

CZECH UNIVERSITY OF LIFE SCIENCES PRAGUE
Faculty of Economics and Management
Department of Economics



Bachelor Thesis

**WATER RESOURCES IN NIGERIA: WATER PRICING, EXTERNALITIES
AND OTHER RELATED ISSUES**

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Declaration

I hereby acknowledge that I have worked on this Bachelor thesis titled

“WATER RESOURCES IN NIGERIA: WATER PRICING, EXTERNALITIES AND RELATED ISSUES” by myself and all used resources are included in the bibliography and supplements section.

In Prague, 30.03.2011

.....

OTEKHILE Cathy-Austin Funke

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DEDICATION

I dedicate this Thesis to God Almighty who has been my source of strength and wisdom

ČESKÁ ZEMĚDĚLSKÁ UNIVERZITA V PRAZE

Provozně ekonomická Fakulta

Oddělení ekonomie



Bakalářská práce

Vodní zdroje v Nigérii: oceňování vody, externality a s tím související problémy

Souhrn:

Nigérie je země v Západní Africe. Odhad počtu obyvatel je 151,212 milionů a rozloha státu činí 923,768 km² (UN Statistics). Podle Světové banky dosáhly v roce 2008 úhrnné srážky v celé zemi 1150 km³ ročně. Průměrný přírůstek obyvatelstva mezi lety 2005 až 2010 je odhadován na 2,3% (Onyjeli N., 2010)

Klima je tropické, charakterizováno střídáním období deště a sucha, přičemž existují rozdíly mezi severem a jihem Nigérie. Dešťové srážky klesají směrem od pobřeží k severu (Kuruk P., 2004). Existuje zde trvalá hrozba pro zemědělství a vodní hospodářství, tato situace je zhoršována probíhajícími globálními klimatickými změnami, nesprávným využíváním vodních zdrojů, znečištěním vody a rovněž absencí propracovaných vodohospodářských metod. Tyto problémy představují nebezpečí pro zajištění dostatku potravin pro stále se zvyšující populaci a pro trvalé udržení celého ekosystému.

ato práce analyzuje určování cen vody v Nigérii jako prostředek k efektivnímu managementu omezených vodních zdrojů. Další souvislosti se zdravím a nemocemi, hygienou, chudobou a zajištěním výživy budou rovněž předmětem diskuse. Bude se uvažovat také o enviromentálně negativních faktorech, způsobených například zavlažováním zemědělské půdy, znečištěním vody průmyslem, únikem surovin při působení nadnárodních společností těžících v regionu delty řeky Niger a dále nevhodným znečišťováním vody odpady - ať již pevnými, nebo splaškami. Problematika vody jako statku veřejného vs. statku soukromého bude v této práci také diskutována.

Hypotéza této práce je založena na určování cen vody. Metodologie práce se zakládá na kvantitativní analýze (víceproměnná regresivní analýza); analýza odhalila a potvrdila ekonomickou prognózu, má jasný vztah k příjmu domácností: čím vyšší byl příjem tázaného, tím větší měl zájem na placení za dobrou kvalitu vody.

V zájmu dosažení Rozvojových cílů tisíciletí (MDGs) je nutné, aby byly vodní zdroje vhodně

a účelně spravovány. Také je třeba zastavit nebo výrazně omezit znečišťování vody na nejnižší možnou míru zavedením a posilováním daně za znečištění. Správné určování cen vody je klíčem k ochraně a udržitelnému využívání vodních zdrojů také pro příští generaci. Je to klíčem k uspokojení největší poptávky po vodě, způsobené zrychlenou urbanizací, industrializací a zemědělským využíváním půdy nejen v rozvojových zemích jako je Nigérie, nýbrž i globálně.

Klíčová slova: Nigérie, voda v deltě řeky Niger, Principy určování cen vody, vodohospodářství, určování cen vody, udržitelnost vodních zdrojů, znečištění vody, zajištění výživy, zdraví, chudoba, Subsaharská Afrika

SUMMARY

Nigeria is a country in the West of Africa with an estimated population of 151,212 million, the square kilometer area of 923,768 (UN Statistics). The precipitation km³ per year is 1150 in 2008 according to World Bank. The average growth rate of the population between 2005-2010 is estimated to be 2.3 percent. (Onyejeli N., 2010)

The climate is tropical, characterized by extreme weather conditions (wet and dry seasons) though there are variations between North and South. (Kuruk P., 2004). There has been a continual threat to agriculture and water resources which is aggravated by the global climate change, the improper use of water, pollution of water and lack of effective water policy. Because of these threats, problem of feeding the ever increasing population and preserving the entire ecosystem is envisaged.

This thesis analyses water pricing in Nigeria seeing it as means of effectively managing scarce water resources, the issues of health and diseases, sanitation, poverty, food security as related to water resources are also discussed in this thesis. The role of environmental negative externalities caused by the farmers' irrigation of their farms, pollution of water by industries, oil spillage caused by multinational oil companies in the Niger delta of Nigeria and improper disposal of waste into water which is either solid waste or sewage. The issue of water as a public good versus private good is also discussed in this thesis.

The assumption used in this paper is based on the pricing of water. And the methodology was based on quantitative analysis (multivariate regression analysis); the regression analysis result revealed and confirmed the economic expectation that WTP has a relationship with the household income; the higher the respondents' income the higher they are willing to pay for good quality water. The coefficient of determinant of household income is statistically significant at 5 percent level of significance. And also the WTP is higher than the current water price.

In order to achieve the millennium Development goals (MDGs); water resources need to be Properly and effectively managed and the level of pollution cut down or reduced to the barest minimum level by enforcing pollution tax; water pricing is the key for conservation and sustainability of water resources for the future generation. And essential for meeting a major demand created by accelerated urbanization, industrialization and agricultural development not only in developing countries like Nigeria but globally.

Keywords: Nigeria, Water, Principles of water pricing, water policy, Water pricing, water resources sustainability, water pollution, food security, diseases, SSA, Niger-Delta

TABLE OF CONTENT

1. INTRODUCTION	8
1.1 Background	9
2. OBJECTIVES AND METHODOLOGY	12
2.1 Objectives	12
2.2 Methodology	12
3. LITERATURE REVIEW	13
3.1 Definition of Water Resources	13
3.2 Utilization of water resources in Nigeria	14
3.3 Water Quality	15
3.4 Water as an economic good	16
3.4.1. The value of water	17
3.4.2. Elasticity of demand for water	17
3.4.3 Demand for water	19
3.4.4 Supply for water	19
3.4.5 The economic value	20
3.4.6 The cost of water	21
3.4.7 Supply cost of water	21
3.4.8 Opportunity cost of water	21
3.5 Water resources sustainability	21
3.6 Legal framework concerning water resources in Nigeria	23
3.7 Drivers of Nigeria water resources	23
4. WATER PRICING (ANALYSIS AND RELATED ISSUES)	25
4.2 Types of water pricing structure	27
4.2.1. Flat rate	27
4.2.2 Public (Administrative) water pricing	27
4.2.3 Uniform price with rebate (UPR)	28
4.2.4 Volumetric water rate	29
4.2.5 Two-Part Rate	29
4.2.6 Block pricing	29
4.2.7 Increasing Block rate	29
4.2.8 Decreasing Block rate	30
4.2.9 Seasonal rate	30
4.3 Principles of water pricing	30
4.3.1 Fair and equal principle	30
4.3.2 Efficient allocation principle	31

4.3.3 Revenue adequacy and stability principle	31
4.4 Public good versus private good	31
4.5 Issues of Health, Sanitation, poverty and Food security	33
4.6 Water negative externalities	36
4.6.1 Municipal water pollution	38
4.6.2 Industrial water pollution	38
4.6.3 Oil-induced pollution	39
4.6.4 Agriculture-induced water pollution	39
4.8 ANALYSIS AND DISCUSSION	42
5 CONCLUSION AND RECOMMENDATIONS	49
5.2 Recommendations	50
6.1 Appendix A:	51
6.2 Appendix B: Results from MS-Excel	53
6.3 BIBLIOGRAPHY	55
6.4 Supplements	61

LIST OF FIGURES

FIGURE 1: RANGE OF PRICE ELASTICITY OF DEMAND FOR WATER IN UNITED STATES	18
FIGURE 2 & FIGURE 3 : ELASTIC DEMAND AND INELASTIC DEMAND	18
FIGURE 4 & FIGURE 5 A TYPICAL DEMAND CURVE AND TYPICAL SUPPLY CURVE	19
FIGURE 6 : TOTAL ECONOMIC VALUE	20
FIGURE 7 : WATER NEGATIVE EXTERNALITY	37
FIGURE 8 : COMPARISON OF WATER PRICING IN SOME SELECTED COUNTRIES [OWN COMPUTATION BASED ON TABLE 4 & 5	42
FIGURE 9 : WILLINGNESS OF HOUSEHOLD TO PAY FOR WATER PER CUBIC METRE (CU ³) [OWN INPUT]	44
FIGURE 10: HOUSEHOLD CONNECTED TO PIPE WATER [OWN INPUT]	45
FIGURE 11: HOUSEHOLD INCOME LEVEL	47

LIST OF TABLE

TABLE 1 PERCENTAGES DISTRIBUTION OF DWELLING UNITS BY TYPE OF WATER SUPPLY	11
TABLE 2: THE DUBLIN WATER PRINCIPLES	16
TABLE 3: REPORTED CASES FROM SOME NOTABLE DISEASES	33
TABLE 4: PRICE OF WATER BY SOURCE IN LAGOS	40
TABLE 5: WATER PRICING OF SOME SELECTED COUNTRIES	40
TABLE 6: THE PERCENTAGES OF PEOPLE WHO ARE SATISFIED AND NOT SATISFIED WITH THE CURRENT WATER QUALITY	45
TABLE 7: PERCENTAGE OF PEOPLE WHO SUFFERED WATER DISEASE IN THE LAST TWO MONTHS	47

LIST OF ABBREVIATIONS

AFDB	African Development Bank
ADB	Asian Development Bank
EIA	Environment Impact Assessment
EU	European Union
FEPA	Federal Environment
IBRD	International Bank for Rural Development
ICWE	International Conference on Water and the Environment
LGAs	Local Government Authorities
LSWC	Lagos State Water Corporation
MDGs	Millennium Development Goals
MEC	Marginal Economic Cost
MSC	Marginal Social Cost
MPC	Marginal Private Cost
NERSEA	National Environmental Standards And Regulation Enforcement Agency
OCED	Organisation for Economic Co-operation and Development
O&M	Operation and Maintenance
PPP	Polluters paid principle
PSP	Private sector Participation
SWAs	State Water Authorities
SSA	Sub-Sahara Africa
UNDP	United Nations Development Program
UNEP	United Nations Environment Program
UN	United Nations
UNICEF	United Nations International Children Educational Funds
UNESCO	United Nations Educational, Scientific and Cultural Organisation
UPP	Users pays principle
WB	World Bank
WFD	Water Framework Directive
WTP	Willingness to Pay
WHO	World Health Organisation
WWDR	World Water Development Report

1. INTRODUCTION

Water is one of the most essential resources on the planet earth; it is vital to life, health and the natural environment. Water is essential for survival of life; no living being on planet earth can survive without it. It is a prerequisite for human health and well-being as well as for the preservation of the environment¹. It is a renewable resource whose supply is uncertain in nature and depends on time and space. Water is a mobile resource whose availability at one place is determined by the use in other places i.e. a trans-boundary effect.

According to water encyclopedia, all human beings need a minimum of 3 litres of water per day to survive but for basic human survival need such as drinking, sanitation, and hygienic needs a minimum of 50 liters of safe water are required each day². Water is essential for achieving sustainable development and the Millennium Development Goals. Properly managing water resources is an essential component of growth, social and economic development, poverty reduction and equity – all essential for achieving the Millennium Development Goals³.

When its availability is less, droughts occurs which affects agricultural yield, municipal life and livestock. An excess availability of water leads to flooding which has a high damage potential. Water is also a good solvent and this property makes it vulnerable to pollution by a number of pollutants which adversely affects its economic values. In developing countries like Nigeria a large amount of industrial wastes are dumped untreated into the water thereby polluting the usable water supply.

The World Health Organisation (WHO) estimate 1.8 million people in developing countries die every year from diarrhea and cholera, Out of these 90 per cent are children under the age of five years. While 88 per cent of diarrhea diseases are attributed to unsafe water supply, inadequate sanitation and hygiene⁴. Access to safe water can improve public health

¹ http://www.un.org/waterforlifedecade/pdf/sg_report.pdf

² <http://www.waterencyclopedia.com/St-Ts/Survival-Needs.html> accessed on the 10 October, 2010

³ WWDR3, 2009. Water in a changing world 3th edition. Available on internet at: http://www.unesco.org/water/wwap/wwdr/wwdr3/pdf/WWDR3_Facts_and_Figures.pdf

⁴ World Health Organisation, 2004. The World Health Report 2002. Geneva. WHO. Switzerland accessed on the 10 October, 2010

and promote social and economic development⁵. The percentage of people who have access to safe water in Nigeria was 58 percent in 2008 and decreased in 2009 to 47 per cent⁶. This shows that there is a problem of people having access to safe water in Nigeria; people have devised different coping mechanism to have access to safe water⁷

Since water is important to life, its availability, efficient management and sustainability is therefore is essential for preserving the entire eco-system in the future. For a long time water has been seen as a public good and it has been underpriced or under estimated, subsidized for by the government and wasted; in this paper we will be analyzing the issue of water as public good versus private good.

1.1 Background

Nigeria is a country in the West of Africa with an estimated population of 151,212 million, the square kilometer area of 923,768⁸. The precipitation km³ per year is 1150 in 2008 according to World Bank. The average growth rate of the population between 2005-2010 is estimated at 2.3 percent per annum⁹.

The discovery of oil in the 1960's brought about the expansion and exploration of crude oil in the Niger Delta of Nigeria, with little concern for the environment, the eco-system is threatened by frequent oil spill in the creeks of water of the area and environmental degradation. This has led to continual loss of wild life, species (biodiversity), poverty and health problems.

According to UNDP, more than 60 percent of people in the Niger-Delta depend on the natural environment for their source of their livelihood. The environmental resource base which they use for agriculture, fishing and collection of forest products is their principal source of food¹⁰.

⁵ UNDP, 2006. Beyond scarcity: power, poverty and the global water crisis

⁶ www.worldbank.org/ida/IDA_Brochure_Elctrcn.pdf

⁷ Obayagbona H., 2008. Governance without Government: Water provision in Lagos State.

⁸ data.un.org/CountryProfile.aspx?crName=NIGERIA accessed on 10 October, 2010

⁹ Onyejeli N., 2010,

http://www.bc.edu/content/dam/files/research_sites/agingandwork/pdf/publications/CP22_Workforce_Nigeria.pdf

¹⁰ UNDP, 2006. Niger-Delta Human Development Report

Major industries are concentrated in urban areas of Nigeria examples: Lagos, Ibadan, port-Harcourt, Warri etc. This has led to migration of people from rural areas to urban areas causing congestion of urban areas and thereby the infrastructural facilities and the environment are over – stretched or stressed. A lot of industries in Nigeria discharge a large amount of untreated liquids wastes and gaseous wastes directly into the water bodies and the environment.

The growth in population without a match of adequate facilities to control or manage the wastes generated as a result of increase in consumption has brought about improper disposal of solid wastes; sewage waste (human waste) are disposed in water bodies in Nigeria.

Nigeria economy is confronted with so many challenges notably the high level of poverty, inefficient delivery of social services, high youth unemployment, poor infrastructure facilities and wide spread insecurity and crime¹¹. Urban areas in Nigeria are faced with challenges ranging from social, health to environmental problems. The issue of water been seen as a public good has made the water resources to be wasted and polluted for a long time now.

According to the data from the National Bureau of Statistics the percentage of the populace who have access to pipe borne water is 10.4 percent, 33.3 percent get their source of water supply from the well water, 24.5 percent get their source of water supply from streams and ponds, 4 percent get their supply of water from Tanker/truck/van and 0.9 percent get their water supply from other sources in 2007¹².

¹¹ OECD and AFDB, 2007. African Economic Outlook pg 448-450

¹² National Bureau of Statistics, Nigeria

Table 1 percentages Distribution of dwelling units by type of water supply

Type of Water	2003	2004	2005	2006	2007
Pipe borne Water	15.78	14.50	16.20	15.35	10.4
Borehole Water	22.04	17.60	24.00	20.80	26.8
Well Water	27.83	36.00	25.10	30.55	33.3
Streams/Pond	33.00	31.50	33.50	32.50	24.5
Tanker/truck/Van	1.35	0.40	1.20	0.80	4.1
Total	100.00	100.00	100.00	100.00	100.00

Source: National Bureau of Statistics

2. OBJECTIVES AND METHODOLOGY

2.1 Objectives

The main objective of the thesis is outlined as follows:

- i) To identify key drivers and providers of water in Nigeria
- ii) Analyze the water pricing in Nigeria
- iii) To evaluate the consumer's willingness to pay for good quality water
- iv) To characterize water externalities and related issues in Nigeria

2.2 Methodology

The material used in the study is both primary and secondary data. The primary data is based on a survey or questionnaire administered in one of the cities in Nigeria (Lagos). Secondary data is from sources such as papers, articles, journals and books. Also the methodology used in this paper is based on the multivariate regression analysis; the data are collected from World Bank, UN, Statistical Bureau office in Nigeria, Central bank of Nigeria. And also a survey (questionnaire) was conducted to find out the willingness to pay for good quality drinking water of a sampled population in Lagos, Nigeria. People are asked how much they are willing to pay for good quality water (WTP).

3. LITERATURE REVIEW

3.1 Definition of Water Resources

The Water Framework Directive (WFD) of the European Union (EU) (2000/60/EC) defines water resources to include surface water, groundwater, inland water, rivers, lakes, transitional waters, coastal water and aquifers(Chave, 2001)¹³. Water resources are necessary inputs to production in economic sectors such as agriculture (arable and nonarable land, aquaculture, commercial fishing, and forestry), industry (e.g. power generation) and tourism, as well as to household consumption.¹⁴

Water is a mineral resource and it should be treated as such, despite its special attribute of being renewable after depletion. Therefore its exploitation should be governed by a set of water laws. Nigeria's water resources may be treated under the following headings¹⁵

1. Surface sources: streams and rivers, lakes, springs, and drainages areas that funnel water towards reservoirs
2. Underground sources: eleven principal aquifers in sedimentary basins
3. Aquifers in the coastal areas
4. Ground water in the basement rocks

Water resources can be broadly grouped into two categories - freshwater and marine water resources respectively. Freshwater resources consist of rivers and their plains, streams, lakes, wetlands and underground water reservoirs. Rainfall can also be grouped under freshwater resources – although man has no influence over its availability. On the other hand, marine water resources include lagoons, seas and the oceans.¹⁶

¹³ Birol E. et al, 2006. Using economic valuation technique to inform water resources. Available online at: nersp.nerdc.ufl.edu/~vecy/LitSurvey/sdarticle.pdf

¹⁴ United Nations Environment Program (UNEP) Vital Water Statistics. Available online at: <http://www.unep.org/vitalwater/2005>.

¹⁵Oteze G. E, 1981. Water resources in Nigeria. *Journal of environmental Geology*, 3(4):177 – 184.

¹⁶ Orubu, (2006). Water resources, environment and sustainable development in Nigeria. Available online at: www.krepublishers.com/.../JHE-19-3-169-181-2006-1302-Orubu-C-O-Text.pdf -

Nigeria is endowed with surface water resources including rivers, streams, lakes, and wetlands which provide a source of drinking water for a large proportion of the population in areas with limited public water supply facilities. Rainfall, which constitutes a significant source of freshwater, is highly variable across the different regions of the country, ranging from about 250 mm in the extreme north to over 500mm in the south. The urban and peri-urban populations, however, rely heavily on underground water resources. Nigeria has a policy on national water resources called the Master Plan: this provides a framework for integrated water-resources planning, development, and management for the period 1995-2020. The first review of the plan was carried out in 2006.¹⁷

Nigeria's surface water resources potential is estimated to be some 267.3 billion cubic meters per annum, while groundwater resources are estimated to total 51.9 billion m³ per annum.¹⁸ Precipitation is the primary source of freshwater, with an annual flow about fifty times the normal stock held in lakes, rivers, and reservoirs. Annual precipitation can be highly variable, and withdrawal levels vary widely¹⁹.

3.2 Utilization of water resources in Nigeria

On the global basis agriculture is currently the largest user of Water; 69 percent of water withdrawn for human use is soaked up by agriculture, industry accounts for 23 percent domestic uses (household, drinking water and sanitation) accounts for 8 percent. But in Africa agriculture soaks up 80 percent of water withdrawn for human uses while domestic use accounts for 7 percent and industry for 5 percent. In Europe, most water is used in industry (54 percent), while agriculture's share is 33 per cent and domestic use 13 per cent.²⁰

Water resources in Nigeria are used for the following purposes:

1. Domestic uses
2. Industrial uses
3. Agricultural uses
4. Hydro electricity
5. Fisheries

¹⁷ OECD and AFDB, (2007). African Economic Outlook pg 448-450

¹⁸ Okoye and Achakpa, (2007). Background study on water and energy issues in Nigeria.

¹⁹ Asad M. et al (1999). Water resources management IBRD and WB 1993

²⁰ <http://www.ozh2o.com/h2use.html> accessed on the 10 October 2010

6. Recreation
7. Navigation

In Nigeria, domestic supply, hydroelectricity, and industry are at present the main targets of water supply projects. The bulk of Nigeria's peasant farmers depend only on natural rainfall for growing their crops. Irrigation is confined to a few areas, which are concentrated mainly in the drier, northern parts of the country and to state-run farms. Flood control usually occurs as a result of harnessing surface waters; e.g., the construction of the Kanji Dam has raised the minimum flood and lowered the maximum flood in the river valley downstream of the dam. The result of this is that (1) navigation on the river is facilitated and (2) vast areas of land hitherto submerged during peak floods are now exposed all the year round and made available for agriculture. The main aim of the dam was to generate hydroelectric power and for fisheries. The other advantages would appear only incidentally, given the normal pattern of development in the country.²¹

3.3 Water Quality

According to the report financed by the European commission on water resources strategy in Nigeria 2006, Water quality falls into two categories – general water quality and drinking water quality; the former deals with raw water in its natural form that can support aquatic life as well as the ecosystem; the latter is raw water that has been treated and is of a quality fit for human consumption. Standards are required for all water, surface and ground water, in all of its uses in order to protect water as a usable resource. At present there is no effective system for protecting the quality of water. There are:²²

- No clear responsibilities
- No mandated water quality standards
- No effective water quality monitoring
- No enforcement
- No sanctions for polluters

²¹ Oteze G.E. (1981). Water resources in Nigeria. *Journal of environmental Geology*, 3(4):177 – 184.

²² Federal Republic of Nigeria: Water Supply & Sanitation Interim Strategy Note, November 2000. Available online at: siteresources.worldbank.org/NIGERIAEXTN/.../wss_1100.pdf accessed on the 12 October, 2010

- No remediation
- No overall picture of the extent of the problem

As environments get urbanized, there is always the influx/increase in population, with increase industrial development, wastes are frequently discharged into water courses which increase and consequently the water quality becomes seriously endangered²³.

In most urban areas in humid tropical African, industrial effluent, toxic metals organic waste and heat island exacerbate the problem of water quality. And in Nigeria there are large volumes of liquid and solid waste in cities like Lagos, Port Harcourt, Warri, Ibadan, Kaduna, Onitsha, Kano etc. (Aina, 1991; Omuta, 1999; Obasi and Balogun, 2001). Leacheates from these wastes according to Adejoke (1990), contain toxic substances that find their ways into boreholes, lakes, wells and other water bodies.²⁴

3.4 Water as an economic good

The concept of water as an economic good can be derived from the definition of economics, which is the study of "how people and society choose to employ scarce resources that could have alternative uses in order to produce various commodities and to distribute them for consumption, now or in the future, among various persons and groups in society."²⁵ The trend to treat water as an economic good was developed in economic literature in the 20th century. Since 1992 Dublin conference on water and environment, it has become generally accepted among water resources managers that water should be considered an economic good (the four Dublin principles, see Table 1). The fourth principle emphasized water has an economic value in all its competing uses and should be recognised as an economic good.²⁶

Table 2: The Dublin Water Principles

1.	Water is a finite, vulnerable and essential resource which should be managed in an integrated manner.
----	---

²³ Obasi and Balogun, (2001). Water Quality and Environmental Impact Assessment of Water Resources in Nigeria

²⁴ EFE S.I. (2005). Quality of Water from Hand Dug Wells in Onitsha Metropolitan Areas of Nigeria.

²⁵ Economics, Samuelson, P.A. et al., (1985), p4

²⁶ ICWE, (1992). The Dublin Statement and Report of the Conference

2.	Water resources development and management should be based on a participatory approach, involving all relevant stakeholders.
3.	Women play a central role in the provision, management and safe guarding of water.
4.	Water has an economic value and should be recognized as an economic good, taking into account affordability and equity criteria.

Source: ICWE, 1992

The conceptual framework of treating water as an economic good is comprised of two components: the value of water and the cost of water. The interaction of these two components contributes to the foundation which the realistic pricing of water resources is based on.

3.4.1. The value of water

Water has a value to users, who are willing to pay for it. Like any other good, consumers will use water so long as the benefits from use of an additional cubic meter exceed the costs incurred. The value of water to a user is the maximum amount the user would be willing to pay for the use of the resource. For normal economic goods which are exchanged between buyers and sellers under a specified set of conditions, this value can theoretically be measured by estimating the area under the demand curve. Since markets for water either typically

3.4.2. Elasticity of demand for water

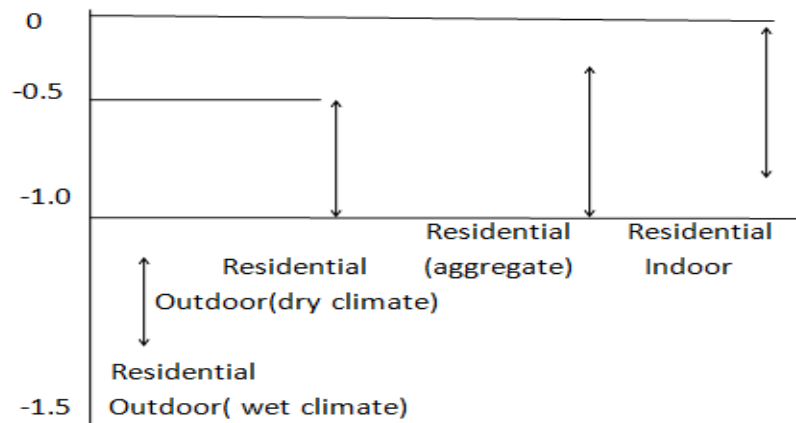
The major point that emerges from the (quite large) literature on the price elasticity of demand for water is that, in developing and developed countries alike, the price elasticity is significantly negative, meaning that users react to price increases by reducing demand. A second important point is that the price elasticity is, as common sense would suggest, related to the price level -- the higher the price, the greater the elasticity. (Obvious and common sensical as these findings may be, they contradict a large body of folk-lore about "non-responsiveness to prices" in the water profession.)²⁷

²⁷ Briscoe J., (1996). Water as an economic good: the idea and what it means in practice

Assumption: Applying WB 5% rule;

1. Price of water $\leq 5\%$ of Household Income =Elastic Demand
2. Price of water $\geq 5\%$ of Household Income =Inelastic Demand

Figure 1: Range of Price Elasticity of Demand for Water in United States



Source : Adapted from from Briscoe J. 1996

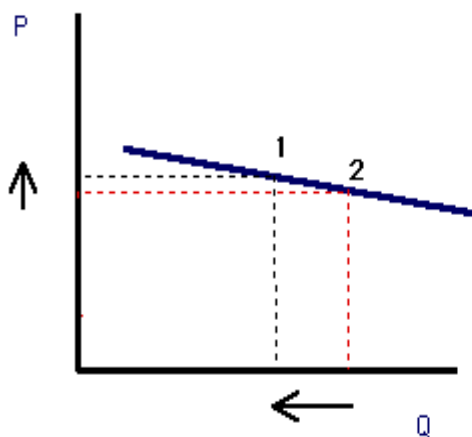


Figure 2 : Elastic Demand

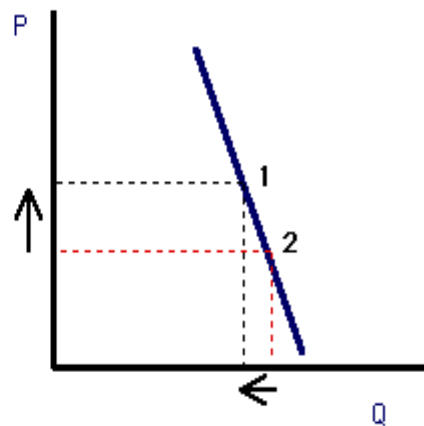


Figure 3 : Inelastic demand

3.4.3 Demand for water

The economic concept of demand states demand as the quantity of goods that an individual is willing to buy at a given price. Demand is effective only when it is backed up with the ability or willingness to pay. The market price of a good may not necessarily represent the individual willingness to pay for it, some individual maybe willing to pay more. 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 a demand or WTP curve for water.

The demand curve is downward sloping indicating a decreasing marginal value of water. As a result, the first 5 liters of water per capita per day will be extremely valuable as they are necessary to sustain life. The second five liters used for hygienic purpose will also be valuable. The next five liters are valuable for food preparation, cooking and laundry. As water is put to less and less valuable use, the marginal value of, and hence WTP for, each additional increment of water tends to decline gradually (ADB, 1999).

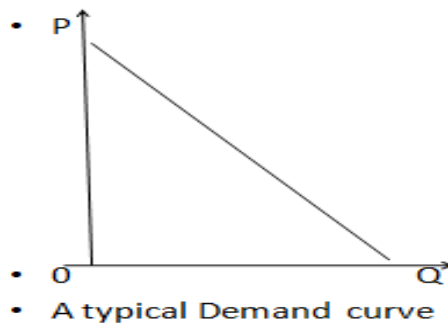


Figure 4: A typical demand curve

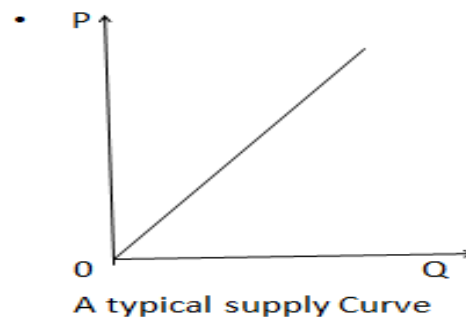


Figure 5 : A typical supply curve

3.4.4 Supply for water

Is the quantity of goods that the suppliers are willing to provide or supply at a given price, the suppliers will supply more if the price of the good or service is higher.²⁸ Water is

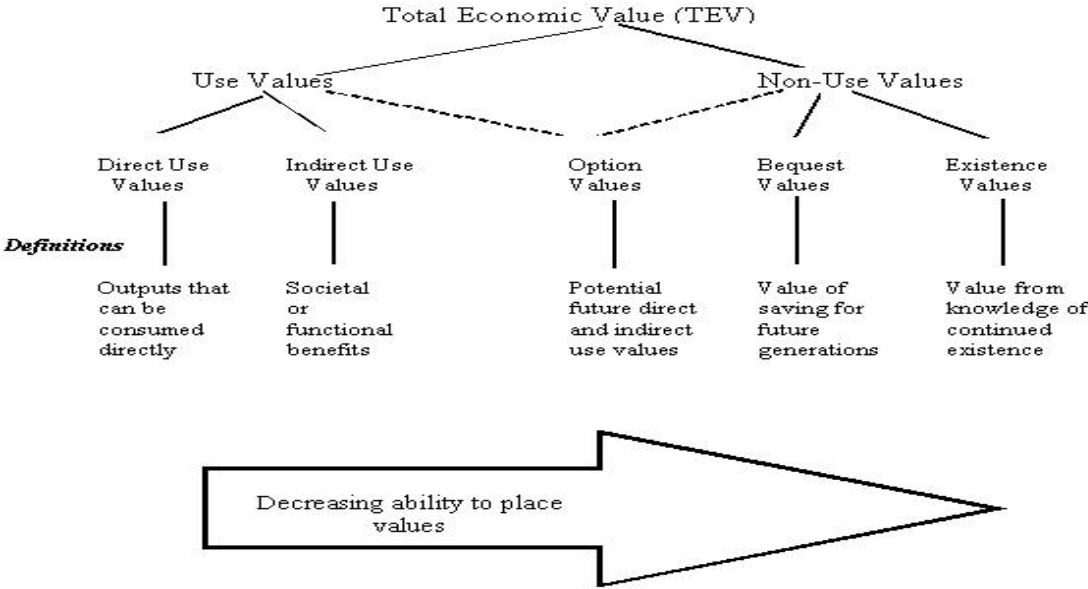
²⁸ Marcouiller D. (1999). Water as a public good: property rights. Water issues in Wisconsin

limited in supply and the demand consumption for water is growing daily due to growth in the population of the world that is why we have water stress in some part of the world.

3.4.5 The economic value

The total value of water is a combination of the use value and the non- use value of water. The use value of water comprises of direct uses, indirect uses, the non use value comprises of existence value, future options and bequest value. Estimating the economic value of water involves understanding that individual value water in different ways²⁹. Many of the world water shortages occur because we do not place proper economic value on water supplies³⁰

Figure 6 : Total economic Value



Source: http://www.coastalwiki.org/coastalwiki/Economic_Value

²⁹ Marcouiller, D., et al.,(1999). The economic value of water: an introduction,

³⁰ Cech, (2009). Principles of water resources: history, development, management and policy, 3rd Edition, 2010. pp 443.

3.4.6 The cost of water

There are three different costs incurred with the supplying of water; the first is the cost of constructing the dam, the cost of operating the system for storing, treating, distributing the water and maintenance. The second cost is the “opportunity cost”; this cost of the alternative uses forgone, i.e. when one uses affects other uses. The last cost is the cost of externalities which will be discussed in details in the subsequent section³¹.

3.4.7 Supply cost of water

Full supply costs are composed of two items: financial costi relating to the production of the water. Which consist of Operation and Maintenance (O&M) cost, and Capital cost. O&M Cost are associated with the daily running of the supply system. Typical costs include purchase of raw water, electricity for pumping, labor, repair materials, and input cost for managing and operating storage, distribution, and treatment plants. In practice, there is little dispute as to what are considered O&M costs and how they are to be measured. Capital costs include capital consumption (depreciation charges) and interest costs associated with reservoirs, treatment plants, conveyance and distribution systems³².

3.4.8 Opportunity cost of water

The cost of depriving the next best user of consuming the water, by consuming water the user is depriving the other users. Opportunity costs (or resource costs), which reflect the scarcity value of the resource; they refer to the cost of depriving the next possible user: if that user has a higher value for the water, then there are some opportunity costs experienced by society due to this misallocation of resources³³.

3.5 Water resources sustainability

Is a water resource system designed to meet needs or demands of this present generation without compromising the future generations’ needs or demands for water resources. The Brundtland commission’s report our common future³⁴; promotes the all compassing

³¹ Roger P., et al (2002). Water is an Economic Good: How to Use Prices to Promote Equity, Efficiency, and Sustainability.

³² IBID

³³ IBID

³⁴ WCED, (1987). Our common future

concept of sustainable development and defines sustainable development as “Humanity has the ability to make development sustainable to ensure that it meets the needs of the present without compromising the ability of the future generations to meet their own needs.”

When the definition of sustainable development is adopted in water resources development and utilization, it could be said that sustainable water resources development and utilization is development and utilization that meet current needs without compromising the ability of future generations to meet their own needs -- both for water supplies and for a healthy aquatic environment³⁵.

The UN’s Agenda 21 sees sustainable development as a way to reverse both poverty and environmental degradation. A major theme is to eradicate poverty by giving poor people more access to the resources they need to live sustainably. Agenda 21’s definition of sustainability includes; economic development, social development, and environmental protection³⁶.

A sustainable economy can only be realized if there is continued adaptation, creation, innovation, the implementation of new knowledge, new attitudes and new technologies and new operating policies to the betterment of humans and the environment. Water resource systems are no exemption. The sustainability of water resource systems will almost require periodic modification of those systems to meet changing demands and conditions³⁷.

One core principle of sustainable development is “**polluter pay principle.**” (PPP) It recognizes that polluters should pay environmental damage created by them. "The ‘polluter pays principle’ states that whoever is responsible for damage to the environment should bear the costs associated with it."³⁸

Polluter pay principle is to encourage water conservation and reduce pollution. According to the World Bank policy paper “preservation of the environment and the resource base are essential for the sustainable development.” The Polluter Pays Principle (PPP) and the User Pays Principle (UPP) are now widely accepted in the OECD countries. The UPP was

³⁵ UNDP, (1998). Capacity building for water resource and aquatic environment

NOTE: IBID means the reference is the same as the previous number

³⁶ Roger P; et al (2002). Water is an Economic Good: How to Use Prices to Promote Equity, Efficiency, and Sustainability.

³⁷ Loucks and Gladwell (1999). Sustainability Criteria for Water Resource Systems, Working Group of UNESCO

³⁸ Taking Action, the United Nations Environmental Programme, chapter 2
<http://www.nyo.unep.org/action/02.htm> accessed on the 10 October 2011

recommended as a measure to “at least cover the opportunity costs of capital, operation, maintenance, and environmental impacts.”³⁹

3.6 Legal framework concerning water resources in Nigeria

Environmental laws in Nigeria⁴⁰

The Nigerian constitution of 1999 recognises the need to preserve the environment of which water resources is included. Section 20 of the constitution makes it an objective of the Nigerian State to improve and protect the air, land, water, forest and wildlife of Nigeria.

Administered by the Ministry of Environment, the National Environment Standards and Regulation Enforcement Agency (NESREA) Act of 2007 replaced the Federal Environmental Protection Agency (FEPA) Act. It is the embodiment of laws and regulations focused on the protection and sustainable development of the environment and its natural resources. Despite the review of these laws, the enforcement of the laws is not effective and the stipulated punishment is not sufficient to curb offenders.

The National Water policy (NWP) 2004 recognises the need to balance water uses, water allocation and water protection carefully through a regulatory system of river-base management participatory approach. It makes it clear that water is a resource that has to be managed in a sustainable manner as a limited natural resource and, as such it has to be treated as an economic good. This is because water is supplied at a cost and the service may not be sustained if the real cost of supplying is not recovered. The NWP also makes it clear that water pricing will be set at levels that ensure financial viability of the providers of water; an essential underpinning to government efforts to involve the private sector in the provision of water, particularly drinking water⁴¹.

3.7 Drivers of Nigeria water resources

All the three tiers of Government in Nigeria are the drivers of water resources in Nigeria.

The federal Ministry Of Water Resources and Rural Development.

³⁹ OECD, (1989). Water resources management: Integrated policies. OECD, Paris

⁴⁰ <http://www.elri-ng.org/news> accessed on 20 February 2011

⁴¹ www.wsscc.org/.../wateraid_water_and_sanitation_in_nigeria_briefing_on_national_policy_2008.pdf accessed on 10 October 2010

The State Water Authorities (SWAs)

The local Governments Authorities (LGAs).

The overall management of water resources is the exclusive responsibility of the Federal Ministry of Water Resources headed by the Minister for Water Resources with the responsibility to enforce all national policies, federal laws and regulations relating to water resources management and development⁴².

The federal government both acts as the provider and regulator of water resources in Nigeria. There is also PSP in providing water to the populace but the activities of the PSP are strictly monitored.

⁴² Okoye J.K. et al, (2007). Journal of sustainable development in Africa, Volume 11, No 2. 2009. Available online at : www.jsd-africa.com/Jsda/V11N02.../MillenniumDevelopmentGoal.pdf

4. WATER PRICING (ANALYSIS AND RELATED ISSUES)

One school of thought sees water pricing as a tool or instrument for water allocation and another school of thought sees water pricing as instrument to achieve financial sustainability. Only if the financial costs are recovered can an activity remain sustainable. It is seen as an instrument to break the vicious circle of “free water dilemma.”⁴³

Water pricing has gained widespread acceptance as a valuable and versatile tool to promote a number of goals⁴⁴ have identified the main goals of water pricing as follows: economic efficiency, revenue stability, equity, income redistribution, and water resource conservation⁴⁵.

Water as an economic good is scarce in some contexts, droughts, degradable quality because of negative externalities. And anything that is scarce and in demand commands a price. so water pricing is increasingly seen as an acceptable instrument of public policy⁴⁶. 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 a demand or WTP curve for water. The demand curve is downward sloping indicating a decreasing marginal value of water. As a result, the first 5 liters of water per capita per day will be extremely valuable as they are necessary to sustain life. The second five liters used for hygienic purpose will also be valuable. The next five liters are valuable for food preparation, cooking and laundry. As water is put to less and less valuable use, the marginal value of, and hence WTP for, each additional increment of water tends to decline gradually⁴⁷.

World Bank promotes pricing of water as a means for public water utilities to manage the allocation of existing water supplies more effectively⁴⁸. It therefore supports the economic concept of willingness to pay for water (1992). The bank’s approach is estimating a level of

⁴³ Savenije and van der Zaag, 2002. *Water as an Economic Good and Demand Management Paradigms with Pitfalls*

⁴⁴ Borland and Whittington, 2000. The political economy of water tariff design in developing countries

⁴⁵ Ayman R. 2009. Water Pricing as a Means to Ensure Water Conservation: A Case Study from Palestine

⁴⁶ OECD, 2010. Water pricing in OECD countries

⁴⁷ AFDB, (1999)

⁴⁸ World Bank, (1997)

WTP is by application of 5% rule. The rule commonly assumes that there is an elastic demand for the purchase of water with the cost of less than 5% of household's income an inelastic demand where the cost exceeds 5% of the household's income. Winpenny (1994) criticizes such a broad approach to accessing level of WTP not least because it does not allow for varying values of water through space and time⁴⁹. Rogerson (1996) agrees with Winpenny by stating that development agencies tend to overestimate the amount individuals are WTP whilst government agencies tend to underestimate. Consequently Rogerson (1996) advocates further research but at the household level in order to assess levels of WTP more accurately⁵⁰.

Water pricing in Nigeria differs across the country, but in all situations, water is generally subsidised. In urban and peri-urban areas, water charges are based either on the volume of water consumed or on a flat rate. In most rural areas, however, water is often supplied to the population free of charge. Water scarcity is a common phenomenon in many towns and cities in Nigeria, and this compels people to buy water from private water vendors. The proportion of unaccounted for water varies across different regions, with the national average being estimated at around 40 per cent⁵¹.

There are different water pricing structures adopted by different countries and in different regions of the world; OECD countries are moving from fixed charges to volumetric water pricing. It is the use of water pricing structure that will determine if it encourages present wasteful consumption, conservation, efficient use of the water resources or if the cost of supply is covered (marginal cost).

The systematic adoption of full marginal cost pricing of water services is what is usually recommended. 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 system⁵². In practice water pricing may be designed to meet many objectives: to ensure cost recovery, raise revenue, manage demand and improve on water allocation and conservation of scarce resources, and redistribute income by discriminating among different categories of users⁵³.

⁴⁹ Winpenny, (1994). *Financing Water for All*

⁵⁰ Rogerson, C. (1996). Willingness to pay for water: The international debates, *Water SA*, 22(4), p373-80

⁵¹ OECD and AFDB, (2007). *African Economic Outlook* pg 448-450

⁵² etd.ohiolink.edu/send-pdf.cgi/UkoliOnodipe%20Grace.pdf?

⁵³ www.springerlink.com/index/862v1771633627r0.pdf

In the past most cities and utilities in the world have provided water to their customers almost free of charge because water is considered a basic necessity, and because water was a relatively cheap and abundant resource. But now with much larger communities requiring service, the only way to ensure that everyone has access to this basic need is to ration it in some way. And perhaps the best way to utilize water to the best and most-valued uses is to put a price on water, and construct appropriate tariff structures to meet different social, political and economic goals in different situations⁵⁴. 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 customers⁵⁵. The public or administrative pricing, two-part tariff system and increasing block tariff structure are popular combinations.

Water pricing has been viewed primarily as an economic instrument for efficient water management, it is increasingly recognized that water pricing could improve use efficiency and conservation thereby improving both quantitative and qualitative state of water resources. Water pricing could play an effective role in enhancing the sustainability of water resources.

4.2 Types of water pricing structure

4.2.1. Flat rate

Flat rate means consumers pay the same amount of charges in respective of the volume of water use or consumed; this kind of regime often gives room for wastage of water by consumers. The advantage is that it is simple and easy to calculate. The disadvantage is that it does not provide incentive for consumers to conserve water. And therefore results into wasting water severely⁵⁶.

4.2.2 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

⁵⁴ Rogers P. et al, (2002). Water is an Economic Good: How to Use Prices to Promote Equity, Efficiency, and Sustainability

⁵⁵ IBID

⁵⁶ Jordan, J.I. (1998)b. Georgia water series, issue 5: rate design for small system. Georgia: University of Georgia Press.

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. In such cases public initiative may be required to ensure that levels of investment are appropriate⁵⁷.

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.

4.2.3 Uniform price with rebate (UPR)

In this tariff structure, a household's water bill is based on a volumetric charge set equal to long run or short run marginal cost, and a fixed monthly rebate. The rebate portion of the price structure reflects basic needs considerations and the size of the rebate is driven by the extent of poverty of the population and the level of basic need. The subsidy aspect of UPR can be targeted to a specific population or non-targeted when it applies to all users regardless of need. Targeting a rebate specifically to low-income households has the effect of increasing the efficiency of this price structure because in this case the total fraction of water use billed at marginal cost is increased.

Reliable identification of low-income households is problematic, but where the institutional capacity to do so is available, existing social agencies may be able to administer the subsidy, as currently occurs in Chile. Even though UPR tariff structure is transparent, easy to implement, requires less data for design and revenue estimation, is arguably fair and equitable in most circumstances, it has a smaller probability of inducing economic inefficiency and is more effective at transferring income⁵⁸.

⁵⁷ Dinar and Subramanian, (1999). Water Pricing Experiences: An International Perspective

⁵⁸ Boland, J.J and Whittington, D., (2000). The political economy of water tariff design in developing countries

4.2.4 Volumetric water rate

According to the report of the international Bank for Reconstruction and Development and World Bank (2005) Volumetric water pricing the charge is based on the amount of water delivered. The economic optimal pricing rule requires that price should be set equal to the marginal cost of providing the water, and it requires accurate measurement of water through meters. The advantage of this pricing method is that it encourages farmers to limit their water use. However, it has several disadvantages. First, the implementation costs can be high because meters are required, and they have to be honestly read and reported⁵⁹.

4.2.5 Two-Part Rate

It combines the volumetric pricing and basic rate, this system is made up of two parts: a fixed element and a variable element. One advantage of the two-part tariff system can ensure that water suppliers have fixed revenue. 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 expenses⁶⁰. The variable element charges the consumer according to his consumption level and therefore encourages efficient use and conservation of water⁶¹.

4.2.6 Block pricing

“Block pricing involves varying the water price when water use for a set time period exceeds a set volume (e.g. 5,000 m³ per hectare per season). If high water charges are a concern, an increasing block charge can be used. The price of the first block can be set below O&M costs. The second and later blocks are raised to higher rates that cover O&M costs and reflect the marginal cost of operations⁶².”

4.2.7 Increasing Block rate

The volumetric charge changes in steps with volumes consumed. The main objective is to encourage conservation of water since the price of water increases as the volume increases.

⁵⁹ IBRD and World Bank, (2005)

⁶⁰ Dinar, (1997)

⁶¹ Rogers, P. (2002). Water is an Economic Good: How to Use Prices to Promote Equity, Efficiency, and Sustainability

⁶² Easter K and Liu Y., (2005). Cost recovery and water pricing for irrigation and drainage projects

Therefore consumers who use less amount of water pay less and consumers who use more amount of water pay more⁶³.

4.2.8 Decreasing Block rate

The volumetric rates decline with successive consumption blocks. It is used to reflect the economies of scale present in serving larger users, it makes the added use of water less expensive on a per unit basis. It does not encourage or promote water conservation⁶⁴.

4.2.9 Seasonal rate

In the water industry it is increasingly common to observe rates that vary by season; volume charges are higher during the peak season and lower during the off-peak season. It is referred to as seasonal rate. This pricing structure approximates marginal cost pricing⁶⁵.

4.3 Principles of water pricing

Water is a "rival" and non-exclusive good. A "rival" good means that the supply of water is decreased or diminished in quality with every additional user. Non-exclusive good means water belongs to everyone but how do we decide who is allowed to use it and who is not⁶⁶. Under this situation, price can not be used as a tool to allocate water among users. Non-exclusive good may result in over exploitation because of the problem of "free rider". Water non-excludable nature makes it impossible for market forces to operate. In order to promote the efficiency of water allocation and provide reliable water supply, water pricing should comply with the principles outlined in subsequent sections

4.3.1 Fair and equal principle

Water is a necessary factor for life and production. It is the basis of human beings' survival and development. Everyone has the right to access clean water to meet his basic needs. Therefore, water pricing must enable all people, regardless of whether they are low-income or high-income earners to afford the water for basic needs. Besides to ensure that everyone can use water, the fairness and equality should ensure that payments by users commensurate with the water services they received. Therefore, the price of water for users should vary with their income level. The fair and equal principle requires the affordability

⁶³ Jordan. J.I., (1998)b Georgia water series, issue 5: rate design for small system. Georgia: University of Georgia Press.

⁶⁴ IBID

⁶⁵ IBID

⁶⁶ Marcouiller D. et al. (1999)

and willingness-to-pay of users. Under some circumstances, it is required to consider making two-part rate or life-line rate⁶⁷

4.3.2 Efficient allocation principle

Water is a scarce resource. Efficient allocation of water should be a priority when water price is set. Only when water price reflects its true economic cost, water could be allocated efficiently among different users. In the economic sense, efficiency occurs when each user pays a price that reflects the marginal cost of the water⁶⁸.

4.3.3 Revenue adequacy and stability principle

In order to keep the water utility operate sustainably, water pricing should do the job to produce the required revenues to meet the water needs of the community. The only way to achieve this goal is through the full supply cost pricing of water. In addition, revenue stability is also important. Stable revenues allow for more accurate budgeting, better planning, and lower long-term financing costs. To run a water utility, revenues must be predictable⁶⁹.

4.4 Public good versus private good

Public good is a good that is supplied to the public at no price but cost of the good is paid for by the government through tax payers' fund and therefore the price is not determined by market forces while a private good is provided or supplied at a given price and the price is usually determined by market forces.

Debates on how water should be allocated or managed arise due to differing views and definition of water, and are often rooted in the differences in legal status of water in various countries. Water is often regarded as "public good"- a "gift" from nature (as exemplified by the enjoyment of a lake for its aesthetic value or for public bathing), the use of it by one person does not diminish the potential for use by others (non-rivalry in consumption), and access to which can not be restricted (non-excludability). In this view everyone has a right

⁶⁷ SHAO, L., (2000). Water pricing towards sustainability of water resources: A case study of Beijing

⁶⁸ Baumann, D., (1997). Urban water demand management and planning. Chapter 5

⁶⁹ Jordan, J.L., (1998)b. Georgia water series, issue 5: rate design for small system. Georgia: University of Georgia Press.

to water, and it is ultimately the government responsibility to ensure that every citizen's basic human needs are met in terms of sufficient quantity and quality.

At the same time, it is generally acknowledge that the right of water does not mean unlimited consumption especially when ecological and economic constraints prevail. In fact when water is provided through infrastructure, access is marked by rivalry in consumption (consumption by one person reduces availability of others) and excludability (access to the resource can be restricted unless payment is made). Water then acquires a "private good"⁷⁰.

According to the article published by the UN on Thursday November 28, 2002 by the internal press service: "The United Nations Committee on Economic, Cultural and Social Rights issued a statement declaring access to water a human right and stating that water is a social and cultural good, not merely an economic commodity".

If water is supplied to the people at a cost, who bears the cost of supplying water to the users and maintaining the system? The users or the government? In Nigeria, the ordinary layman thinks that water is a free gift of nature and human right and as such should be supplied or provided freely by the government. This mentality has made the water resources to be wasted and inefficiently managed in the past.

A public good refers to the right of use of water for all people- for basic human consumption and sanitation needs, for aesthetic values, and for environmental protection. It is generally agreed that no human should be deprived of drinking water even if he or she has no ability to pay for its use. Government has the responsibility for ensuring that basic human needs are met in terms of water quantity and quality⁷¹. The first article of the Israeli water laws states "The water resources in the State are public property." In another section, it is stated that "A person's right in any land does not confer on him a right in a water resource situated thereon or crossing it thereon."⁷² The right to use the water is linked to one of the following purposes:

I. Domestic

2. Agriculture

3. Industry

⁷⁰ OCED, (2002). Social Issues In the Provision & pricing of water services, Pg 19.

⁷¹ Cech, (2009). Principles of water resources: history, development, management and policy

⁷² Oteze G.E. (1981). Water resources in Nigeria. *Journal of environmental Geology*, 3(4):177 – 184.

4. Handicraft, commerce, and services

5. Public services, after which this right ceases. (Aloni 1970)

4.5 Issues of Health, Sanitation, poverty and Food security

4.5.1 Health

The focus of the United Nations summit, 2000 was set in the Millennium Development goals, the goals are eight in number. One of the targets towards achieving these MDGs includes the reduction of the proportion of people without sustainable access to safe drinking water and basic sanitation by half of 2015⁷³. The United Nations Millennium Declaration, signed in September 2000 commits world leaders to combat poverty, hunger, disease, illiteracy, environmental degradation, and discrimination against women⁷⁴.

The World Health Organization (WHO) estimate 1.8 million people in developing countries die every year from diarrhea and cholera, Out of these 90 percent are children under the age of five years, while 88 percent of diarrhea diseases are attributed to unsafe water supply, inadequate sanitation and hygiene⁷⁵. Lack of access to good quality drinking water and lack of sanitation, leading to environmental health hazards contribute largely to the very low life expectancy in many African countries

Water related diseases are amongst the most common causes of illness and death and the majority of people affected by them live in developing countries⁷⁶. 90 percent of malaria cases are in sub-Saharan Africa, good quality water and clean environment will help to eradicate water borne diseases like malaria, typhoid, diarrhea, river blindness, guinea worm etc. In table 3 below malaria and cholera has the highest number of diseases reported from 2003-2007.

Table 3: Reported cases from some notable diseases

	2003	2004	2005	2006	2007

⁷³ Adedeji and Ako, (2008). Towards achieving the United Nations' Millennium Development Goals

⁷⁴ http://www.who.int/topics/millennium_development_goals/en/ Accessed on 10 October, 2010

⁷⁵ WHO, (2004). The World Health Report 2002. Geneva. WHO. Switzerland

⁷⁶ http://www.unesco.org/water/iyfw2/water_use.shtml accessed on the 31 January 2011

Diarrhea	214,183	123,240	362,183	313,575	424,668
Cholera	2,599	1,386	10,785	20,526	12,194
Guinea worm	1,459	496	Nil	Nil	Nil
Malaria	2,631,696	3,109,166	3,183,073	3,547,830	4,481,725

Sources: Federal Ministry of Health, Nigeria

4.5.2 Access to Sanitation

Water and sanitation go hand in hand; water is needed for sanitary purposes; for flushing of toilets, bathing and washing of hands for hygiene. The situation in Africa is more dramatic than water both in terms of the low level of access and limited progress since 1990. In 2004, two out of three people in SSA had no access to improved sanitation, with the case of further increase of 91 million people without access to sanitation services by 2015⁷⁷.

According to the survey carried out by (Stoveland and Bassey, 2000),74.6 percent of people who live in small towns of Nigeria use pit latrines while 27.4 percent get their water supply from rivers and streams and 67 per cent dispose their solid waste on dumping ground. 35 percent of the urban population of Nigeria is using improved facilities, 25 percent of the rural population is using improved sanitation⁷⁸.

Nigeria lacks a comprehensive strategy on sanitation as a whole, including excreta disposal, solid waste disposal, wastewater disposal, drainage and treatment of wastewater. There is very little sewerage in urban areas and waste water disposal pollutes the surface water⁷⁹. According to water aid the mortality rate due to poor sanitation in Nigeria is alarming approximately 5-20 percent resulting from diseases such as diarrhea, cholera, typhoid, Paratyphoid, guinea worm etc ⁸⁰ Lack of access to good sanitation constitutes a serious public-health problem in Nigeria.

It is estimated that improved sanitation facilities could reduce diarrhea-related deaths in young children by more than one-third. If hygiene promotion is added, such as teaching

⁷⁷ OECD and AFDB, (2007). African Economic Outlook pg 448-450

⁷⁸ UNICEF, 2006

⁷⁹ Water Supply & Sanitation Interim Strategy Note November, 2000

⁸⁰ Nigeria sanitation Policy 2004

proper hand washing, deaths could be reduced by two thirds. It would also help accelerate economic and social development in countries where sanitation is a major cause of lost work and school days because of illness⁸¹. The development of water supply and sanitation can reduce waterborne diseases⁸².

4.5.3 Poverty

Nigeria has made great strides in reducing poverty levels. According to a recent survey, the proportion of people living below poverty line decline from 70 percent in 2000 to 54.4 percent in 2006⁸³.

Poverty is no longer seen as a simple lack of income or at national level, low per capita Gross National Product (GNP). It is today recognized to be complex, multifaceted situation that involves both the material and non material conditions of life. Many international organizations have put forward new approaches to poverty reduction in recent years, which have important implications to the development of all aspects of life, including key areas of natural resources management such as water.

Some rural dwellers who dwell in the riverine areas of Nigeria examples Epe, Badagry, Niger-Delta, Ilaje, Ekitipupa etc. depend on the river for their source of income as most of them are fisher people. The Niger-Delta people can no longer fish in their river and farm on their land because the water and land is polluted by multi-national oil companies; the poverty level and crime rate is high in that region.

Poverty in Nigeria is more widespread in the northern parts of the country, but more intense and severe in the riverine and remote southern areas. Urban poverty is on the rise and often severe. It is estimated that about 48% of urban dwellers are living in poverty. About 30 million people were defined as extremely poor in 1996 compared to 4 million in 1980⁸⁴.

One of the earliest new approaches springs from United Nations Development programmes (UNDP) “Human poverty index” introduced in 1997 Human development Report which views poverty in terms of lack of basic capabilities. The index consist of five key indicators: Literacy, life expectancy, access to safe water, availability of health services and the proportion of underweight children aged five and under.

⁸¹ <https://waterforlifeworldwide.com/why-water/the-critical-need/>

⁸² . http://www.uneca.org/awich/African_Water_Regional_Report/chapter5.pdf

⁸³ (OCED and AFDB, (2007).

⁸⁴ Water Supply & Sanitation Interim Strategy Note November 2000

4.5.4 Food security

Food security exists when all people at all times have access to sufficient, safe and nutritious food to meet their dietary needs and food preferences for an active and healthy life⁸⁵. Water is a key to food security; good quality water is needed for irrigating farms in order to boost agricultural supply or production of food supply and invariably provide nutritional food the people. Agriculture mainly depends on rain and irrigation for growth.

“Water scarcity, poor water quality, and inadequate sanitation negatively impact food security”⁸⁶. “Water availability for household consumption and for productive use is closely associated with poverty reduction and food security. There is food insecurity in the Niger-Delta of Nigeria due to frequent oil spills by the multinational oil companies; the environment on which the people depend on food and their source of livelihood is polluted and damaged”⁸⁷.

4.6 Water negative externalities

All human activity has an impact on the environment, either positively or negatively. However, the prices of goods bought and sold in markets tend to exclude environmental costs and benefits. Where the market price fails to take into account such costs and benefits, they are termed 'externalities', since they are external to the market⁸⁸.

Water resources exhibit externalities in the sense that they have the property of "mutually interfering usage"⁸⁹. The pollution of water resources in Nigeria by harmful substances examples sewage, hyacinth, solid waste, industrial chemicals, pesticides, oil spill etc; the cost of cleaning up the polluted environment is not added to the price of the products or services; it is rather borne by the third party which may be the people who depend on the resource for survival. According to the World Bank report in developing countries 70 percent of industrial waste are dumped untreated into the water thereby polluting the usable water supply. Water resources negative externalities induced by oil spill cannot be completely

⁸⁵ <http://www.fao.org/spfs/en/> accessed on 10 October, 2010

⁸⁶ <http://www.un.org/waterforlifedecade/background.html> accessed 10 December, 2010

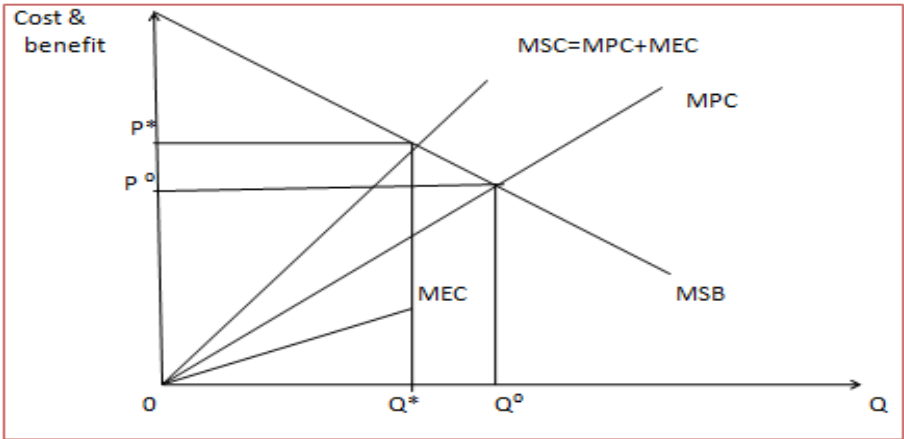
⁸⁷ Amnesty International, 2009. Petroleum pollution and poverty in the Niger-Delta

⁸⁸ Connelly J. et al, 1999. Politics and the environment: from theory to practice. London: Routledge.

⁸⁹ Briscoe J. 1997. Managing water as an economic good: rules for reformers

eliminated even in the best oil fields of the world there is still oil spill, the recent Mexican Gulf oil spill that happened in April 2010 was due to a sequence of failures on the part of a number of the parties involved. There are some accidents that will happen even if necessary precautions are taken.

Figure 7 : Water negative externality



Source: Adapted from Prochazka, 2010

The demand curve represents the marginal social benefits (MSB) to consumers, the marginal private cost to firms (MPC), and the marginal social cost (MSC) to the society or consumers which is equal to the MPC + MEC. The Marginal externality cost (MEC) suffered due to pollution of water resources.

If there is no pollution tax the producers will produce at Q^0 but if there is pollution tax the producers will cut down on there level of production and produce at Q^* ; the Marginal social curve will coincide with the marginal cost to the society curve and thus correct efficient problem. It is economically efficient to produce at Q^* but market forces will move it to Q^0 . The social optimum is attain at the point where $MSC=MBC$.

The government policy dealing with pollution and negative externality has been one of regulation. Most economists believe that this is a less efficient method of dealing with the problem than a policy of pollution tax.

The sources of water pollution in Nigeria can be broadly categorized into four including municipal, industrial, oil induced and agricultural sources. These are highlighted below:⁹⁰

4.6.1 Municipal water pollution

Municipal water pollution consists of wastewater from homes and commercial establishments. Municipal water pollution increased significantly from the 1970s due to the increased population and prosperity in the country as a result of oil-boom that improved consumption habit⁹¹. Unfortunately, these changes were not matched with adequate planning and measures to combat and counteract the natural effect of the tremendous domestic waste generated particularly in the cities and urban centres⁹². Disposing of domestic wastes including sewage, human and animal waste, biodegradable wastes like papers, polythene bags directly into drains, gutters, streams and rivers became the norm. Wastes from pit-latrines that remain a common feature of Nigerian towns and villages also contribute to pollution of water bodies. This has consequences which include scarcity of oxygen for aquatic animals and leads to their death and further pollution of the water⁹³. Many water bodies that flow through many of Nigeria's cities and urban centers are polluted this way.

4.6.2 Industrial water pollution

Industrial by-products including chemical substances used in the manufacturing process are often discharged as untreated wastes and effluents directly into rivers, estuaries, lagoon or the sea. For instance, industrial wastes from the Lagos metropolis that are discharged daily into the lagoon through the streams feeding it

⁹⁰ Adedeji and Ako, (2008). Towards achieving the United Nations' Millennium Development Goals

⁹¹ Akanle, (1975). legal perspective on water resources and environmental development policy in Nigeria, *Nigerian Law J.*, 12(1) (1981)

⁹² Nigeria Third National development Plan, (1991)

⁹³ Nigeria Environmental Study, (1991)

have adversely affected marine life, navigation, and the aesthetic value of the city⁹⁴. The affected rivers have become permanently bluish green in colour and are characterized by high levels of potential hydrogen (pH), sodium compounds and lead content. These and other related factors have made the water unsuitable for domestic and recreational uses⁹⁵.

4.6.3 Oil-induced pollution

Oil pollution is perhaps the most significant cause of water pollution in the Niger Delta region. The water bodies of the Niger Delta region that hosts upstream activities is directly impacted by exploration and production activities. These include dumping of drill mud and oil soaked wastes, oil spillages and gas flaring that result in acid rain. These contaminate the water bodies and result in decline in the availability of quality water. Polluted water sources in the region flow into other water bodies, pollute them and further reduce the quantity of water fit for human consumption and use⁹⁶.

Oil spill on land destroy crops and damage the quality and production of soil that the communities use for farming. Oil in water damages fisheries and contaminates water that people use for drinking and other domestic purposes⁹⁷.

Nigeria has recorded several cases of marine pollution, it would appear, there are two outstanding cases namely, the Funiwa-5 oil well blow-out of 1980 in which, well over 400,000 barrels of crude spilled into the marine environment of Nigeria, as well as Mobil's Qua Iboe oil spillage of 1998 which resulted in the spillage into the marine environment of about 40,000 barrels of crude oil⁹⁸.

4.6.4 Agriculture-induced water pollution

Agriculture has also been a source of water pollution in Nigeria since 1976 when subsequent governments have initiated policies that promote accelerated food production. This has increased the use of fertilizers, herbicides and pesticides that

⁹⁴ Onaji, (1989). . Legislation and technical needs for river pollution in Nigeria

⁹⁵ Odeh, (2006). Industrialist responsible for lagoon pollution, Daily independent Lagos, vol. 3, no. 1033

⁹⁶ Salami, (1998). Statutory control of municipal and industrial water pollution

⁹⁷ Amnesty international, (2009). Petroleum pollution and poverty in the Niger-Delta

⁹⁸ Aghalino and Eyinla, (2009)

contribute to water pollution⁹⁹. For instance, the nitrates, phosphates and other plant nutrients which come from fertilized farm lands encourage the growth of algae and phytoplankton in water bodies. These become a menace to water bodies as their decomposition drastically cuts down the amount of dissolved oxygen in water resulting in the deaths of aquatic animals and consequently, water pollution. These chemicals are also sprayed directly into the water bodies to catch fish. Sediment pollution of water bodies, as a result of accelerated soil erosion is also a serious and widespread problem in Nigeria. The areas particularly affected are the Northern States, and the erosion disaster areas of the South Eastern States where agricultural practice leaves the soil bare at the start of the rainy season¹⁰⁰.

Table 4: Price of water by source in Lagos

Sources of water supply	Average price in Naira/m ³	Average price in USD/m ³
LSWC	50	0.33
Sachet water	100,000	658.55
Wells	100	0.66
Pushcart/Water vendor	400	2.63
Tankers	2,500 per 25,000 gallon of water	16.46

Sources: LSWC, 2007- Adapted from Obayagbona H., 2008 with modification

Table 5: Water pricing of some selected countries

Country	\$/M ³
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⁹⁹ The Punch Newspaper, 2006

¹⁰⁰ Nigeria Environmental Study, 1991. Nigeria's Threatened Environment

Germany	1.91
Denmark	1.64
Belgium	1.54
Netherlands	1.24
France	1.23
United Kingdom & Northern Ireland	1.18
Italy	0.76
Finland	0.69
Ireland	0.63
Sweden	0.58
Spain	0.57
Canada	0.40
U.S.A	0.51
Australia	0.50
South Africa	0.47

Source: Adapted from WWW.UNESCO.ORG\WATER with modifications

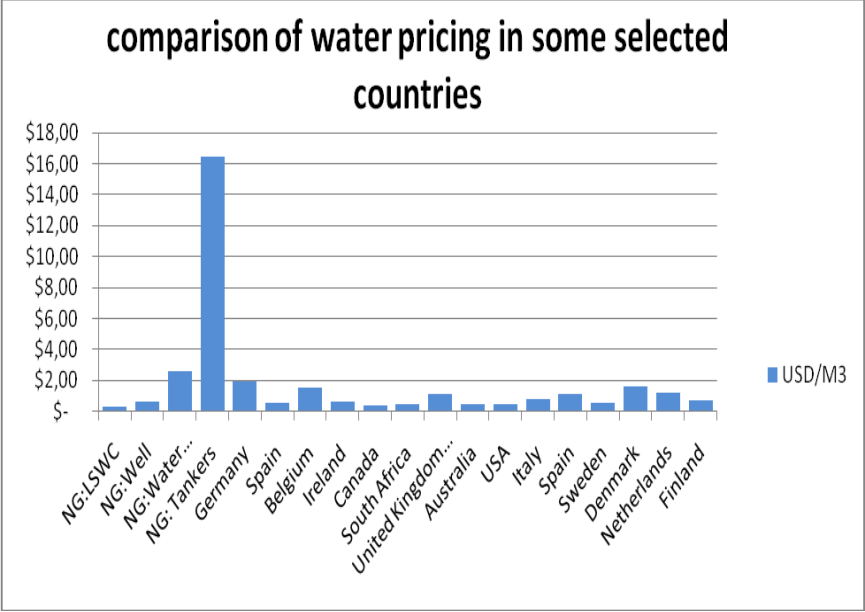


Figure 8 : Comparison of Water Pricing In Some Selected Countries [Own Computation based on Table 4 & 5

4.8 ANALYSIS AND DISCUSSION

WTP is used to analyse the water pricing in Nigeria. It is an economic concept which aims to determine the amount of money a consumer will pay for the supply of water. It is a concept applied to many research studies worldwide revealing very high levels of willingness to pay for water in developing countries.

WTP is the maximum amount that an individual states they are willing to pay for a good or service¹⁰¹. It is an amount of money the consumer is willing to give up in order to enjoy an improved quality of water.

The current method for assessing levels of WTP, contingent valuation Method (CVM) was not possible to pursue in this study because of time and resource restraints. The CVM reveals levels of WTP as interviewees respond to a hypothetical market in terms of a bidding game according to a specific type of water supply service.

Ninety –Six questionnaires were administered. The variables used for the multivariate regression analysis were Gender, levels of Household income (INC), Educational Level (EDC), Household Size and the willingness to pay (WTP) to prove that there is relationship between dependent variables and WTP.

The multiple regression model or analysis is used to determine the relationship between the WTP and the dependent variables; the dependent variables (regressand) are gender, income level, family size and educational level. The independent variable (regressor) is WTP

MULTIPLE REGRESSION MODEL

$$\hat{Y} = \beta_0 + \beta_1 (G)_1 + \beta_2 (HH)_2 + \beta_3 (INC)_3 + \beta_4 (E)_4 + \mu_i$$

Where:

$$\hat{Y} = \text{WTP}; \text{WTP} = f(G, \text{INC}, E, \text{HH})$$

G_1 =Gender

HH_2 = Family Income level

INC_3 =Family size

E_4 =Educational level

μ_i = Stochastic term

WTP depends on gender (G), household income level (INC), educational level (E) and household size (HH)

HYPOTHESIS

¹⁰¹ DFRID, 1997. Available online at:

www.partnershipsforwater.net/.../006T_Willingness%20to%20pay.pdf

H₀=There is no relationship between variables

H₁=There is a positive relationship between variables

To capture various determinants of WTP the following multivariate regression analysis is conducted:

$$WTP_i = \beta_0 + \beta_1 (G) + \beta_2 (INC) + \beta_3 (E) + \beta_4 (HH) + \mu_i$$

The willingness of household to pay for water according to the survey carried out revealed that 10% of the respondents are willing to 300 naira, 15.6% are willing to pay 400 naira, 32% are willing to pay 800 naira, 5% are willing to pay 600 naira, 19% are willing to pay 700 naira and 10% are willing to pay 500 naira.

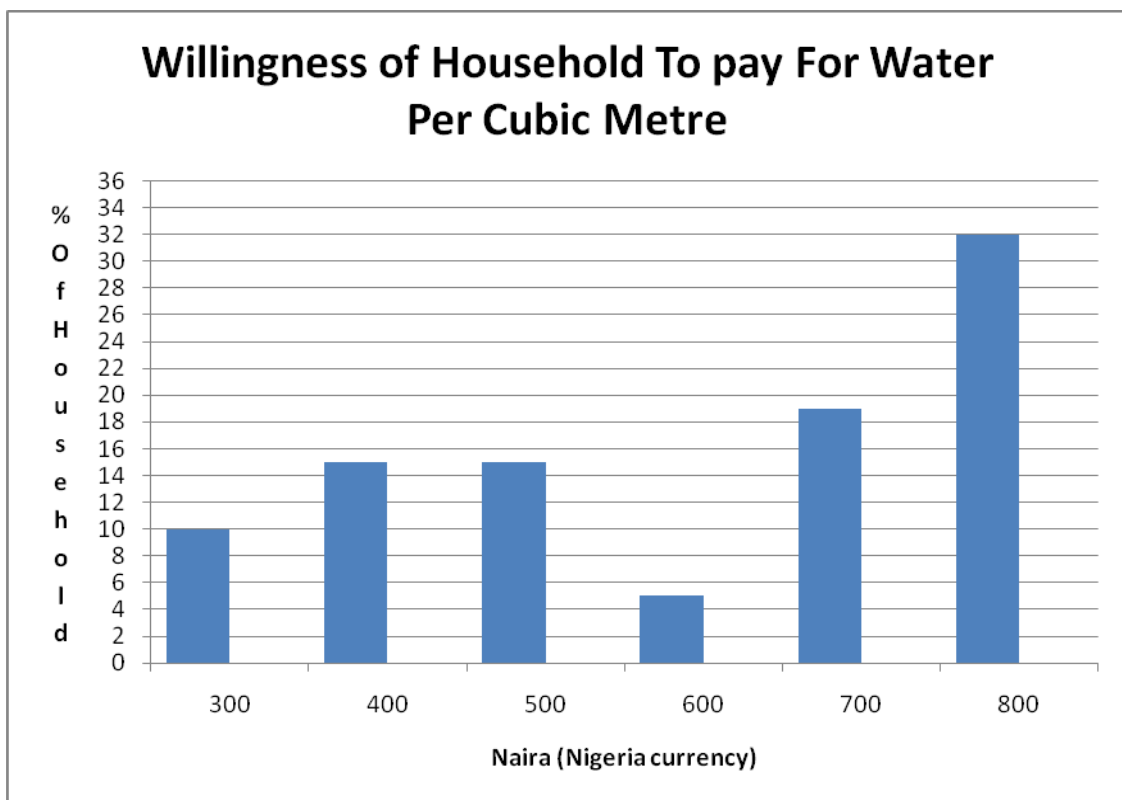
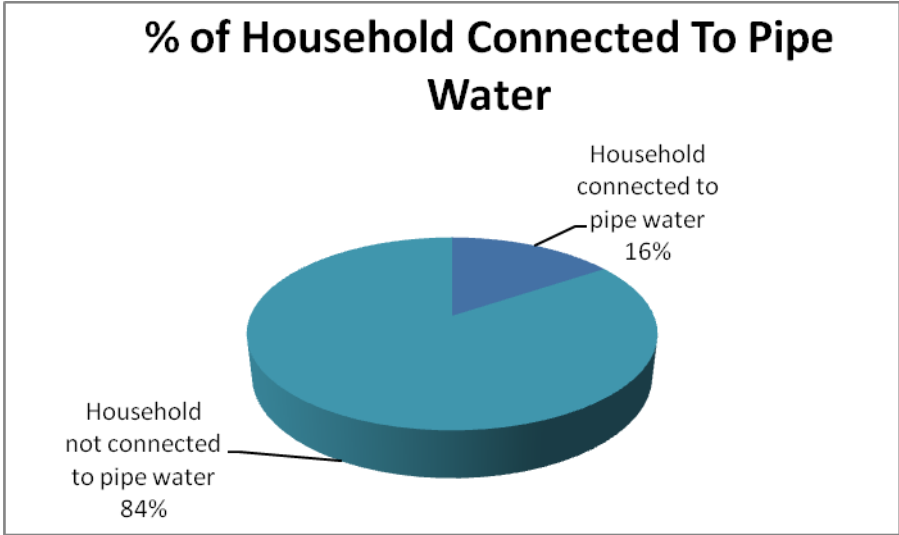


Figure 9 : Willingness of household to pay for water per cubic metre (cu³) [Own input]

Our findings revealed that not all households are connected to the public tap which is called pipe water. Households get their source of water supply from different sources such as public water, water vendor, water tanker and borehole.

From the survey carried out (questionnaire), 16% of the respondents are connected to pipe water and 84% who are not connected get their source of water supply from the borehole constructed by individuals, water vendors and water tankers. The percentage of household connected to pipe water is shown in the pie chart below:

Figure 10: Household connected to pipe water [Own input]



Source: Survey Questionnaire 2011 [Own input]

Table 6: The percentages of people who are satisfied and not satisfied with the current water quality

	NO OF PEOPLE	PERCENTAGE
SATISFIED	36	37.5
NOT SATISFIED	60	62.5

TOTAL SURVEY	96	100
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Source: Survey Questionnaire 2011[Own input

Perception of Respondents about current water quality

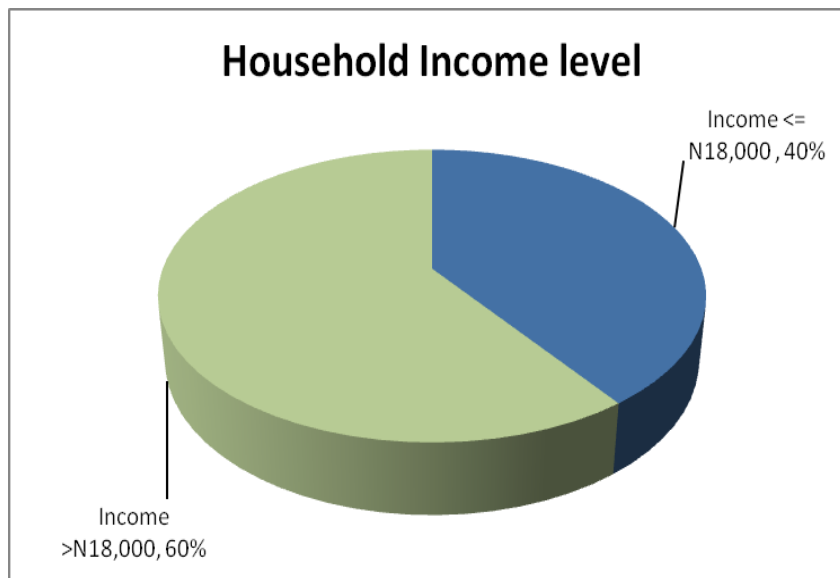
Table 6 illustrates the perception on water quality. Most users give a bad evaluation for taste, colour and odor of water from sources they use; 62.5% a large percentage of the sample survey reported that they are not satisfied with the taste, colour and odor of water. However 37.5% report to be satisfied with the current taste, colour and odor of water.

Respondents who are willing to pay high price for improved quality of water are those who currently pay high price to obtain water and those who value good quality water. The respondents who value good quality water also exhibited averting behaviour by either using water filtering machine or boil their water before drinking; 68 percent of the respondents adopted safe drinking water practice by either boiling or using water filter machine

Household income level

Our survey revealed that the 60 percent of the respondent household Income level is greater than 18,000 naira; 40 percent household income level is less or equal to 18,000 naira. This is the reason why most respondents are willing to pay more a good quality water.

Figure 11: Household Income Level



Source: Survey Questionnaire 2011

Health

Table 7: Percentage of people who suffered water disease in the last two months

WATER DISEASE	NUMBER OF PEOPLE	PERCENTAGE
DIARRHEA	4	4.2
MALARIA	16	16.7
TYPHOID	8	8.3
CHOLERA	-	-
OTHER	-	-
TOTAL	28	29.2

Source: Survey Questionnaire 2011. [Own input]

29 percent mentioned that they had suffered water disease in the past two months; 4 percent report diarrhea, 16.7 percent report malaria 8.3 percent report typhoid. The percentage of the sample survey who suffered water disease in the last two months is low which can be explained by the preventive measure adopted by boiling and using water filtering machine.

The health of the respondents does not have a relationship with the dependent variables (regressors); gender, household size, household income level and educational level are not statistically significant at 0.05 level of significance.

Determinants of WTP

$R^2 = 0.8583872$; 85.8 percent of the variation of WTP(Y) is explained by the regressors. The household size and the educational are insignificant is that they both have no significant effect on WTP. Household Income is statistically significant; it is significantly influence by the WTP. So if the income of household increases the WTP goes up (increases).

The result is in confirms economic expectation; i.e. the higher the income level, the higher the WTP. The coefficient for the determinant of household income level is positive while other coefficients of determinants are negative. The gender is a little bit significant; it showed the male are not so much concerned about quality of water because it is mostly the women who take care of the household water need and supply.

Our null hypothesis (H_0) is rejected and the alternate hypothesis (H_1) is accepted.

Descriptive Statistics of some variables

The mean of the respondents satisfied with taste, colour and odour is below average; it shows most respondents are not satisfied with water quality; the mean of the educational level is above average, is an indicator that the most of the respondents are educated or have university education. The mean of those who improve their water by use of filter is below average. Above average suffered water borne in the past two months

LIST OF VARIABLES AND DESCRIPTIVE STATISTICS

	Variable	Mean	Std.Deviation	Min	Max
Female=1, Male=0	Gender	0.65625	0.477452119	0	1
Household size	HH	5.5625	1.659502145	2	12
Satisfied with taste Yes=1, No=0	WQ1	0.375	0.486664263	0	1
Satisfied with colour Yes=1, No=0	WQ2	0.385417	0.489248439	0	1
Satisfied with odour Yes=1, No=0	WQ3	0.385417	0.489248439	0	1
Monthly Family Income \leq N18,000=1, $>$ N18,000=2	INC	1.604167	0.49159604	1	2
Educational Level	EDC	2.520833	0.615230666	1	3
Improve Quality of water; Use water filter=1, other=0	Fil	0.427083	0.497251216	0	1
Boiling	Boil	0.260417	0.441165721	0	1
Adding Alum	Alum	0.041667	0.200875278	0	1
Health: Water Disease; Yes=1, No=0	WD	0.291667	0.45691567	0	1
What type; Diarrhea=1, malaria=2, Typhoid=3, Cholera=4, Other=5	DT	0.625	1.038723913	0	3

NOTE: The Exchange Rate as at 28 February 2011 is

210 NGN :€1 ; N18,000= €85.35

151.45 NGN: \$1 N18,000=\$117.44

[Own Input]

5 CONCLUSION AND RECOMMENDATIONS

5.1 Conclusion

This paper has been able to enumerate the importance of good quality water resources; characterized the users of water resources in Nigeria and also looked at issues relating to water such as health, sanitation, food security and poverty which are quite important to the survival of the people and the achievement of the MDGs.

Water pricing as a tool for managing water resources is fast becoming a widely recognized and accepted tool due to the increasing scarcity of water resources in the world, high competition between water uses and environment degradation. Shao L, 2002. This paper analyses the water pricing in Nigeria through the survey carried out in Lagos in which the respondents are asked their WTP for good quality water.

Water pricing is the key to water conservation, sustainability and efficient allocation of water resources. It can also provide financial resources that can be used for the operation and maintenance of the existing infrastructure and investing in the building of new water projects.

The flat rate water pricing used in Nigeria by the government (state provider) is not the right option as it does not reflect the full cost of water, it is the rich who are mostly connected to the pipe water while the poor are left at the mercies of the private water providers and this kind of water pricing has made water resources to be over consumed and wasted for a long time and the infrastructure is not been maintained.

From the survey carried out it is obvious that willingness to pay is generally higher than the level of the current water prices; the result of the regression analysis confirm economic expectations that the higher the income the higher the willingness to pay for good quality water. There is a general willingness to pay for a good and sustainable supply. There is substantial variation in the willingness to pay for water between different households who are connected to different source of water supply. This makes the development of a comprehensive water rate structure very challenging task.

It is revealed through this study that government can not adequately provide water for the growing population in Lagos state through its old conventional method of providing water due to the following reasons inefficiency in water bill collection, inadequate investment in distribution of water and lack of maintenance of distributive channel. This failure has resulted into the operation of the water vendors, water tankers and borehole owners.

The analysis of the water pricing reveals that there is a potential large room to increase the price of water to the extent that it does not affect the welfare of the people. Therefore the water pricing should reflect the full cost pricing of water which includes the supply cost, opportunity cost, operation and maintenance cost and environmental externalities incurred during water supply should be adopted

5.2 Recommendations

In order to achieve the MDGs goal by 2015, the following recommendations should be considered by the policy makers in Nigeria.

The public water rate should be reviewed to cover the cost of supplying water and maintaining the system and to also enable the government to provide water to households that are not connected to pipe water.

The private sector participation (PSP) should be recognized and highly regulated by the Ministry of Water Resources both at the Federal, State and Local levels to monitor the water quality and the price of water in order to ensure proper water delivery.

The government should improve the sewerage system in Nigeria, the modern day sewerage system should be constructed to replace the old system; connecting all household to the central sewerage system and the waste water should be treated before they are discharge into the water bodies in order to protect public health and the environment.

If the environment is to be protected which include the water resources, the government should intervene by enforcing some sort of control through tax policies such as pollution tax. The environmental laws in Nigeria should be reformed and upgraded to meet present environmental challenges and also be in conformity with the international environmental laws.

The government should be strict in the implementation and enforcement of its laws concerning the operation of multinational oil companies in the Niger-delta and the rights of people to food, good quality water and a clean environment should not be allowed to be violated by these companies.

6.1 Appendix A:

QUESTIONNAIRE

A student of the Czech University of Life Science, Prague, Czech Republic writing a Bachelor thesis on Water resources in Nigeria. The objective of my research is to analyse the water pricing in Nigeria; we want to find out how much consumers are willing to pay for good quality water in Nigeria using a sampling of Lagos State.

A research question formulated to find out the willingness of people in the Lagos State to pay for good quality water.

1. Gender Male Female
2. What is your family size? _____
3. How much do you earn in a month?
(A) less than 18,000 naira in a month
(B) Over 18,000 naira a month
4. Educational level?
(A) Primary education
(C) Secondary education
(D) University education
5. Are you satisfied with the taste of the water Yes No
6. Are you satisfied with the color of Water Yes No
7. Are you satisfied with the odor Yes No
8. Do you improve the quality of the water yourself? Yes No
If yes how? (A) Boiling (B) Use water filter (C) Adding Alum
9. How much do you pay for water per cubic metre?
10. Source of obtaining water

(A) Pipe borne water (B) Borehole (C) Water vendor (D) Water Tanker (E) Stream

11. How much are you willing to pay for good quality water per cubic metre improved upon, better than your present source of obtaining water in order to maintain the system?

(A) 300 (B) 400 (C) 500 (D) 600 (E) 700 (F) 800

Health Question:

12. Has any member of your household suffered water disease in the last two months?

Yes NO

13. If yes answer question 13 which of the following sickness have they suffered?

- A. Diarrhea
- B. Malaria
- C. Typhoid
- D. Cholera
- E. other

6.2 Appendix B: Results from MS-Excel

SUMMARY OUTPUT:WTP=f(G,HH,INC,E)

Where G=Gender, HH=Household size, INC=Household income level, E=Educational level

<i>Regression Statistics</i>	
Multiple R	0.9264919
R Square	0.8583872
Adjusted R Square	0.8521625
Standard Error	81.512316
Observations	96

ANOVA

	<i>df</i>	<i>SS</i>	<i>MS</i>	<i>F</i>	<i>Significance F</i>
Regression	4	3664955.885	916239	137.8994	9.50237E-38
Residual	91	604627.4488	6644.258		
Total	95	4269583.333			

	<i>Coefficients</i>	<i>Standard Error</i>	<i>t Stat</i>	<i>P-value</i>	<i>Lower 95%</i>	<i>Upper 95%</i>	<i>Lower 95.0%</i>	<i>Upper 95.0%</i>
Intercept	13.998356	52.48341459	0.26672	0.790289	-90.25349781	118.25021	-90.2534978	118.250209
Gender	-32.93281	17.6159223	-1.86949	0.06477	-67.92467232	2.0590573	-67.9246723	2.05905733
Household size	-4.612282	5.081678028	-0.90763	0.366471	-14.7064111	5.4818467	-14.7064111	5.48184673
Household Income	396.10167	17.03272749	23.25533	4.61E-40	362.2682459	429.93509	362.268246	429.935086
Educational level	-9.941211	13.66069539	-0.72772	0.468651	-37.07650389	17.194081	-37.0765039	17.1940814

WTP=F (Gender, Household size, Income level, Educational level)

Y=G, HH, INC, E

G=Gender

HH=Household size

INC= Household Income level

E=Educational level

SUMMARY OUTPUT: Health=f(G, HH, INC, E)

<i>Regression Statistics</i>	
Multiple R	0.1756799
R Square	0.0308634
Adjusted R Square	-0.011736
Standard Error	0.459589
Observations	96

ANOVA					
	<i>df</i>	<i>SS</i>	<i>MS</i>	<i>F</i>	<i>Significance F</i>
Regression	4	0.612124701	0.153031	0.724504	0.577434606
Residual	91	19.22120863	0.211222		
Total	95	19.83333333			

	<i>Coefficients</i>	<i>Standard Error</i>	<i>t Stat</i>	<i>P-value</i>	<i>Lower 95%</i>	<i>Upper 95%</i>	<i>Lower 95.0%</i>	<i>Upper 95.0%</i>
Intercept	0.0760843	0.295916035	0.257115	0.797671	-0.511716496	0.6638852	-0.5117165	0.66388518
Gender	0.1106894	0.099323451	1.114434	0.268028	-0.086604427	0.3079832	-0.08660443	0.30798323
Household size	0.0333108	0.028651909	1.162602	0.248031	-0.023602731	0.0902243	-0.02360273	0.09022426
Household Income	0.0080096	0.096035238	0.083403	0.933714	-0.182752578	0.1987718	-0.18275258	0.19877182
Educational level	-0.021897	0.077022786	-0.28429	0.776837	-0.174892825	0.1310998	-0.17489282	0.13109977

SUMMARY OUTPUT: Health=f(G, HH, INC, E)

<i>Regression Statistics</i>	
Multiple R	0.1756799
R Square	0.0308634
Adjusted R Square	-0.011736
Standard Error	0.459589
Observations	96

ANOVA					
	<i>df</i>	<i>SS</i>	<i>MS</i>	<i>F</i>	<i>Significance F</i>
Regression	4	0.612124701	0.153031	0.724504	0.577434606
Residual	91	19.22120863	0.211222		
Total	95	19.83333333			

	<i>Coefficients</i>	<i>Standard Error</i>	<i>t Stat</i>	<i>P-value</i>	<i>Lower 95%</i>	<i>Upper 95%</i>	<i>Lower 95.0%</i>	<i>Upper 95.0%</i>
Intercept	0.0760843	0.295916035	0.257115	0.797671	-0.511716496	0.6638852	-0.5117165	0.66388518
Gender	0.1106894	0.099323451	1.114434	0.268028	-0.086604427	0.3079832	-0.08660443	0.30798323
Household size	0.0333108	0.028651909	1.162602	0.248031	-0.023602731	0.0902243	-0.02360273	0.09022426
Household Income	0.0080096	0.096035238	0.083403	0.933714	-0.182752578	0.1987718	-0.18275258	0.19877182
Educational level	-0.021897	0.077022786	-0.28429	0.776837	-0.174892825	0.1310998	-0.17489282	0.13109977

HEALTH=F (gender, income level, family size, educational level)

G=Gender

HH=Household size

INC=Household Income level

E=Educational level

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