for pumping water to the town from the treatment plant were mentioned as one of the factors forcing people to go for dug wells and other unprotected water sources in order to cope with water scarcity.Households without piped water connected to their premises assign women in the household to fetch water from various sources for household consumption. Besides, children share this responsibility in meaningful terms and girls under 15 years are twice as likely to carry this responsibility compared to boys in the same age category (Abebe, 2012). Accordingly, the burden upon children is higher as they share this burden even though children are not the main responsible person to shoulder this responsibility (WHO/UNICEF, 2010). According to the Ethiopian rural context, women, young girls and boys are supposed to assume the responsibility of fetching water for the household use. The traditional household division of labor is meant to address water fetching in such a way that some household members (women and children) are responsible to fulfill this task daily (Abebe, 2012).

4.4 Water Demand

The average household water consumption pattern depends on the family size, the level of income, economic activity, the degree of engagement in productive activity and consumption behavior.The water needs of the community satisfied with the different sources vary from 20 liters to 300 liters daily depending on the household. About 16% of the respondents stated that the amount of water they use for cooking, drinking, sanitation and other needs was 20 l/day, 14% use 50 l/day, 16% use 100 l/day, 20% use 200 l/day 30% use 300 l/day while 7% use over 300 l/day. Since the average household size is between 8 and 9 persons, the average water consumption is therefore between 23 and 26 l/per/day. This is well below the recommended value of 60 lcpd for small towns and is close to the 30 lcpd for rural areas in Nigeria. Plates 1 and 2 show how people in Shao get water for their needs.

Plate 1 Waiting to fetch water in Shao, Kwara State

Plate 2 : A borehole with elevated tank located within Shao Township

4.5 Water Quality

Majority of the respondent (92%) in Shao treat the water before use and just 8% of the water users do not treat the water before use. Hence they are conscious of the implication of poor water on their health and the dangers of unsafe water sources. For this reasons, 84% of the respondents stated that they use alum while 16% use cloth as filter for purification of water before consumption. On the contrarymajority of the respondents (92%) indicated that the water from the public supply points is safe as they have never contacted any health hazard due to the municipal water supply. Only 8% considered the water collected from the public water points as unsafe as they have contacted some form of water related diseases from the supply.

Linkages between water quality, sanitation and health have been documented with varying precision in different developing countries. Some of the data and project experience in Nigeria in these sectors suggest clear linkages between consumption of unsafe water and decline in indicators such as health, education and productivity. Specifically, these include low enrollment in schools, particularly of girls who must spend time collecting and looking for water of good quality as well as the more obvious impacts of diseases associated with unsafe water. The quantity and quality of water are the most important parameters to be taken into consideration when planning water schemes (Onesmo, 2006). Being exposed to human contact, let alone that of livestock, agricultural or industrial waste can create a favorable condition for water borne diseases to prevail. In Shao majority of the respondents 66% (33) are less satisfied on the overall quality of the municipal supply based on the color, odor, taste and cleanliness. This further stresses the need for water sources to be protected and safe guarded from possible agents of contamination.

Many other diseases endemic throughout the country are generally associated with unsatisfactory drinking water supplies, poor sanitation conditions and inadequate health education programs. These include diarrhea, dysentery, gastro-enteritis, infectious hepatitis, hookworm, guinea worm, and other parasitic infections. Health implications of water supply deficiencies in Nigeria are enormous, as the percent of people with access to safe water in the country is low. This has directhealth repercussions especially on children, which is often underestimated. Improving water supply infrastructure will help to improve the social well-being of the population directly. The safety and quality of drinking water is further in jeopardy as the culture of open defecation has been socially accepted and widely practiced in most of the rural settings and partly in urban areas as well (Aschalew, 2009).

4.6 Tariff and Willingness to Pay

All respondents indicated that their water supply period is too short and would prefer that water is available round the clock. This will require various improvement strategies by the state water agency. The issue of consumer satisfaction with regards to the service delivery of the water supply scheme is one of the areas that need to be closely assessed using different indicators (Parry-Jones et al, 2001). Such indicators could include frequency of service, quality and pricing. In the case of pricing, all the respondentsare prepared to follow a fixed tariff or flat rate per household as presently in use instead of metered connections.The preference of Shao people is not surprising as most Nigerian water supply connections are not metered. The metering ratio varies from 7% in Katsina State to 16% in Kaduna State and 24% in Lagos in 2007. Unmetered customers are charged a flat rate independent of consumption. For unmetered residential customers the monthly flat rate was N 600 in Lagos, N 1, 000 in Katsina and N 2, 200 in Kaduna (Sudeshna et. al., 2008).Sule and Okeola (2010) in studying the financial sustainability of water supply to Offa, Kwara state, Nigeria concluded that the mean willingness to pay of N1,100 was actually 70% higher than the flat rate monthly tariff in use. In Yobe State it was onlyN100 per month, the lowest level in the country according to the Yobe State Water Corporation while revenue from tariff only covered 2 % of the cost of supplying water (Daily Trust, 2010). The survey showed that 64% of the total respondents pay a fixed flat rate of N1000 monthly for connection of two taps and 36% pay N500 monthly for

one tap connection. At these rates 94% of the respondents indicated that the tariff is high while only 6% of the respondents stated that the tariff is low. However all of them are willing to pay more for an improved service. Majority of the respondents(76%) agreed that the government should decide the appropriate tariff for improved service, 14% are willing to pay N 1,000 more monthly for an improved service, 6% want to pay N 500 more monthly for an improved service and only 4% are willing to pay N 1,500 more monthly for an improved service.

V. Conclusion

The study has identified the problem of inadequate water supply and the increasing incidents of water scarcity in Shao, a town that is rapidly urbanizing. The survey conducted showed that several households are not connected to public water supply and where they are, water supply have been cut off due to frequent cases of pipe leakages and vandalism. Pipe leakages and vandalism can be eradicated if durable pipes are used and effective monitoring is adopted whenever there is road construction or maintenance works. Incessant power failure is another problem that has to be addressed holistically. Dedicated power lines from the national grid are needed if the treatment works are to function properly. Alternatively, tstatehe water agency can invest in separate power generation using solar energy or thermal diesel plants for the production and distribution of water to consumers. However, in the face of current economic downturn in Nigeria, a public – private partnership initiative can be devised to address these issues and similar ones facing water supply in Nigeria. Finally, the population of Shao is increasing and the number of functional water points is not sufficient for the current population. This is also supported by Rosen & Vincent (1999) who pointed out that expansion of water supplies in rural areas of sub-Saharan Africa is not keeping pace with rural population growth in many countries. Shao needs more water points and improved services at affordable rates. It is hoped that the state water agency will rise up to task and provide the much needed service to the people of Shao through requlars pumping of water to the town.

References

[1]. Abebe, T.L.(2012). 'Rural water supply management and sustainability in Ethiopia with special emphasis on water supply schemes in Adama area'.Swedish University of Agricultural Sciences, Faculty of Natural Resources and Agricultural Sciences. Available Online publication:http://stud.epsilon.slu.se

[2]. Adedayo, A. and Ifabiyi, I. P. (1999). 'The distribution of water and the role of public agencies in Kwara State' JOSAMS (Journal of Social and Management Studies) Vol. 6, (1999), pp. 97-112

[3]. Aschalew D., (2009) "Determinants of Household Participation in Water Source Management": Achefer, Amhara Region, Ethiopia, MPS Thesis 2009. Available at: http://soilandwater.bee.cornell.edu/research/international/docs/Aschalew_THESIS_FOR%20PRINT%20AND%20BOUND.pdf.[Accessed 20 June 2015].

[4]. Ayansola, A. A. (2005) Pressure distribution analysis in zonal water supply pipe network: a cae study of Ilorin Metropolis, Unpublished M. Eng Project Report. Department of Civil Engineering, University of Ilorin, Ilorin, Nigeria

[5]. Ayansola, A. A. (2013) Evaluation of supply reliability and sustainability of household water use in Ilorin, Kwara State, Nigeria. Unpublished Ph. D thesis, Department of Civil Engineering, University of Ilorin, Ilorin, Nigeria

[6]. Daily Trust, 7 October, 2010. "Yobe charges least water tariff in Nigeria". Retrieved January 2016.

[7]. FMWR (2013)" Federal Ministry of Water Resources" Innovative funding of the water sector – Presidential summit on water.

[8]. FMWR (2014) Federal Ministry of Water Resources, Project for the Review and Update of Nigeria National Water Resources MasterPlan Vol 1 &Vol 6, Japan International Cooperation Agency, Abuja

[9]. Iroye, K. A. (1993). "Underground Water Demand and Supply in parts of Afon Catchment Area". Unpublished M.Sc. Thesis, Department of Geography, University of Ilorin, Ilorin, Nigeria

[10]. Ishaku, H. T., Majid, M., Ajayi, A. P and Haruna, A. (2011)."Water supply dilemma in Nigeria Rural Communities: Looking towards the Sky for an Answer". Journal of Water Resources and Protection. 3: 598-606

[11]. Mukherjee, N. &van Wijk, C.(2003). Sustainability Planning and Monitoring in Community Water Supply and Sanitation, Water and Sanitation Program, World Bank, IRC International Water and Sanitation Centre 2003.

[12]. National Population Commission (1991): Population census 1991 sectorial summary, NPC, Ilorin.

[13]. Parry-Jones S., Reed R, and Skinner BH, (2001). Sustainable hand pump projects in Africa: A literature review, WEDC, Loughborough University, UK

[14]. Rosen, S and Vincent, J.R. (1999).Household water resources and rural productivity in Sub-Saharan Africa.A review of the evidence. Development Discussion paper no. 673, Harvard Institute for International Development, Boston, USA

[15]. Soy, S .K. (1997).The case study as a research method.Unpublished paper, University of Texas, Austin. [online] Available at; http://www.gslis.utexas.edu/~ssoy/usesusers/l391d1b.htm [Accessed 24 September 2015].

[16]. Sudeshna B. Foster, V., Ying, Y., Skilling, H.and Wodon, Q. (2008). "Cost Recovery, Equity and Efficiency in Water Tariffs: Evidence from African Utilities". African Infrastructure Country Diagnostic, World Bank, p.5.

[17]. Sule, B. F., Adeyemi, S. O., Agboola, S. D. and Catchy, C. C. (1999) Water supply in Kwara State: Problems and prospects, Proceedings of the National Engineering Conference and Annual General Meeting, Nigeria Society of Engineers, Ilorin, Nigeria, pp 258 – 268.

[18]. Sule, B. F. and Okeola, O. G. (2010) Measuring willingness to pay for improved urban water supply. Water Science and Technology: Water Supply, IWA Publishing, 10 (6): 933 – 941.

[19]. World Bank. (2002). Project Appraisal Document for the Rural Water Supply and Sanitation Online project in Tanzania, report No: 22875-TA