EFFECTIVENESS OF PRICING POLICY IN HOUSEHOLDS' WATER DEMAND MANAGEMENT IN KADUNA STATE: A CASE STUDY OF SABONGARI LOCAL GOVERNMENT AREA.

BY

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BEING A THESIS SUBMITTED TO THE DEPARTMENT OF ECONOMICS, AHMADU BELLO UNIVERSITY ZARIA, IN PARTIAL FULFILMENT OF THE REQUIREMENTS FOR THE AWARD OF MASTER OF SCIENCE (M.SC) DEGREE IN ECONOMICS.

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DECLARATION

I declare that the work in this Thesis entitled, 'The Effectiveness of Pricing Policy in Households' Water Demand Management in Kaduna State.: A Case Study of Sabon Gari Local Government Area' was written by me under the supervision of Professor Mike Kwanashie and Dr. Peter Njiforti. The information derived from the literature has been duly acknowledged in the text and a list of references provided. No part of this work was previously presented for another degree or diploma at any University.

…… …… ……..

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CERTIFICATION

This thesis entitled, 'The Effectiveness of Pricing Policy in Households' Water Demand Management in Kaduna State: A Case Study of Sabon Gari Local Government Area' by Ubangida Shuaibu has been read and approved as meeting the requirement governing the award of Master of Science (M.Sc.) Degree in Economics of the Department of Economics, Ahmadu Bello University, Zaria.

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DEDICATION

This research work is dedicated to the Almighty Allah for making it possible and giving me the wisdom and strength to complete the work successfully. I also dedicated it to my parents: Late Mallam Muhammad Bello Abdullahi and Rabiatu Dalhatu.

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My profound gratitude and thanks go to Allah, the Almighty for sparing my life and giving me the wisdom, strength, health and ability to complete this work successfully. In fact, my thanks to him are inestimable.

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ABSTRACT

The effectiveness of water supply policies used in the past is nowadays questionable since the gap between water supply and water demand is increasing despite increase in water supply. With increasing demand for water primarily as a result of increase in population, urbanization and economic growth, attention was shifted from supply management to demand management policies. Water Demand Management aims at minimizing wastage of water and ensuring efficient water use through pricing and non-pricing policies. In spite of the importance of water supply for domestic, industrial, agricultural and other uses and in spite also of the intensifying scarcity of water, empirical researches on water demand and effectiveness of water demand management tools are very rare in developing countries like Nigeria. The States and National governments have introduced policies aimed at reducing the gap between water supply and water demand but the situation has not shown any improvement. This study attempted empirical analysis of the effectiveness of pricing policy in households' water demand management in Kaduna State using Sabon Gari Local Government as a case study. Various pricing policies were reviewed and according to the theory of price determination of both economic and public goods, efficient pricing policy encourages efficient use of water. By the use of primary source of data collection, through administration of questionnaires to water users and staff of the Water Boards, it was revealed that the current pricing policy of the State does not lead to water use efficiency nor does it cover operation and maintenance costs, a situation that led to a serious shortage of funds for proper operation of the water supply institution. The study also found variations in quantity of water used among households based on their income levels and households' size. The study therefore, concluded that the current pricing policy is inefficient. Consumers of the public water supply service indicated willingness to pay for improved service contingent upon increase in water tariff. However, the problems of water supply sector in Kaduna State are not only with the pricing policy but also with poor condition of service and weak policy implementation to mention just a few. This study recommends that review of the pricing policy and other policies should be carried out to address the problems of the water sector. The review should take into consideration demand assessment on the heterogeneous category of the water users by adopting a user focused approach.

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CHAPTER ONE

INTRODUCTION

1.1 BACKGROUND OF THE STUDY

Water is among the fundamental human needs (foods, shelter, clothing and sanitation). This is because the livelihood of man is anchored on water (for domestic use, industrial use, agriculture, maintenance of ecosystem, and aquatic life). Generally, water has been considered by many, more especially third world countries as a gift of nature especially as these countries depend largely on rain fed agriculture, free flowing streams, rivers and oceans for domestic use and agriculture.

Over time and space, water supply has been on the decrease, while the demand for water and the various end-uses have been on the increase. This therefore has created a gap between the demand and supply of water. This also has necessitated the thinking of conceptualizing water as an economic or social good for effective management of water resources. The general agreement in economics thinking is that, when the supply of a commodity is scarce relative to demand, the commodity is considered as an economic good. This therefore calls for the use of economic techniques for water demand management.

The traditional policy, which dominated the 20th century and aimed at confronting the scarcity of water, depended on utilizing new water resources. The socio-economic benefits of transferring water were greater than the costs of exploiting new resources and therefore the so-called supply

policy prevailed. However, the efficacy of such a supply-side measure is nowadays questionable, since the extensive use of water resources has increased globally as a result of increase in population, economic growth and urbanization.

In this context, there has appeared a new model of policy that aims at maximizing the benefits of utilizing water resources already in use in order to minimize or even to eliminate the need for new water supplies (Bithas and Stoforos, 2006). This policy, defined as "water demand management", is gradually becoming popular, especially in developed societies. "Water demand management" mainly consists of the following actions: the minimization of losses in transport and storage systems, the reuse of water, the containment of water use by avoiding waste and the efficient use of water resources (Renwick and Archibald, 1998). The achievement of these actions is gained through pricing and non-pricing policies. In the framework of demand management, it is vital to analyze and understand the characteristics of water demand. How demand is formulated, the factors that determine it, how demand responds to changes in income and relative prices and eventually how future demand will be shaped (Bithas and Stoforos, 2006). Thus, the analysis of water demand is of significant importance in designing and implementing effective pricing policies.

Tamkinat and Wasif (2008), show that through pricing policies, existing demand patterns are modified to achieve various objectives such as cost recovery, conservation, and equitable allocation of water among different income groups. To implement this policy successfully, the value of water is reflected by the price elasticity of water demand such that if the demand is inelastic, the price has little or no effect on the quantity consumed. On the other hand, if

elasticity is high, consumers indicate willingness to reduce/increase the use of water with changes in price. Clearly, this information is fundamental in deciding the manner in which tariffs should be structured.

This study was conducted in an area with specific characteristics such as: intensified scarcity, two seasonal periods (rainy and dry seasons), expanding urbanization etc. Indeed, Sabon Gari area presents water issues representative of many other urban areas. The study focused on domestic use and how it is affected by the current water pricing policy in the state, since it appears to be the more problematic -requiring water of high cost and there is severe scarcity because of the quality standards which have to be met.

1.2 STATEMENT OF THE PROBLEM

Estimated water demand in Kaduna State is put at 751 million litres per day (mld) and services coverage represents 23% of the State's population (KADSEEDS, 2007). The State built twelve water works for water supply to nine urban centers. The table 1.1 shows the estimated population, water demand and capacity of Zaria water works.

Table 1.1: State Water Supply Coverage-Year 2004

Communities	State Population	%State Population	Actual Water Demand (mld)	Actual Water Supply (mld)	Gap (mld)	Population coverage	% Service coverage	% State Coverage
Urban	3,145,837	51,32	540.25	171.00	369.25	995,720.23	31.65	16.24
Semi-Urban	1,287,300	21.00	159.63	31.93	127.70	257,460.00	20.00	4.20

Rural	1,696,863	27.68	50.91	5.60	45.31	186,654.93	11.00	3.04
Total	**6,130,000**	**100**	**751**	**209**	**542**	**1,439,836**	**62.65**	**23.49**

SOURCE: KADSEEDS, 2007

Table 1.2: Zaria and Sabon Gari (Population, Water Demand and Water Works' Capacity)

Town	Population	Demand (mld)	Existing water works' capacity (mld)
Zaria and Sabon Gari	1,131.301	198	60

SOURCE: KADSEEDS, 2007

Table 1.3: Percentage Distribution of Households by Major Sources of Water for Drinking and Cooking in Kaduna State

	2007	2008
Total Households	1,144,276	
Pipe Borne Water treated	15.0	13.9
Pipe borne Water Not treated	0.8	1.0
Borehole/hand Pump	6.3	8.3
Protected Well/Spring	25.2	16.7
Unprotected Well/Spring	29.3	39.9
Rain water	0.0	0.3
Stream Pond/River	16.5	19.5
Tanker Truck/Vendor	4.5	0.3
Other Sources	0.3	

SOURCE: NATIONAL BUREAU OF STATISTICS, 2009

Tables 1.1 vividly shows that the supply capacity of 209mld of water is inadequate given that 751mld is needed to satisfy the estimated population of the State. Also, Table 1.2 shows that the supply capacity of 60mld is inadequate as 198mld is demanded in Zaria service area showing

wide disparity between supply and demand. In table 1.3, percentage of households with pipe borne water treated and not treated were 15.8% and 14.9% in 2007 and 2008 respectively.

Urban water supply operation and maintenance are being commercialized, they are sustained through pricing by fixing tariff (flat rate) sufficient to defray operational expenses. However, water production from the 12 water works has dropped to an alarming rate of 171mld from their initial capacities due to erratic power supply and worn out equipment among others. The low production level coupled with inadequate capacity has resulted in poor service coverage of portable water from the public water supply system daily (KADSEEDS, 2007).

The continuously intensifying scarcity of water resources is a crucial problem in almost all contemporary societies. Thus, problem of water scarcity has manifested itself in different ways in Kaduna State and Sabon Gari LGA in particular. For instance, some areas go without water for months as such taps remain dry for most of the times (Maaruf, 2008), primarily as a result of problems with electricity. Some of the consequences of this lead to social costs of diarrhea and cholera diseases which have been the case in the study area every year especially in the dry season when water shortage is more apparent. The situation in the study area is similar to the findings of Bithas and Stoforos, (2006) that the most common issues of scarcity are: increased cost of water usage, intensified competition over access to water resources and social insecurity (breakout of diseases) due to the lack of water.

It is obvious that one of the obstacles to the supply and provision of water services in Kaduna state is the wastage of water due to poor consumer attitudes towards conservation giving rise to

high unaccounted for water (UFW). Distribution losses arising from old and damaged pipes as well as illegal connections present an obstacle to the water institution. These losses, according to the Kaduna State Water Board (1993) in (Maaruf, 2008), have led to the loss of over 35% of water pumped out from the various public sources but could not be accounted for. This situation has also led to serious loss of revenue to the institution (Maaruf, 2008). It has been observed that the use of flat rate leads to misuse of water resources of which households with tap and flat rate charge offer households without tap access to their tap a situation that encourages wastage of the water resource. Also, funds for capital projects come either directly or indirectly from government and with increasing population and demand for the scarce resource; the burden on funding is surely increasing (KADSEEDS, 2007).

There are other several reasons for inefficiency in the water sector. The strategies of governments and international donors for tackling the problem tend to ignore the fundamental importance of demand in the selection of appropriate pricing policies (World Bank Research Observer, 1993). People have expectation that water should be provided publicly, and it has consequently led to refusal of payment of water bills by many users, leading to inadequate supply due to high cost of production. Many individuals lack a clear understanding of the water rate structure and water bills, raising difficult research issues about which price signals users actually will respond to.

These and other challenges are supposed to be addressed by the pricing policy because a good pricing policy should aim at ensuring cost recovery, conservation, and efficient use of water. Thus, this study focuses on the effectiveness of pricing policy on households' water demand

management and conservation in Kaduna State with particular emphasis on Sabon Gari Local Government Area. This leads us to the following research questions:

1.2.1 RESEARCH QUESTIONS

a. Is the current flat water rate/price capable of ensuring effective water demand management in the study area?

b. Does the current water rate reflect the full cost?

c. Can efficient water rate ensure effective water demand management?

1.3 OBJECTIVES OF THE STUDY

This study aims at analyzing and recommending appropriate and potentially effective policy instruments for water demand management and conservation in Kaduna State, a case study of Sabon Gari Local Government Area. However, to satisfy the above objective, the following specific objectives were addressed:

a. To examine the attitude of various users (households) towards the current water flat rate policy in order to determine whether it is efficient in water demand management in the study area.

b. To analyze the extent to which the current water rate reflect the full supply cost of water.

c. To determine if efficient water rate can ensure effective water demand management.

1.4 JUSTIFICATION OF THE STUDY

Despite various initiatives and a large amount of international thoughts, policies and practices to meet the specific conditions of Nigeria, shortages and misuse of water are wide spread. This water dilemma points to the need for studies on water demand management policy which aims at reallocating existing supplies, encouraging more efficient use and promoting more equitable access.

Many studies have been carried out on water demand management across the world and their findings show that water management has positive impacts on efficient water use. Some of these studies are: Arabiyat (2005), Herve (2002), James (2009), Njiforti (2010), Grace (2003), Whittington (1991), and many more. Empirical studies on water use and determinants of demand in Nigeria are rare and in view of the importance of water, as a necessity of life this study sets out to practically analyze the impact of pricing policy on water demand management. This study is therefore, justified in the following respects:

First, the study offers a more perspective view about pricing as an appropriate tool for management of water resources in Kaduna State with particular reference to the study area. This is imperative because of the growing concern about water supply that does not match with the

demand of water users. It could also help in examining the problem of water wastage despite the pricing policy that is in practice in the state.

Second, the study will be useful to water institutions and water allocation systems in incorporating a user focused approach to address surface water supply/demand and water qualities issues. This is because the study examines the consumers' attitude and their willingness to pay for water service which can serve as a signal for any change in water rates.

Thus, this research will have a direct implication to the policy makers and general public as it will provide an in-depth examination of water resources management in the study area, the prospects and challenges. It is expected that the study will add to the scope of knowledge and serve as reference for more researches on same or related areas.

1.5 HYPOTHESES OF THE STUDY

Hypothesis is a tentative knowledge, claim or proposition subject to empirical confirmation or rejection. They are ideas which are to be tested and building block of any scientific research (Abiola and Adeyeye, 2006).

The Hypotheses developed and tested for this study are as follows:

Hypothesis one

H_0: B = 0 Pricing policy is not effective in households' water demand management

H_1: B ≠0 Pricing policy is effective in households' water demand management

Hypothesis Two

H_0: B = 0 There is no significant difference in the quantity of water used among various domestic users

H_1: B ≠ 0 There is a significant difference in the quantity of water used among various domestic users

Where, H 0 and H1 are Null and Alternative Hypotheses respectively.

1.6 SCOPE AND LIMITATIONS OF THE STUDY

This study covers parts of Sabon Gari LGA connected to the public water supply system for period between 1992 and 2010. This is informed by the fact that the international conference on water and the environment which called for innovative approaches to the assessment, development and management of water resources took place in 1992. The resolution of the conference and some recent conferences, and conventions guided the basis for the formation of national and state water policies. Also, the study did not cover households within the institutional housing areas, notably the Ahmadu Bello University, Zaria in view of the existence of an independent institutional water supply system.

The study like any other research work is not without limitation. Absence of available data on the socioeconomic characteristics of water users and their water usage profiles, made it compulsory for the use of primary data. It is important to note that the perceptions of the

respondents and their responses may be subjective as some of them are ignorant of the concept of water demand management and water pricing policy as well.

The study is on Kaduna State but one local government out of the 23 local governments was taken as a case study and a sample of 363 was drawn out of numerous water users. This coupled with the limited time frame within which the field survey was conducted is another limitation of this study. Thus, the conclusions drawn by this study should be taken with caution.

1.7 ORGANISATION OF THE STUDY

This study is organized into five chapters. Chapter one which is the introduction contains the background of the study, statement of the problem, objective of the study, justification of the study, hypotheses of the study, scope of the study and organization of the study. Chapter two deals with the review of literature and consists of conceptual, theoretical and empirical literatures. Chapter three contains the research methodology which will include: Back ground information on Kaduna state and the study area, Sources of data, Sample and Sampling Designs, Analytical Technique and Definition of variables. Chapter four focuses on presentation an analysis of data in which statistical tests will be carried out. Lastly, chapter deals with summary of findings, conclusion and recommendation.

CHAPTER TWO

LITERATURE REVIEW

2.1 INTRODUCTION

Some Economists are of the view that water should be considered an economic good. Their argument is that, the delivery of portable water makes water a commodity and as such can be used to acquire profit. In 1992, the Dublin Water Principles claimed ‘‘water as an economic good’’ for the first time in a UN setting. But water has been recognized as an economic good for many centuries before 1992. The ‘‘sanitary revolution’’ of the 19th century saw the demand for public ownership and management of most of water supply companies in the name of public health. This, of course, did not obviate the need for water to be treated as an economic good (Peter et al, 2001).

However, a heavy emphasis on the public good nature of water and its disposal led to the development of heavily subsidized public systems. This led to a counter argument that water, much like air, is a necessity of life and should be considered a human right and not at all correlated to one’s economic ability (City –Data.com, 2008). Saganista (2007) in City-Data.com (2008) argues that both water and oil are essentials of modern life and they are of fixed supply with increasing demand, beginning to raise questions over whether that fixed supply will be sufficient to meet demand. Slaleman (2007) in City-Data.com (2008) sees water as a public good that no single person or entity should be able to deny another person the ability to get water. According to him taxing the collection of rain water would be like taxing the air we breathe in.

Water resources have a number of characteristics that make them particularly problematic to manage through markets (Shella, 2007). The following are the characteristics of water: a. Water resources are mobile; they flow, seep and evaporate making it difficult to establish and enforce exclusive property rights. b. The same river can be tapped by many communities, firms and recreational users as it moves through landscape. c. In addition, water is a bulky commodity. Its per unit value is low, making the costs of transportation and storage high relative to its overall value in use. d. Because of the particular cost structure of piped, treated water supply, the cheapest way to serve a given population is to have one firm serve the entire market a condition known as 'natural monopoly'. It would be wasteful for competing firms to establish separate treatment facilities and distribution networks to supply the same population with drinking water. e. Water supply is highly variable in time, space and quality. Storage reservoirs are often necessary to smooth supplies. Reservoirs to mitigate periods of shortage, as well as infrastructure to manage flooding, provide public benefits, often shared by multiple communities. f. Drinking water reservoirs can also be used for other purposes such as recreation, irrigation, and power generation. These and other uses of water resources provide public goods, benefits that are shared by all and whose employment by one party does not diminish the ability of others to enjoy them as well.

The above characteristics and other reasons make water a special good, and if it were traded on simple markets, some aspects of the economic value of water would not be captured, and it would be under supplied in some public uses (Shella, 2007). As a result, the stock of water that supplies ecological, municipal, industrial and agricultural functions are often publicly owned and

managed. Hence, water is often considered a good to which people have a basic right to use (for free or at least at very low cost). Therefore, it becomes necessary to have economic thinking in general and the concepts of efficiency and cost effectiveness in particular, to ensure effective management of water resources.

Economic theory has long ago explained how correct pricing of private and public goods can lead to gains in economic efficiency (Peter et al, 2001). They further argue that higher water rates allow utilities to extend services to those currently not served and those currently forced to purchase water from vendors at very high prices. More surprisingly, it is argued that pricing policy can help maintain the sustainability of the resource itself. When the price of water reflects its true cost, the resource will be put to its most valuable uses. Using pricing policies, however, still requires significant government intervention to ensure that equity and public goods issues are adequately covered. This paper focuses on the role of price policy in water demand management. As such the study will be situated within the framework of the theory of economic and public goods as well as the theory of price determination.

2.2 THEORETICAL FRAMEWORK

2.2.1 THEORY OF ECONOMIC AND PUBLIC GOODS

In economics, a public good is a good that is non-rival and non-excludable. Non-rivalry means that consumption of the good by one individual does not reduce availability of the good for consumption by others; and non-excludability that no one can be effectively excluded from using

the good. In the real world, there may be no such thing as an absolutely non-rivaled and non-excludable good; but Economists think that some goods approximate the concept closely enough for the analysis to be economically useful. For example, if one individual visits a doctor there is one fewer doctor's visit for everyone else, and it is possible to exclude others from visiting the doctor. This makes doctor visits a rivaled and excludable private good. Conversely, breathing air does not significantly reduce the amount of air available to others, and people cannot be effectively excluded from using the air. This makes air a public good, albeit one that is economically trivial, since air is a free good.

Samuelson (1954) is usually credited as the first Economist to develop the theory of public goods. In his classic 1954 paper, ‘‘The Pure Theory of Public Expenditure”, he defined a public good, or as he called it in the paper a "collective consumption good", as follows: ...goods which all enjoy in common in the sense that each individual's consumption of such a good leads to no subtractions from any other individual's consumption of that good. This is the property that has become known as Non-rivalry. In addition, a pure public good exhibits a second property called Non-excludability: that is, it is impossible to exclude any individuals from consuming the good.

The opposite of a public good is a private good (economic good), which does not possess these properties. A loaf of bread, for example, is a private good: its owner can exclude others from using it, and once it has been consumed, it cannot be used again. A good which is rivalrous but non-excludable is sometimes called a common pool resource. Such goods raise similar issues to public goods: the mirror to the public goods problem for this case is sometimes called the tragedy of the commons.

The theoretical concept of public goods does not distinguish with regard to the geographical region in which a good may be produced or consumed. However, some theorists use the term global public good to mean a public good which is non-rival and non-excludable throughout the whole world, as opposed to a public good which exists in just one national area. Knowledge has been held to be an example of a global public good. Mostly, governments regulate companies that provide essential public services such as water, gas or electricity known as public utilities and economic theories provide basis for pricing such public utilities.

2.2.2 PRICING OF PUBLIC UTILITIES

In case of public service that is considered pure public good, free services might lead to wastage of resources. Dalton quoted in Jhingan (2003) advocates the compulsory cost of service principle whereby the government should charge a price for the service provided to people and leave a gap between revenues and costs since they are public utilities. However, Dalton favours the voluntary price principle for public utilities. According to this principle the consumers of these services are required to pay the price fixed by the public sector enterprises (PSEs). The PSEs may have a monopoly in a particular service such as water or power supply and may fix a price lower than its cost of production for it so that the welfare of the community is not adversely affected.

The general principle for pricing such public service is to recover cost without distorting the allocation of resources done by making price equal to short run marginal cost while keeping

productive capacity constant. But water periodically requires large investments. In such cases, average cost falls as production expands and the actual charge is below the average cost. Charging that price will lead to a loss and the public price has to be revised to cover the cost of providing the service. The major theories of pricing public undertakings are presented below:

a. Marginal Cost Pricing Rule

One of the aims of PSEs is to be economically efficient or to maximize social welfare. If a PSE has a monopoly, it will not be economically efficient because it produces where MC=MR. However, for more efficient resource allocation, it is essential to find out whether it is operating under decreasing or increasing returns. If price equals MC under decreasing returns, the PSE will earn profit and if it is operating under increasing returns, it incurs loss. Thus, the application of this principle has an implication for the financial position of the PSE and the output will not be of optimum size because the PSE will be earning either super normal profit or incurring losses.

However, to secure optimum allocation, the output should be increased and this is only possible when the marginal cost pricing principle is followed. This is the most efficient pricing method because consumers are charged for any additional unit of water used and therefore, can lead to efficient use of water. This principle has some limitations like conceptual and practical difficulties in the calculation of marginal cost, administrative and managerial difficulties, and so on.

b. No-Profit No-Loss Policy

Economists like Lewis, Coase, Durbin, Henderson and little in Jhingan (2003) advocate no-profit no- loss policy or the principle of break even for PSEs. They argue that PSEs are meant to serve public interest and not to make profits. According to Lewis, they should neither make profit nor loss after meeting all capital charges. He further states that what the Economist's principle support is not the MC pricing but a system that consumers contribute to fixed cost according to their capacity to pay. This policy means that prices should cover total costs. These include all types of expenses like short and long period fixed and variable costs, current and replacement costs, depreciation charges, interest on capital and advertisement, selling and distribution expenses. These costs may be covered by making the prices equal to the average costs or by two-part/multi-part policy.

The full cost or average cost pricing policy is advocated on the ground that full cost prices are based on average total cost which can be easily estimated. This policy leads to profit which compensate for losses, so that there is neither loss nor profit. However, this policy may lead to mal-allocation of resources when consumers do not buy additional units at the marginal cost. Also, if the demand curve (AR) lies below the AC throughout the length, the AC pricing will not give any output and total cost will not be covered at all. There is a difficulty in distributing appropriate depreciation over a period of time. To overcome these limitations, Lewis, Coase and Henderson advocate two-part/multi-part tariff policy.

c. Profit Price Policy

Some Economists such as Rao (1959), quoted in Jhingan (2003), categorically rejected the theory of no profit no loss and argued for the adoption of profit price policy. Such a policy according to him will make the state utilize its own resources rather than taxing citizens. He stated that PSE must be carried on a profit making basis not only in the sense that the PSE must yield an economic price but also get the community sufficient resources for financing a part of investment and maintenance expenditure of the government. This theory is based on the following argument:

a. When a State invests in PSE, it expects profits to augment resources for development.
b. PSEs should not be dependent on government for finance.
c. Even in case of monopoly, the best course is to charge a price that could give a minimum profit which ultimately goes to the State for capital formation.
d. This policy will contribute to the general revenues of the State.
e. The surpluses from profit will provide adequate funds for expansion and modernization.

The theory also shows that the price policy of the PSE producing public good or service should not be different from the one that the private entrepreneur follows. However, the price should be determined by the Board of Directors or the government but it should be noted that PSEs should aim at a reasonable rate of profit. It is also difficult to earn a particular rate of profit for all PSEs because of the following reasons:

a. The PSEs which have not broken even cannot earn profit because their overhead costs will be high.
b. If the gestation period is long it takes it a very long period to break even and start earning profit.
c. For public utilities, welfare and not profitability is the principal objective. They try to equate MC with price.

2.2.3 THEORY OF PRICE DETERMINATION UNDER FREE MARKET COMPETITION

Under perfect competition, there are two parties which bargain in the market- the buyers and the sellers. It is only when they agree that a commodity can be bought and sold at a certain price. Thus pricing is influenced both by buyers and sellers that is, by demand and supply. Extracted from Jhingan (2003), the law of demand is applicable to buyers. According to this law when price rises, demand falls and vice versa. The law of supply applies on the supply side. This law states that supply increases with the rise in price, and decreases with the fall in price. Thus, demand and supply are the two counteracting forces which move in the opposite directions. Price is determined at a point, where these two forces are equal, and this is known as the equilibrium price. Quantity demanded and supplied at this price is called the equilibrium quantity. When price is less or more than the equilibrium price, there is disturbance in the equilibrium output but ultimately equilibrium price will prevail.

McAfee (2006), states that in the context of supply and demand, equilibrium refers to a condition where the pressure for higher prices is exactly balanced by a pressure for lower prices and that the current state of exchange between buyers and sellers can be expected to persist. When the price is such that the quantity supplied of a good or service exceeds the quantity demanded, some sellers are unable to sell because fewer units are purchased than are offered. This condition is called a surplus or excess supply. The surplus encourages price cutting, which reduces the surplus, a process that ends only when the quantity supplied equals the quantity demanded.

Similarly, when the price is low enough that the quantity demanded exceeds the quantity supplied, a shortage or excess demand exists. In this case, some buyers fail to purchase, and these buyers have an incentive to accept a slightly higher price in order to be able to trade. Sellers are obviously happy to get the higher price as well, which tends to put upward pressure on prices, and prices rise. The increase in price tends to reduce the quantity demanded and increase the quantity supplied, thereby eliminating the shortage. Again, the process stops when the quantity supplied equals the quantity demanded.

However, perfect competitive market conditions do not and probably cannot exist in the majority of cases (Briscoe 1997, Pearce 1999). In most cases, the supply of water is a monopoly (regulated and supplied by the government) whose characteristics closely resemble those of a "natural" monopoly. Specifically, the extremely high infrastructure costs for transporting, treating and delivering water make difficult the operation of multiple water suppliers.

2.2.4 PRICE REGULATION IN THE CONTEXT OF NATURAL MONOPOLY

The conceptual analysis of monopoly regulation focused in principle on the problem of pricing the good or service provision. From the economic point of view, and for the specific case of water and sanitation service provision, the assumed objective of price regulation is to achieve efficiency of the water supply and use of water and sanitation. Of course, pricing water and sanitation services under efficiency goals, it is likely to have impacts on other areas of interests. Put it in another way: A natural monopoly exists when it is more efficient for one firm to serve the market than to have multiple firms serving the market.

Considering that the regulatory goal is to achieve economic efficiency, economics suggests that price should be set equal to the marginal cost of production. Roughly, the very basic conceptual idea behind this principle is that marginal cost represents the cost to the society of producing an additional unit of a good or service. Therefore, it represents the amount of resources that society should allocate to the production of that good or service. Pricing the provision of the good or service at its marginal costs, the producer and consumers arrange their production and consumption decisions according to its true cost. Therefore, a desirable result is achieved.

Although having a lot of appealing from efficiency grounds, using the "marginal cost principle" to price water and sanitation service provision may have a limited scope. Different reasons explain the limitations of this alternative. First, choosing price that equals marginal cost may not allow meeting revenue requirement to guarantee operation of the provider. Second, in cases in which it is possible to anticipate divergences between short run marginal cost and long-run

marginal costs, it is not clear to which one the price should be tied. Third, considering that, at least in the short-run, capacity of operation is fixed, and in some cases demand varies over time (for example, by season) then the "marginal cost principle" does not have a straightforward way of implementation. We now turn to discuss briefly some of these issues

Pricing the provision of water and sanitation services under the marginal cost principle may involve a trade-off between efficiency and raising enough revenue. That is likely in the presence of a firm that is characterized by decreasing average costs. In such a situation, marginal costs of production are expected to be lower than average costs, then pricing at marginal costs although achieving efficiency, will not allow the operator to raise enough revenue to cover total costs. One of the alternatives to deal with this problem is to use a two-part tariff, also called non-linear or non-uniform pricing.

2.2.5 DEMAND FOR WATER

Essentially, the analysis of water demand aims at offering all the necessary information and knowledge for designing an effective water demand policy, and specifically a policy that pursues the efficient use of water resources. Accordingly, efficient use is defined as a pattern of use that maximizes the benefits arising from the exploitation of water resources (Bithas and Stoforos, 2006). A pure competitive water market would ensure efficient use by defining the optimum use of water and its optimum allocation among competitive users. Indeed, in a market that operates under competitive conditions, the price of water would be determined by the interaction of market demand and supply to reflect the actual costs of water usage. This price would induce

users to purchase the optimum quantity of water. In this context, no exogenous administrative intervention would be necessary, as the "invisible hand" would, by itself, ensure the efficient level of use induced by an equilibrium price that reflects water costs. Furthermore, the "invisible hand" would lead to defining the appropriate investments in order to attain the efficient use of water in the future.

The economic characteristics of the water sector, in combination with the fundamental social perception that water is a socially sensitive good related to human existence and health, led to a strict administrative framework for the operation of the water supply sector and hence of the water market (Kaika 2003, OECD 1989). In effect, the fundamental decisions, like the determination of investments and prices, have been strongly influenced by administrative rationale. In such a framework of direct or indirect government interventions, the estimation of demand parameters and characteristics acquires a special significance, since the decision-makers require sufficient knowledge and information. The conditions for determining the efficient use of water and the relevance of demand analysis, which offers the necessary information, are traced in Figure 2.1.

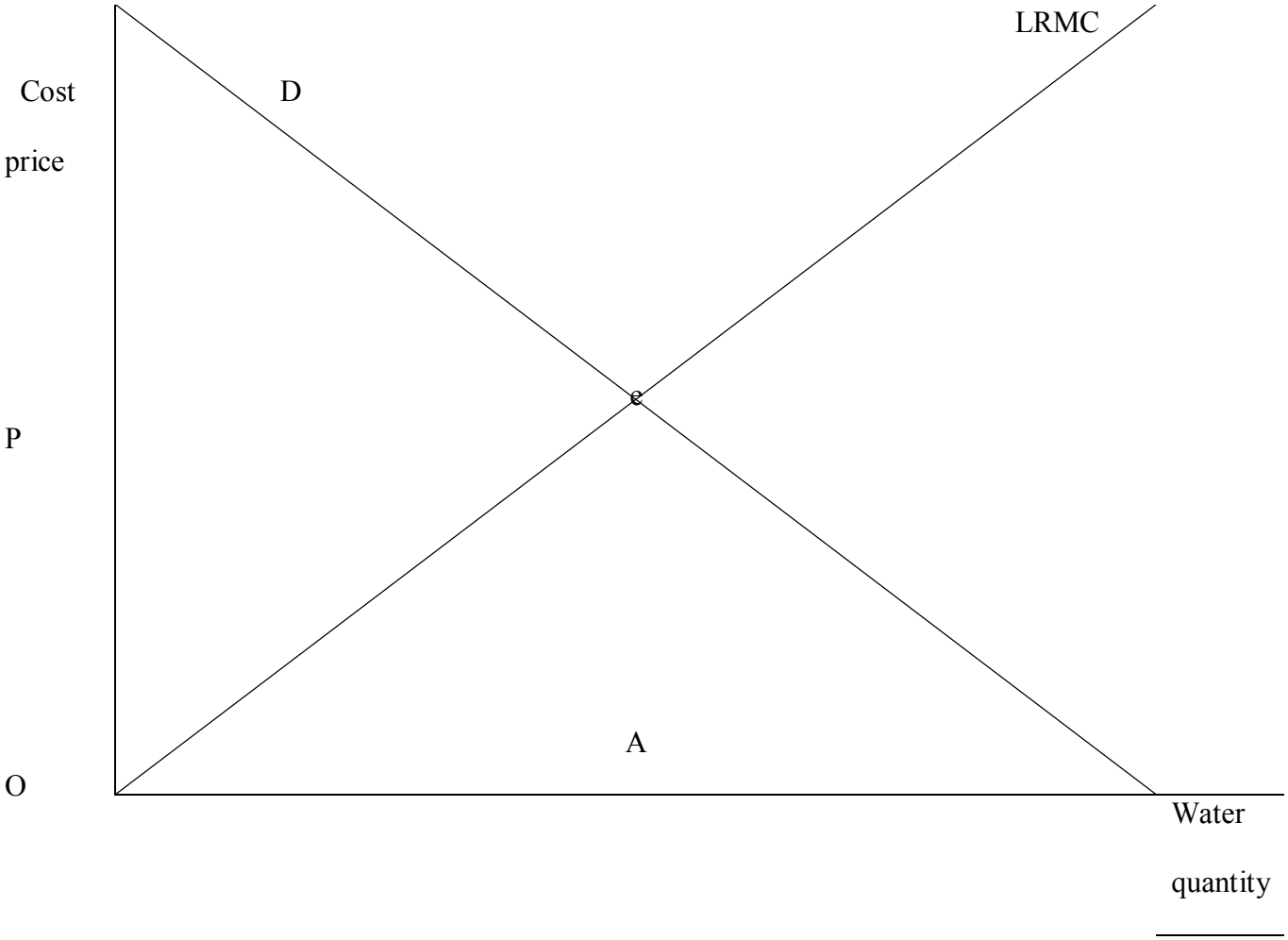


Figure 2.1. The Efficient Use of Water Resources

In Figure 2.1, curve LRMC represents the long-term marginal cost of water supply. The data and the information for the estimation of the LRMC curve are, to a significant level, available to the administrative agencies responsible for formulating water policy. However, the authorities are hardly aware of the functionality and operationability of the long run (marginal) costs of water supply. Curve D represents the marginal benefits of water use. However, the information for defining curve D could be revealed in a free water market as well as through market surveys in the administratively supervised markets. If a competitive market exists, then the curve D defines

the respective demand curve. The efficient use of water is determined by the intersection of the LRMC and D curves. OA represents the efficient quantity of water use (Bithas and Stoforos, 2006). In this light, the efficient optimum use of water would have prevailed in a competitive market.

In the administratively regulated markets, the achievement of effective use, OA in the Figure, can be ensured if the decision makers define the appropriate price, OP, being equal to the marginal cost of OA water use. To define the appropriate price, decision-makers should have sufficient information on water demand. This information is not directly available through the function of the existing water markets functioning under administrative supervision. Furthermore, the analysis of demand can be an important tool in formulating the relevant investment policy. The key factor for making appropriate investment decisions is the expected (future) demand. Forecasting demand leads to the determination of the optimal future level of water use and hence to the design of the future capacity of the water supply system (delivery networks and processing plants). Water supply infrastructure is considered to be expensive, especially as far as urban uses are concerned. Therefore, the forecasting of water demand, and the definition of the level and the appropriate magnitude of investments, is of crucial importance for the decision- makers.

Thus, analysis of demand for water is an important step in economic analysis of water supply projects. From an economics perspective, the price of water is an important determinant of the quantity of water demanded. The relationship between the quantity of water used and the price is illustrated by the demand curve for water in figure 2.1.

Another factor that affects demand for water is population growth. For example, all other factors remaining constant, annual population growth of 2 percent may result in a doubling of both population and demand for water in future years. The opportunity cost of water (OCW) is the foregone benefit of utilizing water for one water supply project compared to its next best alternative. Water can be utilized for several purposes like agriculture (irrigation and livestock), hydropower generation (electricity), and for domestic uses (cooking, drinking, etc.). The OCW is zero if water is abundant in supply, but if a choice has to be made between its alternative uses in order to provide domestic water supply then opportunity costs may be high. The income elasticity was seen to be very low in most of the original studies, some of which are: Omstead, etal (2006), Shella (2007), Briscoe etal (1990), Renwick and Archibald (1998) to mention just a few.

Thus, access to adequate water supply and sanitation facilities are usually described as basic needs. Among other things, this implies that lower-income households tend to spend a large proportion of their disposable income on water and sanitation. Moreover, their expenditures will be proportionately much greater than richer households.

2.3 EMPIRICAL LITERATURE

Howitt (1984) developed a General Equilibrium (G.E.) approach for inter-regional water trade using a spatial equilibrium approach derived from a quadratic programming model. His model examines inter-regional equilibrium supply and demand relationship for California and estimates

that its trade is not allowed and the development of new water sources is exclusively used to meet increasing demand, the resulting prices for all regions are dramatically higher.

Douglas et al (2008), in their study of residential water demand management found that residential water demand management is a function of several factors some are within the control of the water utilities like (price, water restriction, rebate programs) and some are not (like weather and demographic characteristics). Their findings indicate that pricing and other outdoor water restriction policies interact with each other ensuring that total water savings are not preservative of each program operating independently. The study also shows that the effectiveness of pricing and restriction policies varies among different classes of customers (low, middle and high volume users) and between pre-drought and drought periods.

Wichelns et al (1996) evaluate a California incentive program to improve on farm management efficiency via farm specific water allotments, tiered pricing and low interest loan for irrigation equipment. The results confirm that economic incentive can be effective in generating improvements in water quality.

Roumasset (1997) examines water trading schemes and their dependence on top-down or bottom-up regulation: this approach is shown to depend on such variables as transaction cost, asymmetric information, inter-temporal and spatial water supply. However, empirical analysis suggests that all parties benefits from either buying or selling water.

Another study was conducted by Dodley and Scott (1998). They simulate the potential of water markets using dynamic optimization to derive short run demand functions for reservoir water and marginal opportunity costs for a variety of decisions to derive optimal short-run water allocations. Their results show that demand for water is responsive to price.

In 1996, fully 96 percent of surveyed residential water customers were metered, according to a study of 827 U.S. water utilities by the American water works association. From 1996, the prevalence of various rate structures in the residential sector charged little, although, there was substantial growth in the fraction of U.S. residential consumers facing IBPs after 1980.

Briscoe et al (1990) found in a WTP study in Brazil that the income elasticity of demand for yard taps and public standpipes were quite different. Yard taps showed a positive income elasticity of demand, indicating that the wealthier consumers would choose to install yard taps; whereas public taps revealed a negative income elasticity of demand and would therefore be used by the poorer consumers.

A study done in South Africa showed that the total social cost of diarrhea disease was estimated to be at least 1 percent of the country's annual GDP by Pegram, (1998) cited in Okoli (2003). Willingness to pay studies typically treat water as a private good, and policy discussions based on these studies would ignore any market failures that might be involved.

Another recent comprehensive residential demand estimate for households in eleven urban areas in the U.S. and Canada, suggests that the price elasticity of water demand is approximately -0.33

(Olmstead, et al, 2006). For residential and the industrial sector, estimated elasticities tend to be higher in industries where cost share of water inputs is relatively large. Also, the result of five studies between 1967 and 1992 are reported in Griffin 2006. These estimates vary from 0.15 for some two-digit standard industrial classification (SIC) codes to -0.98 for the chemical manufacturing industry.

In New England, there are few studies of water demand (Shella, 2007). Most recently a broad study of residential water consumption in Massachusetts cities estimated price elasticity ranging from -0.10 to -0.69. Given this result, there is no reason to believe that regional responses of water demand to price increases should differ significantly from the nation's averages.

(OECD 1999) in a water demand study shows that significant water saving have been reported for U.S. communities switching from un-metered to metered consumption. For example, the city of leaven worth, Washington began metered billing in 1990, observing a 40% to 60% reduction in peak summer demand over first metered summer.

Another water demand study was conducted in Jordan in 2004 and found that the water tariff structure has helped in improving irrigation efficiency in the Jordan valley to 70% compared to 55% for the last decade (Arabiyat, 2005). The study also recommended a differential pricing structure on water quality based on crop response to water quality.

Renwick and Archibald (1998) estimate water demand elasticities by income quartile in Southern California communities, using data collected over a six year period and these estimates to the

distributional implication of price and non price water conservation policies. Their results show that low income households are more responsive to price than high income households indicating that low income households contribute a greater fraction of the cities aggregate savings than the high income households.

Mansur and Olmstead (2006), examined the distributional impacts of various demand management policies in a study of 11 North American cities. They used residential water consumption data to generate demand curve estimates for the residential water both indoors and outdoors and simulated the effect of a two-day per week outdoor watering restriction and the effect of a price increase that would result in the same aggregate consumption reduction as the prescriptive policy. The consumption share of households above the sample median income and lot size would rise from 35 to 48 percent and the consumption share for households below median income and median lot size fall from 23 to 16 percent. Thus, raising price to reduce consumption would cause a greater consumption reduction for low income than high income households.

A Willingness to Pay (for water) study was conducted by Okoli (2003), using Contingent Valuation Method and Meta regression analysis. The result shows that households are served with some form of price discrimination. The results are sensitive to the spatial dispersion of income classes in the model villages.

Whittington, et al. (1991) in a study of water vending and willingness to pay for water in Onitsha found that installing meters and charging a price for water which covers the full costs of supply

is one means of preventing a situation of water wastage. According to the study, if the water authority charges a flat rate, households with connection offer households without connection access to their tap. Such an arrangement in which a household with a tap and flat rate is supplying many households can represent a serious loss of revenues to the water authority and results in demand that exceeds system capacity.

For non price demand management and conservation programs, a number of empirical studies have analyzed this approach which include the analysis of the effect of conservation programs on aggregate water district consumption. The study found small but significant reduction in total water use attributable to landscape education programs and watering restrictions, but no effect due to non landscape education program, low flow fixture distribution, or the presentation of drought and conservation information on customer bills (Corral,1997).

James (2009), in a water demand management study in Selangor offers recommendations regarded as useful and practical and suitable for implementation within the existing institutional and legislative framework. The study reveals that by 2020, the proposed measures can reduce the total demand of water by around 20% as compared with a scenario without demand management.

Alayande (2006) showed that, water demand management in Nigeria presents better tools to optimize sectoral performance before sourcing for new water for development and thereby allow for prioritizing investment in the water sector. It also ensures sustainability of quality water services and a good return of investment in the sector. Nigeria would benefit tremendously from

implementing water demand management strategies and it will serve as a focal point towards achieving the goal of provision of safe and portable water.

From the reviewed literature, it has been found with strong empirical evidence that using demand management is more efficient and more cost effective than water supply management strategies. Estimates of the water savings attributed to non price demand management policies such as watering restrictions and low fixture, subsidies was from zero to significant saving. However, price based approaches have been found to have advantages in terms of compliance, monitoring and enforcement. It is imperative to note that despite growing demand for water that is outstripping supply, there are very few empirical researches conducted on water demand management in Nigeria. Most of the work concentrates on supply side calling for increase in supply of water to meet the growing demand and are based on conceptual issues. This research work will therefore focus on the demand side to empirically examine the impact of pricing on water demand management and conservation in Kaduna State a case study of Sabon Gari LGA. In fact, this is a gap this study has attempted to fill.

2.4 PRICING POLICIES FOR EFFECTIVE WATER DEMAND MANAGEMENT

2.4.1 FULL COST PRICING OF WATER

Price of water in the context of this study is the amount of money paid for water use that is set by the political and social system to ensure cost recovery, equity and sustainability. The price may or may not include subsidies. Prices for water are not determined solely by cost. The problem

faced by the water sector is that prices and tariffs are almost universally below the full-cost of supply. This means that almost everywhere, there are large inefficiencies in the water sector and that water prices need to be raised. The recent World Water Commission strongly endorsed the need for full-cost pricing of water services: Commission members agreed that the single most immediate and important measure that we can recommend is the systematic adoption of full-cost pricing of water services (World Water Commission, 2000). Unfortunately, there is some ambiguity on the exact definition of full-cost pricing. Here, we use the definitions given by Rogers, Bhatia, and Huber (1998) for full-cost pricing of water services. That paper shows the relationships between full-supply cost, full-economic cost, and full-cost. They also provided definitions of the value-in-use of water services showing the relationship between economic value and full-value. In addition to cost and value, the third parameter needed for implementation of water price policy is the tariff, or price, to be charged for the water service. Unfortunately, the literature on water pricing often confuses costs, value, and price. For a clear policy analysis it is important to keep these three concepts distinct.

Full supply cost includes capital charges and O & M costs. Full economic costs include full supply costs as well as opportunity cost and economic externalities. When water prices are lower than the cost of supply, consumers tend to use water inefficiently and this discourages maintenance, improvements, and expansions in the distribution system (Strand, 2000) in Okoli (2003). This in turn leads to irregular water supply and generally poor service. Very often, the tariffs do not even meet the full supply costs, and sometimes the value of water is lower than the cost of supply (Rogers, 2002) in Okoli (2003).

There are several elements of a tariff or pricing structure. These include: a connection or fixed charge, a volumetric charge, block charge, and a minimum charge. Several countries use a combination of these elements, depending on the specific situation and characteristics of the city, utility and behavior of customers (Rogers, 2002) in Okoli (2003). The public or administrative pricing, two-part tariff system and increasing block tariff structure are popular combination.

2.4.2 PUBLIC (ADMINISTRATIVE) WATER PRICING

Because of the public good aspects of water, many governments in developing countries decide to allocate, distribute and price water for households. This mechanism tends to promote equity objectives and does not always reflect demand and supply considerations. It attempts to protect the poor, and provide a basic needs level of water to meet minimal requirements. Allocation rules in this case are based on individual requirements, equal shares in available water volumes, or based on political pressure. Certain aspects of water activities, such as control of waterborne diseases, are local public goods, and cannot easily be charged on the basis of individual use.

The pricing systems usually adopted under administrative pricing schemes are the minimum charge, flat-rate or fixed charge system because these schemes are easier to manage and easy for users to understand. The disadvantage of public water pricing is that, prices do not represent either the cost of water or its value to the user. That is, prices are not reflective of either marginal costs or average costs. As a result, it can be misused or wasted, because this system does not provide incentives for people to conserve water and improve use efficiency.

2.4.3 INCREASING AND DECREASING BLOCK TARIFFS (IBT AND DBT)

While block tariff methods of pricing have foundations in basic needs and equity considerations, elements of economic efficiency also exist because they are based on the principles of marginal and average cost pricing. An allocation which equates water's unit price or marginal value of water with the marginal cost is considered an economically efficient or socially optimal allocation of water resources (Dinar, 1999) in Okoli (2003). The marginal cost (MC) pricing mechanism targets a price or marginal benefit for water equal to the marginal cost of supplying the last unit of that water.

IBTs and DBTs set two or more prices for water, with each price applying to consumption within a defined block. Prices for IBTs rise in each successive block. Usually in relatively poor areas, the first block price is below cost to cover water provision of basic needs. Beyond this initial level of consumption, the household must pay an increasing per unit price for the additional consumption until it reaches the end of the second block, and then it has to pay an even larger price. But in these poor areas, a significant proportion of households do not have access to private metered connections and so they do not benefit from this subsidization scheme.

2.4.4 TWO-PART PRICING TARIFF

As the name suggests, this system is made up of two parts: a fixed element and a variable element. The fixed element is essentially a sign up or membership fee which may vary according to some characteristics of the user. This is similar to the standard structure for fitness and athletic

clubs. The variable element is based on the volume of water used and it often uses AC pricing. One advantage of the two-part tariff system is the stabilized revenue base it affords the supplier. The fixed element protects the supplier from demand fluctuations and reduces financial risks. It gives the service provider a reliable stream of revenue to cover overhead expenses (Dinar, 1997) in Okoli (2003). The variable element charges the consumer according to his consumption level and therefore encourages efficient use and conservation of water (Rogers, 2002) cited in Okoli (2003).

2.4.5 EFFECTS OF PRICING POLICY

The best tariff design is one which strikes the most desirable balance among the objectives that are important to the community (Boland, 1997) in Peter etal (2001). Consumers and suppliers have different expectation of water tariff. Consumers like high quality water at affordable and stable prices while suppliers like to cover all costs and have a stable revenue base. Water fees can be expected to generate revenue, improve welfare and equity (Potter, 1994) in Peter etal (2001). Thus, pricing policy has the following effects:

(a) Increased price, reduces demand

(b) Increased prices, increase supply

(c) Increased price, facilitates re-allocation between sectors

(d) Increased prices, improve managerial efficiency due to increased revenues

(e) Increased prices, lead to sustainability

(f) Increased prices, reduce the per unit cost of water to poor people

2.5 NIGERIA'S NATIONAL WATER RESOURCE POLICY

The national water resources policy 2004 process reflected other international development, such as the understanding that the support of policy development, institutional reform, and capacity building are as important as capacity development project and that in order to increase the prospects for water and food security, special emphasis should be given to conflict prevention and resolution. The water resources have the vision of optimizing the use of Nigeria's water resources at all times. This represents the challenge of carefully balancing water uses and water protection through a regulatory system of river basin based management and regulating allocation of water.

Moreover, various statutory laws such as; Decree No. 1 of 1993, Mineral Act of 1990, NIWA Decree of 1997, RBDA of 1990 and State Water Edicts are among the several efforts put in place for the development and management of the nation's water but water shortage is still acute (KADSEEDS, 2007). The desire to improve access to water resources is becoming more and more elusive because of the rapidly increasing demand for water. The rise in demand that is outstripping supply is consequent on high population growth rate coupled with increasing urbanization and rising living condition as a result of economic growth (National Water Policy, 2004).

The importance of achieving the right balance between stakeholders based management and enforcement is through for example; developing subsidy and incentive systems rather than

focusing on penalties such as legal action for permit contraventions and the denial of permits. The Nigerian national water policy is guided by the following principles:

a. The water policy shall be subject to and consistent with the constitution in all matters.
b. All water wherever it occurs in the water cycle is a national asset and resource common to all, the use of which shall be subject to national control.
c. The objective of managing the quantity, quality and reliability of the national water resources is to achieve optimum long term environmentally sustainable social and economic benefits for society from their use.
d. There should be no ownership of water but only a right or an authorization for its use.
e. The planning and management of Nigeria's water resources shall take place within a framework which facilitates awareness and participation among all users at all levels.
f. Water resources shall be assessed, developed, apportioned and managed in such a manner as to enable all users to have equitable access taking into account the sustainability of the resources.
g. Water quality management options shall include the use of economic incentives and penalties to reduce pollution.
h. The operational management of water resources and services shall be decentralized to the lowest practicable level.
i. International water resources, specifically shared river systems shall be managed in a manner that optimizes the benefits for all parties in a spirit of actual-co-operation.
j. Beneficiaries of the water services shall contribute to the cost of its establishment and maintenance on an equitable basis.

k. The resource base shall be protected against any kind of pollution. The protection measures shall be based on both regulatory and market based approaches to waste management applying the pollute pay's principle.

For the purpose of improving water related environmental conditions, abstraction fees for raw water shall be charged for the commercial use of it.

2.5.1 WATER RESOURCES DEVELOPMENT AND MANAGEMENT IN NIGERIA

Government programs in the water sector have been centred on water resources development while proper management and conservation of the resource is not given adequate attention. The previous approach to water resource development and management involved treating water as a public social good. It is centralized and entails top down, command and control mechanisms. There have been numerous activities in the area of water resource development in dam construction, urban water supply, irrigation and power generation. Each of these subsectors has developed water resources without adequate consultation with other stakeholders and has resulted in underutilization of the facilities provided. This also results in a vicious cycle of unreliable projects that provides services which do not meet consumer needs and for which the consumers are unwilling to pay

The institutional arrangement for water resources and management in Nigeria is such that all tiers of governments are involved. To boost manpower supply for water resources' sector the National Water Research Institute (NWRI), Kaduna was established in 1979. By 2004, the

Institute had trained a total number of 805 officers of States' water agencies. The operation and maintenance of water infrastructure has been very poor. During its 16th meeting in Asaba in 2002, the National Council on Water Resource set up a national committee to recommend ways and policy initiatives to address the problem in order to make the water resources infrastructure sustainable.

The poor performance of public utility services in Nigeria has been a subject of considerable discussion. Efficient provision of reliable electricity, telephone, water, and transport services has remained elusive in the Nigerian economy especially since the oil boom years of the 1970s. In fact, in recent years, the problems in the sector have reached crisis proportions as the electricity power system collapse became prominent and power supply has become increasingly erratic. Water taps also remain dry for most of the time, while the performance of telecommunication and postal services remain very unsatisfactory.

In response to these shortages, many businesses and households have resorted to self provision, often at high cost. For example, one study of 179 Nigerian manufacturers by Lee and Anas (1996) in Okoli (2006) revealed that 92 percent of firms surveyed owned electricity generators, substantial self-provision of utility is also the norm for low-income consumers and 44 percent had boreholes to assure their own private water supply. According to National Bureau of Statistics (2009), only 7.7% of households have access to Pipe borne water treated, 1.1% Pipe borne water untreated, 28.4% Borehole/Hand Pump, 14% Well Spring protected, 17.5% Well Spring unprotected, 0.5% rain water, 27.1% Stream/Pond/ River and 3.2% Tanker Truck Vendor. Relief from the failure of public providers often comes through the informal sector. The best-

known examples are private water vendors who use trucks or smaller receptacles to haul water either for distribution at central locations or to individual dwellings.

In some places, private vendors served 90 percent of households, and in several places purchases of water from private sources amounted to more than 30 percent of household income. It is important to note that a very large proportion of poor households cannot afford the cost of water from these private sources and has to resort to drawing water from streams and other unhygienic sources. It is against this background that agitation has mounted for private sector involvement in the provision of utility.

2.5.2 MANAGEMENT STRATEGIES OF WATER RESOURCES IN KADUNA STATE.

In Kaduna State, the Water Board and the State Ministry of Water Resources are the main agencies responsible for water supply. The Water Board supplies portable water to urban and towns and Ministry of Water Resources takes care of semi-urban and rural areas. Semi urban water supply schemes are operated by the local government councils. The State government constructs, commissions and hands over the schemes to the respective local government councils for operation. Maintenance of the scheme is tripartite in approach between the State government, local governments and benefiting communities. Available records show that less than 20% of the inhabitants of these areas have access to portable water. Rural water supply is catered for through the sinking of boreholes concrete and hand dug wells etc.

Urban water supply operation and maintenance is being commercialized, it is sustained through pricing by fixing tariff to defray operational expenses. This is an important step towards relieving government of its financial burden. Water supply was hitherto concentrated in urban and rural areas to the neglect of small towns known as semi-urban areas. In addressing this neglect, the State government fashioned out, as a matter of priority a semi-urban water supply program for the provision of portable water in all local government council headquarters.

Rural water supply is catered for through the sinking of boreholes, concretes and hand dug wells etc. there are a total of 1667 boreholes constructed by the Ministry of Water Resources covering all the 23 LGAs. To ensure effective maintenance of the boreholes, a standard mechanical workshop has been constructed to provide training to village-based workers for maintenance of the hand pumps. The rural water supply department has seven zonal offices charged with the maintenance and supervision of these boreholes.

In addition to the above, Kaduna State government set the following targets to achieve: 50% service coverage by 2007, 70% service coverage by 2011, 100% service coverage by 2015, provide minimum service level of 120 liters per capita day(lpcd) for urban areas, 60lpcd for semi urban and 30lpcd for rural dwellers. To achieve these targets the State government uses the following strategies to manage water services:

a. Creating public enlightenment on water conservation and payment of water rate to change consumers' attitude.

b. Charging some nominal fees to enhance operation and maintenance of semi-urban and rural water supply schemes.
c. Monitoring and evaluating water supply schemes.
d. Establishment, control and management of water schemes consisting of dams, water works, distribution system for urban water supply for the purpose of providing water to meet the requirements of the general public, agriculture, trade and industry in the state.
e. The state government will intervene so as to prevail on PHCN to charge concessionary tariff for water to minimize high charges to the water boards.
f. The state government will intervene towards recovery of huge arrears of water bills from military, police and federal institutions.
g. While protecting the low income government considers the privatization of the production, distribution and sale of treated water in order to enhance efficiency in all respect.
h. Speeding up of Zaria water supply expansion project through the collaborative effort of the state government, Federal and the World Bank.

2.5.3 STRUCTURE OF KADUNA STATE WATER BOARDS (KSWB)

KSWB is headed by a Chairman and 12 other members constituting the Board of Directors, who make policies, ratify appointment and endorse operational budgets. The management committee comprises the General Manager assisted by 7 Assistant General Managers. There are 15 branches spread across Zaria, Ikara, Birnin Gwari, Zonkwa, Kafanchan, Kwoi, Saminaka and Kagoro each headed by a manager who report to the General Manager. There are also 12 water works in the

State. On the average, KSWB by 2007 collected revenue of 40 Million Naira per month and the revenue is used to pay salaries, pay electricity bill and purchase chemical for treating water.

From the foregoing discussion, it can be seen that the State government through the Ministry for water Resources and the Water Boards regulate and fix the price to be charged (public/administrative pricing policy). It should therefore be noted that this type of pricing policy does not reflect the cost of water and its value to the users of water which can create enormous waste of the vital resource.

However, the move towards more integrated demand and supply approach takes a great deal of time, effort and commitment and is currently backed by key players at many levels in the institutional and political spectra (WMO/DIFD/UNISCO, 1999). Demand management approach differs from supply-oriented approach by placing more emphasis on social and economic uses to which water is put. When used with current water supply management approaches, water demand management offers the prospect of greatly improved water management in comparison to its present status. Besides efficiency, it should promote equity and environmental integrity. Demand management is another approach to water resources management that contrasts with the traditional supply management, aimed at increasing the supply whatever the demand. It differs from supply management in that it targets the water user than the supply of water to achieve more desirable allocations and sustainable use of water. Apart from structural measures (such as low flush toilets, leak detection and control systems in water distribution networks, and drip irrigation in agriculture) demand management strategies mainly consist of non-structural

measures: economic and legal incentives to change the behavior of water users and the creation of the institutional policy environment that enables this approach.

CHAPTER THREE

RESEARCH METHODOLOGY

3.1 BACKGROUND INFORMATION ON KADUNA STATE

Based on the annual growth rate of 3.2%, Kaduna State population is estimated at 5,775,203 million in 2005 as against 3,935,618 in 1991, making it the third most populous State in Nigeria. These figures show that the state is under siege of population outburst with majority of the people living in towns and semi-urban areas, putting pressure on the limited urban resources and infrastructure in the areas (KADSEED, 2007). Major rivers in Kaduna State include; River Kaduna, River Kogum, River Gurara, River Wonderful and River Galma among others. The channels for making water available in the state are: The pipes borne treated water (21.1%), pipe borne untreated (2.6%), pipe well water (2.6%), unpipe well water (2.6%), stream water (60%), and missing cases (1.5%). There are five existing dams built and owned by the state government mainly for water supply and limited irrigation. These are:

a. Kangimi dam of 58.5 million a cubic meters for Kaduna town
b. Shika dam of 15.3mcm for Zaria water supply.
c. Bagoma dam of 3.9mcm for Birnin Gwari dam.
d. Gimbawa dam of 3.0mcm for Ikara town
e. Saminaka dam of 0.5mcmc.

The state experiences a typical tropical continental climate with two distinct seasons, the dry and rainy seasons. However, in Kaduna State, the seasonality is pronounced with the cool to hot dry season being longer than the rainy season. The wet/rainy season is usually from May to October and varies as one moves northwards. It is very much heavier in the Southern parts which have an average of over 1524mm than the Northern parts which have an average of 1,016mm. On the average, the State enjoys a rainy season of about six months. During the wet season, the grasses and leaves are green and fresh while during dry season they wither and die. This is caused by high evaporation, which creates water shortage problems.

Table 3.1: Average monthly and Yearly Climate Indices in Kaduna State.

Parameters	**Year Average**
Average Rainfall (mm)	1,272.5
Humidity (%)	56.64
Daily Wind Speed (Knot),	176.12
Average Daily Min Temp. (C)	15.1
Average Daily Max Temp. (C)	35.18

SOURCE: KADSEEDS, 2007.

In 2007, the total demand of water in Zaria comprising Zaria and Sabon Gari LGAs was 198mld, this indicates that the demand already exceeds the water during that year. Current approaches towards water resources management tend to be "supply driven"; meaning that whenever there is a shortage, the solution usually involves the capital investment in new water supply projects.

This section of the research presents a sequential of the research procedure. In Kaduna State, the Water Board and the State Ministry of Water Resources are the main agencies responsible for water supply. The Water Board supplies portable water to urban and towns and Ministry of Water Resources takes care of semi-urban and rural areas (KADSEEDS, 2007).

3.2 SOURCES OF DATA

Two main sources of data (primary and secondary) were used for this study.

a. **Secondary data**

Secondary data were sourced which include data on water demands, water price, water policies and so on. These were obtained from the Water Boards, the Ministry of Water Resources, other relevant agencies and other sources that are available.

a. Primary data

For this research, a primary source of data collection through administration of questionnaires was used. The justification for the use of this method is because the method provides enough basis for determining facts where a representative sample is used as the data that will be generated are directly obtained from those directly affected by the different reforms (Abiola and Adeyeye, 2006).

The Questionnaires were used to analyze the attitude of users of water and the effectiveness of the current pricing policy on water demand management in Kaduna State. These methods are useful when an organized and well planned study is made across a large number of people or large department in an organization. The questionnaires were administered to water users (residential water users) and water suppliers from the water providing institutions like official of the Ministry of Water Resource Kaduna State and Water Boards. It is important to note that secondary data on households' water use and socioeconomic characteristics are not available; as such we had to rely on primary data collection.

3.3 SAMPLING AND SAMPLING DESIGN: DETERMINATION OF SAMPLE SIZE

The target population of the study comprises domestic users of water. Available record found in the study area show that there are 3900 domestic users. This total therefore forms the size of population under study. To determine the sample size, we used the following formula to compute the value which was developed by Yamane (1967) and stated as follows: n = $\frac{N}{1+N(e^2)}$ where N=population size, e is the level of precision and n is the sample size.

From the above, N=3900, 95% confidence level implies that the level of precision e=0.05

Thus, $n = \frac{3900}{1+3900(0.05^2)}$

$= \frac{3900}{1+9.75}$

$= \frac{4094}{10.75} = 362.8 \approx 363$

The study has adopted a probability sampling techniques (Systematic Random Sampling Technique in which the sample is divided among the eleven wards of the case study area) for the water users. Also, a sample of 20 staff was used for the staff of Water Boards in which 10 staff were drawn from the Sabon Gari Division and 10 staff from Samaru Division. Sample size should match the anticipated analytical technique. Thus, a sample size of 200-500 is adequate for rigorous analyses such as multiple regressions, analysis of covariance or log linear analysis (Eric, 1998). This implies that the sample size of 363 is adequate for this study.

3.4 ANALYTICAL TECHNIQUES

3.4.1 THE CONTINGENT VALUATION APPROACH (CVA)

A study in Australia undertaken in1987 approached the problem of estimating the value of water and its price elasticity of demand using Contingent Valuation Methodology (Thomas and Syme, 1988). This study will therefore adopt the contingent valuation approach in order to determine based on the responses to the questionnaires that will be administered, the willingness of the households to buy water as the price increased. This approach is carried out to determine the values of goods which are not bought or sold in the market by setting up a situation where respondents are asked how much they will be willing to pay for the non market commodity contingent upon a market being created. Thus, this will provide data on consumers' responses contingent upon price increases for water, so that the price elasticity could be estimated. This will also help in making comparison between the results of this research and the results obtained from other studies undertaken to determine the price elasticity of demand for water. CVM.s

application to water problems in developing countries has been dominated by the work of Whittington etal (1991).

Many more studies have been conducted to determine the usefulness of this method in developing useful estimates for water services in developing countries. These include: Smith etal (1991), Boadu (1992) in Okoli, 2003. Others in this growing field of study in developing countries are: Reweta (2001). Water project designers have sought and extensively used CVM to estimate willingness to pay prior to project design and implementation (Goldblatt, 1999) in Okoli, 2003. Establishing what households are willing to pay would enable policy makers to plan future investments, keeping in mind what consumers want and thus move towards financial sustainability of projects (UNDP, 1999).

The use of Contingent Valuation approach for this study is because of the absence of a readily available database for exogeneous and endogeneous variables in the study area that will enable the researcher use an econometric approach. The questionnaire will be divided into two parts, the first part will consist of water usage profile for different households in the study area. This information is necessary in order to establish the second part of the questionnaire which will provide data on consumers contingent upon price increases of water so that the price elasticity can be estimated. CVM is the most comprehensive technique developed so far for measuring willingness to pay and it is preferred by economists because of its more rigorous theoretical basis. It can measure willingness to pay in a range of alternative scenarios, enabling policy makers to assess, for example, whether people are willing to pay for improved reliability, better quality or more hours of supply. It is based on hypothetical scenarios and so it can provide

estimates of willingness to pay for systems which do not currently exist, which the other techniques cannot obtain (UNDP, 1999), and it is assumed that an individual's response in the hypothetical market is the same as it would be in a real market (Smith, 1986) in Okoli, (2003).

3.4.2 THE CHI-SQUARE

As regards the first specific objectives, a nonparametric test chi-square was carried out to find out if the pricing policy has a significant effect on households' water consumption and to test whether there is significant difference in the quantity of water use among the various end users. The tool will also be used to measure differences in attitudes of households towards the current water rates. The study has also made use of cross tabulation and percentages for analyses. In general chi square (X^2) test is used to find out whether the results obtained from a sample are the likely ones on the basis of some theories or hypotheses. The sample result is termed actual or observed while the result suggested by the theory is called the expected ones. X^2 is defined as

$$X^2 = \sum_{l}^{n} \frac{(F_0 - F_e)^2}{F_e}$$

F_0 = Observed frequencies

F_e = Expected frequencies.

The X^2 method applies where it is possible to lay down certain standards, on the basis of which we can reject or accept a particular article. This method was used to measure differences in perception among water users via the responses obtained.

These techniques (Contingent Valuation and Chi-Square(X^2)) was used to show how all parts of the research work like sample, the programs , (water policies and strategies), the variables and the method of data collection work together to address the central research questions.

3.5 DEFINITION OF VARIABLES

The variables the researcher used in the questionnaires are as follows: Educational Attainment: This was used in order to examine the attitude of both the water users and water providers on the water pricing policy in the state based on their educational level. To find whether there is correlation between levels of education and satisfaction, willingness to pay, quantity of water use and so on. Also, this variable will help us have more valid and reliable conclusions.

Income: This is an important variable in this research so as to analyze water demand/use among different income groups. To find whether there is correlation between levels of income and satisfaction, willingness to pay, quantity of water use and so on.

Water Rates/price: To show the effects of water price on water demand and the variable captured the perception of consumers in terms of their willingness to pay as well as water providers towards the water rates in the state.

Household's Size: This was used to show the variability in households' size in relation with water use and water expenditure.

Connection: This was used to capture the views of the consumers with public water system connection (pipe borne) based on type of connection.

Water Use: This examined the quantities of water use by households in period of water supply and period of break in supply based on their levels of income. The variable also helped in examining consumers' attitudes towards water use.

Service Efficiency: Service efficiency was used in terms of stable and steady water supply. This variable was also used to ascertain the level of consumers' satisfaction.

Other important variables are: water expenditure by the consumers, rate of payment of water bills and billing period. These variables were used to determine consumers' expenditure on water in period of break in supply in comparison with the current water tariff paid per billing period.

CHAPTER FOUR

ANALYSIS OF DATA AND PRESENTATION OF RESULTS

4.1 INTRODUCTION

This chapter examines the data collected through administration of questionnaires. The data are presented and analyzed in order to answer the research questions. Two different questionnaires were administered to water users and the staff of the Water Boards. Hypotheses of this study are tested in this chapter based on which conclusions are drawn as to whether to accept or reject the null hypotheses.

Various techniques were used in the analysis which include: percentages, cross tabulation and Chi-square statistics. Also contingent valuation was used under which the consumers' (water users') willingness to pay for water contingent upon increase in price of water is analyzed.

4.2 ANALYSIS OF WATER USERS' QUESTIONNAIRE

The Questionnaire was administered to households' water users in Sabon Gari local government. Households were not selected using replacement as such the final number of households who responded to the questionnaire was slightly less than the sample size of 363 households selected randomly. Thus, 335 households responded to the questionnaires and about 28 questionnaires were not responded to indicating a non- response rate of 7.7%. The questionnaire is divided into five sections namely: Section A covers the socioeconomic characteristic, Section B covers water

usage profile and attitude of water users towards the current water tariff, Section C covering quality of service and water use efficiency, Section D covering private water supply and section C covers willingness to pay questions.

In Table 4.1 below, out of the 335 water users that responded to the questionnaire, 251 are between the ages of 18 and 43 representing 74.9% of the respondents, this indicates that most of the households are within the active age brackets. About 235 (70.1%) of the total respondents obtained certificates ranging from NCE/Diploma to Masters and above. The households' level of education has implication on how they manage water and about level of awareness of the pricing policy. About 66.3% of the respondents are civil servants or self employed while 61 (18.2%) of the water users sampled are unemployed. Majority of the respondents to the questionnaires live in high population density area representing 53.7% of the total respondents. 134 (40%) of the sampled water users belong to high income group while 146 (43.6%) belong to low and moderate income groups giving a fair representation of income groups. The percent of the respondents with single tap connection (only one tap in the compound) is 46.6%, 35.2% have full connection (more than one tap in the compound) while 18.2% did not respond to the question. Table 4.1 shows the above information representing the socioeconomic characteristics of the respondents.

TABLE 4.1:SOCIO-ECONOMIC CHARACTERISTICS OF HOUSEHOLDS

Age(in years)	**Frequency**	**Percentage**
18-30	105	31.3
31-43	146	43.6
44-56	52	15.5

More than 56	17	5.1
No response	15	4.5
Total	335	100
Level of Education		
No certificate	31	9.3
Prim/Sec	58	17.3
NCE/Dip	84	25.1
Degree/HND	107	31.9
Masters and above	44	13.1
No response	11	3.3
Total	335	100
Occupation		
Civil/public servant	166	49.6
Self employed	56	16.7
Unemployed	61	18.2
No response	52	15.5
Total	335	100
Area		
High pop. Density area	180	53.7
Low pop. Density area	141	42.1
No response	14	4.2
Total	335	100
House size		
3 or more bed room	98	29.3
1-2 bedroom	106	31.6
Single tap house	55	16.4
A and C	23	6.9
B and C	23	6.9
No response	30	9
Total	335	100
Income level		
Low income	60	17.9
Moderate	86	25.7
High	134	40
Others	9	2.7
No response	46	13.7
Total	335	100
Type of connection		
Single tap	156	46.6

Full connection	118	35.2
No response	61	18.2
Total	335	100

Source: Field Survey, 2011

In table 1 of appendix one, sixty percent (60%) of the respondents are not satisfied with **the current water tariff** representing 201 out of the 335 water users and their reasons are that the current water rate relative to the supply is high. Some respondents (27.1%) consider the water rate as too low or low while 36.7% consider the current water rate moderate and according to them water rate should not be higher than what is being paid presently after every billing period. The billing period is one month but bills are mostly sent after every two months. It is important to note that billing is based on the type connection as such for a single tap connection 400 naira is paid per month while 700 naira is paid for a full connection.

On whether **the service received is worth what is being paid per billing period**, 63.3% of the respondents indicated that the supply of water is not worth the value of the money they pay because some of them claimed that they did not get water for more than one month, some experience daily break of supply. Despite the above situation **the rate of payment of water bills** is fair as 64.2% of the sampled water users claimed they pay water rate regularly and even those that default payment (about 32.5%) claim that they do not get water for most of the times for that reason they would not pay for what they do not consume. As an indication of **inefficiency of the system**, more than 20% of the defaulters do not experience service disconnection for nonpayment and some of them about 4.2% have illegal connection meaning that their connections are not in record of the Water Board. Some of them also pay a certain sum of money to the staff of the Water Board instead of paying officially into the account of the Water Board.

Another issue of concern is **break in supply** in which 91% of the respondents confirmed they experience break in supply. Of this, 47.5% experience daily break in supply in which at times water is not available for the whole day. 20.9% and 22.1% experience break in supply weekly and monthly respectively. **Alternative sources of water** especially when there is no supply are well/river, boreholes , water vendors and other sources like water storage during rainy season. 47.2% have wells in their compounds, 16.4 % get water from boreholes, 29.3% buy water from water vendors while 2.4% and 4.8% represent other sources and no response respectively.

Success of any policy implementation cannot be achieved without proper monitoring and evaluation. **Monitoring and evaluation in the water service sector** is poor as 83.6% of the sampled water users indicated that the water board does not monitor consumers' satisfaction and also about 86.5% claimed that the Water Board seeks no feedback on the quality of water they supply. This may be one of the reasons why the respondents complain bitterly of water of poor quality (water with dirt and dust) which is not good for the health.

On the quantity of water use 18.5% and 23.9% of the water users use about 50litres per day in periods of supply and break in supply respectively. 30.7% and 28.7% use about 100 litres in both periods respectively indicating a fall in water use during period of break in supply. 42.7% and 37.9% use more than 100 litres day in the two periods respectively also indicating a decrease in water use between the two periods.

Most of respondents considered **the current water tariff** low, too low and moderate based on the assumption of stable, regular and efficient water supply representing 24.8%, 5.1% and 31.6% respectively. Only 28.6% considered the current water rate as high and 9.9% did not respond. To further confirm **the consumers' dissatisfaction**, 73.1% of them are in support of Public Private Partnership in water supply but only 43.3% are in support of government withdrawal (full privatization) for the fear of exploitation. They believe that private sector participation will bring competition and competition can ensure efficiency in supply with about 81.5% supporting this view. Some of the reasons are competition can lead to: minimization/reduction in wastage of water, appropriate price will be charged and based on water use, excess revenue for expansion and further investment in the water sector as well as provision of employment opportunities, increase in efficiency and productivity.

Looking at **pricing as an effective tool for water demand management**, 69% responded that pricing can be an effective tool but in contrast with this 65.1% assessed the current water tariff as being ineffective in water demand management. From the above it could be seen that there is significant difference in water use between the period of supply and when there is break in supply. Responses to these sections of the questionnaire are presented in Table 1 of Appendix 1.

4.2.1 WILLINGNESS TO PAY

This section presents analysis of consumers' willingness to pay contingent upon increase in water tariff provided there will be efficient, stable and regular water supply.

In the willingness to pay (WTP) questions for a single connection, 72.5% indicated willingness to pay even if the water tariff will be increased to 840 Naira from the current tariff of 420 Naira. 62.1% indicated willingness to pay if the tariff is higher than 840Naira. For the two questions only 17% and 28.7% indicated they would not be willing to pay.

In the willingness to pay (WTP) questions for a full connection, 71% indicated willingness to pay even if the water tariff will be increased to 1400Naira from the current tariff of 700Naira. 61.2% indicated willingness to pay if the tariff is higher than 1400Naira. For the two questions, only 20.3% and 29.9% indicated they would not be willing to pay. The responses for the willingness to pay questions are presented in the table below:

TABLE 4.2: WILLINGNESS TO PAY

Increasing price by 100% for single connection	**Frequency**	**Percent**
Yes(willing to pay)	243	72.5
No (not willing)	57	17
No response	35	10.4
Total	335	100
Increasing price by 100% for full connection	**Freq.**	**Percent**
Yes(willing to pay)	238	71
No (not willing)	68	20.3
No response	29	8.7
Total	335	100
Increasing price by more than 100% for single connection	**Freq.**	**Percent**
Yes(willing to pay)	205	61.2
No (not willing)	96	28.7

No response	34	10.1
Total	335	100
Increasing price by more than 100% for full connection	**Freq.**	**Percent**
Yes(willing to pay)	205	61.2
No (not willing)	100	29.9
No response	30	9
Total	335	100

Source: Field Survey, 2011

From Table 2 in appendix 2, the number of people in the households ranges between 1 and 40 people. Thus, on average the number of people in the sampled households is nine (9) and the standard deviation is six (6). This result shows a high variability in the size of households among the households surveyed. More detail on the above Table is given in Appendix 2.

As explained in the previous part, there is a significant difference in the quantity of water use by income groups in both periods of supply and break in supply. Based on the responses gathered, the quantity of water use (in litres) per day ranges between 50 and 500litres. Thus, the minimum and maximum quantities of water used among the different households surveyed are 40 litres and 500litres respectively. These data can be seen in Appendix 2. Table 2.2 represents quantity of

water used by different income groups in the period of water supply and from the data the average quantity of water used per day is 125litres per day and the standard deviation is ninety (90litres). This also shows a high degree of variability in quantity of water used among households.

For the quantity of water used by different income groups in the period of break in supply, the average quantity is 114litres per day and the standard deviation is eighty six (86litres). The minimum and maximum quantities are twenty five (25) and four hundred and fifty (450litres) respectively. From the two averages (in the two periods) there is reduction in water consumption during period of break in supply and this is because those without wells or boreholes in their compounds have to buy water from water vendors at high prices. Though the difference is not significant, it implies that price can be used to control water demand. There is no significant difference between the standard deviations of the two periods both showing high variability in water use.

The data on daily water expenditure in Naira from water vendors in times of break in supply shows that the expenditures range between 20Naira and 500Naira per day. From the data, the estimated average daily spending on water in times of break in supply is 108Naira per day. This implies that households' average monthly expenditure on water from the vendors stands at 3244.5Naira. This amount is over 7 times what is paid per month for a single tap connection and 4 times more than what is paid per month for a full connection. These averages indicate that if there will be efficient and stable public water supply, people would be willing to pay even if the

water tariff is twice or even three times the current water rate. However, the standard deviation is 88Naira indicating a high variability in the amount spent on water among households.

4.3 STAFF OF WATER BOARD'S QUESTIONAIRE

The questionnaire was administered to the staff of the Water Board in order to confirm some of the responses obtained from the water users' questionnaire. 20 questionnaires were administered and all were filled and collected. Ten of the questionnaires were administered in Samaru division of the Water Board and Ten in Sabon Gari division.

The twenty questionnaires were responded to by different cadres of staff who were administrators, accountants, clerical officers, technologists and technicians of which majority of them were educated with vast experience in their areas of work. Table 3 in Appendix 3 shows the cadres of staff and their personal information.

From the data obtained on motivation of workers, the data as presented in Table 3.1 of Appendix 3 using variables such as salary and condition of service, promotion, complete office equipment, standard facilities, regular payment of allowances, adequate health care facilities, clear policies on salaries and bonuses. It could be seen from the table that there is a weak motivational system. Also, from the researcher's interactions with some of the staff, the staff claimed that they were not paid their salaries for three months as at the time of the field work. They also did not receive their leave grants for over six years. In fact, this situation can discourage the staff from putting in their best and therefore their productivity must be adversely affected. It can also pave ways for corruption.

TABLE 4.3: STAFF'S ASSESSMENT OF THE CURRENT WATER POLICIES

Variables	Always		sometimes		Seldom		Never		total	
	F	%	F	%	F	%	F	%	F	%
Familiarity with the current water policies	7	35	5	25	7	35	1	5	20	100
The water policies are effectively implemented	2	10	4	20	6	30	8	40	20	100
The current water price encourages efficient use of water	4	20	4	20	5	25	7	35	20	100
The water price helps in improving water supply	4	20	3	15	5	25	8	40	20	100
Water users pay water bills regularly (as at when due)	2	10	3	15	7	35	8	40	20	100
Our organization depends fully on payment of water tariff for its revenue	6	30	6	30	7	35	1	5	20	100
Water tariff covers operation and maintenance (O&M) costs	3	15	3	15	8	40	6	30	20	100
Water tariff cover (O&M) costs and capital charges	3	15	3	15	7	35	7	35	20	100
Effectiveness of the current water pricing in WDM	2	10	2	10	11	55	5	25	20	100

Source: Field Survey, 2011

TABLE 4.4: MAJOR PROBLEMS FACING WATER SUPPLY

Variables	SA		A		D		SD		ND		Total	
	F	%	F	%	F	%	F	%	F	%	F	%
Inadequate funds	20	100									20	100
Inadequate staff	4	20	8	40	4	20	4	20			20	100
Lack of monitoring and evaluation	5	25	10	50	5	25					20	100
Lack of training	11	55	7	35	2	10					20	100
Low awareness	7	35	8	40	5	25					20	100

Poor attitude to payment of tariff	11	55	6	30	2	10	1	5			20	100
Worn out/old	10	50	8	40	1	5	1	5			20	100
Irregular power supply	14	70	6	30							20	100
Corruption	6	30	4	20	1	5	7	35	2	10	20	100
Politics	11	55	8	40	1	5					20	100

Source: Field Survey, 2011

From table 4.3, in terms of familiarity with the current water policies, 35% of the respondents are always familiar with the policies, 25% and 35% are sometimes and seldom familiar with the policies respectively. We can therefore deduce that workers to some extent are conversant with water policies. Majority of the respondents amounting to 70% indicated that the policies are either seldom or not effectively implemented with only 10% indicating effective implementation. This goes in line with the responses of the water users about the effectiveness of the water pricing policy.

According to the sampled staff, the current water tariff does not always encourage efficient use of water as only 20% of them claimed that the tariff encourages efficient use of water. The current water tariff does not always improve water supply as only 3 sampled staff claimed so but 7 (35%) claimed otherwise while 25% claimed that it seldom does. This also supports what has been found from the water users and shows that the current water tariff does not always control water use or does not prevent wastage of water.

On the issue of payment of water bills, the situation is alarming because 75% of the staff indicated that water users do not pay water bills regularly. This situation has led to a serious

shortage of funds for operation and maintenance. It is also important to note that the operation of the Water Board is dependent upon payment of water bills.

It was also found that the tariff does not even cover operation and maintenance cost let alone the supply cost. 70% of the respondents indicated that the tariff does not cover operation and maintenance cost. We can conclude with strong evidence and confidence that the current tariff does not cover the full supply cost of water. Also, looking at the effectiveness of the current water tariff in water demand management, we can deduce from the responses that it is not effective as shown in Table 4.3.

The Table 4.4 presents the major problems facing the water supply system in Sabon Gari local Government and Kaduna State in general. Inadequate funds for operation and maintenance is strongly agreed to be a major problem by 95 all the sampled staff, inadequate staff was strongly agreed or agreed by 60% of the respondents, lack of monitoring and evaluation was agreed by 55% and strongly agreed by 25% of the respondents and lack of training of staff was agreed and strongly agreed by 35% and 55% of the respondents respectively.

Worn out equipment and old and damaged pipes constitute another problem with 40% and 50% of the respondents agreeing or strongly agreeing respectively. Irregular and unstable power supply was strongly agreed by 70% of the respondents as one of the major problems and 30% of them also agreed in the same way. Corruption is also a problem but was considered a minor problem because less than 50% of the respondents agreed that corruption by the staff of the water board hinders efficient water supply but from experience and responses of the water users, there

is a strong evidence that corruption constitutes a problem since some water users connive with some staff to default payment of water bills and the situation creates a serious loss of revenue to the water institution. Political interference has been strongly agreed or agreed by 95% of the respondents.

Other problems are on the part of the consumers which include: lack of awareness of the various conservation programs which was agreed and strongly agreed by 40% and 35% respectively. Nonchalant attitude towards payment of water bills was agreed and strongly agreed by 30% and 55% of staff in question.

4.4 HYPOTHESES TESTING

The hypotheses of the study were tested by the use of percentages, cross tabulation and Chi-squares. Cross tabulation displays the relationship between two or more categorical (nominal or ordinal) variables. The size of the table is determined by the number of distinct values for each variable with each cell in the table representing a unique combination of values. The Chi-square tests procedure tabulates a variable into categories and computes the statistics. This test compares the observed and expected frequencies. For this studies a number of variables were used such as: level of satisfaction and level of education, satisfaction and income groups, quantity of water used and income groups, assessment of pricing policy and level of education, assessment of the current water tariff and level of education, willingness to pay and income groups, willingness to pay and level of education, and willingness to pay and types of connection.

Table 4.5: Satisfaction with the current tariff by level of education

	Education						Total
	No res	No Cert.	Pri/Sec	NCE/Dip	Degree/ HND	Masters & above	
Satisfaction no resp	4	0	1	3	1	2	11
Yes(satisfied)	7	7	20	24	45	20	123
No(not satisfied)	0	23	37	57	61	22	201
Total	11	31	58	84	107	44	335

Source: Field Survey, 2011

Pearson chi-square =57.4, df =10

Likelihood ratio =40.9, df =10

Linear by linear association =0.100, df =1

Level of education and satisfaction: These variables are cross tabulated to show the level of satisfaction with the current water tariff by level of education. From table 4.5, out of the 335 respondents, 201 show their dissatisfaction with the current water rate. Of the 201respondents, 57, 61 and 22 respondents are NCE/Dip, Degree/HND and Masters Graduates respectively. Also, to test for differences in the level of satisfaction by level of education, the value of the chi-square is 212.083 showing differences in the level of satisfaction, it also shows a strong correlation between level of education and level of satisfaction and in this case the null hypothesis is rejected.

Table 4.6: Level of Satisfaction by Income Groups

		Level of income					Total
		No response	Low	moderate	High	Others	
Satisfaction	no response	11	0	0	0	0	11
	Yes(satisfied)	35	60	28	0	0	123
	No(not satisfied)	0	0	58	134	9	201
Total		46	60	86	134	9	335

Source: Field Survey, 2011

Pearson chi-square =309.4, df =8

Likelihood ratio =367.8, df =8

Linear by linear association =234.3, df =1

Table 4.6 shows that majority of the water users surveyed are not satisfied with the current water rate. None from the high income group is satisfied with the current water rate. 134 households represent the high income group and all of them show dissatisfaction. Of the 123 households that are satisfied, 60 of them are from the low income group, 28 and 0 from the moderate and high income groups respectively. The value of chi- square which is 234.3 shows a significant difference in the level of satisfaction with the current water tariff among income groups and indicates correlation between satisfaction and income level as such the researcher is able to reject the null hypothesis

Table 4.7: Quantity of water use (period of supply) by income group

Qnty of water use in period of supply	Income groups					Total
	No response	Low	Moderate	High	others	
No response	9	3	7	6	0	25
50 litres	11	11	21	18	1	62
100litres	16	26	28	30	3	103
More than 100 liters	10	20	29	79	5	143
Others	0	0	1	1	0	2
Total	46	60	86	134	9	335

Source: Field Survey, 2011

Pearson chi-square = 40.2, df =16

Likelihood ratio =39.4, df =16,

Linear by linear association =22.8, df =1

Income and quantity of water use in period of supply: These variables are cross tabulated in table 4.7 to show the quantity of water use among different income groups when water is available in the taps: The crosstab shows that high income group use more water than low and moderate income groups. This is because out of the 143 respondents that use more than 100litres per day, 79 of them belong to the high income group. The value of the chi-square test (40.2) shows a significant difference in the quantity of water used among different income groups and there is correlation between income and quantity of water use. Based on the results the researcher is able to reject the null hypotheses in the second hypothesis that that there is no significant difference in the quantity of water use among the various households' water user.

Table 4.8: Quantity of water use (period of break) by income group

Qnty of water use in period of break	Income groups					Total
	No response	Low	Moderate	high	others	
No response	8	3	8	7	0	26
50 litres	13	15	32	18	2	80
100litres	9	23	23	39	2	96
More than 100 liters	16	17	21	68	5	127
Others	0	2	2	2	0	6
Total	46	60	86	134	9	335

Source: Field Survey, 2011

Pearson chi-square =38.9, df =16

Likelihood ratio =39.4, df =16

Linear by linear association =11.5, df =1

Income and quantity of water use in period of break in supply: these variables are cross tabulated in table 4.8 to show the quantity of water use among different income groups in period of break in supply. Even in period when there is break in supply, high income group uses more water than those within low and moderate income groups with 68 out of the 127 respondents use more than 100 litres per day. Also, the chi-square test presents a similar result which is 38.9 meaning that there is significant difference in the quantity of water used by different income groups. This result also shows that there is a significant difference among water users as such the null hypothesis is rejected.

Table 4.9: Assessment of pricing policy by level of education

Pricingeffective tool	Levels of education						Total
	No resp.	No cert	Prim./sec	NCE/Dip	Degree/HND	Masters&above	
No resp	4	5	5	11	10	4	39
Yes	5	17	37	55	85	32	231
No	2	9	16	18	12	8	65
Total	11	31	58	84	107	44	335

Source: Field Survey, 2011

Pearson chi-square =19.0, df =10

Likelihood ratio =17.3, df =10

Linear by linear association =0.2, df =1

Education and pricing as an effective tool: These variables are cross tabulated to show if pricing policy can be an effective tool for water demand management based on educational levels. From table 4.9, 55, 85 and 32 totaling 172 of the 231 that accepted pricing as an effective tool, are educated ranging from NCE/Dip, Degree/HND and Masters Holders. The value of the Chi-square test (which is 19.0) show a significant differences in the way the respondents perceive pricing policy as a tool for demand management and their perceptions have correlation with their levels of education.

We can accept that based on the above result that, pricing policy can be an effective tool for water demand management. Thus, since majority of the respondents accepted that pricing can

effectively be used for water demand management, the researcher therefore rejects the null hypothesis in hypothesis one.

Table 4.10: Assessment of the current water tariff by level of education

Tariff	Levels of education						Total
	No res	No cert	Prim/sec	NCE/Dip	Degree/HND	Masters & above	
No resp	4	4	11	23	19	4	65
V.effective	0	1	2	8	7	3	21
Effective	2	1	4	13	9	2	31
Ineffective	5	18	31	29	55	24	162
Highly ineff	0	7	10	11	17	11	56
Total	11	31	58	84	107	44	335

Source: Field Survey, 2011

Education and effectiveness of the current tariff: These variables are cross tabulated in Table 4.10 to assess the effectiveness of the current water tariff based on levels of education and presented in the Table 4.10. The Table shows that majority of the respondents assessed the current water tariff as being ineffective especially those with higher certificates (29, 55 and 24 NCE, degree and masters holders) and this can increase one's confidence and reliance on the responses. This conforms to the finding above that 65.1% of the total respondents assessed the current tariff as ineffective in water demand management in the study area (Sabon Gari) which can be a good representation of Kaduna State.

Table 4.11 Willingness to Pay 1 by Income Groups

		Level of income					Total
		No response	Low	moderate	High	Others	
WTP1	No response	35	0	0	0	0	35
	Yes(satisfied)	11	60	86	86	0	243
	No(not satisfied)	0	0	0	48	9	57
Total		46	60	86	134	9	335

Source: Field Survey, 2011

Pearson chi-square =354.8, df =8

Likelihood ratio =290.6, df =8

Linear by linear association =164.8, df =1

Table 4.12: Willingness to Pay 2 by Income Groups

		Level of income					Total
		No response	low	moderate	High	Others	
WTP2	No response	29	0	0	0	0	29
	Yes(satisfied)	17	60	86	75	0	238
	No(not satisfied)	0	0	0	59	9	68
Total		46	60	86	134	9	335

Source: Field Survey, 2011

Pearson chi-square =321.9, df =8

Likelihood ratio =277.1, df =8

Linear by linear association =159.0, df =1

Table 4.11 shows that all the respondents from the low and moderate income groups show their willingness to pay higher prices (for single tap connection), if there will be regular and stable supply of water. Also 86 respondents out of the 134 respondents from the high income group

show their willingness to pay. This is an indication that people are ready and will be willing to pay higher prices provided that water supply will be improved. Table 4.12 presents a similar result. The values of the chip-squares are 164.8 and 159.0 respectively. These values enable the researcher to reject the null hypotheses which indicate no differences in willingness to pay for water contingent upon increases in prices. Also, the values indicate strong correlations between levels of income and willingness to pay.

Table 4.13: Willingness to Pay 1 by Level Education

		Level of Education						Total
		No response	No Cert.	Pri/Sec	NCE/Dip	Degree/HND	Masters& Above	
WTP1	No response	11	24	0	0	0	0	35
	Yes	0	7	58	84	94	0	243
	No	0	0	0	0	13	44	57
Total		11	31	58	84	107	44	335

Source: Field Survey, 2011

Pearson chi-square =5.278E2, df =10

Likelihood ratio =403.782, df =10

Linear by linear association =212.083, df =1

Table 4.14: Willingness to Pay 2 by Level Education

		Level of Education						Total
		No response	No Cert.	Pri/Sec	NCE/Dip	Degree/HND	Masters& Above	
WTP2	No response	11	18	0	0	0	0	29
	Yes	0	13	58	84	83	0	238
	No	0	0	0	0	24	44	68

Total	11	31	58	84	107	44	335

Source: Field Survey, 2011

Pearson chi-square =454.3, df =10

Likelihood ratio =365.4, df =10

Linear by linear association =200.5, df =1

Table 4.13 shows the willingness to pay (WTP1 single tap) by level of education. 94 respondents out of the 107 degree/HND holders show willingness to pay and all the respondents with prim/sec and NCE/Dip certificates are willing to pay. In contrast with the above, all the 44 respondents with masters and above that responded to the question indicated unwillingness to pay. However, only 57 respondents out of the total 335 respondents indicated not willingness to pay implying that even based on educational attainment, majority of people will be willing to pay for higher water tariffs if water supply will be regular and stable. Table 4.14 (WTP2 full connection) presents a similar situation. The values of the chi-squares from the two cross tabs are 212.0 and 200.5 respectively both indicating significant differences in willingness to pay by level of education. Thus, based on these values, the null hypotheses of no significant differences in willingness to pay for water are rejected.

Table 4.15: Willingness to Pay 1 by Types of Connection

		Type of Connection			Total
		No response	Single Tap connection	Full Connection	
WTP1	No response	35	0	0	35
	Yes	26	156	61	243
	No	0	0	57	57
Total		61	156	118	335

Source: Field Survey, 2011

Pearson chi-square =292.8, df =4

Likelihood ratio =269.4, df =4

Linear by linear association =169.7, df =1

Table 4.16: Willingness to Pay 2 by Types of Connection

		Type of Connection			Total
		No response	Single Tap connection	Full Connection	
WTP2	No response	29	0	0	29
	Yes	32	156	50	238
	No	0	0	68	68
Total		61	156	118	335

Source: Field Survey, 2011

Pearson chi-square =290.3, df =4

Likelihood ratio =276.3, df =4

Linear by linear association =174.2, df =1

Tables 4.15 and 4.16 show that all the respondents with single tap connection indicated willingness to pay but in table 4.16, 68 out of the 118 respondents with full connection show unwillingness to pay. However, majority of them show willingness to pay. The values of the chi-squares (169.7 and 174.2 respectively) show significant differences in willingness to pay based on type of connection

Based on the above data, we can conclude that the current water tariff is not effective in water demand management. However, this does not mean price cannot be effectively used in demand management since the current water tariff has been assessed to be inefficient as many people are willing to pay higher prices if supply will be regular and stable. Also, from the responses of the

staff, we can conclude that the current water tariff does not encourage efficient water use as such the tariff is not effective in water demand management. The current tariff also does not cover operation and maintenance cost and is far below the supply cost. This is one of the reasons for inefficiency in the water supply sector since the Water Board must provide funds for its operation which the tariff cannot adequately cover.

CHAPTER FIVE

SUMMARY, CONCLUSION AND RECOMMENDATIONS

5.1 SUMMARY OF FINDINGS

There is low level of satisfaction with the current water tariff. The current water rate is far below the full supply cost of water. The rate is too low compared to what is spent on water from water vendors. The presence of substitutes such as wells, boreholes, roof tanks, tankers and water vendors plays an important role not only for non-connected households and businesses but also for those who need to complement the unreliable public water supply system. These substitutes have impact on the economy of the water sector as they take a portion of the water supply budget that could possibly be used to improve the service. However, there is a relationship between levels of satisfaction and income and between levels of satisfaction and levels of education.

The study also found with strong evidence that the quality of water supply is poor and inefficient as a large percent (91%) of the households experience daily break in supply and have not seen water for several days yet they are forced to pay water tariff. This is one of the reasons why some water users default payment of water tariff and bribe some staff in order to hide their connections. Many households complained of water containing dirt and dust as well as coloured water. There is no functional monitoring and evaluation system to check and monitor the services provided. It is vital to note that one of the constraints to proper monitoring and evaluation is lack of metering of households' water use.

Households reduce water consumption in period of break in supply but the decrease in water is small. The average expenditure on water per months is more than 7 times and 4 times the water tariff per month for a single connection and full connection respectively. This implies that households pay high prices to the water vendors relative to the current water tariff. However, it is important to note that there is high variation in households' size as the average households' size is 9 persons per household with the standard deviation of 6 persons. There is also a strong correlation between quantity of water use (both in period when water is available and in period of break in supply) and levels of income.

Due to inefficiency in the public water supply system, there is strong evidence that most water users (households) are in support of public private partnership in water supply. This can help ensure efficiency in supply due to competition. It was found that competition and participation of the private sector can lead to minimization of wastage and can provide enough revenue for expansion and maintenance in the water sector.

The study also found that pricing can be an effective tool for water demand management but the current water tariff is not effective because it does not encourage conservation. Moreover, the current water tariff does not even cover operation and maintenance costs let alone the full supply cost. This finding is with strong confidence because it dominated the views of the respondents (85% of the staff) especially those with higher level of education. Consumers are willing to pay higher prices provided there will be stable water supply. Consumers show willingness to pay even more than twice the current water tariff because even with such increase, the tariff will still be far lower than the price from the water vendors.

Lastly, the study also found with high level of confidence that the problem militating against improvement in water supply are inadequate funds, inadequate staff, lack of monitoring and evaluation, lack of staff training for capacity building, worn-out equipment and damaged and old aged pipes, default of payment of water tariff by water users, corruption and political interference.

5.2 CONCLUSION

Water is vital for life and a major asset for development anywhere. The increasing water demand due to increasing population, urbanization and industrial development has created a thought to consider various mechanisms of demand management. Reforming the water supply sector is needed to increase access to the water service, efficiency of operations and to enhance the reliability, sustainability and affordability of the service. There is no one size-fits all solution that policies have worked well everywhere. However, if solutions have to be directed to local circumstances, issues to be addressed are often similar.

Thus, efficient water pricing can have a demonstrable impact on water demand of different users. As a result of changes in demand, efficient water pricing can reduce pressure on water resources. With this, one can therefore, infer that efficient pricing policy is effective in households' water demand management. Moreover, to play an effective role in enhancing and controlling water demand, the pricing policy should be based on assessment of cost and benefits since the current water rate is not based on cost and benefit analyses of water supply and water use.

Based on the assessment of both water users and staff, the current water tariff is not efficient because it does not cover operation and maintenance costs let alone capital charges. This enables us to conclude that the current pricing policy is not effective in water demand management. The quantity of water use when supply is not available has further confirmed the ineffectiveness of the current policy due to increase in water expenditure during such period. Consumers who buy water from the vendors reduce their water consumption by about 9 litres daily on the average. It is also important to note that water users exhibit different attitudes towards the current tariff and water uses. Middle and high income people use more water than low income people and also households with connection to toilet and bath rooms (full connections) use more water than households with single connections.

Finally, based on the willingness to pay responses, it can be concluded that even if the current tariff is increased, consumers will be willing to pay. There is no doubt, with the current government policy which commercialized urban water supply and left the Water Board to finance its operation from payment of water bill cannot lead to improvement in the system. Thus, without embarking on policy review on both pricing and the water sector in general it will be nearly impossible to achieve efficiency in the sector.

5.3.0 RECOMMENDATIONS

It was observed that consumers constitute a fairly heterogeneous category in terms of educational and income levels as well as size of households. There are low income, middle income, high

income and poor income households who have different expectations about the water tariff and the public water supply as a whole. Thus, all categories of consumers should be taken into consideration (a user focused approach) when designing a pricing policy which can be done through structured surveys in order to assess their preferences and willingness to pay. To have effective water pricing policy, water demand management and improved performance of the water supply institutions, the following recommendations are offered:

a. Ensure effective implementation of policies and fight against corruption on the part government, staff of the water supply boards, water users and the general public. Government should check the activities of the Water Boards especially the management. This can be done through enactment of clear laws to guide the operation of the water boards. This is because there is much complaint from the staff of the Water Boards against management and Board of Governors of mismanagement and neglect workers' incentives.

b. Public private partnership should be encouraged. This can bring about competition to boost supply but should be monitored to avoid exploitation and unhealthy competition.

c. There should be change in attitudes towards water use (people should know the value of water so as to avoid wastage) and pay water bills regularly. This can be achieved through public enlightenment and the use of community leaders. Government should increase its commitment to water supply. It should be proactive, provide infrastructure and conducive environment to facilitate and improve water supply.

d. Proper treatment of water before supply in order to ensure water supply is of good quality. This will help in minimizing the rate of break out of cholera, diarrheal and other water borne diseases. Increasing the capacity of the existing water supply dams and construction of new ones. The capacity of the existing water works is inadequate as the capacity is 209mld while the estimated demand stands at 751mld for the whole state.

e. There should be regular monitoring and evaluation and also public education on water conservation should be encouraged so as to minimize illegal connections. This can go a long way in changing consumers' attitude towards payment of water bills as well as encourage efficient water use. Appropriate water price that can provide the Water Board enough revenue/funds be fixed and government should increase funding in order to ensure that equity and welfare are considered.

f. Adequate staff with staff motivation should be provided, good maintainance and sufficient facilities/ standard equipment be made available. This no doubt can improve the performance of the sector.

g. Wornout equipment should be replaced and damaged and old aged pipes repaired to prevent wastage and loss of water from distribution network. A large percent of the total water supply gets lost on distribution due to this problem. Ensure steady power supply by providing power plants to effectively power the pump station, review of staff emolument to enhance efficiency and productivity.

h. The whole system should be overhauled both in terms of human and material resources, measures of control be placed to minimize wastage and vandalization. Water consumption should be metered so that consumers will only pay for what they conssume. This can check the manner in which people use water.

Improvement in customer relations by providing them several service options, making them understand the impact of the tariff on their water use, monitoring the handling of their complaints and making independent assessment of the institutional performance became imperative. In this regard therefore, designing and implementing a program aimed at generating reliable technical, commercial and financial data should be one of the first issues to be addressed in order to help monitor the progress or performance improvement so as to formulate informed policies.

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APPENDIX 1:
WATER USERS' QUESTIONNAIRE.

Table 1: RESPONSES TO SECTIONS B, C AND D

Satisfaction	Frequency	Percent
No response	11	3.3
Yes (satisfied)	123	36.7
No (not satisfied)	201	60
Total	335	100
Assessment of the current water tariff		
No response	15	4.5
Too high	37	11
High	86	25.7
Low	53	15.8
Too low	38	11.3
Moderate	106	31.6
Total	335	100
Billing period		
No response	23	6.9
Weekly	7	2.1
Monthly	175	52.2
Others	130	38.8
Total	335	100
Value of service relative to water tariff		
No response	17	5.1
Yes (service worth the tariff)	106	31.6
No	212	63.3
Total	335	100
Regular payment of water tariff		
No response	11	3.3
Yes	215	64.2
No	109	32.5
Total	335	100
Total	335	100

Disconnection for nonpayment	**Freq.**	**Percent**
No response	142	42.4
Yes	126	37.6
No	67	20
Total	335	100
Reasons for defaulting payment		
No response	166	49.6
Irregular supply	126	37.6
Water tariff too high	22	6.6
Illegal connection	14	4.2
Others	7	2.1
Total	335	100
Break in supply	Freq.	Percent
No response	12	3.6
Yes	305	91
No	18	5.4
Total	335	100
Frequency of break in supply		
No response	22	6.6
Everyday	159	47.5
Once or more a week	70	20.9
Once or more a month	74	22.1
Others	10	3
Total	335	100
Other sources of water		
No response	16	4.8
Well/river	158	47.2
Borehole	55	16.4
Water vendors	98	29.3
Others	8	2.4
Total	335	100

Monitoring by the water board	Frequency	Percent
No response	19	5.7
Yes	36	10.7
No	280	83.6
Total	335	100
Feedback		
No response	20	6
Yes	25	7.5
No	290	86.5
Total	335	100
Quantity of water use		
No response	25	7.5
50 litres	62	18.5
100litres	103	30.7
More than 100 litres	143	42.7
Others	2	.6
Total	335	100
Quantity of water use in period of break in supply		
No response	26	7.8
50 litres	80	23.9
100litres	96	28.7
More than 100 litres	127	37.9
Others	6	1.8
Total	335	100
Assessment of the current water rate on the assumption of stable and efficient water supply		
No response	33	9.9
Too high	39	11.6
High	57	17
Low	83	24.8
Too low	17	5.1
Moderate	106	31.6
Total	335	100
Private sector participation	**Frequency**	**Percent**
No response	8	2.4
Yes (in support)	245	73.1
No	82	24.5
Total	335	100
Government withdrawal		
No response	10	3

Yes (in support)	145	43.3
No	180	53.7
Total	335	100
Competition ensures efficiency		
No response	8	2.4
Yes	273	81.5
No	54	16.1
Total	335	100
Reasons for (yes) above		
No response	52	15.5
Wastage will be minimized	14	4.2
Charging economic price	14	4.2
Enough revenue for expansion	23	6.9
Price based on water use	28	8.4
All of the above	204	60.9
Total	335	100
Price an effective tool for water demand management		
No response	39	11.6
Yes	231	69
No	65	19.4
Total	335	100

Effectiveness of the current water tariff	Frequency	Percent
Very effective	21	6.3
Effective	31	9.3
Ineffective	162	48.4
Highly ineffective	56	16.7
No response	65	19.5
Total	335	100

Source: Field Survey, 2011

APPENDIX 2:
AVERAGES (MEANS) AND STANDARD DEVIATIONS

TABLE 2: MINIMUM, MAXIMUM, MEAN AND STANDARD DEVIATION

	Household size	Quantity (Period of supply)	Quantity (Break in supply)	Daily Expenditure
Minimum	1	50litres	25litres	20Naira
Maximum	40	500litres	450litres	500Naira
Mean	9	125litres	114litres	108Naira
Standard Deviation	6	90litres	86litres	88Naira

Source: Field Survey, 2011

Table 2.1: Number of people in the household

Range	Freq	X	FX	D	D2	FD2
1-10	216	5.5	1188	-3.5	12.25	2646
11-20	60	15.5	930	6.5	42.25	2535
21-30	12	25.5	306	16.5	272.25	3267
31-40	4	35.5	142	26.5	702.25	2808
	$\sum F$ = 292		∑FX = 2566			11257

Source: Field Survey, 2011

Mean= $\frac{2566}{292}$ =9 , Variance=11257/292=38.6, SD=6.2

Table 2.2: Quantity of water use in period of supply (Q1)

Qnty in litres	F	Q	FQ	D	D2	FD2
1-50	48	25.5	1224	-99.5	9900.25	475212
51-100	84	75.5	6340	-49,5	2450.25	205821
101-150	60	125.5	7530	0.5	0.25	15.000
151-200	40	175.5	7020	50.5	2550.25	102010
201-250	16	225.5	3608	100.5	10100.25	161604
251-300	8	275.5	2204	150.5	22650.25	181202
301-350	8	325.5	2604	200.5	40200.25	321602
351-400	4	375.5	1502	250.5	62750.25	251001
401-450	0	425.5	0	300.5	90300.25	0
451-500	4	475.5	1902	350.5	122850.25	491401

	$\sum F = 272$		∑FX =33936			2189868

Source: Field Survey, 2011

Mean =33936/272=124.8 that is 125litres per day approx. Variance=2189868/272=8050, SD=89.7

Table 2.3: Quantity of water use in period of break in supply (Q2)

Qnty in litres	F	Q	FQ	D	D2	FD2
1-50	56	25.5	1428	88.5	7832.25	438606
51-100	88	75.5	6644	-38.5	1482.25	130438
101-150	64	125.5	8032	11.5	132.25	8464
151-200	24	175.5	4212	61.5	3782.25	90774
201-250	20	225.5	4510	111.5	12432.25	248645
251-300	0	275.5	0	161.5	26082.25	0
301-350	12	325.5	3906	211.5	44732.25	536787
351-400	0	375.5	0	261.5	68322.25	0
401-450	0	425.5	0	311.5	97032.25	0
451-500	4	475.5	1902	361.5	130682.25	522729
	$\sum F = 268$		∑FX =30634			1976443

Source: Field Survey, 2011

Mean=30634/268=114.3 that is 114 litres per day approx.

Variance=1976443/268=7375.8, SD=85.8

Table 2.4: Average daily expenditure on water in period of break in supply

Expenditure in naira	F	Q	FQ	D	D2	FD2
1-50	44	25.5	1122	-82.5	6806.25	299475
51-100	72	75.5	5436	-32.5	1056.25	76050
101-150	48	125.5	6024	17.5	306.25	14700
151-200	12	175.5	2106	67.5	4556.25	54675
201-250	4	225.5	902	117.5	13806.25	55225
251-300	4	275.5	1102	167.5	28056.25	112225
301-350	8	325.5	2604	217.5	47306.25	378450
351-400	0	375.5	0	267.5	71556.25	0
401-450	0	425.5	0	317.5	100806.25	0
451-500	4	475.5	1902	367.5	135056.25	540225
	$\sum F = 196$		∑FX =21198			1531025

Source: Field Survey, 2011

Mean=21198/196=108.15 per day that is 3244.5 naira per month.

Variance=1531025/196=7811.35, SD=88.4

APPENDIX 3
STAFF'S QUESTIONNAIRE

Table 3: STAFF PERSONAL DATA

Variables	Frequency	Percent
Cadre		
Admn	7	35
Acctng	7	35
Clerical	4	20
Technician	2	10
Total	20	100
Sex		
Male	15	75
Female	5	25
Total	20	100
Age in years		
18-30	3	15
31-43	16	80
44-56	1	5
Above 56	0	0
Total	20	100
Education		
No cert.	0	0
Pri/sec	2	10
NCE/Dip	7	35
Degree/HND	11	55
Masters & above	0	0
Total	20	100
Income		
Low	4	20
Moderate	5	25
High	11	55
Total	20	100
Years in service		
1-3	0	0
4-6	2	10
7-9	6	30
10 & above	12	60
Total	20	100

Source: Field Survey, 2011.

Table 3.1 MOTIVATION

Variable	Always		Sometimes		Seldom		Never	
	F	%	F	%	F	%	F	%
Favorable salary			6	30	8	40	6	30
Promotion			7	35	10	50	3	15
Office equipment	1	5	4	20	10	50	5	25
Standard facilities	1	5	5	25	8	40	6	30
Payment of allowance			5	25	8	40	7	35
Healthcare					4	20	16	80
Policies on salaries & bonus			4	20	8	40	8	40

Source: Field Survey, 2011.

APPENDIX 4:
SAMPLE OF WATER USERS' QUESTIONNAIRE

Sir/Madam,

I am a postgraduate student in the Department of Economics, ABU, Zaria, conducting an academic research on the topic:"The Effectiveness of Pricing Policy in Households' Water Demand Management in Kaduna State". A Case Study of Sabon Gari Local Government Area as a part of requirement for the award of Masters of Sciences (M.Sc.) Degree in Economics. Please, kindly attend to the questionnaire, as we assure you that your responses will be held in strict confidence and used only for this academic research. Thank you.

Please tick or fill as appropriate.

Section A

Socioeconomic characteristics:

Age: A. (18-30) years B. (31-43) years C. (44-56) years D. more than 56 years

Level of education (A) No certificate at all (B) prim/secondary certs. (C) NCE/Diploma
(D) Degree/HND (E) Masters and above

Occupation: A. civil/public servants B. self employed C. unemployed

No. of people in the household: ……

Area: A. High population density area B. low density population area

House size: A. 3 or more bed room house B. 1-2 bedroom house C. single tap house any where
D. (a and c) E.(b and c)

Income level: A. Low income (4,500-30,000) naira per month
B. moderate income (30,000-60,000) naira per month

C. high income (more than 60,000) naira per month

D. others, please specify

Type of Connection: A. single tap B. full connection

Section B

Water Usage Profile and Attitude of Water Users towards the Current Water (rate) Tariff

1. Are you satisfied with the current water rate? A. Yes B. No

2. How do you assess the current water rate? A. too high B. high C. low D. too low E. moderate

3. How much do you pay per billing period? …….. Naira

4. How long is the billing period? A. weekly B. monthly C. others, please specify…….

5. Is the service you receive worth what you are paying? A. Yes B. No

6. Do you pay water rate (bill) regularly? A. Yes B. No

7. If No above, do you experience service disconnection for nonpayment? A. Yes B. No

8. Also, if No above, why do you default payment? A. supply not regular and stable B. water rate too high C. my connection is not in record D. others, please specify ……

Please state how you are affected by the current water rate

……

Section C

Quality of Service/ Water Use Efficiency

9. Do you experience break in supply? A. Yes B. No

10. If Yes, how frequent is the break? A. everyday B. once or more per week C. once or more per month D. others please specify…….

11. During break in supply where do you get water? A. well/river B. Borehole C. water vendors D. others, please specify……

12. Does the Water Board monitor your complain? A. Yes B. No

13. Does the Water Board seek feed back from you on the quality of service provided? A. Yes B. No

14. In period when water supply is available, what is your estimated quantity of water use per day (on average)? A. 50 litres (one gallon) B. 100litres (two gallon) C. more than 100litres(more than two gallons), please specify the number of gallons …… E. Others, please specify …….

15. In period of break in supply, what is your estimated quantity of water use per day (on average)? A. 50 litres (one gallon) B. 100litres (two gallon) C. more than 100litres(more than two gallons), please specify the number of gallons …… E. Others, please specify …….

16. What is the cost of one gallon (50 litres) of water from the water vendors? ..... Naira

17. What is your average daily water expenditure in period of break in supply? ..... Naira

18. Assuming efficient and stable supply will be provided, how do you assess the present water rate charged by the Water Board? A. too high B. high C. low D. too low E. moderate

Section D

Private water supply

19. Are you in support of allowing the private sector to partake in water supply? A. Yes B. No

20. Are you in support of government withdrawing and allowing competition in the supply of water? A. Yes B. No

21. Can competition ensure more efficiency in water use and water supply? A. Yes B. No

22. Please state your reasons for choosing yes above.

a. Wastage of water will be minimized
b. Providers will charge economic price
c. There will be enough revenue to allow for expansion and maintenance
d. Price will be based on the quantity of water used
e. All of the above
e. Other reasons, please state……

23. Can water pricing be an effective tool/way for water demand management? A. Yes B. No

24. How do you assess the effectiveness of the current water rate in terms of your water demand?.

A. Very effective B. effective C. ineffective D. highly ineffective E. No response

25. What in your opinion can be done to improve the public water supply system?

.....……

……

Section E

Willingness to pay Questions

Everybody should have as much water as he demands and when he needs it. To be fair each household should pay only for the amount it uses. Assume you could have an improved service, the decision on whether or not to connect to the water board's improved service depends on your willingness and ability to pay. Assume also, that increasing water price will enable the public water supply institution render an efficient service. Please, answer the following questions:

(1). If the price you will be charged for water is 840 naira for a single tap per billing period, would you like to be connected to the improved scheme? B. Yes B. No

(2). If the price you will be charged for water is 1400 naira for full connection per billing period, would you like to be connected to the improved scheme? A. Yes B. No

(3). If the price you will be charged for water is higher than 840 naira for single tap, would you like to be connected to the improved scheme? A.Yes B. No

(4). If the price you will be charged for water is higher than 1400 naira for full connection, would you like to be connected to the improved scheme? A. Yes B. No

APPENDIX 5:
SAMPLE OF STAFF'S QUESTIONNAIRE

Sir/Madam,

I am a postgraduate student in the Department of Economics, ABU, Zaria, conducting an academic research on the topic:"The Effectiveness of Pricing Policy in Households' Water Demand Management in Kaduna State". A Case Study of Sabon Gari Local Government Area as a part of requirement for the award of Masters of Sciences (M.Sc.) Degree in Economics. Please, kindly attend to the questionnaire, as we assure you that your responses will be held in strict confidence and used only for this academic research. Thanks.

Please tick or fill as appropriate.

SECTION 'A'

Bio Data

1. Name of cadre: Administrator [ ], Accounting [ ], Clerical [ ], Technologist [ ], Technician [

2. Sex: A. male [ ] B. Female [ ]

3. Age: A. (18-30) years B. (31-43) years C. (44-56) years D. more than 56 years

4. Level of education (A) No certificate at all (B) prim/secondary certs. (C) NCE/Diploma
(D) Degree/HND (E) Masters and above

5. Economic Status; Low Income group [ ], middle income group [ ], High income group[]

6. How many years have you worked? A. [1-3] B. [4-6] C. [7-9] D. [10- above]

SECTION B

Motivation of workers

A. Always B. Sometimes C. Seldom D. Never

	A	B	C	D
My salaries and condition of service are favourable to me				
My promotion is done as at when due.				
Our office equipment are complete and functional				
The facilities we need to work with are of high standard.				
The allowances are paid regularly as at when due.				
We have adequate health care centre for staff and family.				
We have clear policies related to salaries and bonuses to deserving staff.				

SECTION C

Staff's views about the current water policies

A. Always B. Sometimes C. Seldom D. Never

	A	B	C	D
Staff are familiar with the current water policies				
The water policies are effectively implemented				
The current water price encourages efficient use of water				
The water price helps in improving water supply				
Water users pay water bills regularly (as at when due)				
Our organization depends fully on payment of water tariff for its revenue				
Water tariff covers operation and maintenance (O&M) costs				
Water tariff cover (O&M) costs and capital charges				

The current water pricing is effective in water demand management				

SECTION D

Major problems

What are the major problems that limit the effort of the water boards to achieve the objective of the pricing policy? Please select the most appropriate

A.Strongly Agree B. Agree C. Disagree D. Strongly Disagree E. Not Decided

	A	B	C	D	E
Shortage of Fund					
Few number of staff					
Lack of monitoring and evaluation					
Non-availability of training					
Lack of awareness of the water conservation programs					
Water users' nonchalant attitude to the payment of tariff					
Worn out equipment/machine (old aged pipes)					
Irregular power supply					
Corruption by the Water Board's staff					
Politics					

Other problems if any, please specify

……

…….

Please assess the effectiveness of the current pricing policy

……

……..

What other sources of funding does your agency have? Please specify ……

……

……..

Please, state how you monitor customers' complain about the quality of service you provide

……

…….

What in your opinion can be done to improve the public water supply system?

.....……

……

……