ADOPTION OF WATER AND SANITATION RECOMMENDED PRACTICES AMONG FARMERS IN RURAL AREAS OF PLATEAU STATE, NIGERIA

By

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Ph.D./AGRIC./30551/12-13

A DISSERTATION SUBMITTED TO THE SCHOOL POSTGRADUATE STUDIES, AHMADU BELLO UNIVERSITY (ABU), ZARIA

IN PARTIAL FULFILLMENT OF THE REQUIREMENTS FOR THE AWARD OF A DEGREE OF DOCTOR OF PHILOSOPHY IN AGRICULTURAL EXTENSION AND RURAL SOCIOLOGY.

DEPARTMENT OF AGRICULTURAL ECONOMICS AND RURAL SOCIOLOGY
FACULTY OF AGRICULTURE
AHMADU BELLO UNIVERSITY, ZARIA
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MARCH,2014

DECLARATION

I declare that the work in this dissertation entitled "**Adoption of Water and Sanitation Recommended Practices among Farmers in Rural Areas of Plateau State, Nigeria** has been carried out by me in the Department of Agricultural Economics and Rural Sociology. The information derived from the literature has been duly acknowledged in text and a list of references provided. No part of this dissertation was previously presented for another degree or diploma at this or any other Institution.

_____	_____	_____
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CERTIFICATION

This dissertation entitled: **"ADOPTION OF WATER AND SANITATION RECOMMENDED PRACTICES AMONG FARMERS IN RURAL AREAS OF PLATEAU STATE, NIGERIA"** by Nengak Elisha YILKUDI mets the regulations governing the award of the degree of Ph.D Agricultural Extension and Rural Sociology of the Ahmadu Bello University, Zaria, and is approved for its contribution to knowledge and literary presentation.

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DEDICATION

To my Late Dad, Nde Gonzhi Gokir Yilkudi and Mum, Nana Pemwa Jummai Gonzhi.

My darling wife Rhoda and children, Kangrot, Jikerit, Kamji and Dirnen.

ACKNOWLEDGEMENTS

God has been faithful to me. He has taken me to this height despite my shortcomings. I understand that His mercy upon me is immeasurable and I give Him all the praise and adoration.

Words cannot exactly express how grateful I am to Professor T.K. Atala, the Chairman of the Supervisory Committee. Your guidance in this work was beyond measure. Sir, I used to think your thoroughness and insistence that the right thing must be done was too over bearing. Now I know better - "Degrees are supposed to be earned and not given" even if the student you are supervising is your son. I appreciate your thoroughness, for it has remoulded me.

I would also like to extend my sincere gratitude to Professor D.F. Omokore for doubling as a big brother and also a supervisor. The teachings on what is expected in a Ph.D. dissertation that you gave me opened my eyes, thank you sir. To Dr. R.A. Omolehin, your inclusion in the Supervisory Committee was all I needed to tap from your wealth of knowledge of statistics. In fact, you were the icing on the cake of a wonderful supervisory committee. I want to express my profound appreciation to you, God Bless.

I would like to appreciate the contributions of Professor J.G. Akpoko (Babban Yaya) who was my pseudo-supervisor, Prof. S. Rahman, Dr. M. A. Damisa (my friends and lecturers), and to Dr. M.O.Akinola, Dr. M.G. Maiangwa and all the lecturers in the department. You opened your doors to me whenever I had challenges.

To my “small” supervisor and friend Mr. Emmanuel Y. Dodo, you made my stay in Zaria comfortable and provided me with a space in your office to work. Most importantly, you lifted my spirit up whenever I was down from bombardments from my supervisors about issues I did not have ready solutions to. God Bless you and your family.

I would like to extend my sincere thanks to the farmers who volunteered to be interviewed. Without sacrificing their valuable time to answer the survey questions, this study would not have been possible. I am also grateful to the field staff that assisted in collecting the data.

The entire members of the Yilkudi and Yilji families, the drive and encouragement to move on came from you. Despite enormous challenges as a result of my office work and studying, you pushed me on when you always tell me you believed in my capability. I love you all and I pray that I would be able to use the knowledge acquired to contribute positively to your lives and add value to humanity in general.

To my friends and brothers who teased me in a loving manner by calling me “Dacta” when I was not one yet. You would not know how much that has challenged me.
Thanks a million times Professor N.N Wannang of University of Jos (Prof.), Oga Cleophas Dariya, Stanley Kichime, Dr. Monday Yilkudi and Victor Yilkudi (Bulldozer).

My loving wife, I thank God for having you. You weathered the storm with me from the beginning of this dream. You will not regret this, rest assured that you will reap the fruits of your labour.`

I am indeed indebted to my employer, Plateau State Government specifically, the Ministry of Agriculture and Natural Recourses, Jos. Without your cooperation this work would not have been possible. Specifically, my Commissioner, Mr. Steven Nanven Barko, and the Permanent Secretary Mr. E.I. Baleri, thanks for your understanding. To my colleagues, Mrs. Esther Pwaspo (Big Aunty), Mrs. Keziah Makwin, Mrs. Victoria Pam, Dr.Sunday Akpa, Dr. Ezekiel Pam and Mr. Emmanuel Yakzum. I thank you so much for your companionship and prayers.

Finally, Kangrot (Baby, the baby), Jikerit (Prof. Alliance François), Kamji (Kamjo) and Dirnen (Diriboy). Do I need to thank you? Yes, I do because I have you to set high standards for. My children, I love you very much and the stage is set for you to beat my records. I wish you the best in your lifetime.

ABSTRACT

The issue of bad water and sanitation practices leading to cases of water borne diseases among farmers has continued to be a concern in Plateau State. Stakeholders in water and sanitation sector introduced a set of recommended practices to farmers with the aim of reducing the incidences of the diseases. This study was conducted to determine the adoption of water and sanitation recommended practices among farmers in rural areas of Plateau State. The specific objectives of the study were to: determine the levels of awareness and adoption of WATSAN recommended practices; determine the attitudes of farmers towards WATSAN recommended practices; determine the factors influencing adoption of WATSAN recommended practices; compare the levels of compliance of WATSAN recommended practices in rural areas of Plateau State with international standards; assess the perceived effects of adoption of WATSAN recommended practices on farmers and identify constraints to adoption of the recommended practices in rural areas of Plateau State. From a total of 1860 farm households, 279 heads of households were sampled to be the respondents through the use of both purposive and systematic random sampling techniques. Data were analyzed by descriptive analysis and multiple regression using Statistical Packages for Social Sciences (SPSS). Findings revealed that average household size was about7 people with mean income of about ₦454, 000.00 per annum. Formal educational level of farmers was generally low with mean years of schooling of about 9 years. It was further observed that 99% of farmers were aware of the WATSAN recommended practices and out of the seven recommended practices, adoption of storage of water in clean containers had the highest adoption. On the attitudes of respondents to WATSAN recommended practices, findings revealed that only 30% of farmers generally had positive attitudes towards WATSAN recommended practice. In the case of factors that influenced adoption of WATSAN recommended practices, results of multiple regression showed that seven out of the ten variables in the conceptual model influenced adoption of WATSAN recommended practices significantly at the $P<0.1$ chosen for this study as follows: attitude to WATSAN recommended practices ($r=7.514; P<0,01$), gender($r=-2.146$; $P=0.05$), formal educational level ($r=2.375; P<0.05$) , compatibility($r=1.823$ $P<0.10$), household size ($r=-1.778; P< 0.10$), affordability ($r=1.78; P<0.10$) and sources of information ($r=1.767; P< 0.10$). Results of this study also revealed non compliance to the international standards of WATSAN recommended practice. This was precipitated by high percentage of people with WATSAN related diseases in the previous one year, inadequate water usage, low percentage of people with appropriate hand washing behaviours and also low percentage of people with access to and proper use of toilets/latrines which were 30%, 37 lcd, 8% and 15% respectively against the international standards of 25%, 50Lcd 50% and 75% respectively for the same recommended practices. Results on assessment of perceived effects of WATSAN on respondents indicated that majority of farmers actually perceived the adoption of WATSAN recommended practices as having positive effects on them, especially in increased hygienic practices, decreased health-care expenditure, increased productive time for agricultural activities and increased children's school attendance. Bad habits towards hygiene (94%) were found to be the major constraint of adoption of WATSAN recommends practices. Based on the finding of this study, it was recommended that there is need for sustained efforts in educating farmers on the dangers of non adherence to WATSAN recommended practices and also legislation in the local government council's by-laws is necessary to enforce compliance .There is need to mainstream gender equality in our school curriculum to wipe away sex

discrimination in performing house chores, Farmers should be encouraged to develop their local water purification methods like the use of Moringa leaves' powder which is cheaper and readily available disinfectant in the study area. Government should prioritize improvements in living conditions of farmers by creating enabling environment for observation of improved hygienic practices.

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LIST OF ABBREVIATIONS

BOLDA	Bol Development Association
CLTS	Community-Led Total Sanitation movement
COWAN	Christian Women Association of Nigeria
DFID	Department for International Development
DOI	Diffusion of Innovation theory
DWAF	Department of Water Affairs and Forestry
DWSTs	District Water and Sanitation Teams
IFPRI	International Food Policy Research Institute
IPM CRSP	Integrated Pest Management Collaborative Research Support Programme
KAP	Knowledge, Attitude and Practice
KCT	Kashmir Charitable Trust
LCBs	Local Capacity Building Institutions
LCD	Litres per Capita per Day
LEK	Local Ecological Knowledge
MDGs	Millennium Development Goals
NPC	National Population Commission
ODF	Open Defecation Free villages
PRUWASSA	Plateau Rural Water Supply and Sanitation Agency
RURCON	Rural Development Councilors for Christians in Africa
RBST	Recombinant Bovine Somatotropin Technology
SAFE	Sanitation and Family Education
SNV	Schweizeriche Normenvereinigung (Netherlands Development Organization)

SPSS	Statistical Package for Social Sciences
UNICEF	United Nations Children Education Fund
VIP	Ventilated Improved Pit latrines
WASH	Water and Sanitation for Health
WATSAN	Water and Sanitation
WHO	World Health Organization
WSS	Water Supply and Sanitation
WSSCC	Water Supply and Sanitation Collaborative Council

CHAPTER ONE

1.0 INTRODUCTION

1.1 Background to the Study

Water is a key component in determining the quality of human and plants' lives. Its importance cannot be overemphasized. Despite its importance to man, its misuse can lead to diseases. In 2008, it was estimated that 40 percent (60.7 million) of the global burden of disease and 1.6 million deaths per year were attributed to unsafe water supply and sanitation, including lack of hygiene (WHO/UNICEF, 2008). Diarrhoael diseases are still a leading cause of mortality and morbidity in children under the age of five. Each child has an estimated five episodes of diarrhoea per year and approximately 150,000 Nigerian children die each year from diarrhoea and dehydration (WHO/ UNICEF/WSSCC, 2009). In developing countries sanitation has continued to deteriorate to such an undesireable level that, in 2002 it was included in the Millennium Development Goals (MDG7 Target 10).

During the 1980's and 1990's there was considerable investments in the provision of water supply and sanitation in developing countries. By 2010, however, a significant proportion of the world's population still remained without access to improved water and sanitation. In Africa, roughly 40 percent of the population lacks access to improved water and sanitation, and in Asia 19 percent lacks access to improved water and 52 percent to improved sanitation. Other regions of the world have higher rates of access, but even in Latin America and the Caribbean many millions remain without access (WHO/UNICEF/WSSCC, 2009).

In Nigeria, rapid population growth has not been accompanied by an increase in the delivery of essential urban services such as water supply, sewerage and sanitation, and collection and disposal of solid wastes. By 2010 it was estimated that only about 50 per cent of the urban and 20 per cent of the semi-urban population had access to reliable water supply of acceptable quality which is better than a traditional source (FMWR, 2010). Overall effective urban water supply coverage was as low as 30 per cent of the total population due to poor maintenance and unreliability of supplies, while rural coverage was estimated at 35 per cent in 2010 (FMWR, 2010).

Commenting on the state of water supply coverage, Federal Ministry of Water Resources (FMWR) noted that water supply coverage in Nigeria increased from 30 per cent in 1999 to 68 per cent in December 2010, while sanitation coverage stood at 63 per cent. Despite some improvements in coverage, a study by the FMWR (2011) reported that in 2010, only about 11 out of 36 States of the Federation had more than 20 litres per capita water supply. In order to ensure strategic approach to realization of the vision 20:20:20 on water in Nigeria, the timeline for the achievement of the set targets and goals has been defined as Short Term (2009-2011); Medium Term (2011-2015) and Long Term (2016-2020). Accordingly, the main goals and targets set out for the Short-Term are as follows: (i) increase in national improved water supply coverage from current 47 per cent to 50 per cent, (ii) increase in national improved sanitation coverage from current 30 per cent to 35 per cent, (iii) increase in minimum water supply service from 25 litres per capita per day to 30 litres per capita per day for rural communities and (iv) increase minimum water supply service from 25 litres per capita per day to 30 litres per capita per day for small town (semi-urban) communities (FMWR, 2011).

Linkages between water supply and sanitation (WATSAN) and a cluster of key stakeholders in health, education, agriculture, and environment sectors are intuitively obvious, and documented with varying precision in different developing countries. Some of the data and project experience in Nigeria in these sectors suggest clear linkages between poor WATSAN standards and decline in health, education and productivity. Specifically, these include low enrollment in schools, particularly of girls who must spend time in collecting water, higher crime against women due to lack of toilet privacy, as well as the more obvious impacts of disease, higher infant mortality, high absenteeism in schools and at work, and lower productivity (WaterAid, 2004).

Water-related diseases (diarrhoea, typhoid, dysentery, guinea worm, filiariasis and yellow fever) are human tragedy killing millions of farmers each year. They prevent millions of people from living healthy lives and undermine development efforts (Nash, 1993). About 2.3 billion farm families in the world suffer from diseases that are linked to water and sanitation. The infections cut off affected individual's potential supply of labour from farm and non-farm economic activities (Kristof, 1997).

There appears to be paucity of information in Nigeria that presents the linkage between water supply and sanitation and farmers' health and socioeconomic status. Since the poor water and sanitation conditions of these rural areas expose farmers to various water and sanitation-related diseases, this occurrence leads to loss of labour hours on farming activities when sick farmers or members of their household are on treatment. Also, the poor farmers spend the monies, they would have used in buying farm inputs to increase their yields, on medication thereby affecting farmers' income negatively (Hutton, 2004).

Several studies have been carried out on factors that affect agricultural productivity where health status of the farmer has been found to be an important determinant of farmer's productivity. Bad water and sanitation behaviours in rural areas appear to be the major cause of farmers' poor health condition. Therefore, it is imperative that in addition to teaching farmers best agricultural practices; the extension worker should supplement his agricultural recommended practices to farmers with appropriate water and sanitation practices. This will go a long way in keeping the farmers fit for agricultural activities leading to benefits such as increased labour hours and savings from not falling ill. The time limit given for achieving the set target in the strategic approach in the 20:20:20 WATSAN short-term plans was 2011.This target timeline has expired and yet WATSAN standards remain very low in Plateau State. According to WaterAids, reasons could be that the water and sanitation sector could be both internally and externally challenged by Socio-economic factors, institutional factors and attributes of WATSAN innovations.

In rural areas of Plateau State, WaterAids (2006) estimated that about 70 per cent of diseases are related to water and sanitation; as a result, addressing WATSAN issues in Plateau captures a lot of attention from both local and international bodies. In Plateau State serious work in the water and sanitation sectors began in 2001 with the establishment of Plateau Rural Water Supply and Sanitation Agency (PRUWASSA). PRUWASSA was established as a condition to enable the State to key into the Federal Government of Nigeria and UNICEF Joint Rural Water Supply and Sanitation (WATSAN) Programme. The agency works in collaboration with recipients/Local Government Areas/Communities and External Financial Support and Donor agencies to promote WATSAN. Presently, the external agencies working in the State are: United

Nations Children Fund (UNICEF), WaterAid, Un-Habitat, Country Women Association of Nigeria (COWAN), Rural Development Councillors for Christian Churches in Africa (RURCON), Department for International Development (DFID) and Bol Development Association (BOLDA). Like PRUWASSA, all these bodies have as their main objective; giving local authorities the competencies and means to spearhead expected change process towards access to safe water, sanitation and hygiene in the perspective of achieving the MDGs.

Probably, the most important determinants of the effectiveness of such programmes are (1) the level of adoption of introduced innovations and (2) on their profitability (Griliches, 1957, Caswell *et.al*., 2001, Aysha, 2012). A common problem for many individuals and organizations is how to speed up the rate of diffusion of a programme's innovations (Jmurph, 2007). Yet, speeding up the rate of adoption of technologies requires knowledge of the underlying factors that influence adoption decisions. It is therefore important that a study of this nature is conducted to determine the factors that influence adoption of WATSAN recommended practices. Aysha, (2012) demonstrated that the adoption of technologies depends on their characteristics: compatibility with existing values and norms, complexity, observability, trialability, and relative advantage. These attributes pertains to technologies in agriculture and in a variety of disciplines and areas such as water and sanitation.

1.2 Statement of the Problem

It is worrisome that despite an array of diversified efforts that have been mounted towards achieving adequate WATSAN, evidence abound that rural farmers in Plateau State continue to use unsafe water and sanitation practices. Often the unhygienic practices include unsafe human excreta disposal (open defecation), unsafe solid and

liquid waste disposal and unsafe drinking water. Unhygienic practices result in diseases which can affect quality of life, education and development. Also, place additional financial and health burden on rural farmers, as well as lead to exposure and increased risks to personal safety. Poor health keeps farm families in a cycle of poverty. Environmental problems associated with unsafe WATSAN practices include dispersed and diffuse pollution of water sources resulting in the water and feacal disease cycle for communities with untreated water supplies and increased downstream water treatment costs.

Plateau State government and external support and donor agencies have made impressive efforts in spear-heading change processes towards promoting safe water and hygiene. They do this through teaching rural dwellers, in a collaborative manner and controlled by PRUWASSA. The following seven recommended practices were promoted:

(1) boiling of water before drinking,

(2) filtering and disinfecting water at point of use,

(3) storage of clean water in clean containers,

(4) collection of water from protected sources,

(5) defecating in toilets/latrines,

(6) appropriate hand washing behaviours and

(7) burning of garbage to control flies.

Despite these efforts, water and Sanitation coverage has remained low and sluggish. Water and sanitation related diseases such as malaria, dysentery, diarrhoea, scabies, typhoid fever, bilharziasis, trachoma, dental flourisis continue to be prevalent among

farmers in rural areas of Plateau State (WaterAid, 2001). It appears the supply-oriented approach to disseminating water and sanitation recommended practices with heavy amounts spent on advocacy by WATSAN stakeholders' subsidies will not lead to achieving the MDGs' 2015 target (WaterAid, 2009). This is because of the low adoption of WATSAN recommended practices observed during the reconnaissance survey.

In view of the concerted efforts made by stakeholders in promoting safe water and sanitation recommended practices among farmers, it was imperative to rise fundamental questions of what could be the underlying factors influencing adoption of WATSAN recommended practices among farmers in rural areas of Plateau State. Accordingly, the pertinent research questions addressed by this study were as follows:

i. What are the levels of awareness and adoption of water and sanitation recommended practices by farmers in rural Plateau State?
ii. What are the attitudes of rural farmers with regards to water and sanitation recommended practices?
iii. What are the socio-economic and institutional factors and attributes of WATSAN innovations influencing adoption of water and sanitation recommended practices by rural farmers in Plateau State?
iv. What are the current standards of water and sanitation in rural Plateau State compared with international standards?
v. What are the perceived effects of adoption of water and sanitation recommended practices on rural farmers' levels of hygienic practices, health-care expenditure, productive time for agricultural activities and children school attendance?

vi. What are the constraints to adoption of water and sanitation recommended practices?

1.3 Objectives of the Study

The broad objective of this study was to determine the adoption of water and sanitation recommended practices among farmers in rural areas of Plateau State. The specific objectives were to:

i. determine the levels of awareness and adoption of water and sanitation recommended practices by farmers in rural Plateau State;
ii. identify and describe the attitude of rural farmers with regards to water and sanitation recommended practices;
iii. determine the socioeconomic factors, institutional factors and attributes of WATSAN innovations influencing adoption of water and sanitation recommended practices by rural farmers;
iv. compare the current standards of water and sanitation in rural Plateau State with the International Standards;
v. assess the perceived effects of water and sanitation recommended practices on rural farmers' levels of hygienic practices, health-care expenditure, productive time for agricultural activities and children school attendance; and
vi. identify and describe the constraints in the adoption of water and sanitation recommended practices.

Achieving the above objectives could be a major step towards designing a system that can encourage adoption in the study area and up-scaling the adoption pattern to other geographical areas with similar conditions in terms of farming activities and rural.

1.4 Justification of the Study

There is general lack of understanding of the factors affecting the adoption of WATSAN recommended practices by farmers in rural communities of Plateau State. WATSAN stakeholders (Government and Non Governmental Organizations) who report the adoption of WATSAN recommended practices in Plateau State based their assertions on subjective, passionate or politically motivated methods of assessments that do not give a true position of the performances of the interventions. These have always been reported to impress donors even when practically these interventions have not significantly changed WATSAN status in the rural areas of the State. It is not uncommon to find inconsistencies in reporting WATSAN activities in the State by different stakeholders. Therefore, an independent, unbiased and empirical explanation of adoption of WATSAN recommended practices in rural Plateau State is necessary for comparison.

By unveiling the factors that influence adoption of WATSAN recommended practices, this work provides guidance to the WATSAN stakeholders. The added knowledge on which factors have the greatest influence on WATSAN adoption would help administrators make more informed decisions on how to promote WATSAN recommended practices. The results from this study would provide useful information for policy makers when planning in the WATSAN sector.

Another benefit from the research is the exposition of the current state of WATSAN recommended practices adopted by rural farmers which are useful for the purpose of comparison with and adjustments to meet the internationally set standards where necessary.

In terms of accountability and fairplay, it is worthy of note that in Plateau State the WATSAN programmes are mostly externally funded. Continued support is dependent on the effectiveness of the programmes. Therefore for continual funding, the WATSAN programmes must demonstrate efficiency to justify the spending by donors on the programmes. A crucial step therefore seems to be to identify the factors that enhance WATSAN adoption so that plans are made to achieve efficiency in WATSAN programmes. Achieving efficiency would impress external donors and attract continued support. This work aims to fulfill this important task.

1.5 Hypotheses of the Study

The following null hypotheses were tested (Ho):

Ho_1: There is no significant influence of farmers' socio-economic characteristics and institutional factors and attributes of WATSAN innovations on adoption of WATSAN recommended practices.

Ho_2: There is no significant effect of adoption of WATSAN recommended practices on farmers' levels of hygienic practices, health-care expenditure, productive time for agricultural activities and children school attendance.

CHAPTER TWO

2.0 LITERATURE REVIEW

2.1 The Role of Extension Personnel in Integrated Rural Development

During the past quarter century, the work of the extension personnel have often become more diversified. In the less developed countries, the main focus of extension work remains on agricultural production (mainly food) but there has been a growing recognition of the need to reach, influence and benefit the multitudes of small, resource-poor farmers. Strong efforts have been made in this direction, notably through the training and visit system (T&V). The T&V seemed to be strikingly original and promising because it combined a set of rather convincing simple elements in a plausible way. Olukosi and Atala (1991) cited the seven key features of the T&V as conceptualized by Benor and Baxter (1984) to be (1) Professionalism (2) Single line of command (3) Time-bound work (4) Concentration of effort (5) Regular and continuous training (6) Farm and field orientation and (7) Research and extension linkage. However, controversial debate on the merits of the T&V tends to obscure the fact that it was originally meant to solve some very specific problems of extension services.

A more holistic approach to extension, the Unified Agricultural Extension Approach, emanated to fill the gap of the T&V approach. This approach aimed at influencing the entire rural development process including WATSAN issues. The underlying concept of the unified approach is typically multi sectoral. While working conditions of extension personnel have deterioted, expectations with regard to their roles are increasing. They are no longer to be simply transmitters of agricultural knowledge. They are to practice participatory methods, recognize and respect gender issues, identify indigenous needs and solutions to problems, and serve as link to the world outside the village, to name a

few of the areas. The emerging role is closer to that of a "socio-economic community worker" than a technical expert (Blackburn and Flaherty, 1994).

The structures and institutions engaged in extension services should therefore encompass a diverse range of socially sanctioned and legitimate activities that seek to adopt more appropriate and often new practices and to adjust to changing conditions and societal needs such as effective water and sanitation delivery (Jones and Garfoth, 1997).

2.2 Water and Sanitation in Developing Countries

Most communities in developing countries have a high level of collective responsibility for water services. Water systems are commonly owned and managed by a public authority or utility, which may have local accountability. Management and operations may also be delegated to private agents, and communal or cooperative management has been successful in some cases. In the Philippines, for example, low-income families in Manila rely on water provided in bulk at the local community level and then distributed to individual households by collective arrangements (SNV, 2007).

In sanitation a number of initiatives depend on a high level of community involvement. In South Asian countries and elsewhere, the Community-Led Total Sanitation Movement (CLTS) has been successful. Its model relies on local community initiatives; appropriate technology and strong peer-group pressure to achieve 100% latrine coverage in villages to replace the prevailing practice of open defecation (SNV, 2007). In different circumstances, the condominium systems of local sewerage networks in some cities in Brazil and Pakistan depend heavily on community involvement in their planning and implementation (SNV, 2007).

Experts believe that community involvement is necessary for the development of water and sanitation systems. But increasing the involvement of local communities has not had a significant impact on the success of these systems. Most systems do not supply water on a large scale, and their prospects for long-term sustainability are weak, the issue of sanitation has received far less attention from policy makers than has water supply access. In most cases, the development and management of sanitation facilities takes place at the household level, whereas a water supply facility is often a communal concern (WHO/UNICEF, 2010).

2.3 Overview of Water and Sanitation Practices in Local Communities of Nigeria

Nigeria has the largest population in Africa at 140 million based on the 2006 National Population census. By 2012, this population was projected to be 160 million. Nigeria is among the ten most populous countries in the world (FGN, 2012). Nigeria is a country of farmers while urbanization is occurring at a rapid rate, the vast majority of Nigerians, like most Sub-Saharan Africans, are small scale farmers with land holdings often at 5 acres or less, Per capita incomes are low, and many people struggle just to meet the basic necessities of food and shelter. Poverty also impacts overall social welfare. Quality of education, public health and standards of living all suffer under the weight of poverty. Amidst material poverty, however exist cultures of hope and vibrancy. Religious involvement is intense and passionate, the arts flourish, and individuals retain close attachments to family and neighbourhoods (FGN, 2012).

Economic conditions have a vital role to play in people's experience and perceptions of a place. A household's socio-economic status influences the range of opportunities and constraints that people face. In fact socio-economic status affects almost all aspects of

life. It affects nutrition level and health, geographical mobility, educational attainment, and overall quality of life. For example poor urban residents often deal with realities of poor sanitation; informal trash dumps are often just around the corner. Water supplies are often polluted and unsanitary. In rural areas crime is often lower and living conditions less congested. But rural people often have much lower access to amenities like pipe-borne water and electricity. Lack of these amenities has major impact on daily life in rural Nigeria. Women often deal with these effects in a more direct way: when safe water is not available in each house women are often responsible for acquiring the daily supply of water, while wells are sometimes relatively close, yields from such wells are often poor hence many women spend one or two hours or even more each day getting household water (FGN, 2012).

In Nigeria issues of water and sanitation had been given attention since 2001 and within 2004-2005 periods a research was conducted on water meanings and sanitation practices in Akwa Ibom State where it was found that the general views about water and sanitation related problems and hygiene practices were largely dictated by a whole range of physical, socioeconomic, cultural as well as temporal factors. Water meanings, sanitation practices, hygiene behaviours in rural Nigeria are not only nested in cultural beliefs, physical environment as well as socioeconomic factors do render most intervention efforts unrealizable. Their impacts cut across diverse locations and socioeconomic groups and consequently keep reinforcing the prevalence of water-related diseases (water-borne, water-washed and water-based).

Also, findings revealed that most of the respondents do not have serious concerns for germs (bacteria causing organisms). There is a popular saying associated with ‘disease

germs' which goes as 'germs never kill Africans'. The perceived 'impotency' of germs, which is largely based on ignorance and helplessness, is at least one entry point for understanding various sanitation and hygiene related behaviours (Akpabio and Saravanan, 2012).

Within the hierarchy of needs, acquisition of essential items as food, shelter, water and security attract high priorities than quality and hygiene. Consequently financial investments in hygiene to ensure safety and quality of acquired needs remain the least in priority list. This pushes back government's efforts towards providing sanitation services. Although government's attitudes could be changed through programmes of community-driven education, it appears such efforts will have to be matched by significant improvement in the standard of living for it to have any meaningful outcome.

Socioeconomic improvements (education, poverty reduction, exposure to better information and improved services and effective settlement planning) were noted to play a role in driving sanitation and hygiene related behaviours and could possibly lead to behavioural change. However, such behaviour may slightly be difficult where cultural and religious barriers take roots. This is because some of the hygiene related behaviours were still within the clutches of beliefs. Respondents were very particular about these with clearly cited instances on infants/child's hygiene health and wellbeing. They ascribed diseases' epidemics to spiritual forces, patronage of local healing and spiritual homes as well as the various deep-seated beliefs and meanings attached to water and bodies of water among others. On the issues of drinking dirty things for protection, it was found that this behaviour was not limited to the common uneducated

people, but also to top government educated officials. Beliefs and behaviours about water, sanitation and hygiene were found to be very strong among elders and the less exposed.

Given this unique interplay of the physical, traditional, religious, spiritual factors, achieving effective water and sanitation and hygiene practice interventions will have to depend on available local institutions and groups in a manner that utilizes dialogue and information dissemination practices. (Akpabio and Saravana, 2012).

2.4 The Nigerian WATSAN Policy

The centre-piece of Nigeria's water supply and sanitation programme is the provision of sufficient portable water and adequate sanitation to all Nigerians in an affordable and sustainable way through participatory investment by the three tiers of government, the private sector and the beneficiary. With the advent of the Rural Water Supply and Sanitation programme, the strategic framework focus is to consolidate, increase and sustain universal access to adequate quantities of affordable and safe water by the year 2015 and also consolidate, increase and sustain universal access to hygiene sanitation facilities by the year 2020. In the National Water Policy formulated in 2009, FMWR showed consumption standards matching with three socio-economic profiles as follows:

(i) Rural water supply minimum level of service of 30 litres per capita per day within the community of 150-5000 people, serving about 250-500 persons per point.

(ii) Semi-urban (small towns) water supply, represent settlements with population of between 5000-20000 with a fair measure of social infrastructure and some level of economic activity with minimum supply standard of 60 litres per capita per day.

(iii) Urban water supply of 120 litres per capita per day for urban areas with population greater than 20000 inhabitants.

(iv) Numerous efforts have been made by the three tiers of Government in Nigeria and External financial support and donor agencies, to enhance portable drinking water and sanitation to all citizens. However, there still exist a wide gap between the demand for and supply of portable water and adequate sanitation (FMWR, 2010).

2.5 Plateau State Water Resource

Plateau State has abundant ground and surface water resources. The spatial distribution has been unequal and the means of exploitation especially ground water, has largely remained traditional. This has retarded its maximum exploitation at affordable cost. Water in the Basement complex area which covers about 50 per cent is mainly from thick weathered, overburden and /or fissures in the weathered fresh rocks. Hence, ground water availability is generally poor giving a specific capacity range of 0.2 m^3/hr/m to 2m^3/hr/m. Wells constructed after due site location using geophysical techniques have been relatively successful (Aku, 1992). The water bearing bodies, sands, sandstone, fissures in hard rock and alluvium constitutes about 20 percent of the State's land area and is restricted to the belt bordering the basement rock areas. Specific capacity of wells in this area ranges from 0.5m3/hr/m to 5.6m^3 /hr/m (Aku, 1992).

The shale and sand-stone province covers extensively about 26 percent of the state's land area and is the most difficult terrain in obtaining ground water. Groundwater is practically unavailable in the dry season. Ironically, this province harbours one of the largest rural population densities. The stream morphology and physiography do not lend

themselves to construction of small earth dams except for dredged dams (WaterAid, 2004).

2.6 Water and Sanitation Issues in Plateau State

Water Supply and sanitation to the rural areas in Plateau is deficient. This has resulted to drop in Life expectancy to 50 years (WHO, 2010). One of the main reasons of premature death is water borne/water related disease, such as typhoid, cholera, and diarrhoea. The State is in dire need of expansion and construction of water schemes. The State water supply facilities which are inadequate are usually contaminated. Some of the existing facilities have already out-lived their design horizon and have been abandoned because of lack of spares. The lack of hydrological and Hydro geological studies have resulted to low production of safe water. Plateau State Government has used substantial efforts and investments in the water supply and sanitation sector but the availability of safe drinking water and effective sanitation and sustainable water supply is not satisfactory (PRUWASSA, 2004).

2.7 WATSAN Technologies in Plateau State

The water and sanitation programmes in Plateau State involved the introduction of certain technologies and innovations by interveners. Some of these technologies and innovations were adopted while some were not because of certain factors. The technologies/interventions are in two packages (1) water technologies and (2) rural sanitation technologies.

2.7.1 Water sources

For improved water, low cost supply options were introduced. These include:

i. Shallow wells: Shallow or dug wells are very common in the rural areas because of its relative cheapness and reliability. This has proved successful and where rocks are encountered blasting is employed to create fissures in rocks. The wells are lined with caisson method of construction and 2 meters of penetration below the water table with the bottom rings perforated. Pre-cast concrete rings are used in some places. The depths of the wells are about 10 metres each and the hand pumps are installed on them. Siting of wells using geophysical techniques are employed in some cases.

ii. Boreholes with hand pumps: The main options for shallow wells, primarily on a long term, are the borehole. The success rate of drilling boreholes is improved by use of geophysical techniques of water exploration. A minimum acceptable yield from boreholes is 10 litres per minute, that is, 600 litres per hour, to cater for an estimated 300-500 person per installation. Boreholes are equipped with appropriate hand pumps depending on the depth of the borehole.

iii. Borehole with power distribution: In some settlements with population between 1000-5000 people, water from drilled boreholes are pumped to over-head tanks and reticulated through batteries of stand pipes. Mostly, these boreholes are powered using solar energy where affordable and diesel powered by generators.

iv. Protected springs: Springs exist in many parts of Plateau State due to its rocky nature. Where such advantages exist, springs are protected at minimal cost.

v. Gravity flow system: Gravity flow systems are relatively expensive to construct even though they are relatively cheap to maintain. It is therefore a low cost technology for rural areas of Plateau State mostly used in areas that have relatively dense population. Not much of it has been built in the State though.

vi. Earth Dams: There are areas in the State where boreholes and shallow wells are not feasible. In such places, earth dams are considered as suitable and used as domestic sources of water. The water is drawn via intake wells with hand pumps constructed near the dam. Connections to the dam are made through an infiltration gallery. The water could be pumped to an overhead tank, treated and reticulated to the communities. The cost of constructing earth dams is the most expensive low-cost technological option; however, this lies as the best and only option in some areas of the State.

vii. Rainwater harvesting- Rain water harvesting (which is limited to individual households) is considered where there are no other visible water options. Roof catchments collect rainfall from a roof and channel it through a gutter with storage for use. The size of the storage tank is determined by the resources at hand.

2.7.2 Rural sanitation technologies

Water is life, sanitation sustains life. Therefore, it is imperative for the two to be run concurrently for the rural dwellers. The sanitation facilities introduced to rural households in Plateau State are: Sanitary Platform Latrines (Sanplat), Mozambique latrine, Simple Pit Latrines, Ventilated Pit Latrine (VIP) and Pour Flush Latrines.

2.7.2.1 Sanplat latrines

The word ‘’SanPlat’’ stands for Sanitation Platform. SanPlat is an improved latrine slab with the following features:

1. Smooth and sloping surface which encourage regular cleaning.
2. Elevated footrests to help the user find the right position even at night.
3. A drop hole which is both comfortable to use and safe for children

   A SanPlat can also be made with a tight fitting lid which effectively stops smells and flies.

2.7.2.2 Mozambique latrine

Mozambique latrine is a composting latrine where human excreta are mixed with soil and ash to decompose into compost which can be dug out and used in agriculture. WaterAid promoted composting latrines that boosted crop yield largely in Mozambique hence the name.

2.7.2.3 Simple pit latrines

A pit latrine is a dry toilet system which collects human excrement in a large container and range from a simple slit trench to more elaborate systems with ventilation. They are more often used in rural wilderness areas as in much of the developing world. The waste pit, in some cases, will be large enough that the reduction in mass of the contained waste products by the ongoing process of decomposition allows the pit to be more or less permanent. In other cases, when the pit becomes too full, it may be emptied or the hole made be covered with soil and the associated structure moved or rebuild over a new pit. The pit toilets share some characteristics with a composting toilet but the

latter combines the waste with saw dust, coconut coir, peat moss or similar materials to support aerobic processing in a more controlled manner.

2.7.2.4 Ventilated pit latrines

The Ventilated Improved Pit latrine (VIP) is a pit toilet with a black pipe (vent) fitted to the pit and a screen (fly screen) at the top outlet of the pipe. VIP latrines are an improvement to overcome the disadvantages of simple pit latrines, i.e. fly and mosquito nuisance and unpleasant odours. The smell is carried upward by the chimney effect and flies are prevented from leaving the pit and spreading disease.

2.7.2.5 Pour flush latrines

A Pour Flush toilet is like a regular Flush Toilet except that instead of the water coming from the cistern above, it is poured in by the user. When water supply is not continuous, any cistern Flush Toilet can become a Pour Flush Toilet.

Just like a traditional Flush Toilet, there is a water seal that prevents odours and flies from coming back up the pipe. Water is poured into the bowl to flush the toilet of excreta; approximately 2 to 3 litres is usually sufficient. The quantity of water and the force of the water (pouring from a height often helps) must be sufficient to move the excreta up and over the curved water seal.

Both pedestal and squatting pans can be used in the pour flush mode. Due to demand, local manufacturers have become increasingly efficient at mass-producing affordable, Pour Flush Toilets and Pans. Toilets can be made from plastic and ceramics, or from galvanized sheet metal.

The S-shape of the water seal at the bottom of the Pour Flush Toilet or Pan should have a slope of 25 to 30 degrees. Water seals should be made out of plastics or ceramic to prevent clogs and to make cleaning easier (concrete may clog more easily if it is rough or textured). The optimal depth of the water seal is approximately 2cm to minimize the water required to flush the excreta. The trap should be approximately 7cm in diameter.

Advantages of the Pour flush latrine:

1. The water seal effectively prevents odours
2. The excreta of one user can be flushed away before the next user arrives
3. Suitable for all types of users (sitters, squatters, wipers and washers)
4. Low capital costs; operating costs depend on the price of water.

Hygiene education was introduced through a community-based behaviour change programme in 2001. It was tagged 'WATSAN recommended practices' which involved teachings on a 'package' of seven practices including

1. Boiling of water before drinking,
2. Filtering and disinfecting water at point of use,
3. Storage of water in clean containers,
4. Collection of water from protected sources,
5. Appropriate hand washing behaviours,
6. Defecating in toilets/latrines and
7. Burning of garbage around surroundings (PRUWASSA, 2003).

2.8 Management of Water and Sanitation Facilities through Communal Efforts in some Developing Countries

2.8.1 SNV's experiences in Tanzania

A 2008 water point mapping study undertaken by SNV in ten rural districts of Tanzania revealed that 43% of 6109 existing water points were no longer operational SNV (2009). Only two thirds of people in the ten districts had access to safe drinking water. However, the number dropped to one third when functionality was taken into account. The study concluded that access is limited by such factors as poor location of the water source, inappropriate technology, substandard quality and uncertainty about the ownership of the water source.

Most community members were not consulted during the preparation phase of water supply development, yet the facilities were built and subsequently handed over to the communities to operate and maintain. In cases where consultations did take place, only community leaders were involved. Those most affected by the lack of a functional water supply system, notably women, were not included. In spite of decades of experience in developing systems for water and sanitation, genuine community involvement during all stages of water supply development leaved much to be desired. What communities' needed-including technology, level of service, access to spare parts-were all too often ignored SNV (2009).

Communities also made sanitation a lower priority than water supply access. Water supply is considered a communal concern, whereas sanitation and hygiene are seen as having much more to do with an individual's choice. CLTS seeked to encourage action to create a clean and hygienic environment. Hand washing with soap or ash and other hygiene-related behaviours were encouraged. During the community planning and

assessment process of CLTS, other aspects of hygiene behaviour change were identified. The focus shifted from mere toilet construction for individual households to the creation of open defecation free (ODF) villages. Overtime, ODF villages moved up along the sanitation ladder, improving the structure and design of their toilets (WaterAid, 2006).

Another promising approach was to start Water and Sanitation for Health (WASH) programmes in schools which consist of establishing water supply, toilets and hand washing facilities where there was a serious lack. For example, in ten schools in Mwanza, Tanzania, 8,453 pupils shared 57 latrines. This amounted to approximately 1 latrine for 150 pupils, whereas the Tanzanian standard is 1latrine for 20 girls and 1 for 25 boys. One advantage of WASH programmes focusing on schools was that they directly reached out to large numbers of children. Hygiene promotion and awareness creation as part of the broader education curriculum positively influenced the behaviour of children. These children became change agents spreading sanitation and hygiene messages in their communities (WaterAid, 2006).

To give more voice to communities, Tanzania established District Water and Sanitation Teams (DWSTs). A DWST facilitated community meetings and discussed the benefits and limitations of different options so that communities made informed choices. A DWST also trained community members in required skills and provided support for major repairs or expansions of water supply systems. In the late 1980s, a gravity flow water supply was constructed in the Nivamero district, to provide drinking water to three villages. But as the population of the villages increased, the supply was no longer sufficient. The local water committee tried to find a solution by setting up a distribution

system. This system provided water from a tap at specific hours. Although this temporarily solved the problem, a long-term solution involved increasing the water flow. This meant a major expansion of the project and the community lacked the technical knowledge to undertake the work, and in 2008 sought support from the DWST in Mvomero. Several meetings between the community and the DWST were held. This was an action plan, whereby the DWST committed technical assistance and materials (cement, pipes and fittings), and the community provided local materials and labour for excavation and transporting materials to the sites. This improved the situation vastly. As a result more water became available, and users showed increased willingness to pay for the operating costs of their water supply. The project also helped the DWSTs gain recognition and hence credibility as a government agency (SNV, 2007).

2.8.2 CLTS approach in southern Ethiopia

In 2008, SNV Ethiopia supported local government authorities in six districts of Southern Ethiopia to implement CLTS in 52 villages and help achieve the ODF status. SNV, together with six local capacity building institutions (LCBs), trained 250 government staff and seven NGOs (SNV, 2008) The following lessons were learnt:

- Strong facilitation skills were crucial. The change process required effective communicators who need not necessarily be technical people.
- The participation of outsiders in the launch and follow-up sessions was essential to evoke behavioural change.
- Sustaining the process and participation of the community required recognition of efforts by peer communities and government authorities.

- Involvement of LCBs and local NGOs deepened the community's understanding of the concept, sustained the process and assisted in scaling up the process across the wider community.
- Including local leaders in comprehensive advocacy sessions at the district level fostered participation.
- School and village representatives were made members of the local CLTS team and participated jointly in all steps of the CLTS exercise. The village community transected where pupils defecate, calculated the volume of fecal matter from the school and discussed its impact on the village. In the village CLTS action plan in the school was considered as a household in the village with special needs.
- Commitment of local leaders of key social institutions such as churches, mosques and so on were obtained to enhance an active role in CLTS implementation and follow up.

2.8.3 CLTS approach in schools, Eldoret, Kenya

In Eldoret, a 2008 'routine' assessment of 42 public and 94 private primary schools by the municipal education department identified the lack of school sanitation and hygiene as one of the key issues affecting school performance of 47,000 enrolled pupils. The municipal education and public health departments, the water and sanitation company (ELDOWAS),Uasin Gishu District Environment (NEMA) office and members (including NGOs and PSOs) of the Eldoret 'Green Town' initiative hosted a stakeholder meeting. The purpose was to assist 30 participating public schools in leading the development of WASH improvement plans as well as focusing on water and sanitation facilities, training events targeting, pupils and parents to address the contributing factors to behavioural change. These included hygiene education (content and approaches),

hygiene practices, greater appreciation of sanitation facilities (environments conducive to proper usage) and linking hygiene practices in pupils' homes to the community at large to monitor performance and provide an incentive to participating schools. The scope of the school environment competition (for the best progressing and performing schools) was widened to include:

- Water: quantity, quality, distance to source, conservation, utilization and maintenance;
- Sanitation**:** gender-specific pupil/toilet ratio, minimum design standards, cleanliness and innovation; and
- Hygiene**:** hand washing and disposal of sanitary towels.

2.9 Global Water and Sanitation Statistics

- In developing countries rural communities have less than half the sanitation coverage (37 percent) of urban areas (81 percent). Sanitation coverage levels are lowest in the sub-Saharan Africa (36 percent) and South Asia (37 Percent) regions (WHO/UNICEF, 2010).
- WHO /UNICEF, (2004) reported that if increases in sanitation coverage stay as low as those between 1990 and 2002, the world will fall short of its MDG target by over half a billion people by 2015.
- WHO/UNICEF, (2004) also reported that in 2002, 2.6 billion people, roughly 42 percent of the world's population-had no access to improved sanitation facilities. An additional 1.8 billion people needed to be provided with improved sanitation from 2002 to 2015 to achieve the MDG's to half target of the proportion not served in 1990.

- The number of people that gained access to safe water drinking water between1990-2002 was 1.1 billion. The greatest access gains were achieved in South Asia, where water access increased from 71 percent in 1990 to 84 percent in 2002. In Sub-Sahara Africa, access grew normally, form 49 percent in 1990 to 58 percent in 2002 (WHO/UNICEF, 2004).
- The number of world's population that used improved drinking water sources in 2008 was 83 percent, up from an estimated 79 percent in 1990 WHO/UNICEF/WSSCC (2009). Appropriately 42 percent of the people with access to water have a household connection or yard tap.
- People in slum areas have very limited access to safe water for household uses. A slum dweller may have 5 to 10 litre per day at his or her disposal, while a middle-or high-income person in the same city may use some 50 to 150 litres per day if not more (U-WWAP, 2009).

2.10 Determinants of Adoption of Technologies

A variety of studies are aimed at establishing factors underlying adoption of various technologies. As such, there is an extensive body of literature on the theory of technology adoption. Several factors have been found to influence adoption. These include government policies, technological change, market forces, environmental concerns, demographic factors, institutional factors, innovation attributes, socio-economic characteristics and delivery mechanisms.

Classifications of adoption factors into broad categories differ for different adoption studies in literature. For instance the classification into: farmer characteristics, farm structure, institutional characteristics and managerial structure (Mcnamara, Wetzstein

and Douce, 1991), while others classify them under social, economic and physical categories (Kebede, Gunjal and Coffin 1990). Others group adoption factors into human capital, production, policy and natural resource characteristics (Wu and Babcock, 1998) or simply whether they are discrete or continuous (Shakya and Flinn, 1985). By stating that agricultural practices are not adopted in a social and economic vacuum, Nowak (1996) brought in yet another category of classification. He categorized factors influencing adoption as informational, economic and ecological.

There is no clear distinguishing feature between elements within each category. Actually, some factors can be correctly placed in either category. For instance, experience as a factor in adoption is categorized under 'farmer characteristics' (MacNamara, Wetzstein and Douce, 1991; Tjornhom, 1995) or under 'social factors' (Kebede, Gunjal and Coffin1990; Abadi Ghadim and Pannell, 1999) or under 'human capital characteristics' (Caswell et al., 2001).

Over the past few years, research has been directed on understanding water resources and sanitation management in Nigeria. Given the constellation of plural authorities (legal, traditional, spiritual, religious, administrative) and multiplicity of environmental contexts as well as varying socio-economic characteristics of actors, Akpabio and Saravanan (2012) utilized the Local Ecological Knowledge (LEK) framework in accounting for the contribution of the diversities of cultural, socio-economic, physical environmental and temporal factors in explaining water and sanitation practices in Africa- specifically in understanding the various ways in which people draw on believes, tradition and religious concepts and authorities in dealing with water and environmental health issues.

The interplay of cognitive and ecological factors produce some patterns of locally sanctioned and meaningful norms, behaviours and practices which may not necessarily be acceptable to wider socio-ecological and cultural order. Consequently, such peripheral behavioural tendencies are often discriminated against and labeled as 'deviant' (Mielke *et a*l., 2011). Given that there is a world of difference between universalized norms and highly localized ones, it will appear therefore that the entire struggle for which pattern or system of knowledge and behaviour about water and sanitation is a manifestation of inexorable power struggle- in this case the dominant power between universalized norm and localized ones would tend to have its way.

In relation to water and sanitation practices in Africa, issues directly emerging from these arguments include: (a) the existence of actors outside the immediate social and ecological situation who recognize the problems and prescribe solutions mostly in a scientific manner- the WATSAN institutions; (b) the existence of elite groups (government) who use all instruments of state resources to promote 'sanctioned knowledge practices' even if it is obviously outside the norms of the local knowledge systems.

Often times, the relationship between 'outsider actors' and 'local ones' in involving common intervention or knowledge system remain unworkable given the domineering attitude of the outsider actor as well as mutually unwilling attitudes to learn from each other's knowledge. Given that a groups ecology, economy, social differentiation, and cultural convictions and behaviours are important in the entire constellation of knowledge struggle, the LEK model holds the assumption that the only way to assess and understand human behaviours in relation to water and sanitation practices is to

understand the contexts of the person and group. The contexts will then include the physical, temporal, social and cultural features while humans are interpreted in the contexts of experiences, cognitive and psycho social skills and abilities (Dunn *et al.*, 1994). In this case, human knowledge and experience reflect environmental contexts.

The temporal dimension of human contexts imply a continuously shifting and changing situations, which also sets the stage for behavioural change/ adjustment in relation to emerging set goals. For instance, the meanings and images of water and sanitation and the behaviours accompanying such image could undergo some gradual metamorphosis and change depending on factors such as education, exposure, age, income level, and changes in the reformations in the structure of local governance, among others.

Perhaps it is not necessary to try and make clear-cut distinctions between different categories of adoption factors. Besides, categorization usually is done to suit the current innovation being investigated, the location and the researcher's preference. However, as some might argue, categorization may be necessary with regard to policy implementation.

Even though not much literature is available on adoption of WATSAN recommended practices in Nigeria, extensive work on WATSAN practices in developing countries have been pioneered by Akpabio and Saravanan (2012) in their work "Water Supply and Sanitation Practices in Nigeria: Applying Local Ecological Knowledge to Understand Complexity". The following section provides a review of selected factors that affect adoption of agricultural technology and WATSAN technologies. In this study it is assumed that similar factors that influence adoption of agricultural technologies

might be the same factors in adoption of WATSAN recommended practices adoption. Therefore, for the purpose of this study factors classified under socio-economic characteristics of farmers, Attributes of WATSAN recommended practices and institutional factors were investigated.

210.1 Socio-economic characteristics of farmers

In Nigeria and Plateau State in particular, there has not been many systematic and documented scientific studies of the relationship between individual characteristics and adoption of water and sanitation recommended practices. However, some studies elsewhere have demonstrated the relationship between individual characteristics and adoption in general. For instance, Rogers worked on innovativeness of individuals (as a factor in adoption) which he defined as the degree to which an individual is relatively earlier in adopting an innovation than other members of his social system. This was modified and extended by Hirschman (1980) to include: inherent/actualized novelty seeking, creative consumer and adoptive vicarious innovativeness. Other individual characteristics studied are: reliance on others as source of information, adopter threshold and need-for-change/need-for-cognition (Wood and Swait, 2002). These studies showed that favourable individual characteristics affect adoption positively. More specific studies on the characteristics of adopters are reviewed hereunder.

Gender

Research is replete on gender issues in adoption studies. Most show mixed evidence regarding the different roles men and women play in technology adoption. In one of such studies, Doss and Morris (2001) in their study on factors influencing improved maize technology adoption in Ghana, and Overfield and Fleming (2001) studying coffee

production in Papua New Guinea show insignificant effects of gender on adoption. Since adoption of a practice is guided by the utility expected from it, the effort put into adopting it is reflective of this anticipated utility. It might then be expected that the relative roles women and men play in 'adoption' are similar, hence suggesting that males and females adopt practices equally. In another study Amao and Awoyemi (2009) found that gender was not significant in adoption, United Nations (2006) reported that traditionally women and children are the primary collectors, users and managers of household water. When water systems break down women and children are the most affected since they have to trek far to search for water for household use. Women are the key players in implementing changes in the hygiene behaviour

Age

According to the 2006 National population census, 55.8 percent of rural dwellers were 20 years and below indicating the population of rural Nigeria to be 'young' at that time. Age is a factor thought to affect adoption. Age is said to be a primary latent characteristic in adoption decision. However, there is a contention on the direction on the effect of age on the adoption. Age was found to positively influence Integrated Pest Management on peanuts in Georgia (McNamara, Wetzstein, and Douce, 1991). The effect is thought to stem from accumulated knowledge and experience of farming system obtained from years of observation and experiments with various technologies. In addition, since adoption pay-offs occur over a long period of time, while cost occur in earlier phases, age of the farmer can have a profound effect on technology adoption.

However, age has been found to be either negatively correlated with adoption or not significant in farmers' adoption decisions. In studies on adoption of land conservation

practices in Niger (Baidu-Forson, 1999), rice in Guinea (Adesina and Baidu-Forson, 1995), fertilizer in Malawi, Green and N'gong'ola, 1993) age was either not significant or was negatively related to adoption. As a matter of fact, it is expected that older people adopt a technology at a slower pace because of their tendency to adopt less swiftly to a new phenomenon (Tjornhom, 1995).

Most adoption studies done in Nigeria show that the mean age of heads of farm households is between 45 and 50 years, with the age graph skewed towards the right. These studies have also shown that there is no association between age and adoption behaviour of farmers (Ekong, 2010). However, studies which can be considered more recent than those Ekong reviewed have revealed that old farmers tend to be more conservative (traditional) and afraid of taking risk, which the adoption of new farm technology entails. It was said that young farmers are more dynamic and more willing to take such risk connected with the adoption of new agricultural technologies (Olagunju and Adeyemo, 2007). Nwachukwu, *et al;* (2009) found that age significantly and positively influenced adoption of Fadama Telfaina production in Imo State.

Household size

The 1991 population census adopted the United Nations definition of a household as all the people living together under one roof, eating from the same pot and recognizing one person as the head of the household. Analysis of the 1991 census indicated that 70% of rural States like Jigawa, Kebbi, Sokoto, Bauchi and Katsina have 5-7 persons per household. Rural areas tend to have larger household sizes than urban areas (Ekong, 2010).

Studies on adoption of agricultural technologies have often found positive correlation with household size and also farm labour, suggesting that a big household which yielded a large labour force will also relate in the same manner with adoption. In general, big households have larger food demands than smaller ones hence are likely to adopt any technology that improves on their production to meet their needs. In the study of agricultural technology adoption, Bonabana-wabbi *et al* (2001), household size positively correlated with adoption. Tokula *et al* (2009) found that household size was important in the adoption of rice varieties and was negative implying that the more the household size, the lower the probability of adopting improved rice varieties. In a separate study, Nwachukwu and Onyenweaku (2007) also found that large household sizes impose pressure on the output of the farm and as such affect adoption hence productivity and efficiency negatively.

Education

Studies that have sought to establish the effect of education on adoption in most cases relate it to years of formal schooling (Tjornhom, 1995, Feder and Slate, 1984). Generally, education is thought to create a favourable mental attitude for the acceptance of new practices especially on information- intensive and management-intensive practices (Waller *et al*., 1998; Caswell *et al*., 2001). Adoption literature (Rogers, 1983) indicates that technology complexity has a negative effect on adoption. However, education is thought to reduce the amount of complexity perceived in a technology thereby increasing a technology's adoption. The ability to read and understand sophisticated information that may be contained in a technological package is an important aspect of adoption. In the case of WATSAN the ability to comprehend WATSAN recommended practices becomes useful. In recent studies reviewed on

WATSAN practices in Cameroun (Yamakoshi, 2010) education positively affected WATSAN adoption. In another study, Tokula *et al;* (2009) found that educational level positively influenced adoption of improved cassava variety by farmers in Kogi State of Nigeria.

Attitude

An attitude is a general predisposition that is based on beliefs and leads to a set of intentions, rather than a specific behaviour. Intentions are a special kind of belief in which the person is the subject and the behavior the attribute. A specific behaviour is viewed as determined by the person's intention to perform that behavior (Fishbein and Ajzen, 1975). Socio-economic improvements (education, poverty reduction, exposure to better information, and improved services provision and effective settlement planning) in water and sanitation could possibly lead to behavioural change. However, such behavioural change may be slightly difficult where cultural and religious barriers take root. DWAF, (1994) reported that people in Africa continue to use unsafe hygiene practices, despite an array of diversified effort that has been mounted towards adequate water and sanitation. Akpabio and Saravanan, (2012) reported that belief in 'divine protection' for children influences parents' attitudes of allowing the infant or child to explore all manner of things around the environment including 'soil eating'. Such daily exploration/experimentation by infants/children represents a way of cultivating parental confidence about the capability of the child in mastering the immediate environment.

2.10.2 Institutional factors

Membership of social organizations

Social organizations are formed when a number of people come together to share certain values and interests and thereby identify closely with each other. Membership of such organizations is generally perceived as a more efficient way of disseminating technologies to farmers in rural areas communities (Godquin and Quisumbing,2006) as well as a source of social capital that facilitates exchange of resources between actors (Bourdieu, 1985). Social capital manifested in community-based organizations or personalized social networks has been found to play an important role in the adoption of crop technologies (Isham, 2000; Katungi, 2007). Ironkwe *et al;* (2008) found that membership of social organizations influenced adoption of yam minisett technology among women farmers in Abia State. Organizations may generate externalities such as information about new technologies (Colliers, 1998) that may facilitate adoption decisions. The externalities generated by local social organizations may vary as a function of the characteristics and functioning of these organizations. It is expected that membership of social organizations of farmers would positively influence adoption of WATSAN recommended practices in this study.

Sources of information

Acquisition of information about a new technology demystifies it and makes it more available to potential adopters. Information reduces the uncertainty about a technology's performance hence may change individual's assessment from purely subjective to objective over time (Caswell *et al*., 2001). Exposure to information about new technologies as such significantly affects adopters' choices about it. Feder and slade (1984) indicate how, provided a technology is profitable, increased information induces

adoption. However, in the case where experience within the general population about a specific technology is limited, more information induces negative attitudes towards its adoption, probably because more information exposes an even bigger information vacuum hence increasing the risk associated with it. A good example is found in the adoption studies (McGuirk *et. al.*, 1992; Klotz, *et al.*, 1995) on the adoption of recombinant bovine Somatotropin Technology (rbST) in dairy production. Nkeme et al; (2009) found that sources of information positively influenced adoption of Chorkor Smoker Kiln Technology in Akwa Ibom State. Information is acquired through informal sources like the media, extension, personnel, visits, meetings, and social organizations and through formal education. It is important that this information is reliable, consistent and accurate. Thus, the right mix of information properties for a particular technology is needed for effectiveness on adoption.

2.10.3 Characteristics WATSAN recommended practices

Affordability

The decision to adopt is often an investment decision. And as Caswell *et al*, (2001) note, this decision presents a shift in farmers' investments options. Therefore, adoption can be expected to be dependent on cost of technology and whether farmers possess the required resources. Technologies that are capital-intensive are only affordable by wealthier farmers (El Oster and Morehart, 1999) and hence the adoption of such technologies is limited to larger farmers who have the wealth (Khanna, 2001). In addition changes that cost little are adopted more quickly than those requiring large expenditures; hence both extent and rate of adoption may be dependent on the cost of a technology. Economic theory suggests that a reduction in price of a good or service can result in more of it being demanded. Nancy and Nimish (2005) reported in a study of

factors that could motivate people to adopt safe hygienic practices in the Eastern Cape Province, South Africa, that high cost of water and sanitation to families of low income and the shortage of capital for investments were de-motivating factors in adoption of safe hygienic practices.

Compatibility

Compatibility is the degree to which an innovation is perceived as consistent with existing values, past experiences, and needs of potential adopters. An idea that is more compatible is less uncertain to the potential adopter. An innovation can be compatible or incompatible (1) with socio-cultural values and beliefs, (2) with previously introduced ideas, or (3) with clients needs for innovations. In general, the compatibility of an innovation, as perceived by members of a social system, is positively related to its rate of adoption (Rogers, 1995) technical solutions alone to adoption of safe hygienic practices are not sufficient for adoption. Sanitation technologies need to suit local material and building practices, local economic conditions and local cultural practices and beliefs (Black and Fawcett, 2008., Alley, 2002), reported in literature how the Water of Ganges which is widely reported to be polluted and yet the Hindus perform their ablutions in it because of their beliefs in the restorative powers of mother Ganga.

This finding falls under the ecology of local peoples' lives especially the motives for doing something. Akpabio and Saravanan cited Wellin (1955) who had explored the core motives and circumstances of the women who boiled water and those who did not. Wellins found that irrespective of the demonstrable risks of 'not boiling', the greatest numbers of people were not convinced of boiling water purely on cultural reasons. For the few who were willing to accept the intervention measure, routine of activities

prevented them from doing so. In the literature, the water of Ganges is widely reported to be polluted but the Hindus perform their ablutions in it because of their beliefs in the restorative powers of mother Ganga (Alley, 2002).

2.11 Measuring Adoption

Most studies on measuring WATSAN concentrate on the indicators. Measuring adoption at a glance appears to be nothing more than a question of whether a rural dweller is or not using a specific practice. This simplistic view is not correct. Much more work is needed in refining methods and in compiling data needed to credibly measure adoption of WATSAN recommended practices.

The rate of adoption is usually measured by the length of time required for a certain percentage of members of a system to adopt an innovation. Extent of adoption on the other hand is measured from the number of technologies being adopted and the number of rural dwellers adopting them. The current study would focus on the extent of adoption and factors affecting it.

Depending on the technology being investigated various parameters may be employed to measure adoption. Measurement also depends whether they are qualitative or quantitative. For instance, farmers' perceptions are examined in several studies including the one by Baidu-Forson (1999) and that by Tjornhom (1995). In the former, farmers' perception of characterization of sorghum and modern varieties are taken into account. In the latter, farmer perceptions on harmful effects of pesticides on water quality, on health of individuals and on natural enemies of insects are sought. Baidu-

Forson (1999) examined farmers' perceived utility from adopting half-crescent shaped earthen mounds- a land enhancing technology.

While direct qualitative attributes are harder to measure, several studies have used estimate of probabilities (Shakya and Flinn, 1985; Harper *et al.*, 1990; Green and Ng'ong'ola, 1993; Kebede, *et al.*, 1990). In soliciting respondents' subjective perceptions, researchers capture the qualitative attributes that influence farmers' decision probably because farmers' technology choices are based on their subjective probabilities Feder *et al.* (1985). Farmers' perceptions are interpreted as perceived profitability of a technology and translate into more being devoted to it.

2.12 Adoption of Water and Sanitation Practices

Most literature on adoption of water and sanitation recommended practices in developing countries report low levels of adoption. DWAF, (2001) report that people in developing countries continue with unsafe water and sanitation practices despite an array of efforts mounted towards adequate water and sanitation education. Duncker, (2001) stated that often the unhygienic practices include unsafe human excreta disposal, unsafe solid and liquid disposal and unsafe drinking water.

A Pre-KAP report of the survey conducted by Kashmir Charitable Trust (KCT) to establish levels of knowledge, attitude and practice of overall sanitation and hygiene in 2008 showed low adoption levels. The report revealed that 5 per cent of people in Muzaffarabad Union Council, Kahon in United Kingdom boiled water before drinking, 8% filtered and disinfected water at point of use while only 4 per cent stored water in clean containers. Report of the study further showed that 12 per cent of the people collected water from protected sources, 33 per cent used latrines to defecate/urinate, 12

per cent had appropriate hand washing behavours and 12 per cent burnt garbage around their surroundings to prevent flies KCT (2008).

2.13 Effects of Adoption of Water and Sanitation Recommended Practices

There are many and diverse potential benefits derived when WATSAN recommended practices are adopted, ranging from the easily identifiable and quantifiable to the intangible and difficult to measure (Hutton, 2001). Adoption of WATSAN leads to increased income indirectly in that a reduction in water-related diseases leads to cost savings in health care related expenditures mainly due to the reduced number of treatments of diarrhoeal cases (Pruss et al., 2002). Also, Ajayi and Ogba (2008) found that 75% of respondents were of the opinion that there was a reduction in medical expenditure due to decrease in water and sanitation related diseases.

Gold *et al*. (1996) stated productivity effect of improving health as a result of adoption of safe water and sanitation practices. Curry and Weiss (1993) argued that whatever is actually done with time, the true opportunity cost is the amount in monetary units or in kind that the person earns over the same period of time if he/she were not ill and was working. One major benefit of water and sanitation improvements is the time saving associated with better access. Time savings translate into either increased production, improved education levels or more leisure time (Whittington *et al.,* 1990). For example, a study in Nigeria reported that in the dry season, average journey time to the local spring was 4-7 hours for some rural communities which do not include waiting time at the spring Whittington *et al* (1991). Time and energy gained may be applied to a variety of activities including agriculture, leisure and income generation (Parker and Skytta, 2000). Ajayi and Ogba (2008) found that 87.5% of respondents used time saved due to adoption of WATSAN recommended practices for other socioeconomic activities. They

further reported that children's attendance at school became improved or regular (74.3 %) with the adoption of water and sanitation practices in Igede land of Benue State, Nigeria. In the same study 75% of respondents were found to have a change in hygienic behaviour as result of adoption.

WaterAid (2001) produced a report called 'Looking Back', which evaluated a number of water supply and sanitation projects carried out by it and its partners in Ethiopia, Ghana, India and Tanzania. The results showed that water supply and sanitation projects had wide impacts on people's lives. For instance, in Tanzania, WaterAid reported that before intervention, cases of sicknesses and deaths arising from unsafe water and sanitation practices were common. But the situation changed with the intervention of WaterAid in promoting hygienic practices. The report had it that the simple act of washing hands with soap and water reduced diarrhoeal diseases by over 40 %. It went further to report that its projects on WATSAN reduced diseases caused by worms, and diseases like scabies and trachoma caused by having too little water, while the use of latrines decreased the risk of nocturnal insects and snake bites.

In Chipongwe village in Zambia, Water Aid reported that its WATSAN projects helped families in reducing the distance to water sources by its intervention. Beneficiaries reported that they had more time for other activities and their children's school attendance rate increased since they do not spend a lot of time collecting or queuing for water before going to school. In Zambia this can often mean that five hours each day is saved. In Bangladesh, WaterAid (2001) further reported that their projects led to savings from treatment of water and sanitation related diseases. A beneficiary was quoted to have said "we had to spend between 1000-1500 taka per month for treatment which was

about one third of our monthly income. Nowadays this is reduced to 100-300 taka per month". Also, in Dar es salaam, Tanzania, the poorest people spend an average of 10 per cent of their income buying water from vendors at inflated prices.

2.14 Indicators for WATSAN International Standards

The Guide for measuring the performance of WATSAN practice was developed by the Food and Nutrition Technical Assistance Project for use by PVOs and USAID in monitoring and Evaluation (Patricia *et al.*, 1999). The purpose of the guide is to facilitate the consistent measurement of a set of generic performance indicators for results reporting to USAID. The WATSAN indicators include the following: percentage of people with WATSAN-related diseases in the last one year, quantity of water used per capita per day (for drinking, bathing, food preparation and hygiene and sanitation), percentage of people with appropriate hand washing behaviour , and percentage of population using hygienic sanitation facilities.

2.14.1 Percentage of population with WATSAN-related disease in one year

Percentage population with WATSAN-related diseases in the last one year is calculated thus:

$$\frac{Number\ of\ people\ with\ WATSAN\ related-diseases\ in\ the\ sample\ in\ the\ previous\ \ year}{Total\ number\ of\ people\ in\ the\ sample}\ x\ 100$$

Water and sanitation-related programs include improvements in facilities as well as hygiene education for behaviour change. It is well-documented that such programs can bring about decreases in the rate of diarrheal disease on the order of 25 per cent. In an assessment of the impact of combined water, sanitation and hygiene education, Aziz *et al*. (1990) found 25 per cent decrease in diarrheal morbidity. Since then this value has

been reported as the minimum acceptable percentage of people with WATSAN related disease in household. Esrey *et al*. (1991) reviewed 74 studies on the effect of water and sanitation on diarrheal disease morbidity and mortality and nutritional status and results concurred with that of Aziz *et al*. An update of Esrey's review by Huttly *et al*. (1997), which added studies completed in the interval, reported similar findings.

2.14.2 Quantity of water used per capita per day (for drinking, bathing, food preparation and hygiene and sanitation)

Quantity of water used per capita per day is calculated thus:

$$\frac{\text{Volume of water (in litres) collected for domestic use by all households in the sample}}{\text{Total number of persons in the sampled household}} \times 100$$

It is difficult to establish uniform per capita water quantity goals because of local and regional differences in availability of water, climate, and type of water supply. However, Gleick (1996) sets a reasonable target by looking at basic needs for the specific uses of water as follows:

i. Drinking- Gleick recommends minimum of 5 litres per capita per day (lcd).
ii. Bathing- minimum of 15 lcd.
iii. Food preparation- minimum of 10 lcd.
iv. Hygiene and sanitation- minimum of 50 lcd.

2.14.3 Percentage people with appropriate hand washing behaviours in household

Percentage of people with appropriate hand washing behaviours in household is calculated thus:

$$\frac{\text{Number of persons who report that demostrate hand washing behaviour}}{\text{Total number of persons interviewe d in the sample area}} \times 100$$

Sanitation and Family Education (SAFE) pilot project in Bangladesh aimed for behavioural change through two project models. From SAFE project's findings, a

minimum of 50 per cent appropriate hand washing behaviour practice was set as the international minimum standard (Bateman *et al.*, 1995). The appropriate hand washing behaviours included: washing of hand after defecation, urinating, cleaning babies, before eating, before feeding babies (critical hand washing times) and hand washing techniques-use water and soap or ash, wash both hands rubbing both at least thrice and dry hands hygienically by air drying or using a clean cloth.

2.14.4 Percentage population using hygienic sanitation facilities

Percentage population using hygienic facilities (hygienic toilets/latrine) is calculated thus:

$$\frac{\text{Number of people} > 12 \text{ months of age in household in the sample using hygienic facilities}}{\text{Total number of people greater than 12 months of age in the sample area}} \times 100$$

Bateman and Smith (1991) found that for a maximum health impact, a majority of households in a given community (about 75 per cent) should have and use a hygienic toilet or latrine. This percentage has been adopted as the international minimum standard for assessing access and use of toilets/latrines.

2.15 Water and Sanitation (WATSAN) Recommended Practices

In this study, the following seven WATSAN recommended practices were identified as having been exposed to the rural farmers in the study area and therefore were expected to have been known and practiced by them:

(i) boiling of water before drinking, (ii) filtering and disinfecting water at point of use, (iii) storage of water in clean containers, (iv) collection of water from protected sources (wells and springs), (v) defecating in toilets/latrines (vi) appropriate hand washing behaviours and (vii) burning of garbage around surroundings to control flies (PRUWASSA, 2003).

CHATER THREE

3.0 THEORETICAL FRAMEWORK

3.1 The Adoption and Diffusion of Innovation (DOI) Theories

Diffusion of Innovation (DOI), a theory that seeks to explain how, why and at what rate new ideas and technologies spread through cultures. The concept was first studied by the French sociologist Gabriel Tarde in 1890 and by German and Austrian anthropologists such as Friedrich Ratzel and Leo Frobenius in 1898. Its basic epidemiological or internal influence form was formulated by H. Earl Pemberton in 1936 that provided examples of institutional diffusion such as postage stamps and compulsory school laws (Rogers, 1983).

Since then several other DOI theorists have emerged notable amongst them is Evarett Rogers. In his theory, he sees innovations as being communicated through certain channels over time and within a particular social system (Rogers, 1995). Individuals are seen as possessing different degrees of willing to adopt innovations and thus it is generally observed that the portion of the population adopting an innovation is approximately normally distributed over time (Rogers, 1995). Breaking this normal distribution into segments leads to the segregation of individuals into the following five categories of individual innovativeness (from earliest to latest adopters): innovators, early adopters, early majority, late majority, laggards (Rogers, 1995).

Adoption is an outcome of a decision to accept a given innovation. Feder *et al.* (1985) while quoting Rogers' earlier work of 1962 define adoption as "a mental process an individual passes through from first hearing about an innovation to practice". Much scholarly interest falls in two categories: rate of adoption, and intensity of adoption. It is

usually necessary to distinguish between these two concepts as they often have different policy implication. Rate of adoption, the relative speed with which adopters adopt an innovation, has one of its pillars, the element of 'time'. On the other hand intensity of adoption refers to the level of use of a given innovation in any time period.

Clearly, a technology/innovation that is being adopted has an edge over conventional practices. Usually, a technological innovation encompasses at least some degree of benefit of its potential adopters (Rogers, 1995). In this study, a set of innovations(recommended practices), as it relates to WATSAN is packaged to rural dwellers in a manner that is proven more effective than the conventional ways.

Ryan and Gross first indicated the identification of adoption as a process in 1934. Several stages precede adoption and awareness of a need is generally perceived as a first step in adoption process (Rogers, 1983). The other stages are: Interest, Evaluation, Acceptance, Trial and finally Adoption (Lionberger, 1960). The Lionberger analysis also notes that these stages occur as a continuous sequence of events, actions and influences that intervene between initial knowledge about an idea, product or practice, and the actual adoption of it.

Since the early applications of DOI theory, the five attributes of innovations presented by Rogers have been expanded. Moore and Benbasaf (1991) working in an Information Service (IS) context expanded the five factors to eight (voluntariness, relative advantage, compatibility, image, ease of use, result demonstrability, visibility and triability). Tornatzky and Kathrine (1981) reviewed 105 publications that assessed innovations attributes and derived 10 attributes.

Dearing (2007) parsed out this attribute, relative advantage resulting in six basic innovation attributes: effectiveness, cost, compatibility, simplicity (the inverse of complexity), observability and trialability. Research has however consistently found that technical compatibility, technical complexity and relative advantage (perceived need) are important antecedents to the adoption of any innovation (Bradford and Florin, 2003, Crum *et al*., 1996).

Theories of innovation diffusion no longer focus exclusively on explaining the rate at which innovations diffuse or the sequence in which they are adopted. They also focus on explaining why certain innovations diffuse extensively becoming standards, whereas others do so partially or not at all. Many of these theories specify a bandwagon process. In Abraham and Rosenkopf(1990) Bandwagon and Threshold theory, they explain that a feedback loop in which increases in the number of adopters create stronger bandwagon pressures and stronger bandwagon pressures, in turn, cause increases in the number of adopters. Factors affecting if and how many times this feedback loop cycles explain if and how many potentials jump on bandwagon.

It is argued that one important factor has not been incorporated into theories explaining bandwagon's extent; the structure of social networks through which potential adopters of innovation find out information about these innovations which can cause them to adopt. In this regard, Abraham and Rosenkopf advanced a theory of how the structure of social networks affects bandwagons' extent. They propose that both the number of network links, as well as small seemingly insignificant idiosyncrasies of their structures can have very large effects on the extent of an innovation's diffusion among members of a social network.

In Midgley and Dowling (1978) Contingent Model, an individual's predisposition to innovation is seen to be modified by socially transmitted messages about the innovation; as well as by other situation specific factors. This model was used to make predictions about the future behaviour of a sample of consumers that were tested with data collected during the diffusion of six innovations. While findings supported the model, especially with respect to the role of the innovative individual, they also demonstrated the need to develop explanations of rejection.

3.2 Critique of the Adoption and Diffusion of Innovation Theories

DOI theory is at its best a descriptive tool, less strong in its explanatory powers and less useful still in predicting outcomes and providing guidance as to how to accelerate the rate of adoption. There is doubt about the extent to which it can give rise to the readily refutable hypotheses. Many of its elements may be specific to the cultures in North America in the 1968s, and 60s from which it was derived, and hence less relevant in for example, East Asian and African Countries, and as time goes on (Dearing, 2007).

Technologies are not static. There is continual innovation in order to attract new adopters all along the S-curve. The S-curve does not just 'happen'. Instead, the S-curve can be seen as being made up of a series of 'bell curves' of different sections of a population adopting different versions of a generic innovation (Wejnert, 2002). That awareness is the starting point of the adoption process is an incomplete conceptualization. Process might skip stages and adoption could happen even before an innovation is introduced. Adoption process might even end in rejection even when awareness is created (Reynolds, 1971 and Holden, 1992).

The literature on Adoption and Diffusion of Innovation Theories reviewed has made assumptions which might not be tenable in this study. Reason being that the study area has a different culture from the areas studied to arrive at the assumptions made in the theories.These assumptions are that:

i. farmers and other rural dwellers have access to sources of relevant information is only tenable in technologically advanced nations and disregards the inadequacies of communication facilities in developing countries;
ii. there are infrastructure sufficiently strong to support a new practice. This is not always true. Most innovations have failed mainly because of the absence of the necessary supporting infrastructural facilities required for their success instead of the lack of adoption by the local people;
iii. the social distance between clients and change agent is similar to that in North America. However, there is often a great social gap between the elites who bring innovations and the farmers who are to adopt those innovations. This social distance has often blocked communication between the change agent and the client.

3.3 Relevance of Adoption and Diffusion Theories to the study

Despite the short comings of the adoption and diffusion of innovations theories in explaining adoption, these theories staved as the framework on which hypothesized variables on adoption of water and sanitation were tested.

The few adoption studies done in developing countries like Nigeria have pointed out that there may be a significant difference between findings in the advanced nations and those of developing nations (Ekong, 2010). Moreover, in Nigeria, most adoption studies are done in agriculture neglecting other areas like water and sanitation which also plays

an important role in the health and socioeconomic status of the farmers and other rural dwellers. Given that the environment in which adoption of innovations vary, it is important that those factors tested in other ecological settings are tried in Plateau State, Nigeria. This study tried to see if the variables studied in the diffusion and adoption of agricultural innovations to farmers are relevant in the transfer and adoption of water and sanitation recommended practices to farmers in the study area.

3.4 Conceptual Framework

A typical model that illustrates relationship between causal, dependent and output variables, was provided by Harsey and Blanchard (1982). This study adopted the model, however, with slight modification and application. Figure 1 illustrates the conceptual frame-work upon which this study is based. It depicts the variables (socioeconomic characteristics of respondents, institutional factors and attributes of WATSAN recommended practices) that influence adoption of WATSAN recommended practices and the resultant effects on them. Osuala, (1987) defines a variable as symbols to which numerals are assigned. The variable X may take to any (*sic*) justifiable set of values.

3.4.1 Independent variables

In this framework the column on the left contains the independent variables which are: Socio economic characteristics of respondents (gender age, marital status, household size, formal educational levels, attitudes towards WATSAN recommended practice), institutional factors (membership of social organizations, sources of information) and attributes of WATSAN innovations (affordability, compatibility) are expected to influence the adoption of the WATSAN recommended practices. Theoretically, the independent variables (X) are expected to predict the dependent variables (Y).

3.4.2 Dependent variable

The column in the middle (figure 1) indicates the dependant variable which is the adoption of WATSAN recommended practices. These practices are: boiling of water before drinking, storage of water in clean containers, collection of water from protected sources, defecating in toilets /latrines, appropriate hand washing behaviours and burning of garbage around surroundings. Thus, the assumption is that the factors arising from the socio-economic characteristics of respondents, institutional and the attributes of WATSAN recommended practices (independent variables were expected to influence adoption of WATSAN recommended practices (dependant variable).

3.4.3 Effects of adoption of WATSAN recommended practices

The column on the right (in Figure1) depicts the expected effects of the adoption of the recommended practices. It is expected that farmers who adopt the WATSAN recommended practices will have more benefits than their counterparts who do not. This column indicates the effects of adoption in terms of:

(1) Level of hygienic practices

(2) Level of health-care expenditure

(3) Level of productive time for agricultural activities

(4) Level of children's school attendance.

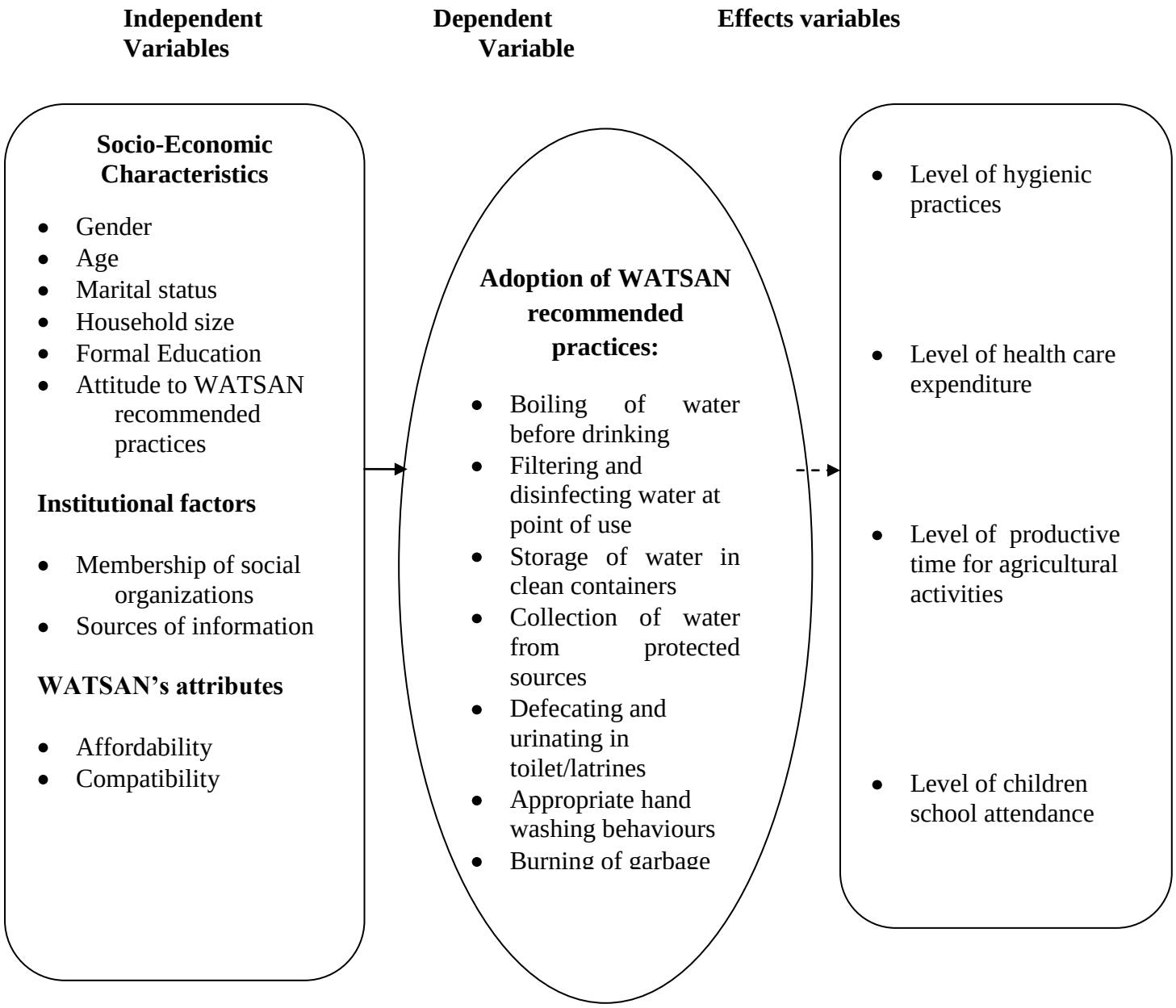


Figure 1: Model of Factors Influencing Adoption of Water and Sanitation Recommended Practices among Farmers and the Effects of Adoption.

CHAPTER FOUR

4.0 METHODOLOGY

4.1 Study Area

The study area was Plateau State, Nigeria. Geographically, Plateau State is located between Latitude 8^0 22' and 10^0 24' North and Longitude 8^0 32' and 10^0 38' East and has a total land area of 26,901 square kilometres. The State is positioned in the center of Nigeria (Figure 2). It is bounded on the Northwest by Kaduna State, Northeast by Bauchi State, the Eastern part by Taraba State and the Southern part by Nasarawa State (Figure 2).

The state is administratively organised into 17 Local Government Areas (LGAs) (Figure 3) namely Barkin Ladi, Bassa, Bokkos, Jos East, Jos North, Jos South, Kanam, Kanke, Langtang North, Langtang South, Mangu, Mikang, Pankshin, Qua'an Pan, Riyom, Shendam and comprises of 207 Federal wards. According to the 2006 census figures, 60 % of the population in Plateau State live in rural areas (NPC, 2006). Agriculture is the main economic activity and major crops cultivated include maize, millet, rice, acha (Fonio), irish potatoes, and fruits and vegetables. The National population census of 2006 put Plateau State at 3,206,531 people. At 2.8% growth rate projection, by 2011 when data were collected, Plateau State's population was expected to have increased to about 3,655,445 people out of whom 2,089,904 lived in rural areas



Figure 2: Map of Nigeria showing the study area

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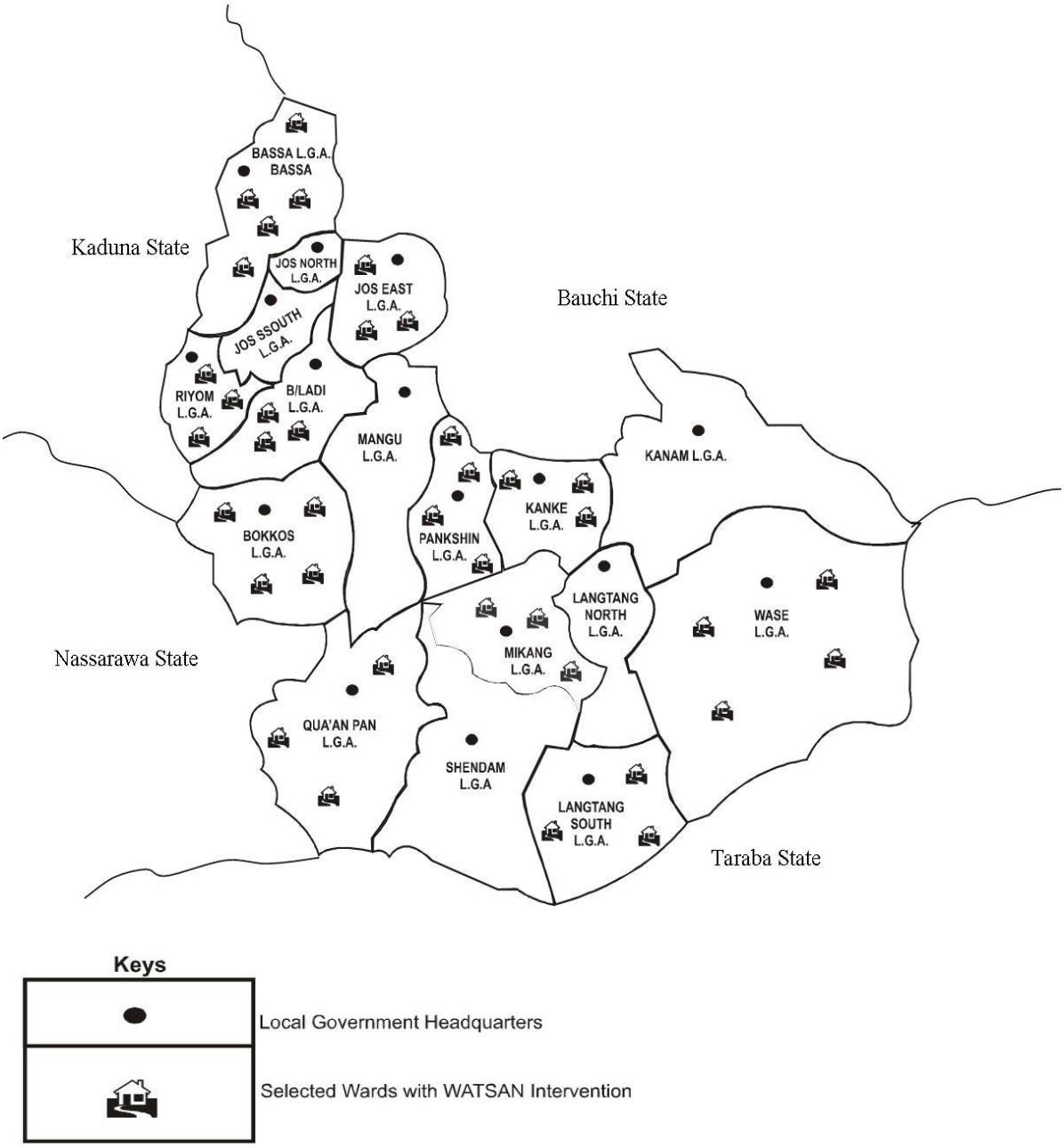


Figure 3: Map of Plateau State showing LGAs and Wards under study

4.2 Sampling Procedures and Sample Size

The Causal Design type of research design was chosen as the strategy to integrate the different components of the study in a coherent and logical way, thereby, ensuring that the research problems were effectively addressed. Causal studies may be thought of as understanding a phenomenon in terms of conditional statements in the form, "if X is…, then Y is …." This type of research is used to measure the impact a specific change will have on existing norms and assumptions. So data were coherently and logically gathered from respondents on adoption and effects of adoption on farmers of WATSAN recommended practices introduced to them by WATSAN stakeholders. The causal effects were determined when variations in the independent variables led or resulted, on average in variation in the dependent variables.

Plateau State is divided into three geo-political zones namely: Northern, Central and Southern zones. Samples of farmers were drawn from each of these zones. A multi-stage sampling technique was adopted. First, 9 LGAs out of the 17 LGAs in the three geopolitical zones were purposively selected based on the presence of WATSAN intervention on recommended practices. The 9 LGAs were selected because the LGAs had interventions on WATSAN recommended practices, so identifying factors that influence adoption of WATSAN recommended practices in these areas may be important in explaining factors affecting adoption for a larger part of rural areas in the State and Country at large. Second, 30 wards out of 99 wards representing 30 per cent from the 9 LGAs selected were purposively selected based on how much these areas had received WATSAN interventions and only wards or areas which qualified as rural and with WATSAN interventions were selected as follows: Jos East (3wards), Riyom (3 wards), Bokkos (4 wards), Pankshin (4 wards), Kanke (3 wards), Langtang South

(3wards), Mikang (3 wards) Quan'anpan (3 wards) and Wase (4 wards). It should be noted that the selection of only two LGAs in the northern zone out of 6 LGAs is because 2 LGAs are urban (Jos North and Jos South) leaving 4 that have rural areas. Third, 15 percent of a total of 1860 farm households were randomly selected using systematic sampling method, employing table of random figures. From a total of 1860 households of the selected 30 wards, a total of 279 households were selected, of which 279 households' heads served as respondents. Table 1 shows the number of Zones, LGAs, Wards and Households and the sample sizes that were used in sampling.

Table1: Showing the Sampling and Sample Size of Households.

	Purposively selected Zones	**No.**	**Purposively Selected LGAs**	**No.**	**Purposively Selected wards**	**No.**	**Randomly Sampled households (15%)**
1	Northern Zone	6	1.Jos East	10	3	186	28
			2.Riyom	10	3	186	28
2.	Central Zone	5	1.Bokkos	14	4	248	37
			2.Pankshin	12	4	248	37
			3.Kanke	10	3	186	28
3.	Southern Zone	6	1.Langtang South	10	3	186	28
			2.Mikang	10	3	186	28
			3.Q/Pan	11	3	186	28
			4.Wase	12	4	248	37
	Totals	**17**	**9**	**99**	**30**	**1,860**	**279**

4.3 Data Collection

The relevant data for this study were collected from primary sources. From these sources, data were collected from household heads of farm families in the selected rural communities using a questionnaire instrument.

Pre-testing of the questionnaire was conducted in December of 2011 by interviewing the farmers that adopted WATSAN recommended practices. An informal group

discussion was held with farmers and also WATSAN stakeholders in the study areas in order to obtain general information on WATSAN recommended practices prior to formal data collection. To avoid respondent bias, and by way of introduction of the research, a one-page statement of intent preceded the survey questions. Fifteen Village extension workers with Diploma-level training in agriculture who were also conversant with the local languages of the respondents undertook an intensive one-day training session on data collection techniques prior to the survey. Each of the extension workers administered the questionnaire to eighteen respondents and the researcher administered it to nine respondents, giving a total of 279 respondents. Data collection took place in the entire month of January 2012 and the data were coded and transferred into excel spreadsheets.

4.4 Data Analysis

4.4.1 Descriptive statistics

Descriptive statistics is the discipline of quantitatively describing the main features of a collection of data. Descriptive statistics are distinguished from inferential statistics (inductive statistics) in that descriptive statistics aim to summarize a sample, rather than use the data to learn about the population that the sample of data is thought to represent. This generally means that descriptive statistics, unlike inferential statistics, are not developed on the basis of probability theory. Even when inferential statistics is used mainly in analyzing a particular data to draw conclusions, descriptive statistics are usually also presented alongside. Descriptive statistics is also a set of brief descriptive coefficients that summarizes a given data set, which can either be a representation of the entire population or a sample. The measures used to describe the data set are measures of central tendency and measures of variability or dispersion. Measures of central tendency include the mean, median and mode while measures of variability include the

standard deviation (or variance), the minimum and maximum variables, kurtosis and skewness.

4.4.1.1 Measures of central tendency

These are also referred to as measures of location or central values. A distribution is a set of data that may have been generated from one or more related sources. It is often necessary to describe the distribution or describe profiles by condensing the data with a simple figure to be able to know what is typical about the distribution. To do this, there is need to calculate different measures of central tendency for data in the distribution. Some of these measures are: Mean, Mode and Median.

4.4.1.2 Measures of dispersion

In the various measures of central tendency, each measures the tendency of the distribution towards the center but does not show the spread or scatter of the values in the distribution. The measures of dispersion show the spread or scatter of the values in a distribution. Some of these measures are: The range, variance, standard deviation, and coefficient of variation.

Uses of measures of Dispersion in Research

The standard deviation and coefficient of variation are extremely useful to the researcher. One very powerful property of standard deviation σ, in relation to the mean μ, is that in a normal distribution or a symmetrical distribution, the observation values distribute themselves about the mean in a symmetrical way. In a normal distribution, it has been statistically established that about 68% lies within the mean, μ, and ± 1 standard deviation; 76% lies within the mean, μ, and ± 2 standard deviation and about

99% lie within the mean, μ, and ± 3 standard deviation Asika (2006). In other words, the entire area under the normal curve measures ± 3 from the mean μ. This relationship between standard deviation, σ and the mean μ, is particularly useful in the calculation of some statistics such as correlation, coefficient of variation and standard error.

Standard deviation (as well as coefficient of variation) is used when two samples are to be compared. It is usually assumed that the means of the samples are equal, or that they are means of related samples drawn from one population. The standard deviation and the coefficient of variation, $S_{\bar{X}}$ offer the researcher the comparable measurement of variability in the distribution of values in the two samples. The closer the standard deviation of the two samples, the more likely the chances that they are drawn from the same population. Also, in comparing the dispersion of more than one distribution, it may be concluded that the distribution with a lower coefficient of variation is more homogeneous than the distribution with a higher coefficient of variation, $S_{\bar{X}}$.

In this study frequencies, percentages, means, were used to analyze data on (1) levels of awareness and adoption of WATSAN recommended practices, (2) attitudes of farmers towards WATSAN recommended practices, (3) standards of water and sanitation practices in rural areas of Plateau State, (4) effects of adoption of WATSAN recommended practices on farmers and (5) constraints of adoption of WATSAN recommended practices.

4.4.1.3 Uses of descriptive statistics

Descriptive statistics provides simple summaries about the sample and about the observation that have been made. Such summaries may be either quantitative, i.e.

summary statistics, or visual, i.e. simple-to-understand graphs. These summaries may either form the basis of the initial description of the data as part of a more extensive statistical analysis, or they may be sufficient in and by themselves for a particular investigation.

Descriptive statistics are used in univariate analysis. Univariate analysis involves describing the distribution of a single variable, including its central tendency (including the mean, median and mode) and dispersion (including the range and quantities of the data-set, and measures of spread such as the variance and standard deviation). The shape of the distribution may also be described via indices such as skewness and kurtosis. Characteristics of a variable's distribution may also be depicted in graphical or tabular format like the histogram.

Descriptive statistics are also used in bivariate analysis. When a sample consists of more than one variable, descriptive statistics may be used to describe the relationship between pairs of variables. In this case descriptive statistics include:

(1) Cross-tabulation and contingency table

(2) Graphical representation via scatter plot

(3) Quantitative measures of dependence

(4) Descriptions of conditional distribution

Quantitative measures of dependence include correlation (such as Pearson's r when both variables are continuous, or Spearman's rho if one or both are not)) and covariance (which reflects the scale upon which variables are measured). The slope in regression analysis also reflects the relationship between variables. The unstandardized slope

indicates the unit change in the criterion variable for one unit change in the predictor. The standardized slope indicates the change in standardized (z- score) units.

4.4.2 Multiple regression

In this model one variable, called the dependent variable, is expressed as a linear function of one or more other variables called the explanatory variables. In such models it is assumed implicitly that causal relationships, if any, between the dependent and explanatory variables flow in one direction only, namely, from the explanatory variables to the dependent variable.

If a study involves the dependence of a variable on only a single explanatory variable, such a study is known as simple or two-variable, regression analysis. However, if the study involves studying the dependence of one variable on more than one explanatory variable it is known as multiple regression analysis. The expression for multiple regression is explicitly specified as follows:

$Y = a + b_1 x_1 + \ldots\ldots\ldots b_n x_n + u$ ……. equation (i)

Where:

Y= dependent variable

X= independent (explanatory) variables

a= intercept

$b_1 - b_n$ = slope coefficients

u= error term

The intercept and slope coefficients are known as regression coefficients. Regression coefficients called the t-test gives the level of significance. A test of significance is a procedure by which sample results are used to verify the truth or falsity of a null

hypothesis. The key idea behind tests of significance is that of a test statistic (estimator) and the sampling distribution of such a statistic under the null hypothesis.

The decision to accept or reject H_o is made on the basis of the value of the test statistic obtained from the data at hand. In the language of significance tests, a statistic is said to be statistically significant if the value of the test statistics lies in the critical region. In this case the null hypothesis is rejected. By the same token, a test is said to be statistically insignificant if the value of the test statistic lies in the acceptance region. In this situation, the null hypothesis is not rejected, Damodar and Dawn (2009).

In regression results, the coefficient of determination R^2 is a summary measure that tells how well the sample regression line fits the data. The F-value which is a measure of the overall significance of the estimated regression is also a test of significance of R^2. The larger the R^2, the grater the F-value. In the limit, when $R^2 = 1$, F is infinite (Damodar and Dawn, 2009). The P (probability) value or exact level of significance of a test statistic is defined as the lowest significance level at which a null hypothesis can be rejected.

Multiple Regression was used to analyze objective (iii) which states: "To determine socioeconomic, institutional factors and attributes of WATSAN recommended practices influencing adoption of WATSAN recommended practices among farmers".

The expression for multiple regressions is explicitly specified as follows:

$Y = a+b_1X_1.....b_{10}X_{10} + u$

Where,

Y = Adoption of water and sanitation recommended practices (Total number of WATSAN recommended practices adopted in the respondent's household. Minimum=0; Maximum=7).

X_1 = Gender (Male = 1, female = 2)

X_2 = Age (Years)

X_3 = Marital status (single =1, divorced or widowed=2, Married = 3)

X_4 = Household size (Number of people)

X_5 = Formal Education (Years of formal schooling)

X_6 = Attitude towards WATSAN recommended practices (5-point Likert scale: strongly agreed = 5, Agreed = 4, Uncertain = 3, Disagree = 2 Strongly disagree = 1)

X_7 = Membership of social organizations (Number of organizations)

X_8 = Sources of information (Number of formal sources)

X_9 = Affordability (5-point Likert scale: strongly agreed = 5, Agreed = 4, Uncertain = 3, Disagree = 2 Strongly disagree = 1).

$1X_{10}$ = Compatibility (5-point Likert scale: strongly agreed = 5, Agreed = 4, Uncertain = 3, Disagree = 2 strongly disagree = 1)

a= constant

b_1 - b_{10}= Régression coefficients

u= Error term

4.4.2.1 Significance level

In social research, less conservative tests are required than in pure sciences because human beings' behaviours cannot be predicted. For instance, the significance level for a study involving airbag deployment failures will not be the same as the significance level for a study involving the satisfaction of five-year old children with a particular brand of red crayons. It is therefore necessary that statistics solutions be determined by setting an

appropriate significance level for a particular study, ensuring meaningful, dependable results that are easy to understand.

One easy way to increase the power of a test is to carry out a less conservative test by using a larger significance criterion, for example 0.1 instead of 0.05. This increases the chance of rejecting the null hypothesis (i.e. obtaining a statistically significant result) when the null hypothesis is false, that is it reduces the risk of a type II error (false negative regarding whether an effect exists) Bauesell and Li (2002).

In this study, the regression coefficients were evaluated at 10% level of statistical significance which was used in choosing acceptability or otherwise of the parameters of the variables under consideration.

4.5 Definition, Operationalization and Measurement of Variables

There were three classes of variables that were measured namely: Independent variables, Dependent variables and Effect variables.

4.5.1 Measurement of the dependent variable (Y)

Adoption of WATSAN Recommended Practices (Y): The following seven WATSAN recommended practices were identified as having been promoted to the rural farmers in the study area and therefore were expected to have been known and practiced by them:

(i) boiling of water before drinking, (ii) filtering and disinfecting water at point of use, (iii) storage of water in clean containers, (iv) collection of water from protected sources (v) defecating in toilets/latrines (vi) appropriate hand washing behaviours and (vii) burning of garbage around surroundings to control flies (PRUWASSA, 2004).

The dependent variable was measured by percentage of WATSAN recommended practices adopted. Each of the seven recommended practices was scored as non-adoption=0, adoption=1 and the total number of the recommended practice of the respondent was his score on adoption. A respondent could have a minimum of 0 (if respondent did not adopt any of the recommended practices) and maximum of 7 points (if respondent adopted all the WATSAN recommended practices)

4.5.2 Measurement of independent variables (X_n)

Gender (X_1): - Refers to the sex of a respondent, male or female. This variable was measured by assigning 1 and 2 to males and females respectively. It is assumed in this study that the composition of household members in terms of sex will determine adoption of WATSAN recommended practices since water and sanitation practices are mainly the responsibilities of women and children.

Age (X_2): Age is the actual number of years an individual has spent on earth from birth to the study period. This was measured in years. It is assumed that younger people will adopt WATSAN recommended practices more than older ones tend to be conservative and would rather keep to traditional ways of handling water and sanitation issues. The score for this variable is the number of years.

Marital Status (X_3): - This refers to the status of the household head with respect to either being married, single, divorced or widowed. This variable was scored as follows: single=1, divorced or widowed =2 and married=3. It is assumed that a household that has a housewife would adopt WATSAN recommended practices more than one without

because women are primarily responsible for domestic work including fetching of water, cooking, sweeping and washing among others which are among the WATSAN recommended practices introduced.

Household Size (X_4): - This is the total number of people living in a given household eating from the same pot. In this study it is assumed that larger households will adopt WATSAN practices less than smaller ones because of the extra demand on items like soap and disinfectants needed to maintain good hygiene. The total number of the people in the household is the score for this variable.

Formal Education (X_5): - This is the number of years a respondent has spent in formal schooling. It is assumed that the higher the number of years of education of farmers the more their likelihood of understanding and adopting the WATSAN recommended practices. This variable is scored by recording the number of years of schooling of respondent.

Attitude towards WATSAN Recommended Practices (X_6): - Attitudes were measured by asking respondents to react to a number of statements about their affinities for, and aversions to, water and sanitation recommended practices using the Likert scale. Likert scale measures the intensity or the degree of agreement by the respondents to a statement that describes a situation, phenomenon, item or a treatment (Asika, 2006). Likert scale varies from 3 points to as high as 7 points. The commonest Likert scale has 5 points. In this study the 5-point Likert scale type was used to measure the respondents' attitudes towards adoption of WATSAN recommended practices with 5,4,3,2 and1 scores for strongly agreed, agreed, uncertain, disagreed and strongly

disagree to positive statements. This scoring was reversed for negative statements about the WATSAN recommended practices. To minimize possible "response sets", approximately half of the statements were favourable, and the other half consisted of unfavourable statements about adoption of WATSAN recommended practices.

The interpretation of an attitude score was not made independently of the distribution of scores for a particular group of respondents. Thus, respondents who got score of 0% on the 7-item scale (7 WATSAN recommended practices) were interpreted as indicating unfavourable attitude because the respondent strongly disagreed with all positive statements and strongly agreed with all negative statements about adoption of WATSAN recommended practices. Similarly, a score of 100% was interpreted as indicating a favourable attitude towards WATSAN recommended practices because the respondent strongly agreed with all the positive statements and strongly disagreed with all the negative statements. Scores between the maximum and minimum were determined along the favourable-unfavourable continuum of 0-100%.

The overall percentage attitude of respondents towards WATSAN recommended practice was calculated thus:

$$\frac{Frequency\ of\ respondents\ (-ve\ or\ +ve)\ \ response\ multiplied\ by\ response\ score\ x\ 100}{\sum \text{respondents multiplied by maximum score of 5 (strongly agree)}}$$

Where:
% = percentage

∑= summation

Membership of Social Organizations (X_7): - These are groups of people who come together for the promotion of special interests or needs that are usually unachievable by individual efforts. This was measured by the number of years a respondent claimed to belong to a group as at the time of the study. It is assumed that the more the number of

social organizations a respondent belongs to, the more he/she is exposed to knowledge in different subjects; hence the more he/she is likely to adopt the WATASAN recommended practices. This variable is scored by the number of social organizations a respondent belonged to.

Sources of Information (X_8): - This refers to the sources through which respondent first heard about each of the seven WATSAN recommended practices. The score for this variable was the number of sources through which the respondent claimed to have heard about the recommended practices. It is assumed that the more informed farmers through many sources, the more are likely to adopt WATSAN recommended practices.

Affordability (X_9): - This was the ability to bear the cost the WATSAN recommended practice. This was measured by the perception of the ability to afford the facilities required for WATSAN recommended practices using a 5-point Likert-Scale as follows: strongly agree=5, agree=4, undecided =3, disagree=2, strongly disagree=1.

Compatibility (X_{10}): - This was the degree to which a WATSAN recommended practice was perceived to be consistent to the respondents' existing values, norms, beliefs and past experience. This was measured using a 5-point Likert-Scale as follows: strongly agree=5, agree=4, undecided=3, disagree=2, strongly disagree=1.

4.5.3 Measurement of effect variables

In this study, the effect variables were; levels of hygienic practices, health care expenditure, productive time for agricultural activities, and children's school attendance.

Level of Hygienic Practices

This refers to the degree to which a respondent agreed that adoption of WATSAN recommended practices increased his/her level of hygienic practices. This was measured using a Likert 5-point scale and scored as follows: strongly agree=5, agree=4, undecided =3, disagree =2, strongly disagree=1.

Level of Health-care Expenditure

This was the degree to which a respondent agreed that adoption of WATSAN recommended practices led to a decrease in his/her health-care expenditure. This was measured using a Likert 5-point scale and scored as follows: strongly agree=5, agree=4, undecided =3, disagree =2, strongly disagree=1.

Level of Productive Time for Agricultural Activities

This refers to the degree to which a respondent agreed that adoption of WATSAN recommended practices increased his/her level of productive time for agricultural activities. This was measured using a Likert 5-point scale and scored as follows: strongly agree=5, agree=4, undecided =3, disagree =2, strongly disagree=1.

Level of Children School Attendance

This refers to the degree to which a respondent agreed that adoption of WATSAN recommended practices increased his/her level of children's school attendance. This was measured using a Likert 5-point scale and scored as follows: strongly agree=5, strongly agree=4, undecided =3, disagree =2, strongly disagree=1.

For the interpretation of the perceived effects, the highest score on each of the four effect variables was 5points. The maximum score for combined effect of all the variables equals 20 points (4x5=20). A pass mark of 50% is pegged to conclude that a respondent agreed that adoption of WATSAN recommended practices actually had a positive effect on him/her. This is equivalent to 10 points which was the cut-off point. Therefore scores of less than 10 points meant low effect while scores above 10 points mean high effect.

CHAPTER FIVE

5.0 RESULTS AND DISCUSSIONS

5.1 Socio-economic Characteristics of Respondents

Table 2 summarizes the socio-economic characteristics of respondents. The result indicates the mean age of respondents was 46.05 years implying that majority of the respondents were middle aged people. Having a population that is middle aged suggests that understanding water and sanitation recommended practices would be easier since most middle aged people are expected to have had at least the minimum level of formal education and are likely to be more curious in trying new ways of handling hygiene issues.

Results further revealed household size had a mean of 6.56. This finding is in agreement with Ekong, 2010 who stated that 70 % of some rural states in Northern Nigeria had 5-7 persons per household, which he considered as large size. The finding in this study therefore also suggests that the people had large household sizes in the study area. This implies more pressure on WATSAN facilities in households which increases lack of compliance where such facilities are insufficient. The mean income of respondents was N297, 000.64 per annum. A calculation using an average household size of 7 people in study area would mean each member in a household lives on N116.24 per day! That respondents were low income earners might be the reason for low adoption of WATSAN recommended practices due to inability to afford WATSAN facilities like soap and detergents, disinfectants, dig wells, build latrines etc.

Furthermore, results showed a mean farm size of 1.02 hectares among respondents, implying that respondents were small scale farmers. This finding is in agreement with

Ekong, (2010) that most Nigerian farms are small-size family farms in which family members contribute the required labour. The implication of small scale farming is that it hardly gives yields beyond the level needed to keep the family hence, less income from sales of excess. Small incomes mean that farmers are poor and may have problems with affording WATSAN facilities, hence low adoption. Results further show that the mean years of formal schooling was 8.5years, implying that respondents had low educational levels, results suggests that respondents barely attended the primary school level of education. With this low educational level, the implication is that respondents hardly appreciated the WATSAN recommended practices.

From the results, membership of social organization had a mean of 1.45 suggesting that most respondents in the area studied belonged to only one social organization. The low membership of social organizations by respondents suggests that they were not much exposed to education on WATSAN practices generally since it is expected that the more a person belonged to different social organizations the more his chances of getting information and education on different issues discussed during meetings of the organizations. The implication of this finding is that low membership of social organization by farmers could be the reason for low adoption found in the study. This finding agrees with that of Colliers, (1998) who found that farmers that belonged to many social organizations tended to have more access to information which facilitated their adoption decisions. Table 2 further showed that the mean of formal sources of information to respondents on WATSAN activities is 3.29 suggesting that there were adequate channels of communication of WATSAN recommended practices hence, the high levels of awareness revealed in the results which was expected to lead to increase in adoption but did not. This finding ran contrary with that of Feder and Slade (1984)

who indicated that, provided a technology is profitable, increased information induces adoption.

Table 2: Distribution of respondents by their socio-economic characteristics

Variable	Minimum	Maximum	Mean	SD	SE
Age	20	74	46.5	11.6	0.668
Household size	1	30	6.56	4.99	0.299
Income	50000	2,050,000	454,430	297,000.64	17783 .47
Farm size	0.1	5.0	1.02	1.13	0.068
Years of farming	0	24	8.50	6.55	0.392
Membership of social orgs	0	5	1.48	1.15	0.069
No. of WATSON extension contacts	0	4	3.67	2.14	0.128
Sources of information	1	7	3.29	1.57	0.094

5.2 Levels of Awareness and Adoption of WATSAN Recommended Practices

The first objective of the study was to determine the levels of awareness and adoption of WATSAN recommended practices in the study area. Findings in this study revealed that the percentage of respondents that identified each of the WATSAN recommended practices were as follows: 99% for boiling of water before drinking, 98% for filtering and disinfecting water before drinking, 100% for storage of water in clean containers, 100 % for collection of water from protected sources (wells and springs), 98% for defecating in toilets/latrines, 98% appropriate hand washing behaviours and 100% for burning of garbage around surroundings to prevent flies. Therefore, it was concluded that farmers were aware of the recommended practices. This finding suggests that sensitization on WATSAN recommended practices employed was effective which led to

high levels of awareness and consequently adoption of some of the recommended practices. There is need to sustain efforts in sensitization.

Figure 3 shows the distribution of farmers by levels of adoption of WATSAN recommended practices. Findings revealed that 96 per cent, 70 per cent and 56 per cent, adopted storage of water in clean containers, burning of garbage to control flies, collection of water from protected wells and springs respectively. These results were higher and differed from the 4 percent, 12 percent and another 12 percent respectively found by KCT (2008) for the same recommended practices. Adoptions were higher in these practices because they were easy to practice and had no cost implications. Moreover, these practices conformed to existing tradition and cultures of hygiene in the area.

Results further revealed that 10 per cent, 8 percent, 8 percent, and 5 percent adopted defecating in toilets/latrines, appropriate hand washing behaviours, boiling of water before drinking and filtering and disinfecting of water before drinking respectively. These results were lower and differed from the 33 percent, 12 percent, 52 percent and 2 percent found respectively by KCT (2008). This result suggests that respondents did not value these practices or were not conscious of the implications of not adhering to them. Other reasons for these results were attributable to inability to afford soap and disinfectants and building of toilets. Also it was not convenient for the farmers to be moving around with hand washing materials wherever they go because they can never tell when they will be urinating or defecating.

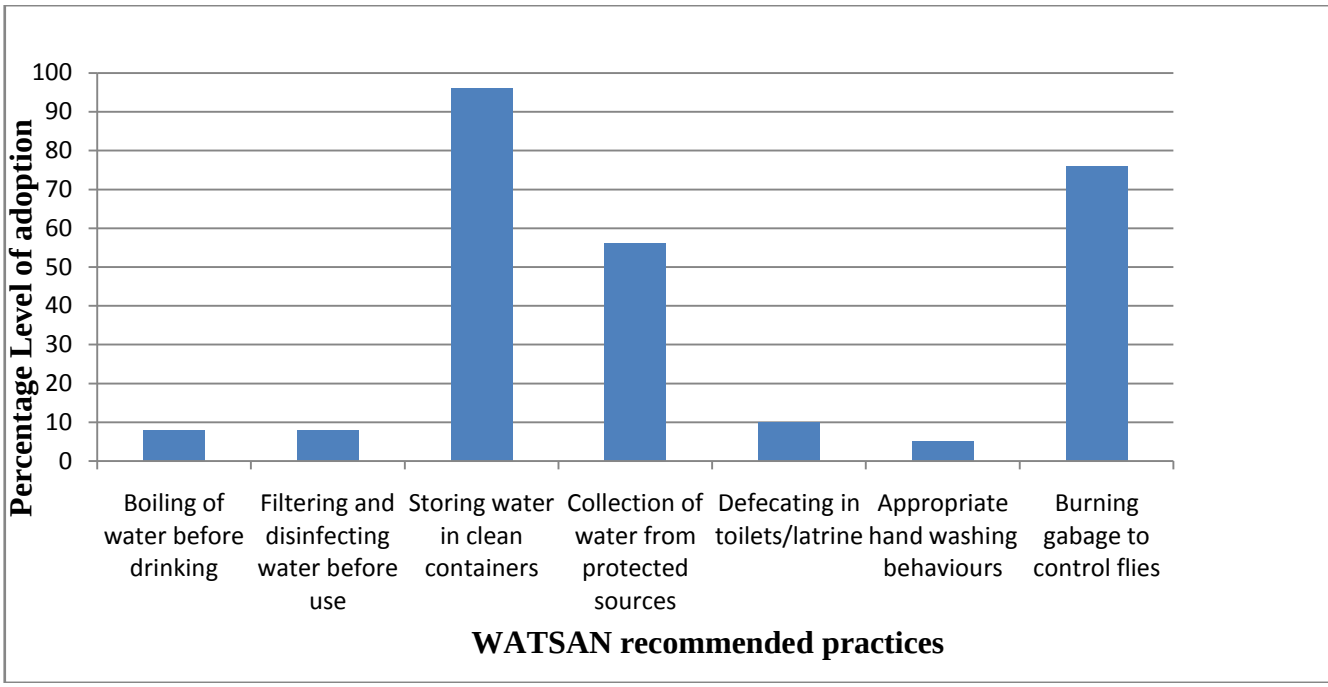


Figure 3: Chart representation of levels of adoption of WATSAN recommended practices among respondents

5.3 Attitudes of Farmers to WATSAN Recommended Practices

The second objective of this study was to identify and describe the attitudes of rural farmers towards WATSAN recommended practices. Results in Table 3 show the distribution of respondents' attitudes towards WATSAN recommended practices. The Table summarizes the result obtained from using the Likert scale to measure the attitude of respondents towards the 7 WATSAN recommended practices by getting responses on a set of positive and negative statements about WATSAN recommended practices. The number of respondents who responded favourably to positive statements and unfavourably to negative statements is aggregated, so also are responses from respondents that are favourable to negative statements and unfavourable to positive statements about WATSAN are aggregated. Thereafter, these aggregates are used to give the percentage general attitude of respondents (positive or negative) on WATSAN recommended practices by farmers. In the Table, out of a total of 279 respondents, only 30 % had positive attitudes towards WATSAN recommended practices. The percentage

79

distribution of respondents with positive attitudes towards WATSAN recommended practices is given as follows: majority of respondents had positive attitudes towards storing water in clean containers (78%), collection of water from protected sources (51%) and burning garbage to control flies (56%) leading to high adoption levels in these practices. Results show further that out of 279 respondents, 64% had negative attitudes towards WATSAN recommended practices. Specifically percentage distribution of respondents is given as follows: boiling of water before drinking (85%), defecating in the toilets/latrines (88%), appropriate hand washing behaviours (73%) and filtering and disinfecting water before use (79%) leading to low levels of adoption of these practices. About 6% of respondents were undecided on their attitudes to the practices. This finding agrees with that of DWAF (2001) that people in developing countries generally have negative attitudes towards safe water and sanitation practices. The implication of having high percentage of farmers with negative attitudes is low adoption which results in farmers continuing with their unhygienic practices leading to high incidences of water and sanitation related diseases in study area.

Table 3: Showing the Distribution of Respondents by Attitudes to WATSAN Recommended Practices

Statements on WATSAN Recommended Practices	Respondents Attitudes					
	Positive freq.	**%**	**Undecided freq.**	**%**	**Negative freq.**	**%**
Boiling of water before drinking kills germs	18	7	23	8	238	85
Filtering and disinfecting water before use is not necessary	12	5	7	16	26	79
Storing water in clean containers prevents disease build-up	217	78	8	3	54	19
Fetching water from protected sources is not mandatory	141	51	6	5	132	44
Defecating in latrines is not as comfortable as in the open	21	8	12	43	246	88
Appropriate hand washing behavior is good hygiene practice	20	8	54	19	205	73
Burning garbage to kill flies will lead to fire outbreak	151	56	18	6	110	38
Mean		**29.70**		**6.55**		**63.75**

5.4 Factors Influencing Adoption of WATSAN Recommended Practices by Rural Farmers.

Objective iii of this study was to determine the socioeconomic factors, institutional factors and WATSAN recommended attributes that influence the adoption of WATSAN

recommended practices by rural farmers**.** Results in Table 4 shows that seven variables were found to significantly (P<0.1) influence adoption of WATSAN recommended practices.

In Table 4, results of multiple regression analysis of factors influencing adoption of water and sanitation recommended practices are shown. The result show that attitude to WATSAN recommended practices (r=7.5140***, P<0.01), gender (r=-2.146**,P<0.05) and formal education (r=2.375**,P<0.05) b and compatibility(r=1.823*, P<0.1), household size (r=-1.778*, P<0.1),affordability (r=1.783*, P<0.1) and sources of information (r=1.767*, P<0.1) were strong determinants of adoption of WATSAN recommended practices among rural farmers in Plateau State.

Results in Table 4 further indicate that attitude to water and sanitation recommended practices positively related to adoption of WATSAN recommended practices at P<0.01 level of significance implying a direct relationship. This means that farmers that had positive attitudes to WATSAN recommended practices had favourable dispositions and hence adopted more than those with negative attitudes. This implies that attitude is the major determinant in adoption of WATSAN recommended practices. With negative attitudes, adoption is low and unhealthy WATSAN behaviors continue to persist. This finding is in consonance with the finding of Akpabio (2011) that belief in 'divine protection' for children influenced parents' attitudes negatively leading to poor WATSAN practices. For example they allow their infants or children to explore all manner of things around the environment including 'soil eating'.

Furthermore, results of study show that gender and formal educational level were found to significantly ($P<0.05$) influence adoption of WATSAN recommended practices. In the case of gender, which had negative relationship with adoption implying an inverse relationship, result is interpreted to mean that the more the number of a particular sex (in this case men) in a household more than women, the less the likelihood of adopting the recommended practices. Women are primarily responsible for collection of water and maintaining hygiene and sanitation in the house. This finding concurs with most literature which suggests that women and children are primarily responsible for collection of water (WaterAid, 2004). As stated in WaterAid (2004), "Many benefits of water, sanitation and hygiene projects impacts upon women. As the main collectors of water it is often their lives that are affected positively as they are relieved from the hardship of running around and time wasting during collection of water for house use and also missing school sessions". However, this finding runs contrary to the findings of Doss and Morris (2001) in their study on factors influencing improved maize technology adoption in Ghana, and that of Overfield and Fleming's (2001) study of the influence of gender relations on the technical efficiency of small holder coffee production in Papua, New Guinea who indicated insignificant effects of gender on adoption. Contrarily, also Amao and Awoyemi (2009) found gender as an insignificant factor in the determination of adoption of rice varieties and its impacts on farmers' poverty levels in two agricultural development programmes of Osun State, Nigeria. A plausible reason given as an explanation to the significance of gender could be that women play the important role of housekeeping in terms of maintaining hygiene-washing of cooking utensils after use, washing of clothes, sweeping and cleaning in and outside surroundings, fetching of water and most domestic work. Therefore a household that has more females is likely to adopt the recommended practices more than those

households that have less number of females. The implication of this result is that if gender inequality is not addressed, then adoption of WATSAN recommended practice would be affected negatively as the WATSAN recommended practices would be restricted to only a particular sex in a household. Gender mainstreaming in all facets of living is necessary to change the tradition that exempts the male sex from performing house chores which achieve hygienic practice in a household.

The finding on education shows education having a positive relationship with adoption implying a direct relationship. This means that those farmers that were more educated adopted WATSAN recommended practices more than less educated ones. Education is thought to create a favourable mental attitude for the acceptance of new practices. Education affords a person the ability to read and understand sophisticated information that may be contained in a package thereby increasing adoption. The finding in this study agrees with the result of a similar work on adoption of WATSAN practices in Cameroun by Yamakoshi (2008) where educational level was found to positively and significantly influence adoption of WATSAN recommended practices.

Results in Table 4 shows further that household size, affordability, compatibility and sources of information significantly ($P<0.1$) influenced adoption of WATSAN recommended practices. In the case of household size, the variable was negatively related to adoption of WATSAN recommended practice. These implies an inverse relationship suggesting that the larger the household size the less the likelihood of adoption of the recommended practices. It can be understood that larger households would require more water, soap and disinfectants to maintain good hygiene and sanitation within the house. Water availability is a major challenge in the study area;

therefore larger households are likely to just manage to observe the recommended practices even if they are willing to adopt all the practices in full. It is also logical that larger households would have more people imposing more pressure on the water and sanitation facilities thereby making the observance of the recommended practices more difficult. This finding goes contrary to that of Tokula *et al;* (2009) who found that household size was important in the adoption of improved cassava production technologies in Kogi State. The number of adult agricultural workers in the farmers' household is expected to ease labour constraint, thereby enhancing adoption.

Table 4: Multiple regression results of factors influencing adoption of WATSAN recommended practices (N = 279)

Variables	**Coefficients**	**Standard error**	**t-stat**
Intercept	37.81228***	7.18051	5.266
Gender	-1.34932**	0.60910	-2.215
Age	-0.01535	0.04542	-0.338
Marital status	1.67114	3.44097	0.486
Household size	-0.72949*	0.41022	-1.778
Formal educational level	0.55778**	0.23488	2.375
Affordability	8.97E-06*	5.03E-06	1.783
Compatibility	0.76746*	0.42097	1.823
Membership of social organizations	-0.67718	1.64506	-0.412
Sources of information	8.87E-074*	5.02E-07	1.767
Attitude towards WATSAN	20.54032***	2.73371	7.514

F-value = ***9.26E-39
R^2 value = 0.537587
Adjusted $\bar{R}^2$ = 0.518536
** P < 0.05
* P < 0.10
***P < 0.01

In the case of affordability, result of the finding revealed a positive relationship with adoption which implies that those WATSAN recommended practices that were perceived to be affordable had higher adoption compared to those practices that were perceived to be unaffordable. This result suggest that some of the WATSAN recommended practices like filtering and disinfecting water at point of use, boiling of drinking water, appropriate hand washing behaviours and defecating in toilets/latrines have cost implications in purchase of facilities like soap, disinfectants, fuel and building of toilet facilities there had low levels of adoption because most farmers cannot afford due to low incomes, This finding concurred with that of El Oster and Morehart (1999) who found that technologies that are capital-intensive are only affordable by wealthier farmers and hence the adoption of such technologies is limited to larger farmers who have the wealth (Khanna, 2001).

Similarly, for compatibility result found revealed a positive relationship of the variable with adoption. This suggests that the more a WATSAN recommended practice was consistent with the existing practices and norms in the study area, the more it was adopted. Storage of water in clean containers, protection of water sources and burning of garbage in surroundings had high adoption levels because these practices were consistent with the existing water and sanitation practices observed by farmers in the area, consequently these particular practices were the most adopted. This finding agreed with Black and Talbot, (2005) who found that sanitation technologies need to suit local material and building practices, local economic conditions and local cultural practices and beliefs for adoption to take place. Also, finding is in consonance with that of Mielke *et a*l., (2011) who found that the interplay of cognitive and ecological factors produce some patterns of locally sanctioned and meaningful norms, behaviours and

practices which may not necessarily be acceptable to wider socio-ecological and cultural order. Consequently, such peripheral behavioural tendencies are often discriminated against and labeled as 'deviant' hence low acceptance.

Sources of information also positively and significantly ($P<0.1$) influenced adoption, implying that households that had more access to information on WATSAN recommended practices adopted the recommended practices more. Findings suggests that the effort in utilizing numerous sources during sensitization on WATSAN recommended practices paid off as evident in the high percentage of respondents with awareness on WATSAN recommended practices. Implication of this is that more efforts be employed to sustain these sources of information. Information reduces the uncertainty about a technology's performance hence may change an individual's assessment from purely subjective to objective over time (Caswell *et al*., 2001). The finding in this study also tallies with that of Feder and Slade (1984), who indicated that, provided a technology is profitable, increased information induces adoption.

On the other hand, age, marital status and membership of social organizations were found not to be significant factors influencing adoption of WATSAN recommended practices among farmers in rural areas of Plateau State. Age has been found to be a determinant factor in most adoption studies. Age is said to be a primary latent characteristic in adoption decision. However, there is a contention on the direction on the effect of age on the adoption. For instance, age was found to positively influence Integrated Pest Management on peanuts in Georgia (McNamara, Wetzstein, and Douce, 1991). The effect is thought to stem from accumulated knowledge and experience of farming system obtained from years of observation and experiments with various

technologies. In addition, since adoption pay-offs occur over a long period of time, while cost occur in earlier phases, age of the farmer can have a profound effect on technology adoption.

However in some studies, age has been found to be either negatively correlated with adoption or not significant in farmers' adoption decisions. In studies on adoption of land conservation practices in Niger (Baidu-Forson, 1999), rice in Guinea (Adesina and Baidu-Forson, 1995), fertilizer in Malawi (Green and N'gong'ola, 1993), age was either not significant or was negatively related to adoption. As a matter of fact, it is expected that older people adopt a technology at a slower pace because of their tendency to adopt less swiftly to a new phenomenon (Tjornhom, 1995).

Age in this study was also not a significant variable in determining adoption of WATSAN recommended practices at the chosen level of significance probably because respondents were all heads of households implying that all of them were adults and mature enough to make decisions on adoption of the WATSAN recommended practices introduced to them which needed no years of experience to make a difference.

Membership of such organizations has been found to be a more efficient way of disseminating technologies to farmers in rural areas communities (Godquin and Quisumbing, 2006) as well as a source of social capital that facilitates exchange of resources between actors (Bourdieu, 1985). Social capital manifested in community-based organizations or personalized social networks has been found to play an important role in the adoption of crop technologies (Isham, 2000; Katungi, 2007). Ironkwe *et al* (2008) found that membership of social organizations influenced adoption

of yam minisett technology among women farmers in Abia State. Organizations may generate externalities such as information about new technologies (Colliers, 1998) that may facilitate adoption decisions. The externalities generated by local social organizations may vary as a function of the characteristics and functioning of these organizations. It was expected that membership of social organizations of farmers would positively influence adoption of WATSAN recommended practices as obtainable in most adoption studies. However, result showed that membership of social organizations was not a significant factor in influencing adoption of WATSAN recommended practices at the chosen level of significance. This result is unexpected and the possible reasons for getting this result can be attributable to the fact that attitudes of farmers towards WATSAN recommended practices over shadowed the awareness and education provided by social organization which the farmers belonged to.

The result for marital status could be further explained thus: It was expected that households with wife (s) will adopt the WATSAN recommended practices more than those without, reason being that the traditional roles of wives is in domestic chores, which basically is about the recommended practices. However, a household without a wife(s) can have females who can equally perform the responsibility of the wives as prescribed in the traditional division of labour. Marital status was not significant to adoption of the WATSAN recommended practices at the chosen level of significance.

The result of the regression analysis in Table 4 with adjusted $\overline{R}^2$ value of 0.518536 implies that about 52% of the variation in adoption of water and sanitation recommended practices was accounted for by the selected independent variables.

5.5 Current Standards of Water and Sanitation in Rural Areas of Plateau State Compared to International Standard

The fourth objective was to compare current standards of WATSAN recommended practices international standards. In Table 5 results show that 30% of respondents had had WATSAN related diseases such as bilharziasis, typhoid, diarrhea, malaria etc, in their household in the previous year. The 30% status is above the acceptable limit of 25% International standard Aziz *et al* (1990). This finding suggests that the low adoption of WATSAN recommended practices is responsible for the high incidences of water and sanitation related diseases in farmers' households. Water usage in litres per capita per day (lcd)- the quantity of water used in the household for cooking, drinking, bathing and food preparation in a day was 36.9 lcd. This value is below the International standard of 50lcd. This finding means that water used in farmers' households is insufficient to maintain good hygiene and thereby favouring disease development. The results further showed that only 8% of respondents practiced appropriate hand washing behaviour in a household suggesting non compliance to the practice. This percentage is far too low compared to the International acceptable limit of practice of at least 50% of members of a household having appropriate hand washing behaviour (Bateman *et al.,* 1995). Only 15% of households in survey had access to and used toilets/latrines against the 75% international standard recommended by Bateman and Smith (1991). This means that almost all farmers' household members in the area passed their excreta in the open providing favourable conditions for pathogens build up which is the cause of the high incidences of water related diseases recorded in the area.

These generally low standards of WATSAN indicators found in the study area imply that the practice of WATSAN in rural Plateau was low and falls below the

internationally acceptable standards. This could possibly be responsible for the high incidences of water and sanitation diseases in rural areas of Plateau State.

Table 5: Showing the Standards of WATSAN in Study Area against the International Standards (2012)

WATSAN performance indicators		Recommended international standards	Standards in rural Plateau State (2012)	Differentials
1.	Percentage people with WATSAN related diseases	<25%	30%	5%
2.	Water usage	50lcd	36.9lcd	-13.11cd
3.	Percentage people with appropriate hand washing behavior	50%	8%	-42
4.	Access and use of hygienic toilets or latrines	75%	15%	-60%

5.6 Perceived Effect of Adoption of WATSAN Recommended Practices on Farmers' Levels of Hygienic Practices, Productive Time for Agricultural Activities, Health-care Expenditure and Children's School Attendance.

The fifth objective of this study was to determine the effects of adoption of WATSAN recommended practices on farmers. Table 6 shows the respondents perception of the effects of adoption of WATSAN recommended practices. Result showed that 75.2% of respondents agreed that adoption of WATSAN recommended practices actually led to an increase in their hygienic practices, 68.8% of farmers agreed that adoption of the practices led to a decrease in their health-care expenditures, 69.4% were of the view that adoption of the introduced practices actually led to an increase in their productive time for agricultural activities and 72% agreed that adoption of WATSAN recommended practices increased children's school attendance in their households meaning that farmers who adopted the WATSAN recommended practices testified that they had positive effects with respect to all the effect variables listed . In Table 6, results further

reveals that the four effect variables with a combined score of 14.2 points which is above the cut-off point of 10 points set in the measure of dispersion meant that adoption of WATSAN recommended practices actually had high positive effects on respondents.

Based on the results found, the null hypothesis which stated that 'adoption of WATSAN recommended practices has no effect on farmers levels of hygienic practices, productive time for agricultural activities, health-care expenditure and children's school attendance' is therefore rejected. This finding is in agreement with Pruss et al. (2002) who found that adoption of WATSAN recommended practices leads to cost savings in health care expenditure mainly due to the reduced number of diarrhoeal cases. This result also agrees with WaterAids (2004) which found that WATSAN projects in Chipongwe village in Zambia helped families in reducing the distance to water sources. Beneficiaries reported that they had more time for other activities and their children school attendance rate increased since they do not spent much time collecting water for domestic use before going to school.

WaterAid reported further that appropriate hand washing behaviours increased by 40 per cent after WATSAN campaigns in Bangladash. The implications of the results found in this study are that respondents who adopted the recommended practices became more informed about appropriate WATSAN practices and this influenced their attitudes positively, hence increased hygienic practices in their households. Also, adopters of WATSAN recommended practices had fewer cases of water and sanitation related diseases and by implication a reduction in the household's expenditure on medical bills when farmers or members of their households fall ill due to WATSAN related diseases. Again when farmers adopt WATSAN recommended practices,

incidences of illness would reduce and with good health conditions more time is available for agricultural and non agricultural activities by household members thus increasing their productivity. The results found in this study agrees with that of Ajayi and Ogba (2008) who found that respondents used time saved due to adoption of WATSAN recommended practices for other socioeconomic activities thereby increasing their productivity.

Table 6: Measure of Central Tendency and Percentages of Respondents' Perceived Effects of Adoption of WATSAN Recommended Practices on them

Effects of WATSAN recommended practices	**Mean score**	**% of respondents**
Level of hygienic practice	3.76	75.20
Level of health- care expenditure	3.44	68.80
Level of productive time for agricultural activities	3.47	69.40
Level of children's school attendance	3.60	72.00

5.7 Constraints to the adoption of WATSAN Recommended Practice.

Table 7 shows the distribution of respondents by their responses on what they perceived as the problems they had in adopting the WATSAN recommended practices introduced to them. These problems were ranked and the results found revealed that bad habits towards hygiene ranked first as indicated by 93.9% of respondents. This means that despite the knowledge on WATSAN best practices, farmers' bad habits prevented them from adopting the recommended practices. Habits are usually difficult to change. Until some form of legislation is put in place to enforce compliance, it would be difficult to change these bad habits. This was followed by misleading perceptions about WATSAN recommended practices (89.2%). Result suggest that farmers do not see WATSAN

recommended practices as any serious thing as they hardly can link their illnesses to the way they use water or how they maintain hygiene. They have a simplistic view of the issue of WATSAN which is misleading. There would be need for video/cinema show on documentaries of people who suffered from WATSAN related diseases elsewhere in community town halls for farmers to appreciate the gravity of not complying with WATSAN recommended practices. This was followed by low incomes (87.8%). Result mean that even when a farmer is willing to adopt all the WATSAN recommended practices, he might be challenged by lack of money to buy facilities like soap, disinfectants, build toilets, fuel. Poor living conditions were the next constraint to adoption (85.3%). This result suggests that the living conditions which are often overcrowded and without facilities makes it difficult for a farmer who might be willing to adopt recommended practices to do so. Suspicion and lack of trust of WATSAN advocators (70.25 per cent) was also found to be a barrier to adoption of WATSAN recommended practices. This finding means that farmers do not have trust on advocators of this programme. This is not surprising since advocators do not come with any reasonable incentive to show commitment to the programmes, rather they come with big cars and earn huge allowances, and this does not go down well with farmers. Negative cultural beliefs (65.9%) also constituted a challenge to adoption as most farmers were tight to their cultural believes that Africans are resistant to diseases, and lastly unemployment (59.8%) Without employment source of income is affected and affordability of WATSAN facilities is challenged. From the results found, it can be concluded that bad habits towards WATSAN constituted the biggest constraint in the adoption of the WATSAN recommended practices introduced in the study area. Other major problems of importance included, misleading perception of WATSAN recommended practices, low incomes and poor living conditions of respondents.

Table 7: Distribution of Respondents by Constraints to Adoption of WATSAN Recommended Practices

Constraints to the Adoption of WATSAN Recommended Practices	**Frequency**	**Percent**	**Ranking**
Bad habits towards hygiene	262	93.90	1^{s}
Misleading perceptions about WATSAN practices	249	89.25	2nd
Low incomes	245	87.81	3rd
Poor living conditions	238	85.30	4th
Suspicion and lack of trust of WATSAN agents	196	70.25	5th
Negative cultural beliefs	184	65.95	6th
Unemployment	167	59.86	7th

Respondents offered interesting explanations for reasons for mentioning particular constraints. These included the following:

> "We appreciate the VIP latrines introduced to us but we cannot afford them, it costs about two hundred thousand naira to construct one unit''.
>
> "A real farmer does not need to wash off soil on his hands before using it to eat, and also rubbing hand on the head to clean and continue work shows seriousness on the farm''.
>
> "Hygiene practice is a practice for the rich".
>
> "Carelessness and non-challance are responsible for the negative attitude of some people to the WATSAN recommended practices introduced to us".

“Sometimes we feel people are just using us to siphon money. There is too much of talk against action of provision of WATSAN facilities, so even when one wants to adopt some practices, it is practically impossible due to insufficient water and absence of toilets”.

“There are better issues of survival to think about, issues of sanitation are the least of our problems’’

“WATSAN stakeholders come with these programmes without consulting us, we are never ever involved at any stage until they leave after the programme. This often leaves us with problems of maintenance of some facilities which we don’t have knowledge of’’.

“Our people are so poor that any programme that does not have monetary or social benefit is not taken seriously. The people are tired; it appears as if authorities come only during crisis. For example, when HIV/AIDs were focused as a global issue, stakeholders emerged and we started receiving visitors on HIV/AIDS awareness and campaign. As soon as water and sanitation came in, WATSAN advocators rushed to the rural areas again. We feel being used as conduits for siphoning donor agencies’ funds”.

CHAPTER SIX

6.0 SUMMARY, CONCLUSION AND RECOMMENDATIONS

6.1 Summary

This study examined the factors influencing adoption of water and sanitation recommended practices and the perceived effects of adoption on the levels of hygienic practices, productive time for agricultural activities, health-care expenditure and children's school attendance among farmers in rural areas of Plateau State, Nigeria. A total of 279 heads of farm households were selected for the study using multi-stage purposive and systematic random sampling methods. Descriptive statistics (means and percentages) and inferential statistic (Multiple regression) were used for data analysis. The results obtained revealed that respondents had high levels of awareness (99%) of the WATSAN recommended practices. It was also found that 64% of respondents had negative attitudes towards WATSAN recommended practices. Among the recommended practices, storage of water in clean containers (96%), fetching of water from protected sources (56%), and burning of garbage to control flies (76%) were the most adopted practices out of the seven introduced WATSAN recommended practices to farmers. The high levels of adoption of these practices were attributed to simplicity and low cost implications of adoption of the practices. Findings from the study also showed low standards of water and sanitation practices. The local standards (scores) were 30%, 37 Lcd, 8% and 15% with respect to WATSAN related diseases, water usage, percentage people with appropriate hand washing behaviours and access and use of hygiene toilets or latrines in the previous one year respectively, as against the international standards of 25%, 50Lcd, 50% and75% respectively for the same indicators. Results further showed that farmers actually perceived the adoption of WATSAN recommended practices as having a positive effect on their levels of hygienic

practices, productive time for agricultural activities, health-care expenditure and children's school attendance. This was revealed in results with the score of 14.27 which was above the cut-off mark of 10 points (when 50% of the responses agreed with positive statements about the effect variables). Respondents highlighted the constraints in adopting the WATSAN recommended practices to be with bad habits, low incomes, poor living conditions and suspicion of WATSAN advocators.

6.2 Conclusion

Results showed that farmers were aware of the seven WATSAN recommended practices introduced to them and that some of the recommended practices had high adoption. These were, storage of water in clean containers, burning of garbage to control flies and fetching of water from protected sources. However, some of the recommended practices had very low adoption. These were filtering and disinfecting water at point of use, boiling of water before drinking, defecating in the toilet. The low levels of adoption found with these practices implied that despite the high levels of awareness on these practices, they were other important factors hindering adoption. Farmers generally had negative attitude towards WATSAN recommended practices. Findings revealed that adoption of WATSAN recommended practices was perceived by farmers as having some positive effects on them. Bad habits towards WATSAN practices, low incomes, poor living conditions and suspicion of WATSAN advocators by farmers were important constraints to adoption of WATSAN recommended practices.

6.3 Recommendations

Based on the findings of the study, the following recommendations are suggested in order to improve the adoption of WATSAN recommended practices in rural areas of Plateau State:

(i) Only 30% of farmers had positive attitude towards WATSAN recommended practices hence low levels of adoption. The environmental health workers should be strengthened to enforce sanctions on non compliance with adoption WATSAN recommended practices. This can be done through legislation in the local government council's by-laws. This will change the negative attitudes, especially the practice of open defecation.

(ii) Gender was found to be a significant determinant of adoption of WATSAN recommended practice; therefore, gender equality should be mainstreamed in school curriculum so that children would be guided at early ages against restrictions on house chores based on sex difference.

(iii) Affordability and compatibility of WATSAN recommended practices were significant determinants of adoption. Farmers should be encouraged to develop local water purification methods compatible to their culture of using herbs, like the use of Moringa leaves' powder which is cheaper and readily available.

(iv) Formal education was a significant determinant of adoption, therefore it is recommended that government should focus on building more schools with facilities so farmers and their children can have access to formal education

(v) Formal sources of information are a determinant of adoption of WATSAN recommended practice, so concerted efforts should be made by WATSAN stakeholders to sustain this channel of sensitization.

(vi) Government should prioritize poverty eradication programmes in rural areas so that famers can afford WATSAN facilities and improved living conditions in their households thereby create enabling environment for observation of improved hygienic practices.

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APPENDIX: QUESTIONNAIRE

DEPARTMENT OF AGRICULTURAL ECONOMICS AND RURAL SOCIOLOGY, FACULTY OF AGRICULTURE, AHMADU BELLO UNIVERSITY, ZARIA

QUESTIONNAIRE

TOPIC: ADOPTION OF WATER AND SANITATION RECOMMENDED PRACTICES AMONG FARMERS IN RURAL AREAS OF PLATEAU STATE, NIGERIA

This questionnaire is designed to solicit for your responses on adoption of water and sanitation recommended practices introduced to you. Your responses will be used for academic purposes only and be assured they will be treated with the uttermost level of confidentiality.

Date of Interview ---------- Interviewer……

Local Govt. Area:……. Name of Respondent……

Ward:…….

SOCIOECONOMIC CHARACTERISTICS

1. Gender: Male:……. Female:…….
2. Marital Status:
   i Married:…….
   ii. Single:……
3. Household size: No, of people living in your household by Gender:
   (a) males……. (b) females……. (Total…….)
4. Respond to the following statement about WATSAN recommended practices by ticking the appropriate response in the columns in front of each statement.

S/No	Statement	Strongly Agreed	Agreed	Undecided	Disagreed	Strongly
1.	Boiling of water before drinking kills germs					
2.	Filtering and disinfecting water before use is not necessary					
3.	Store of water in clean containers prevent disease					

	build-up					
4.	Fetching of water from polluted sources is not mandatory					
5.	Defecating in latrines/toilets is not as comfortable as defecating in the open (bush)					
6.	Appropriate hand wash behaviour is good hygiene					
7.	Burning garbage around will lead to fire outbreak					

5. What is your farm size? ..... Ha
6. How many years have you spent in a formal school?.....years.
7. Can you please give an estimate of annual income from your farming, enterprises and other sources?

   N.....
8. Do you belong to any social organization? Yes …… No ……
9. If yes, how many? ……
10. Have you ever participated in any activity (s) of the WATSAN programme introduced to you? Yes -—-- (1) No…….
11. If yes, describe the nature of participation

    ……

    ……

    ……
12. Have you ever heard about the WATSAN recommended practices?

    Yes……(1) No……(0)
13. If yes, which one, indicate by ticking from list below:

    i. Boiling of water before drinking [ ]

    ii. Filtering and disinfecting water at point of use [ ]

    iii. Storage of clean water in clean containers [ ]

    iv. Collection of water from protected sources [ ]

    v. Defecating in toilets and latrines [ ]

    vi. Wash hands with soap after defecating or urinating [ ]

    vii. Burn garbage daily in surroundings [ ]
14. When did you first become aware of WATSAN recommended practices?

    2001-2004 [ ]

2005-2008 [ ]

2009-2011 [ ]

15. What are your sources of information on WATSAN recommended practices?

Radio [ ]

Newspapers [ ]

Bulletins [ ]

Friends/Neighbours [ ]

Social organization [ ]

Government agency [ ]

Non Governmental Organization [ ]

Others specify……

16. Tick your response to the following statements in the table below:

S/No	Statement	Strongly Agreed	Agreed	Undecided	Disagreed
1.	Boiling water before drinking is affordable				
2.	Filtering and disinfecting water at point of use is not affordable				
3.	Storage of water in clean containers is affordable				
4	Collection of water from protected sources is not affordable				
5.	Defecation in toilet/latrine is not affordable				
6.	Appropriate hand wash behaviour is affordable				
7	Burning garbage daily is not affordable				

17. Tick your response to the following statements in the table below:

S/No	Statement	Strongly Agreed	Agreed	Undecided	Disagreed
1.	Boiling water before drinking is compatible with existing practice				
2.	Filtering and disinfecting water at point of use is not compatible with existing practice				
3.	Storage of water in clean containers is compatible with existing practice				
4	Collection of water from protected sources is not compatible with existing practice				
5.	Defecation in toilet/latrine is compatible with existing practice				
6.	Appropriate hand wash behaviour is not compatible with existing practice				
7	Burning garbage daily is compatible with existing practice				

18. What were your most important reasons for adoption / non adoption of the following recommended practices:

S/no	Recommended Practices	Adoption (tick) Non-adoption (x)	Reasons
i.	Boiling of water before drinking		
ii.	Filtering and disinfecting water at point of use		
iii.	Storage of clean water in clean containers		
Iv	Fetching water from protected sources		
V	Defecating and urinating in toilets/latrines		
Vi	Appropriate hand washing behaviours		
Vii	Burning garbage daily in surroundings to control flies		

19. Give information/data on the following WATSAN indicator as applied to your house hold.

S/No	WATSAN Performance Indicators			
1.	**Percentage people with WATSAN related diseases in the last one year in household.** How many times in the last one year did you or any member of your household fall ill due to one or more of the following: diarrhea, bilhaziasis, typhoid fever, dysentery, trachoma, dental fluris, scabies and malaria? Number……. Episode(s)……			
2.	**Water usage:** Estimate the quantity of water used in your household for: i. Drinking…… ii. Bathing……. iii. Food preparation…….. iv. Hygiene and sanitation…….			
3.	**Percentage people in household with appropriate hand washing behaviour** Indicate how frequent you practice the following.	**Always**	**Sometimes**	**Not at all**
	i. Wash hand after defectioning and or urinating ii. Wash hand after cleaning babies iii. Wash hand before eating iv. Wash both hands rubbing both at least twice v. Dry hands by air drying or using cloth			
4.	**Access and use of hygienic toilet or latrine** i. Do you own or have access to toilet/latrine facility? Yes…….. No……. ii. If yes how often do you clean and use them?			

20. Tick as appropriate among the following what effects you think adoption of WATSAN recommended practices has had on you.

Perceived effects of adoption of WATSAN	**Strongly agree(5)**	**Agree (4)**	**Undecided (3)**	**Disagree (2)**	**Strongly disagree (1)**
Increased hygiene practices					
Decreased health-care expenditure					
Increased productive time for					

agricultural activities					
Increased children school attendance					

21. Mention the problem (s) you encountered in adopting of the WATSAN recommended practices introduced to you:

Problems:

a……

b……

c. …….

d. ……

e……

f……

g……

22. Please give suggestions if any, how you think these problems can best be solved.

……

……

……..……

I thank you immensely for your patience and cooperation.

Sincerely

Nengak Elisha, YILKUDI