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SOME FACTORS IMPACTING ON QUANTITY OF WATER USED BY HOUSEHOLDS IN A RAPIDLY URBANIZING STATE CAPITAL IN SOUTH WESTERN NIGERIA

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ABSTRACT

A water supply is an essential requirement for all people. However, a certain minimum quantity of water per person per day is required to meet the domestic and hygiene needs of the people. This paper examined some factors that impact on the quantity of water available to households in Ado-Ekiti, Nigeria. Such analysis is critical to any attempt by government to improve domestic water supply in the city. Empirical estimates show that factors that significantly affect the quantity of water used by households include: distance from main source to house, average time spent to fetch from main source, average number of trips per person per day to main source, adequacy of supply from main source, performance of supply from designated water institution, main source of domestic water used by household, education level, profession/occupation and annual income. Some policy implications of findings are discussed.

Keywords: Atomization of sources; Distance; Time-spent; Number of trips, and Water quantity.

INTRODUCTION

Water is crucial to development. It has a vital role to play in human health and development. Irrespective of its importance, a global paucity of adequate and safe drinking water had been established (UN, 2002; UNEP, 2002; WHO and UNICEF 2004). Specifically, 1.1 billion people representing 18% of the world’s population lack access to safe drinking water (UN, 2002). The consequence of this scenario is that a large proportion of human beings have resorted to the use of potentially harmful sources of water. The implications of this collective failure are dimmed prospects for the billions of people locked in a cycle of poverty and disease (UNEP, 2002). Brown (2003) contends that at any time, more than half of the hospital beds in the world are filled with people suffering from water-borne diseases. Dowdeswell (1996) concludes that about 80% of all diseases and more than one-third of all deaths in developing countries are caused by contaminated water. It has been confirmed that with adequate supplies of safe drinking water, the incidence of some illnesses and death could drop by as much as 75% (UN, 2002).

The quantity of water used per person per day has been found to be more important than actual water quality in improving the health status of households (WHO, 2003). Esrey et al (1991) assert that in terms of the reduction of water-related diseases, water quantity is more important than water quality. It has therefore been concluded that for domestic and hygiene needs of households to be effectively met, a certain minimum quantity of water per person per day is required (WHO and UNICEF, 2004; Franceys, 1993; Cairncross and Feachem, 1993 and Cairncross, 1990). WHO and UNICEF (2000) puts this minimum per capita per day requirement at 20 litres.

The distance between the water supply points and the home has been considered as critical to the quantity of water that households could fetch. In households using only a remote source, the quantity of water collected is likely to be too small for effective hygiene, even if bathing and laundry are carried out at the source. Using improved water sources within a reasonable walking distance therefore, provides substantial health benefits (WHO and UNICEF, 2004). Cairncross (1990) and Cairncross and Feachem (1993) observed that health impacts of water are related to both the quality of water and its availability within a reasonable distance. Studies indicate that clean water within a distance of not more than 1 kilometer from the house tends to lead to improved health status, since people tend to use substantially more water for cleaning and washing. Improved water source is therefore defined as water available from a defined list of technologies, with access to at least 20 litres of water per person per day from a source within 1 kilometer of the user's dwelling (WHO and UNICEF, 2000). In general, to be effective, domestic water supply requires a moderate amount of water, of moderate quality, as close to home as possible.

The relationship between distance from main source to house, average time spent to fetch from water main source to house and average number of trips per person per day to main source has been well amplified in literature (Cairncross, 1990; Cairncross and Feachem, 1993; Franceys, 1993, WHO and UNICEF 2004). While time and number of trips made to fetch water are directly related to distance, distance and these other variables set limitation on the quantity of water that household could access. Limitations in the potential quantity of water from an improved source may transform otherwise improved status to an unimproved one especially if the source could not meet the minimum sanitary requirements.

Again, fetching from a source that would require more than 30 minutes of walking is also considered unhealthy. WHO and UNICEF (2004) assert that for people to satisfy their basic needs for water, the source must be reachable in a round trip of 30 minutes or less. When it takes more than 30 minutes to get to the water source and back, people typically haul less water than they need to meet their basic requirements. Several trips to a water source imply water shortage. Any household that makes more than 3 trips to a water source in this study is considered as hauling less water that is essential to meeting basic hygienic needs. In addition, such households are seen as wasting time that could otherwise be committed to a more productive venture.

The purpose of this paper is to present empirical estimates (regression elasticities) of some factors that determine the quantity of domestic water available to households in Ado-Ekiti, Nigeria. An understanding of these factors will definitely enhance the formulation of policies aimed at ensuring the development of improved and sustainable water system in Ado-Ekiti and other cities in Nigeria.

RESEARCH METHOD

Research locale: The study area is Ado-Ekiti. It is located in the south west of Nigeria. Following the creation of Ekiti state on October 1, 1996, Ado-Ekiti became a capital city. The city lies entirely within the pre-Cambrian Basement complex rock group which underlies most south western part of Nigeria. Due to its peculiar gneisses formation with small aquifers and relatively shallow overburden, Ado-Ekiti is poor in groundwater potentials (Fadipe and Adeduro, 1993; Ebisemiju, 1993). These peculiarities result into low yield situation of boreholes in this city while most wells often dry up during dry season. Ado-Ekiti experiences a tropical climate with distinct wet and dry seasons. These seasons are associated with the prevalence of maritime south westerly monsoon winds from the Atlantic Ocean and the dry continental north easterly harmattan winds from the Sahara Desert. The city therefore enjoys water surplus between May and October with substantial water deficit between November and April when all stream channels are completely dry while the main rivers are reduced to a chain of pools (Ebisemiju, 1993). Therefore, the low yield of boreholes and wells coupled with seasonal flow regime of rivers in Ado-Ekiti indicate that reliable and adequate water supply can only be guaranteed by developing the surface water potential through the building of dams.

The responsibility for the supply of potable water to the city is assigned by government to Ekiti State Water Corporation (EKSWC). This mandate is to be met through a supply from Ureje Dam, Ado-Ekiti, a dam that was commissioned in 1962. With a design capacity of 4,950 cubic metres per day on commissioning, the current capacity utilization of the dam still remains at 95%. With an estimated population of 209,866, Ado Township currently needs about 16,000 cubic metres of water supply everyday, but the town receives only 4,950 cubic metres daily. There is therefore an obvious gap between the water supply from the designated water supply agency and water need in this growing city. Most people therefore rely on other sources of supply, such as wells, streams and rivers and supplies from vendors among others that are often highly contaminated or in most cases inadequate to meet the basic hygiene requirements.

Database description: As an addition to the main thrust of this research, the study was interested in the analysis of the spatial variation in water supply and demand systems in Ado Ekiti. To achieve this, three residential zones were identified in the city. They include the urban core, transitional zone and urban periphery. Basic assumption made with respect to the populations of these zones was that fifty percent (50%) of the total population live in the city core while thirty five percent (35%) and fifteen percent (15%) live in the peripheral neighborhood to the core and the suburb respectively.

The projected population figure for Ado-Ekiti in 2006 was put at 209,866 (op cit). Average family size in Nigeria has been estimated at 7 (Abumere, 1984; Fasakin, 2000). This implies that there were about 29,981 households in Ado-Ekiti. For this research, a sample size of 1,200 amounting to 4.0% of the total number of households in Ado-Ekiti was chosen. This appears plausible since there are traits of homogeneity in habitability in this study area.

Having stratified the city into three zones, specific areas that are convenient for data collection otherwise referred to in this study as Data Delineation Areas (DDAs) were identified in each zone. Based on the estimated population of each DDA, the number of households to be interviewed was estimated. In consonance with our earlier assumptions, 600 (50%) questionnaires were administered in the city core while 420 (35%) and 180 (15%) questionnaires were administered in the transitional zone and urban periphery respectively. Subsequently, systematic sampling procedure was adopted in the choice of households to be interviewed in each DDA. Fieldwork commenced in September 2007 and ended in December 2008. The survey utilized 22 variables out of which 10 were selected for multivariate analysis (Appendix l). Table 1 shows the variables used in determining the various factors that influence the quantity of water used by households.

As a basis for empirical analysis, the specification, rationale and justification for the choice of variables are discussed. The variable of notable interest is Q-PERDAY, which is a direct measure of factors determining the quantity of domestic water available to households.

Table 1: Definitions of Research Variables

S/N	Variable Code	Definition of Variable
1	M-SOURCE	Main source of domestic water used by households
2	D-SOURCE	Distance from main source to house
3	TI-SOURCE	Average time spent to fetch from main source
4	TRI-SOURCE	Average number of trips per person per day to main source
5	ADE-SOURCE	Adequacy of supply from main source
6	PERFORM	Performance of supply from Government Water Agency (EKSWC)
7	EDUC	Education level
8	PROF	Profession/Occupation
9	INCOME	Annual income
10	Q-PERDAY	Quantity of water used per person per day

M-SOURCE identifies the main source of domestic water that is adopted by each household in Ado-Ekiti. Options available to households in this city include piped water, borehole, well, rainwater collection, rivers/ponds, vendor-provided water and tanker truck water. However, it is not all these sources that are considered safe for drinking.

The relationship between distance from main source to house **(D-SOURCE)**, average time spent to fetch from water main source to house **(TI-SOURCE)** and average number of trips per person per day to main source **(TRI-SOURCE)** has been earlier amplified in this research report. Essentially, time and number of trips made to fetch water are directly related to distance, while distance on the other hand sets limitation on the quantity of water that household could access. For this research, any source that is more than 1.0 kilometer from home was considered as unsuitable to meet the required minimum quantity of water per capita per day. Again, fetching from a source that would require a round trip of more than 30 minutes of walking would not permit households to haul adequate water that could meet their basic requirements. In like manner, any household that made more than 3 trips to a water source in this study was considered as hauling less water that is essential to meeting hygienic needs.

From the household perception, **ADE-SOURCE** explains the adequacy or otherwise of the main source of domestic water. However, this perception does not indicate the adequacy of main source of domestic water from WHO guideline on the per capita per day requirements. **Q-PERDAY** measures this parameter. In accordance with the WHO standards, if Q-PERDAY is less than 20 liters, it is concluded that such source cannot meet the expected health criteria of such household.

There is no doubt that it is the inadequacy arising from the failure of the public water systems at meeting the need of the populace that normally results to household seeking alternative water sources such as wells, boreholes, surface water, tanker-drawn water, rain water among others. In most cases, these sources are often expensive, inadequate or unsafe for human consumption (Brown, 2003; Sullivan et al, 2003; UNEP, 2002; UN, 2002; UNDP, 1998; World Bank, 1995). The institution that has the mandate for public potable water provision for Ado-Ekiti is the Ekiti State Water Corporation (EKSWC). Variable **PERFORM** measures the performance of this Corporation in terms of service delivery.

INCOME is a basic socio-economic attribute of the household. It is expected that households with higher income would have higher water per capita per day. This assumption hinges on the fact that such households could afford to provide their own wells and boreholes. They also have enough resources to link their houses with the public water supply system. Other variables that closely relate to income are occupation **(PROF)** and education **(EDUC).** These two variables largely determine access of households to income generating opportunities and subsequent propensity to consume more water.

EMPIRICAL ESTIMATION AND DISCUSSION OF RESULTS

The model used in the empirical estimation of parameters of analysis in this study is the logistic (double-log) linear regression function expressed below:

$$\ln(Y) = b_o + \sum_{i=1}^{n} b_1 \ln X_i \qquad \text{..} \quad (1)$$

Where ln is natural logarithm, $\mathbf{b_0}$ is constant, $\mathbf{b_1}$ …….. $\mathbf{b_n}$ are the parameter estimates or elasticity estimates or regression coefficients measured on a continuous scale and $\mathbf{X_1}$ …. **Xn** represent the predictor variables. Equation (1) can be re-written in the light of the variables used in the analysis as:

$$\ln(\text{Q-PERDAY}) = bo + b_1\ln(\text{M-SOURCE}) + b_2\ln(\text{D-SOURCE}) + b_3\ln(\text{TI-SOURCE}) + b_4\ln(\text{TRI-SOURCE}) + b_5\ln(\text{ADE-SOURCE}) + b_6(\text{Q-PEFORM}) + b_7\ln(\text{EDUC}) + b_8\ln(\text{PROF}) + b_9\ln(\text{INCOME}) \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots..2$$

A combination of factors was considered crucial in choosing double log version of the regression model over linear and semi-log models. First, the double log regression model enables the presentation of the regression coefficients directly as elasticity estimates (Fasakin 2000, Canning 1998, Arimah 1994, 1995 and Arimah and Ekeng 1993). Second, it translates the skewness of the data frequency to a normal one thereby enabling much better estimates of the explanatory variable (Fasakin, 2000). Third, it reduces the occurrence of heteroscedasticity, that is, the variance of the distribution of the residual is uniform or constant for all values of the variables of research. Fourth, it ensures the stability of and significance of the implied relationship thereby enabling better explanatory power of the coefficient of multiple determination (R^2) (Fasakin, 2000 and Arimah, 1995).

One of the greatest problems confronting the use of regression models has been the issue of spatial autocorrelation and the problem of two or more variables aligning or having high correlation coefficients between or among themselves otherwise known as collinearity and multi-collinearity (Fasakin, 2000). The need to eliminate such occurrence in a bid to validate the various estimates from this model is crucial. It therefore became imperative to first test for such inter-correlation among the variables used in the model for this research. The results of this test are displayed in the correlation matrix in table 2. Generally, collinearity or multi-collinearity seriously affects regression coefficients when pair-wise correlation coefficients among independent variables exceed 0.80 (Fasakin, 2000). The results indicate that the regression will in no way be affected by either pair-wise collinearity or multi-collinearity since there is no pair-wise correlation in excess of 0.80 among the independent variables. In our own case the highest observed correlation coefficient is 0.523. This therefore confirms the true independence of and the reliability of the variables and parameter estimates, used in this analysis.

Table 2: Correlation Matrix of Quantity of Water used per Person per Day

Variables	**M-SOURCE**	**D-SOURCE**	**TI-SOURCE**	**TRI-SOURCE**	**ADE-SOURCE**	**PER FORM**	**EDUC**	**PROF**	**INCO ME**
M-SOURCE	1.000	0.180	0.167	-0.167	-0.030	0.215	-0.142	-0.011	0.033
D-SOURCE		1.000	0.523	-0.009	0.126	0.028	-0.097	-0.042	0.030
TI-SOURCE			1.000	0.002	0.268	0.074	-0.052	-0.129	0.049
TRI-SOURCE				1.000	0.048	0.036	0.032	-0.071	0.177
ADE-SOURCE					1.000	0.147	0.072	-0.021	0.013
PERFORM						1.000	-0.031	-0.044	-0.001
EDUC							1.000	0.266	-0.430
PROF								1.000	-0.415
INCOME									1.000

The prime factors impacting on the quantity of water used per person per day in Ado-Ekiti are ADE-SOURCE, D-SOURCE, EDUC, PROF and INCOME (Table 3). The influence of ADE-SOURCE is pervasive city-wide and in all the three residential zones in the city. ADE-SOURCE has coefficient estimates of 0.067, 0.034, 0.377 and 0.134 that are significant at 0.000, 0.001 and 0.01 respectively. This implies that a 100% increment in the supply of a given water system would increase the quantity of water used per person per day by 6.7% city-wide and by 3.4%, 37.7% and 13.4% in the city core, transitional zone and urban periphery respectively. This is expected as most city households currently considered supply from main source as inadequate. Any slight improvement in this supply situation would result into a corresponding increment in Q-PERDAY.

The next most significant factor influencing quantity of water used per person per day is D-SOURCE with a parameter estimates of -0.122 city-wide and -0.030, -0.489 and -0.483 in the city core, transitional zone, and urban periphery all at 0.01 alpha level. This result indicates that a reduction by 100% in the present distance covered by households to the main source will lead to a corresponding increment of 12.2%, 3.0%, 48.9% and 48.3% in the quantity of water used per person per day city-wide and the city core, transitional zone and urban periphery respectively. These results conform to a priori expectation in that logically once the water source gets closer to households; there is a large chance that they would have the opportunity of fetching more water than before and with less stress.

Another significant factor that contributes to the quantity of water used per person per day is TRI-SOURCE. This variable which is only significant city-wide and urban periphery at 0.01 alpha level exhibits coefficient estimates of -0.188 and -0.134 respectively. This result implies that if the number of trips that households could make to main source of domestic water is reduced by 100%, there will be a corresponding increment of 18.8% and 13.4% in the quantity of water used per person per day for such households city-wide and in the urban periphery. These results are rather expected since the fewer trips a household makes to the main source, the more the likelihood of hauling more volume of water. This situation presupposes that the main source of domestic water must be relatively close to the household to afford households better opportunities to haul sufficient water thereby reducing the number of trips and increasing the quantity of water used per person per day.

Another relatively important factor affecting quantity of water used per person per day is PERFORM. It displays regression estimates of 0.049 and 0.073 city-wide and in the urban core at 0.001 and 0.01 significant level. These coefficients implies that doubling the supply from the EKWC would increase the quantity of water used per person per day by 4.9% and 7.3% city-wide and in the city core. This again appears logical in the sense that if the institution statutorily charged with the responsibility of providing potable water for the city dwellers could maximally achieve this goal, definitely the quantity of water used per person per day would be enhanced.

Rather expected is the influence of INCOME on the quantity of water used per person per day. This variable displays coefficient estimates of 0.222, 0.183 and 0.055 in the city level, urban core, and in the urban periphery at 0.01 alpha level respectively. This indicates that doubling the level of income of households would lead to increase in the quantity of water used per person per day by 22.2% city-wide, 18.3% in the city core and 5.5% in the urban periphery. It is a common practice among households in Ado Ekiti to strive to own their own sources of domestic water. Usually, these sources are mostly well. In general, most new houses are nowadays normally constructed alongside with the development of wells. Such practice could be seen as the manifestation of the failure of the EKSWC to meet up with its statutory responsibility. It is therefore reasonable to conclude that such tendency would be reinforced by an enhanced income. With increased income, more houses would be built while existing landlords whose houses were devoid of wells or other water sources might also endeavor to now furnish their houses with their own sources of domestic water thereby increasing the quantity of water used per person per day.

Closely related to this variable in behavior is EDUC. Education usually enhances income since it is a tool that access one to better job opportunities. The enhanced awareness usually created by education is also expected to facilitate wealth creation among households. More so, education should mirror awareness on the need for a given quantity of water per person per day that could meet both the domestic and hygiene needs. It is therefore intuitive to expect that this variable would greatly influence the quantity of water used per person per day. As expected, EDUC records regression estimates of 0.014 and 0.142 city-wide and in the urban periphery both at 0.05 significant level. This implies that an improvement in the education status of households, say by 100%, will increase the quantity of water used per person per day by 1.4% and 14.2% city-wide and in the urban periphery.

Other factors such as M-SOURCE, TI-SOURCE and PROF have mixed influences on the quantity of water used per person per day city wide and in the different residential areas. However, none of these coefficients either positive or negative is significant.

The results of the multiple regression model shows some stability and a moderately high collective influence of estimated parameters (R^2) in that 66.6% of the variation in the quantity of water used per person per day in Ado-Ekiti is accounted for by the variables used for the analysis. In terms of zonal disparity, R^2 becomes higher for both the city core and the transitional zone while becoming moderate for the urban periphery. The parameter estimates are 0.800, 0.802 and 0.670 respectively. The F-ratio of 7.056 and 12.924 for the whole city and the city core disclose that the observed variations are significant at 0.000 alpha level. At the transitional zone and urban periphery, the F-ratio also reveals that the variations are significant at 0.001 and 0.01 respectively.

Table 3: Regression Analysis Result for Quantity of Water Used per person per Day Variables

Zone / Variable	City-Wide		City Core		Transitional Zone		Urban Periphery	
	Reg. Coff.	**Abs. t-Value**	**Reg. Coff.**	**Abs. t-value**	**Reg. Coff.**	**Abs. t-value**	**Reg. Coff.**	**Abs t-value**
ln M-SOURCE	0.071	-1.161	0.040	-0.834	0.146	-1.360	0.157	4.756
ln D-SOURCE	-0.122*	-1.654	-0.030*	-0.535	-0.489	1.200	-0.483*	-1.554
ln TI-SOURCE	-0.092	1.146	-0.060	1.021	-0-595	-1.448	-0.577	1.245
ln TRI-SOURCE	-0.188*	3.085	-0.167	3.458	-0.137	1.308	-0.134*	-1.486
ln ADE-SOURCE	0.067**	0.986	0.034**	0.666	0.377***	-3.133	0.274***	1.408
Ln PERFORM	0.049***	0.766	0.073**	-1.488	0.118	1.130	0.121	-2.670
ln EDUC	0.014*	0.738	0.044	-0.892	0.013	0.111	0.142*	3.479
ln PROF	0.170	0.267	0.130	2.513	0.260	2.418	0.033	0.737
ln INCOME	0.222**	2.329	0.183*	3.739	0.307	2.547	0.055**	1.252
Constant	0.63**		0.196****		0.196****		0.196****	
R	**0.469**		**0.482**		**0.449**		**0.316**	
R^2	**0.666**		**0.800**		**0.802**		**0.670**	
Adjusted R^2	**0.5707**		**0.610**		**0.718**		**0.661**	
F-Ratio	**4.609++++**		**4.226++++**		**2.416++**		**2.413++**	
N	**1,200**		**600**		**420**		**180**	

ln is natural logarithm

**** Significant at 0.000 alpha level (one-tail test)

***Significant at 0.001 alpha level (one-tail test)

**Significant at 0.01 alpha level (one-tail test)

*Significant at 0.05 alpha level (one-tail test)

++++ F-ratio is significant at 0.001 alpha level

++ F-ratio is significant at 0.01 alpha level

SUMMARY, IMPLICATIONS AND CONCLUSION

In this paper, the parameters of the various factors influencing the quantity of domestic water available to households have been estimated using data drawn from a rapidly urbanizing city in Nigeria. The R^2 values indicate that the variables used in the model accounted for 66.6% of the variations in the quantity of water used by households in the city, based on logistic analysis. These factors that significantly influenced the quantity of domestic water per person per day include: main source of domestic water used by households, distance from main source to house, average time spent to fetch from main source, average number of trips made per person per day to fetch from main source, adequacy of supply from main source, performance of supply from government water agency, education level, occupation/profession and household income. One observation that is obvious in this analysis is the pervasive influence of distance from the main source to house and the adequacy of supply from main source. The implication of this is that any effort that would increase the per capita consumption of water in the city must attempt to reduce the distance covered to access water and also increase the quantity of water from main source.

The place of policy in any meaningful intervention in the water sector cannot be overemphasized. Without an articulate policy, it becomes difficult to effectively characterize, operate, manage and improve water system. Paradoxically, until the recent past, Nigeria cannot be said to possess an articulate water policy. This long delay perhaps explains the backlog of problems presently confronting the sector. The newly formulated national water policy in Nigeria aims at resolving the problem of inadequate water supply as it strives at providing potable water to all inhabitants of Nigeria by the year 2020. It is also the desire of this policy to increase the present inadequate level of services to 120 liters per capita per day, and 60 liters per capita per day to urban, peri-urban and rural areas respectively by the year 2020. Paradoxically, as it is, the existing policy in Ekiti state is garnered by practice rather than precepts and documentation. It has therefore become imperative and urgent for the state to evolve a well articulate policy on water provision. It is canvassed that the policy targets should consider the following as minimum: increased access to piped water to 80% in 2010 and ensuring that no one goes beyond 500 meters to access water in any part of the state.

It has been concluded that for effective and sustainable water delivery, Ado-Ekiti cannot rely on underground water resources (Fadipe and Adeduro, 1993; Ebisemiju, 1993). The only meaningful source is therefore the surface water. Unfortunately, the city possesses a dam whose current design capacity cannot meet the city's water need even at full capacity utilization. Ideally, it is rational to consider the construction of additional dam for Ado-Ekiti as a viable option but the cost could be prohibitive. It is therefore suggested that the capacity of the existing dam be upgraded. In addition, it is proposed that the city's water supply system be linked with other existing dams (Egbe and Ero) in the state. These dams are about 30 kilometers away from the city.

There is no doubt that the conventional centralized water supply and distribution systems can no longer be effective in a rapidly growing city like Ado-Ekiti. Any effort to meet the water need of the city dwellers must therefore consider the atomization of sources through linking the city with other dams and construction of large-scale water distribution centres as a priority. The objective of this strategy is to create sectional waterworks that would have defined sphere of influence and coverage to be known as Water Supply Area (WSA). The capacity of these waterworks must be strengthened to provide water to all sections in the city. However, this recommendation does not totally rule out the possibility of construction of additional dams especially from the private sector initiative. It is suggested that the development of such new dams for the city must be preceded by the Surface Water Resources Inventory Survey (SWRIS) that would clearly indicate total annual discharges of existing rivers, lakes, springs, streams and rivulets in Ado-Ekiti in an attempt to determine their optimum design capacity.

In realization of the influence of distance and time on both quantity and quality of water, efforts should be made to bring piped water close to the homes. It therefore becomes imperative for the State Water Corporation to urgently expand piped water network that is currently restricted to the city core. Essentially, the long term desire of water supply system in the city should be to ensure that every household is connected to the piped water system. The success in this direction would however be largely determined by the efficiency of the agency responsible for water supply. The agency should therefore ensure ceaseless flow of water from pipes, regular maintenance of the system and quick response to leakages. This implies institutional restructuring and substantial additional financing from the state government and other sources.

From our survey, it was observed that the existing number of public standpipes in the city is largely inadequate. Again, in terms of spatial distribution, they are restricted to the city core. Generally, with respect to safety, household connection is preferred. However at this stage of development in Ado-Ekiti, public standpipes cannot yet be discouraged rather the existing ones need to be coordinated and improved upon. To ensure adequate number of public standpipes, we suggest that government should take a census of each neighborhood in the city with the aim of determining the required number of standpipes per neighborhood. In addition to the absolute population figure, the number of standpipes to be established should take into consideration the characters of the population. However, in a bid to eliminate queuing around these standpipes that usually lead to time wastage, the adoption of multi-pronged standpipes is suggested. In view of the limitations posed by public standpipes, we wish to propose that government should wipe away public standpipes and legislate on the need for household connection in 2015.

Appendix C

Research Variables Used in the Evaluation of Domestic Water Needs for Ado-Ekiti, Nigeria

1) Available Sources of Domestic Water for Household
2) Main Source of Domestic Water used by Household
3) Access to Improved Source of Domestic Water
4) Access to Unimproved Source of Domestic Water
5) Distance from Main Source of Domestic Water to House
6) Distance from Improved Source of Domestic Water to House
7) Distance from Unimproved Source of Domestic Water to House
8) Average Time Spent to Fetch from the Main Source
9) Average Number of Trips made per Person per Day to Fetch from Main Source
10) Adequacy of Supply from the Main Source
11) Quantity of Water used per Person per Day
12) Supply from Ekiti State Water Corporation
13) Service Delivery Rating of Ekiti State Water Corporation
14) Adequacy of Supply of Ekiti State Water Corporation
15) Frequency of Pumping of Water by Ekiti State Water Corporation
16) Response to Leakages
17) Adequacy of Public (Street) Standpipes
18) Appropriate Location/Distribution of Public (Street) Standpipes
19) Education Level
20) Occupation/Profession
21) Household Size
22) Annual Income

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