# BOREHOLES PROVISION AS A KEY FACTOR IN FACILITATING POVERTY REDUCTION IN RURAL COMMUNITIES - A STUDY OF THE ATEBUBU AND AFRAM PLAINS DISTRICTS OF GHANA

By

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## CERTIFICATION

I hereby declare that this submission is my own work towards the PhD and that, to the best of my knowledge, it contains no material previously published by another person nor material which has been accepted for the award of any other degree of the University, except where due acknowledgement has been made in the text.

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## DEDICATION

This work, is dedicated to God Almighty, my saviour and my lord Jesus Christ of Nazareth, and to God the Holy Spirit, from whom unrestricted grace, insight, much knowledge and understanding was given to enable me be able to undertake and to accomplish this mission, be the eternal praise and glory. To the chief of rural water supply in Ghana – Project Manager of World Vision Ghana Rural Water Project Phase II, and the initiator of the West Africa Water Initiative (WAWI) - Mr. Bismark Nerquaye-Tetteh; and Dr. (Mrs.) Nerquaye-Tetteh, through whom God Almighty gave me the opportunity to enter into His Ministry in World Vision, I dedicate this work as a celebration of professional excellence. This work is further dedicated to the many unsung heroes – committed, indefatigable, hard labouring gallant men and women – the usually forgotten staff of World Vision Ghana Rural Water Project (GRWP) Phases II and III, who tirelessly laboured in the Lord's vineyard in the Greater Afram Plains from 1990 to 2003, (some of whom have gone ahead and laid down their lives in course of duty), and into whose labour I have entered and gathered this invaluable data, to analyze and tell the story of the great contribution of their labours in freeing the lives of helpless thousands of rural folks from the interminable, cyclical scourge of guinea worm infestation and other waterborne/related diseases: "And herein is that saying true, one soweth, and another reapeth. I sent you to reap that whereon ye bestoweth no labour: other men laboured, and ye are entered into their labours" (John 4:37-38).

To the uncountable, unknown thousands of rural folks in the Atebubu and Afram Plains Districts, impacted by the World Vision Ghana Rural Water borehole drilling Project, who were the principal subjects of this study and who gave audience for this research – whose lives have now improved and enjoy tremendous freedoms, and who now have hope and better cause to live their lives for the realization of their hopes and life's aspirations for themselves and their children, whose voice of gratitude may never be heard, to them also, I unreservedly dedicate this work and do pray that their lives will continually and unceasingly improve as they hold on dearly to, and maintain their God-given boreholes. Finally, may this work lift us up to higher horizons, to dedicate and make ourselves available to serve humanity in better ways, as pleases the Lord God Almighty!

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**ABSTRACT**

This study assessed the impact of ‘boreholes provision as a key factor in facilitating poverty reduction in rural communities in the Atebubu and Afram Plains Districts of Ghana’. Prior to boreholes being provided in these two districts the major cause of poverty was identified as the lack of potable water. Poor health was common due to recurring infestation with water borne/related diseases contracted from patronage of surface water sources. These diseases, especially guinea worm, physically incapacitated both adults and children. Thus, ill-health and time poverty due to long hours spent searching for water combined to deny adults of basic substantive freedoms and compromised their ability to engage in productive livelihood activities to earn income to facilitate their emergence from poverty. Also, the tedium of searching for water in the physical environment affected the physical health and cognitive capacity of the children resulting in very poor learning experiences at school.

The general objective of this study was to examine the extent to which boreholes provided in the Atebubu and Afram Plains Districts facilitated poverty reduction. Three hypotheses relating to how boreholes provision has impacted health and hygiene, promoted quality education, and facilitated occupational livelihoods income poverty reduction were stated and tested to validate or refute the trends noticed in the study area. An integrated approach was used in collecting field data involving the use of both quantitative and qualitative research methods. Other relevant information was obtained from secondary sources. Findings from the study show that, 96.9% of respondents indicated complete eradication of guinea worm from their communities and directly attributed that to boreholes provided, resulting in freedom from the incapacitating disease and improved health. Also, 96.1% of respondents indicated boreholes facilitated improved personal hygiene. Boreholes also facilitated growth in occupational livelihoods, increased earnings from occupations and facilitated wealth creation as indicated by 88.6%

of respondents. Provision of boreholes helping to facilitate improved education was indicated by 91.3 % of respondents. In contrast, evidence from Control communities show that water borne/related diseases such as diarrhoea, guinea worm, skin diseases, and schistosomiasis were in high occurrence as indicated by 76.3% of respondents. Poor occupational livelihoods portraying endemic poverty, was indicated by 100% of respondents. In terms of contribution to knowledge, the study revealed that within geographic space, providing boreholes and their consistent patronage facilitates the emergence of substantive freedoms which constitute intangible wealth that creates opportunity for people to reduce poverty and eventually realize their potentials in life. This concept is termed as 'the freedoms platform concept in geography and in rural development.'

The study recommends boreholes provision as a vital poverty reduction strategy, especially to be based on the new paradigm of 'freedom platforms concept for rural development.' Also further research should be conducted on how the gains in poverty reduction through the provision of boreholes may have resulted in comprehensive economic and social development transformations in the study area. This will help unearth another model of rural development which can be adopted and replicated to promote the well-being of people in many rural communities globally.

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## LIST OF ABBREVIATIONS AND ACRONYMS

| | |
|---|---|
| ANOVA | Analysis of Variance |
| CDAP | Community Development Action Plans |
| CHPS | Community-based Health Planning and Services |
| COM | Community Ownership and Management |
| CWSA | Community Water and Sanitation Agency |
| DA | District Assembly |
| DC | District of Columbia |
| DHMT | District Health Management Team |
| DPCU | District Planning and Coordinating Unit |
| DWSP | District Water and Sanitation Plans |
| DWSTs | District Water and Sanitation Teams |
| ESP | Educational Strategic Plan |
| FGDs | Focus Group Discussions |
| FHI | Failed Human Index |
| GAP | Greater Afram Plains |
| GDHS | Ghana Demographic and Health Survey |
| GDP | Gross Domestic Product |
| GES | Ghana Education Service |
| GHS | Ghana Health Service |
| GLSS | Ghana Living Standards Survey |
| GNI | Gross National Income |
| GNP | Gross National Product |
| GOG | Government of Ghana |
| GRWP | Ghana Rural Water Project |
| GSS | Ghana Statistical Service |
| GWEP | Ghana Guinea Worm Eradication Programme |
| GWSA | Ghana Water and Sewerage Agency |
| GWSC | Ghana Water and Sewerage Corporation |
| GWCL | Ghana Water Company Limited |
| HDR | Human Development Report |
| HIPC | Highly Indebted Poor Country |
| HIV | Human Immune Virus |
| ICCES | Integrated Community Centres for Employable Skills |
| IDIs | In- Depth Interviews |
| ILGS | Institute of Local Government Service |
| JHS | Junior High School |
| JSS | Junior Secondary School |
| KNUST | Kwame Nkrumah University of Science & Technology |
| MDGs | Millennium Development Goals |
| MOESS | Ministry Of Education and Science and Sports |
| MOFEP | Ministry of Finance and Economic Planning |
| MOH | Ministry of Health |
| MLGRDE | Ministry of Local Government, Rural Development and Environment |
| MWRWH | Ministry of Water Resources, Works and Housing |
| NCWSP | National Community Water and Sanitation Programme |

| | |
|---|---|
| NDPC | National Development Planning Commission |
| NGOs | Non-Governmental Organizations |
| PPP | Purchasing Power Parity |
| PMTs | Pump Maintenance Technicians |
| PRSP | Poverty Reduction Strategy Paper |
| RAs | Research Assistants |
| SHS | Senior High School |
| SMCs | School Management Committees |
| SOWC | State of The World's Children |
| SPSS | Statistical Package For Social Scientists |
| SRS | Simple Random Sampling |
| TBAs | Traditional Birth Attendants |
| UK | United Kingdom |
| UN | United Nations |
| UNDP | United Nations Development Programme |
| UNICEF | United Nations Children's Education Fund |
| USA | United States of America |
| WATSAN | Water and Sanitation |
| WSS | Water Supply and Sanitation |
| WVG | World Vision Ghana |
| WVGRWP | World Vision Ghana Rural Water Project |
| WVUS | World Vision United States |
| WEDC | Water Engineering & Development Centre |

## OPERATIONAL DEFINITIONS

**Borehole** - is the generalized term used for any narrow shaft drilled, either vertically or horizontally to access groundwater stored in aquifers.

**Boreholes provision:** potable water sources accessed by drilling with machinery into aquifers and developed with a hand-pump fixed on it to facilitate the continuous extraction of groundwater for household and livelihoods uses.

**Borehole Sustainability** – practices and strategies employed to operate, and maintain boreholes for water security assurance over the long haul. These include technical (training of local Pump Maintenance Technicians), economic or financial (levies and other fundraising methods used to generate funds for borehole maintenance), social (community mobilization strategies employed to ensure community ownership of boreholes), and environmental (community actions to ensure sustained aquifer re-charge).

**Community well-being** - elements of well-being that exist in communities and thereby promoting the wellness of their inhabitants – these include the existence of basic needs such as water, food, shelter, access to health facility, and education for children. The absence of which causes hardships and makes communities and their inhabitants vulnerable to environmental, economic and social calamities.

**Construct validity** – the extent to which a survey measurement instrument measures the intended construct.

**Content Analysis** – is a qualitative data processing method. The process identifies and codes the presence of specific words, phrases, or concepts within text, and speech. It is a systematic approach that identifies and summarizes the messages hidden in the information given by respondents into specific themes relevant to the study objectives.

**Control Community** - Community in which no boreholes were provided.

**District –** Government's decentralized level of political administration and jurisdiction.

**Dracunculiasis** – is a technical term for Guinea worm. It is a waterborne parasitic disease hosted by contaminated surface water sources.

**Economic refugees –** persons migrating to other places purposely to work for financial gains and possibly create wealth.

**Education** – formal (school-based), and non-formal education in the form of Literacy Classes.

**Environmental refugees** – people migrating from the geographical origin of their birth primarily due to adverse climatic conditions to places they perceive as safe, stable and conducive for pursuing their occupational livelihoods.

**Extreme poverty –** people whose standard of living is insufficient to meet their basic nutritional requirements even if they assign all their meager earnings to food.

**Generational Poverty –** endemic poverty passed on to the younger population due to inability of adults to break from the poverty cycle.

**Geographical determinism** - a state in which environmental conditions, especially climate and circumstances influences a person's or nation's ability to progress.

**Income poverty** - environmental constraints that militates against productive occupational activities for financial income earnings and thus resulting in conditions of living consistently under hardships with little or no money on hand.

**Head of Household** – is defined as the person in the household recognized as such by other household members. This is generally the person responsible for the upkeep and maintenance of the household. All relationships are defined with reference to the head of household.

**Programme Community –** Community in which boreholes were provided.

**Potable Water** – clean, safe water.

**Poverty Reduction** – efforts, strategies, and mechanisms employed to reduce the extent, the depth and magnitude of poverty prevalent in an area or in peoples' lives; and manifests as improved quality of life and standard of living.

**Rural community** – settlements located in non-urban areas and having populations up to 5,000 or less.

**Rural Household** – is defined as a person or group of persons who live together in the same house or compound, share the same house-keeping arrangements and are catered for as one unit. The emphasis is on living in the same place and having common provision for food and necessities for living, irrespective of size and relationship. Such a type of household located in a community with a population less than 5,000 persons is termed a rural household.

**Rural water provision:** potable water infrastructure constructed in rural communities.

**Substantive Freedoms** – freedoms that are naturally available to all persons from birth, and include freedoms of speech, association, right to education, and good health.

**Waterborne disease** – diseases directly associated with parasites using water as medium of incubation and infecting, such as bilharzias and guinea worm.

**Water-related disease** – diseases caused in relation somehow to water as agency. These include malaria, diarrhoea, dysentery, cholera, and trachoma.

**Water hunting** – process of trekking long distances in search of water or keeping vigil around water holes to scoop water that slowly emerges from the ground throughout the day and night.

**Occupational poverty** – the type of poverty people get into due to the collapse of their livelihood occupations.

**Opportunistic poverty** – the type of poverty resulting from chronic vulnerabilities and incapacitations that people suffer over a long period.

# Chapter One

# INTRODUCTION

## 1.1 General Background

In many developing countries, the lack of access to potable water constitute a critical form of deprivation that threatens life, causes untimely deaths, seriously undermines the potential and full utilization of human capabilities, and compromises opportunities for building human capacity towards poverty reduction (Cairncross and Valdmanis, 2006; UNDP, 2006; World Bank, 2006b; 2006c).

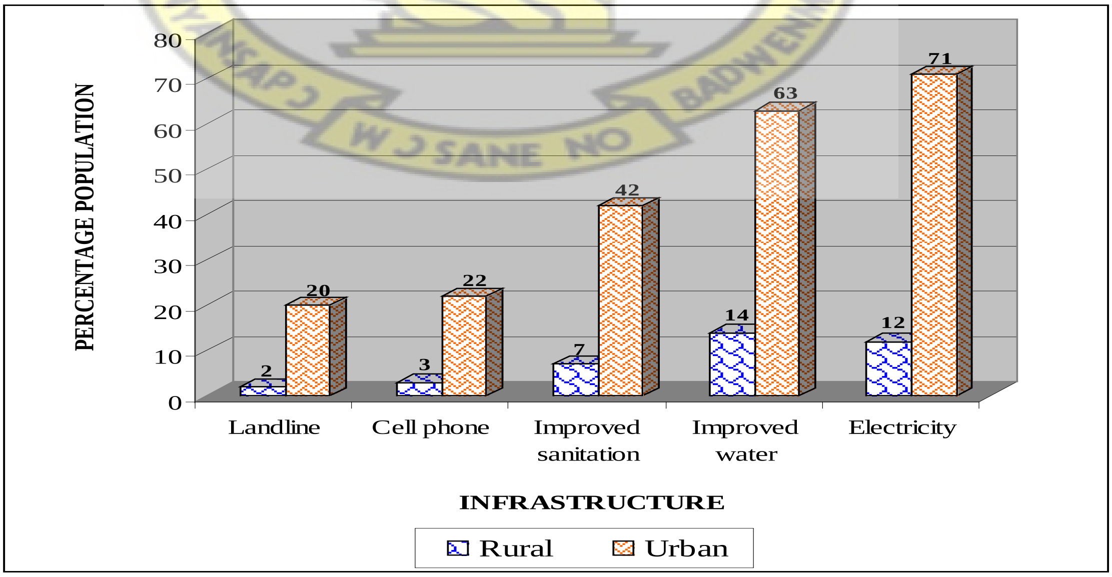
One school of thought, however, is of the view that potable water infrastructure provision facilitates poverty reduction, reduces infant and child mortality, breaks lifecycle disadvantages, frees women and children's time from trekking long distances searching for water, helps improve children's effective participation in school, and provides a sense of human dignity (African Development Bank, 2011; Ademiluyi and Odugbesan, 2008; UNDP, 2006).

For instance, in affirming the case of populations at the 'bottom of the pyramid', Prahalad and Collier have indicated that the very high economic losses associated with deficits of water infrastructure provision are borne by mostly the poor rural populations living below the poverty line (Prahalad, 2010; Collier, 2007). By implication, Singh and Sachs have observed, that some poorest households in the rural areas are helplessly caught in a trap of observing how their genuine efforts to invest their meager resources in the health of their households, in productive livelihoods, and in the education of their children are constantly being undermined by the lack of adequate provision for potable water infrastructure in their rural communities (Singh, 2009; Sachs 2005).

Continually living in a state of vulnerability due to the severe dictates of the physical environment, with persistent lack of potable water also limits human substantive freedoms and disempowered them. Thus, many affected rural populations are unable to mobilize and organize themselves to emerge out of poverty (Singh, 2009; World Bank, 2006b). On the contrary, the daily availability of potable water provides, among other things, a powerful preventive means for households and their communities to reduce water borne and water-related diseases to regain their health, build capacity and employ their capabilities to create wealth, build strong households, eventually emerge out of the poverty trap and be able to contribute to the growth of their communities (Pruss-Ustun, et al, 2008; Bartram, 2008; World Bank, 2005).

As depicted in Figure 1.1, only about 14 percent of Africa's rural communities are served with improved water infrastructure as compared to 63 per cent in urbanized Africa. The sheer magnitude of this under-service indicates the gravity of the exposure of Africa's rural communities to severe poverty which is also an affront to their human rights and human well being (UNDP 2006, World Bank 2010e).

**Figure 1.1: Access to Infrastructure by Location**




**Source: World Bank 2010e:129**

Water resources underdevelopment in Sub-Saharan Africa leads to underutilization of economic potential, such as job creation and employment and income earnings to break from poverty. The issue being that the non-availability of water infrastructure such as boreholes and poor water management institutional structures deeply affect Africa's poor (World Bank 2010e). As a very important asset for survival and livelihoods activities, the lack of access to potable water for use in households constitute a major constraint to progressive poverty reduction, community growth and development in rural Africa (Singh 2009; Olabisi 2009; Gleitsmann, et al 2007; Mays, 2007).

Rural communities in Ghana, according to Mba & Kwankye (2007), mainly rely on rivers, streams, ponds, springs, rain water and lakes for their water supply. Most of these sources they indicated are polluted and are the main sources of the water-borne diseases prevalent in the rural areas. Several rivers and streams in Ghana do not flow all year round and the rural communities cannot therefore depend on them for their water needs.

Also, rainfall harvesting cannot be undertaken throughout the year due to the erratic nature of rainfall. As a result, the percentage of rural residents depending on boreholes and wells rose from 7,800 in 1986 to 11, 500 nationwide by 1998. During the decade (1994-2004) 13,196 boreholes were constructed to provide additional sources of water to rural communities as a result of the intensive and extensive work carried out by the national Community Water and Sanitation Agency (CWSA) (Mba and Kwankye, 2007).

In Ghana, the CWSA is the national agency responsible for coordinating and facilitating the implementation of the National Community Water and Sanitation

Programme (NCWSP). The objective of the NCWSP, launched in 1994, is to seek sustainability in water supply through the adoption of Community Ownership and Management (COM). It gained autonomous status in 1998, when by an Act of Parliament (Act 564) it was carved off the Ghana Water and Sewerage Company (GWSC). CWSA provides District Assemblies (DAs) with support in water and sanitation delivery for rural communities and small towns (Mays, 2007).

Potable water availability in rural communities facilitates everything else including the development of human hopes, aspirations and achievements. Therefore, the availability of water is crucial in everyday human existence and the lack of potable water in rural communities deprives the rural inhabitants of good health, invaluable time, choices, options, and the capabilities which they could have utilized to develop their occupational livelihoods, earn income and eventually break from poverty (Burgi and Rydbeck, 2010; World Bank, 2006d; World Bank, 2010b).

## 1.2 Statement of the Problem

Prior to the commencement of borehole drilling operations by World Vision Ghana, the Atebubu and Afram Plains Districts had long been neglected in terms of the provision of physical and basic life sustenance infrastructure. The two Districts were also very deprived in terms of social and economic development programmes. Also contributing to the neglect was lack of access to potable water and inaccessible transportation routes. Each year during the rainy season spanning April to June, it was almost impossible to travel to and within rural communities in the two Districts (World Vision 1989; 1993; and 2003).

During the pre-boreholes provision era, waterborne and water-related diseases such as guinea worm, schistosomiasis, trachoma, diarrhea, dysentery, and skin diseases such as yaws were common. These are diseases that often incapacitated and blighted human potentials for life. Infant and child mortality was also of high occurrence. Inhabitants of the area, especially women and children trekked long distances hunting for water, leaving behind their homes, families, and farms for long periods of time (World Vision Ghana, 2007a; 2007b).

The burden of collecting water from distant sources also heavily involved school-aged children. These children were frequently absent from school or most often late to school (World Vision 1989; 1996). Also, basic schools could not function well because trained teachers would not accept postings to such deprived rural communities. School attendance was very low and education quality was severely compromised. Thus, high level illiteracy, low school participation rates, gender discrimination in school enrolment, and child labour characterized the rural communities in the Atebubu and Afram Plains Districts.

The poor living conditions in these two Districts also precipitated frequent out-migration, especially during the dry season of each year, as people moved to areas where they could access surface water sources, even if of poor quality. Many rural communities in these two Districts were therefore destabilized, disorganized and stagnant in growth, and some communities collapsed where the inhabitants could not survive the dry, waterless seasons (World Vision Ghana, 2007a; 2007b).

The absence of socio-economic infrastructure, especially access to potable water, good access roads, and markets led to very low incomes in terms of livelihood occupations. The combined effect of these problems further manifested as chronic low labour productivity, very low incomes, and opportunistic and occupational poverty which characterized all the rural communities in the two districts (World Vision, 2003; GSS, 2000 and 2007).

The lack of access to potable water posed a critical problem that threatened life and caused the untimely deaths of infants and children. It also seriously undermined the potential and full utilization of human capabilities, destroyed potential opportunities, and undermined human dignity in the Atebubu and Afram Plains Districts.

In terms of its relevance, though other studies (Pruss-Ustun, et, al, 2008; Bartram, 2008) have shown significant changes in people's lives as a result of improved water supply, this study has been carried out to unearth the impact of boreholes provision specifically as a direct instrumental factor facilitating progressive poverty reduction in the Atebubu and Afram Plains Districts. The study also seeks to introduce a new alternative approach that can be recommended as a sustainable poverty reduction model. This model will contribute to the already existing body of knowledge on poverty reduction strategies, update knowledge on rural water supply delivery (especially in relation to boreholes provision), and also serve as a tool for policy formulation.

### 1.2.1 The World Vision Ghana Rural Water Project

Following the severe drought in Ghana in 1983, World Vision Ghana, an international Non-Governmental Development Organization, made it a goal to improve the health and quality of life of people living in the most deprived rural areas of Ghana through the provision of potable water. Therefore, from 1990 to 2003, World Vision Ghana drilled 363 boreholes in 249 communities in the Atebubu and Afram Plains Districts to support the Government of Ghana's efforts at eradicating guinea worm and other waterborne/related diseases. In the Atebubu District, 196 boreholes were provided in 125 rural communities, while in Afram Plains District, 167 boreholes were drilled in

124 rural communities. The provision of boreholes, as a point of access to the two Districts, was expected to result in poverty reduction and accelerated socio-economic development (World Vision, 2003).

### 1.2.2 Research Questions

There is the general assumption that the drilling of boreholes to provide potable water for deprived rural communities has facilitated the eradication of some water-borne and water-related diseases, especially guinea worm infestation, and also facilitated health and time gains which have brought immense social and economic benefits to rural communities in the study area. In that respect, four questions have been posed to guide this research as follows:

(1) How has boreholes provision facilitated health and hygiene improvements, especially with particular reference to guinea worm eradication, for poverty reduction in the Atebubu and Afram Plains Districts?

(2) How has boreholes provision facilitated improved occupational livelihoods engagements, increased labour productivity and incomes for poverty reduction in the Atebubu and Afram Plains Districts?

(3) How has boreholes provision facilitated and promoted quality education attainment for long-term poverty reduction in the Atebubu and Afram Plains Districts?

(4) What measures have been instituted at community level to ensure sustainability of boreholes provided and to assure continual potable water availability to the rural population in the Atebubu and Afram Plains Districts?

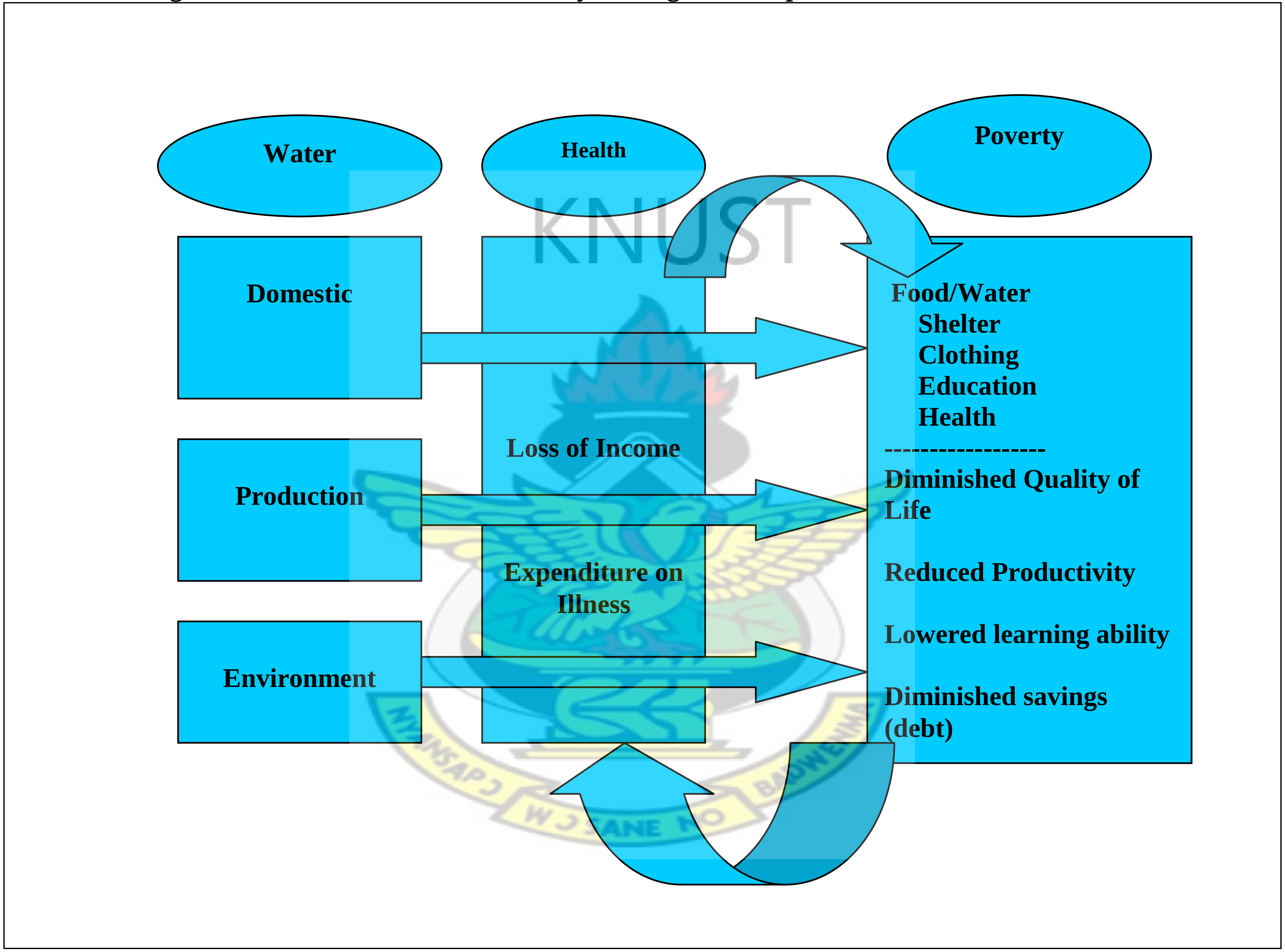
## 1.3 Conceptual Framework

Assessing the impact of potable water supply through boreholes provision on poverty requires a comparative framework which identifies almost all the interrelationships between water and poverty linkage. Figure 1.2 shows a schematic presentation of linkages between water, health and poverty, as proposed by Abayawardana and Hussein (2002), for a critical assessment of water and poverty interconnectivity. It depicts health and poverty as having a two-way relationship where poverty is both a cause, as well as a consequence, of poor health. In terms of causality, they are of the view that, as poor people remain unable to secure even the basic necessities of life, such as adequate food, safe water, clothing, shelter, health care, and unable to engage in sustaining livelihoods, they fall deeper into poverty. This is a condition which Sachs (2005) refers to as the poverty trap.

Furthermore, they are of the view that poverty restricts access to healthy living conditions such as access to preventive health measures, and effective health treatment, therefore the poor are more likely to suffer from adverse health effects more often. Again, they indicated that poor health and illnesses have a negative effect on livelihoods, and that unhealthy people are much less productive. They indicated that to escape from poor health and to treat sudden illnesses one requires money which the poor can hardly afford. Consequently the loss of income and the inability to pay for the cost of treatment do push families further into debt and plunge them into cycles of poverty.

It is evident from the linkages framework shown in Figure 1.2 that any positives, in terms of interventions introduced to serve as the platform and catalyst towards reducing poverty, will have a cyclic effect resulting in improved health and

**Figure 1.2: Water, Health and Poverty Linkages - a simplified framework**




**Source: Abayawardana and Hussein, 2002: 8**

productive output. This will consequently reduce poverty and cause an upward spiral improvement towards enhancement in the quality of life and living standards. Similarly, adverse effects can make it spiral downwards depicting deterioration in standards of living and increasing poverty.

However as depicted in Figure 1.2, Abayawardana and Hussein's model does not show the clear linkages between: (i) water availability and its non-availability; (ii) water quality and quantity to meet domestic needs and production to earn income; (iii) as well as the lack of capacity by people due to ill- health to draw on the resources in their physical environment to engage in productive livelihoods. (iv) Again, the fact that the environment may be the source of illness, due to the lack of potable water, and thus the source of incapacitating people and constraining them into opportunistic and occupational poverty was missing in their analysis. Some other weaknesses in their model of water/poverty relationship are that: they used only health as their intermediary variable and did not take into consideration the interplay of other intermediary variables such as education, occupational livelihoods and income generation, and their potentials to reduce poverty.

For instance, poor livelihoods and loss of income were stated only as effects of poor health but such ill-health was not categorically linked to lack of potable water. Livelihoods engagements were also not indicated as a process, and that would have been the emerging freedom enabler needed to serve as a catalyst for the gradual empowerment for emergence out of poverty. Another weakness also noticed in the model was that, the authors viewed poverty solely as an income dependent phenomenon; however current world view recognizes the multi-dimensional causative factors of poverty.

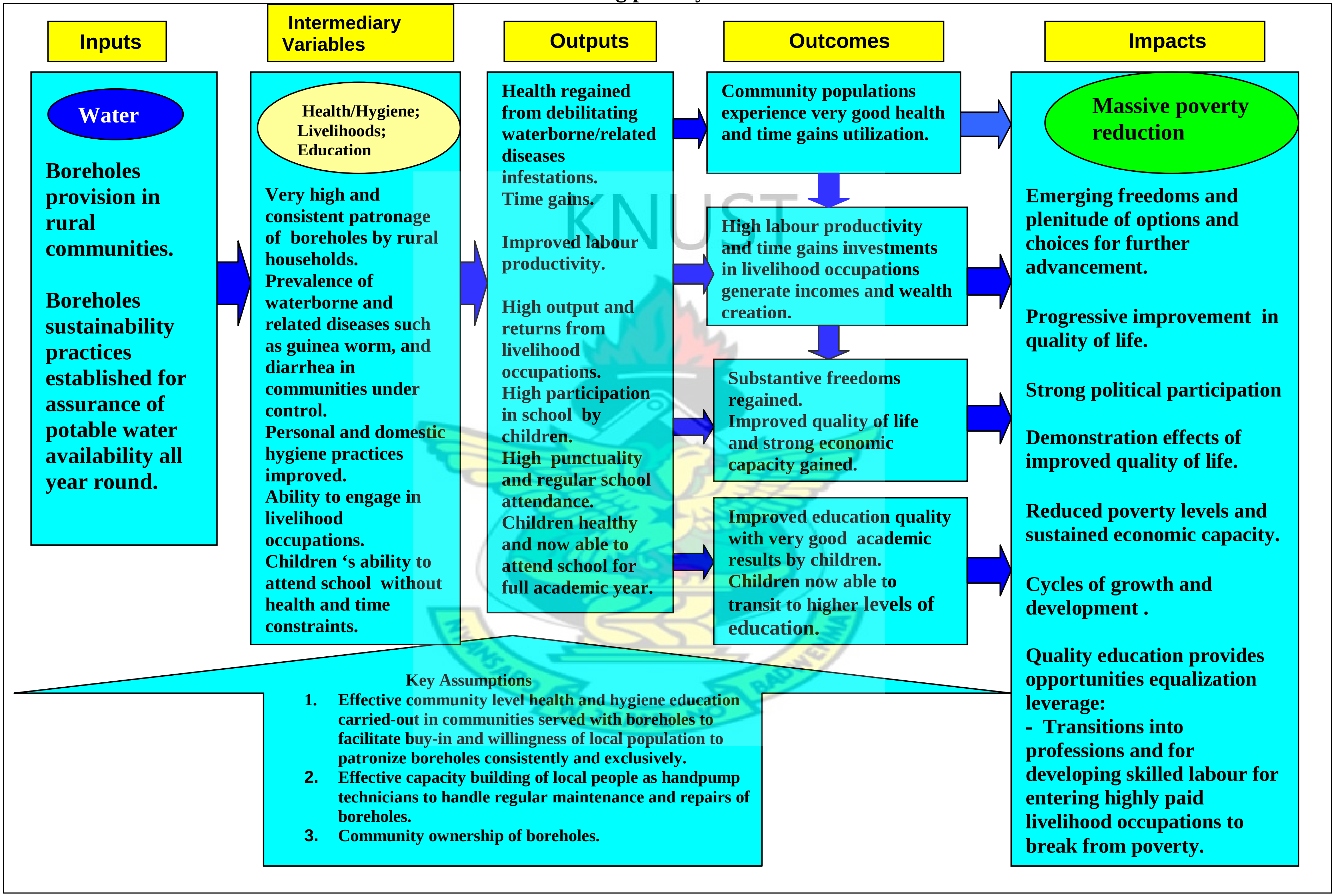
The model does not indicate anything about how quality education is an equalizing factor in long term poverty reduction. Therefore how the lack of water compromises and negatively impacts the potential of school-age children to break from poverty or be the agents of poverty reduction, were not indicated. Their model is also silent on the lack of freedoms associated with lack of potable water.

Therefore taking the above insights and limitations into consideration, an appropriate conceptual framework was constructed to guide the study. The missing intermediary variables have been added as key indicators to further and better explain the causal linkages between the lack of boreholes and opportunistic poverty, or its availability in reducing poverty. The improved conceptual framework has been stated based on the theory of change approach, as illustrated in Figure 1.3.

A theory of change is a description of how an intervention is supposed to deliver the desired results. It describes the causal logic of how and why a particular programme will reach its intended outcomes. A theory of change depict a sequence of events leading to outcomes, it explores the conditions and assumptions needed for the change to take place, make explicit the causal logic behind the programme, and map the programme interventions along logical causal pathways (Gertler, et al, 2011). In this logical framework, inputs are the resources at the disposal of the project. The activities or actions taken to convert the intermediary variables using the inputs into outputs come next.

Outputs are the tangible goods and services that the project activities produce. Outcomes are the short-to-medium term effects of the processes showing as interventions

**Figure 1.3: Modified Conceptual Framework - Borehole provision and role of Health & Hygiene, Livelihoods and Incomes, and Education in facilitating poverty reduction in rural communities**




**Source: Abayawardana and Hussein's Framework Modified, 2006**

and change in development conditions. Impact constitutes the long term final project results and show as permanent changes in the lives of people over a timeframe.

As depicted in Figure 1.3, the provision of boreholes in rural communities creates access to potable water sources. High and consistent patronage of the boreholes lead to the eradication of water-borne and water-related diseases such as guinea worm, diarrhoea, skin diseases such as yaws. Subsequently, improved physical health and personal hygiene practices such as bathing and for laundry do occur. In relation to livelihoods for income generation and wealth creation, time gains from accessing potable water from nearby boreholes are now invested in high income earning occupational livelihoods activities.

Wealth creation involves incomes and savings accruing from all occupational livelihoods initiatives. In relation to quality education delivery, time gained from being freed from water-borne/related disease incapacitation and the long trekking for water by children reflected in children's ability to attend school, improved punctuality at school, higher contact time with teachers, all of which translate into improved quality teaching to enable children progress ultimately to tertiary education level.

Time gains from improved health of adults also manifest in increased productivity, improved economic capacity leading to wealth creation, and the ability to provide basic domestic household needs, and the ability to discharge the responsibility of sustaining the boreholes provided in the community. There is also the emergence of improved quality of life and the attendant visible demonstration effects in assets acquisition and sustained economic capacity. These lead to emerging freedoms and plenitude of options, improved quality of life, and eventually in reduced poverty.

These benefits derived from the provision and availability of boreholes serve as major drivers for continual patronage to satisfy basic domestic water requirement, and encourages them to bear the responsibility of borehole maintenance to ensure continual potable water availability.

It also facilitates positive incremental income earnings from occupational livelihoods which eventually support them to emerge out of poverty. The sum effect translates into progressive improvement in the quality of life in the rural communities which were provided with boreholes, strong political participation, and cycles of growth and development at the micro-social and economic levels.

Quality education provides the opportunities equalization leverage through transitions into professions and for developing skilled labour for entering highly paid livelihood occupations to break from poverty. The demonstration effect of wealth creation manifests as construction of new and better houses roofed with metal sheets; ability to provide for basic domestic needs-all year round (e.g. food and clothing); ability to afford health bills; and ability to afford children's school bills.

The key assumptions on which this modified conceptual framework is based are: effective community level health and hygiene education carried-out in communities served with boreholes. This will facilitate acceptance and willingness of local population to patronize boreholes consistently. Also effective capacity building of local people as hand pump technicians is required to handle regular maintenance and repairs of boreholes. Finally, community ownership of boreholes to generate the commitment needed for taking responsibility of the boreholes' continual operation is essential for boreholes sustainability.

## 1.4 Objectives of the Study

The general objective was to examine the extent to which boreholes provided in the Atebubu and Afram Plains Districts have facilitated poverty reduction.

The specific objectives were to:

(a) Investigate how borehole provision has facilitated improved health and hygiene practices, with specific reference to guinea worm eradication, for poverty reduction in the Atebubu and Afram Plains Districts.

(b) Examine how borehole provision has facilitated improved income earnings and wealth creation for poverty reduction in the Atebubu and Afram Plains Districts.

(c) Assess how borehole provision has facilitated quality education delivery for long term poverty reduction in the Atebubu and Afram Plains Districts.

(d) Use the findings from the study as a basis to develop and recommend an approach that can be adopted to promote sustainable poverty reduction in rural communities.

As already stated, this study focused on health and hygiene, livelihoods and incomes, and education, as the key intermediary variables directly impacting poverty reduction after the provision of boreholes in rural communities in Atebubu and the Afram Plains districts. Though other variables such as human security enhancement, individual and community well-being, and gender emancipation also impact poverty reduction, this study examines only the three intermediary variables in much depth, and in conclusion make known the observed relationships between boreholes provision, the intermediary variables, and poverty reduction.

## 1.5 Hypotheses

Flowing from the literature reviewed and conceptual framework, three working hypotheses were stated to guide this study as follows:

1). Boreholes provision has positively impacted health and hygiene for poverty reduction in rural communities.

2). Boreholes provision has promoted quality education for poverty reduction in rural communities.

3).Boreholes provision has promoted occupational livelihoods income poverty reduction in rural communities.

These hypotheses were tested and the results captured in the fifth chapter of this study.

## 1.6 Research Methodology

### 1.6.1 Population for study

The local population identified for this study was drawn from rural communities in the Atebubu District in the Brong Ahafo Region and the Afram Plains District in the Eastern Region of Ghana. These constituted the population of interest in relation to the topic being studied. The two Districts were selected for this study because they seriously lacked potable water infrastructure, and were the two most guinea worm endemic districts in the country where World Vision Ghana focused most of its boreholes drilling operations from 1990 to 2003 (World Vision, 1993). The fourteen years timeframe of boreholes provision also justifies this impact study to verify or disprove the topic as stated for this study.

### 1.6.2 Types of data

The study applied both primary and secondary data. A survey was undertaken to collect primary data in quantitative and qualitative form from the communities sampled for the study. Data collected related to age, sex, housing, marital status, level of education, and years of schooling of respondents, current work status, occupation, literacy level, ethnicity, and religion. These constitute demographic data, and were collected to serve as background information critical in informing the analyses of how each variable has been impacted by the provision of boreholes.

Data was also collected on several other variables reflecting the socio-economic status of respondents and their communities before and after boreholes provision. These included information on productivity such as ability to hire farm hands, proxy poverty measurement indicators such as ownership of items like radio, television set, bicycle, and or tractors. Information was also collected on the availability of water facilities and practices relating to health and hygiene, in households and communities.

Information was gathered on the situation before and after boreholes were provided as it related specifically to guinea worm prevalence and health status. Also information on capacity for engaging in livelihoods occupations, and the status of school enrollment and attendance by children were collected. Strategies and practices on boreholes sustainability were also captured, and finally, the demonstration effects or the physical evidence of the impact of boreholes on individuals in households and on communities were gathered. Being an impact study another set of survey instruments were administered in control communities to gather counterfactual information on the non-availability of boreholes in those communities.

This study was undertaken to assess the magnitude of impact made by the provision of boreholes in geographic space (the Atebubu and Afram Plains Districts), and not for comparison of poverty reduction efforts made in the two Districts. Therefore, since the focus of this study was to undertake a comparative analysis of the situation before and after the provision of boreholes in the communities sampled other poverty reduction factors had to be assessed to know their influence and impact in the study area. However some comparisons of data between the two Districts were made in relation to the variables chosen for the study so as to bring to the fore the spatial variations of the impact observed.

The availability and influence of other poverty reduction factors such as the availability of access roads, electricity, and health facilities were therefore built into the survey instruments to solicit evidence of their impact on communities where the survey was carried out. Also information was collected on the status of these factors from the District Administration offices of Atebubu and the Afram Plains Districts. This provided information on the ground situation, and also to confirm or refute information gathered through the survey. This enabled the magnitude of the impact of boreholes provided to be assessed independently.

### 1.6.3 Sources of Data

Primary data on socio-economic experiences within the sampled communities were collected using an integrated approach of quantitative and qualitative data collection methods. Data were collected from sampled communities (in both Programme and

Control communities). The data collected from the Control communities located in the study area, served as the counterfactual evidence for effective comparative analyses.

Secondary data/ information were captured from publications and project reports from World Vision Ghana Rural Water Project (WVGRWP) relevant to the research topic. Reference materials which included journals, conference papers, Internet sources, and government publications from the Ghana Statistical Service (GSS) and the National Development Planning Commission (NDPC) were also consulted extensively in the process of this study. Also, information was obtained from the District Offices of the Ghana Health Service and Ghana Education Service in both the Atebubu and Afram Plains Districts; and from the Ghana Guinea Worm Eradication Programme (GWEP). Profiles on the Atebubu and Afram Plains Districts were obtained mostly from World Vision Project documents and Internet sources.

### 1.6.4 Sampling Design

This study employed a conventional or rule of thumb method in determining the sample size. Thus initial sampling was based on selecting about thirty percent of communities in the two Districts targeted for the study. Thirty per cent is considered an acceptable social science research sampling standard for a high degree of accuracy (Kreuger and Neuman, 2006; Guiseppe, 2006).

The actual size and composition of the sample for this study was determined based on three factors: (i) the objectives of the study; (ii) the degree of accuracy required, which is 0.05 level of significance; and, (iii) the number of different variables to be examined simultaneously during the data analyses. In this study three intermediary variables: health and hygiene, livelihoods and income poverty, and, education quality were examined.

In this study therefore, attention is focused on how the provision of boreholes became the platform, catalyst, and enabler for wealth creation to reduce poverty in the study area through three intermediary variables: health and hygiene, livelihoods and incomes improvement and quality education delivery.



The probability sampling technique was employed to obtain the sample needed for the study. This technique allowed for each individual unit in the population universe to have a chance or probability of being included in the sample. Specifically, the probability technique - Simple Random Sample (SRS), was used to select the samples (communities and respondents) for this study (Guiseppe, 2006).

The sampling frame was based on a database of boreholes drilled by World Vision in the two Districts. As already indicated, WVGRWP drilled 363 boreholes in 249 communities in the two Districts, as shown in Table 1.1. 196 viable boreholes were drilled in 125 communities in the Atebubu District; and, 167 viable boreholes were drilled in 124 communities in the Afram Plains District (World Vision, 2003).

**Table 1.1: Sampling Frame For Data Collection**

| **District** | **1990 – 2003** | | **Sampling size** | |
|---|---|---|---|---|
| | **Boreholes drilled** | **Communities benefitted** | **Programme Communities** | **Control communities** |
| **Atebubu** | 196 | 125 | 41 | 20 |
| **Afram Plains** | 167 | 124 | 39 | 14 |
| **Totals** | 363 | 249 | 80 | 34 |
| *Number of respondents added in other Control communities to make up for the shortfall in sample size for the Afram Plains District. | | | 80 x 15 | 34 x 15 |
| | | | 1,200 | 510 + 90* = 600 |

**Source: Author's Construct based on WVGRWP database**

From a sampling universe of all communities in which boreholes drilling was carried-out by World Vision Ghana from 1990 to 2003 in the two Districts, a sampling frame made up of communities with boreholes and communities without boreholes (Control) was created. Thirty-two percent of communities with boreholes (Programme communities) were sampled by application of the simple random sampling technique. This gave a total of eighty (80) communities with boreholes (Atebubu - 41; Afram Plains - 39) as depicted in Table 1.1. Further, fifteen respondents were randomly selected from each programme community to arrive at a households respondents sample size of 1,200.

Six hundred respondents in the Control communities (300 from each of the two Districts) were also selected by simple random sampling. This represents 50% of the sample size for programme communities and the essence was to offer them the opportunity to give counterfactual evidence of the impact of lack of boreholes on their lives. This generated a sample size of 34 Control communities (Atebubu – 20; Afram Plains – 14). However, due to less Control communities in the Afram Plains District, the number of respondents had to be increased to 21 in some communities to make up for the sample of 300 respondents required for that District. The sample size of fifteen household respondents per community was large enough to enable the necessary data needed to be collected to carry out analyses to arrive at meaningful conclusions.

#### 1.6.4.1 The Sampling process

By employing the simple random sampling methodology, eighty (80) Programme communities (Atebubu-39; Afram Plains - 41), and 34 Control communities (Atebubu – 20; Afram Plains – 14) were selected for the survey based on the following steps: (i) All the 249 communities were listed with serial numbers, printed and cut into pieces of single communities. These were folded and put in a box, shuffled and the 80 communities picked randomly. After each pick, the remaining communities were re-shuffled before the next community was picked. (ii) The same process as outlined in (i) was used to select the 34 Control communities.

After selection of the 80 Programme communities and the 34 Control communities, detailed maps of the two Districts showing the communities and borehole locations were used to assess and ascertain accessibility, distances, cost of reaching the communities. The potential stress on Research Assistants so as to avoid excessive fatigue, and also in order not to compromise quality of data to be collected were also taken into consideration. All the communities selected were within reach so there were no replacements made. To determine the actual number of households to be selected randomly since every household in a community sampled qualified to be a respondent, the households were selected as per the five geographical orientations (North, South, East, West and Centre). Three households were selected as per each orientation, and as such fifteen (15) households were selected from each community. The same process was followed in accessing household respondents for the Control communities. Since the study is meant to assess the extent to which populations in beneficiary communities have been impacted in terms of poverty reduction through the provision of boreholes, the sample size of fifteen household respondents per community was large enough to adequately enable the author obtain the necessary data to carry out analyses and to arrive at meaningful conclusions.

### 1.6.5 Data Collection Methods

Quantitative data were collected by using structured household questionnaires administered to household heads. Qualitative information was gathered through the use of three instruments: (i) Key informants in-depth interviews (ii) Focus groups discussions, and (iii) Community meetings.

Key informants in-depth interviews – these follow all rules and procedures of research interviewing. However, instead of a large number of questions to be asked, a few questions considered to be of much relevance to the objectives of the study are chosen and probed in much detail. In this type of interviews, the number of respondents is intentionally restricted due to time constraints. The interviews are in-depth and structured interviews (Leeuw, et, al 2008, Guiseppe, 2006).

The key informants in-depth interviews are applied to informants or personalities considered as key to a community's existence especially in respect of a community's governance and development. Such people include chiefs, queen-mothers, District Chief Executives, opinion leaders, women's group leaders, and head teachers.

Focus groups discussions – according to Kreuger & Neuman, a Focus Group Discussion is “a type of group interview in which an interviewer asks questions to the group, and answers are given in an open discussion among the group members”(Kreuger & Neuman, 2006:557).

A Focus group discussion (FGD) therefore, is a type of In-depth Interview, but with a selected group instead of with individuals separately. The area of interest emphasizes group interviews with responses being made at the same time and location, instead of individual interviews. The Focus group discussion is in the form of an exchange of views and opinions through discussions with a group which are known to be patronizers and sympathizers and have much knowledge about the issues being discussed. Thus, the Focus Group Discussion is an in-depth interview with a relatively homogeneous group with respect to the subject-matter under discussion (Leeuw, et, al 2008, Guiseppe, 2006).

Community meetings - this is a field approach which use face-to-face discussion and presentation of facts and counter views with community audiences through the local medium of traditional rulers and /or elders and those in authority. This approach is familiar and acceptable among community audiences as a means of conveying important and urgent messages concerning them to development stakeholders. The type of information obtained depends on the purpose and objectives of the study being undertaken. In terms of process, after community people have been assembled, a spokesperson of the community’s chief and elders indicates the main objectives of being summoned. He goes on to introduce the official message bearers, whose spokesperson is asked to present their message in clear terms to the audience. After the message is presented, the discussion is then opened to all present for questions and explanations (Kreuger & Neuman, 2006).

In this study, key informants in-depth interviews were carried out in both Programme and Control communities. Those interviewed included chiefs and queen-mothers, Assemblymen, school head-teachers, and retired civil servants, all of whom were resident in the communities. Focus Group Discussions were also organized for Water and Sanitation (WATSAN) Committee members, borehole Hand pump Maintenance Technicians, and Women's group leaders.

In this study the composition of each Focus Group was made of eleven persons as follows: WATSAN Committee Chairman, Secretary, Treasurer and two other members present in the community that day; three Hand pump Maintenance Technicians trained for that Community; and three Women's Group leaders in the community. Each Focus group had a facilitator who was a research assistant and a secretary/recorder, also a research assistant. The Facilitator initiated the questions by referring to the question guide and guided the discussions while the secretary recorded the responses given by group members. The essence was to assess how these groups perceived and understood the linkages between boreholes provision and poverty reduction within their rural environment and how it impacted their health, occupational livelihoods income generation capacity, and children's education.

Community meetings were held in each community sampled to capture the perceptions of community members on the topic under study and also to triangulate with the individual household heads perceptions captured in the household interviews. The

Community meetings were basically face-to-face interactions with residents of the communities sampled. The Community meetings were organized to enable communities tell their side of the story on their poverty reduction experience as relates to boreholes provided in those communities. Community meetings were also organized in communities without boreholes (control communities) to gather information on what the prevailing situation was in regard to the lack of potable water.

In this instance, triangulation involved monitoring for consistency and accuracy of responses. For example, some (check/control questions) were phrased in a slightly different form – in wording and not in its substance, and repeated at different points in the questionnaire to help check or clarify inconsistencies or incomplete answers. Thus, the purpose and the principle of triangulation is to increase the validity of the data collected by looking at different data sources or by going back to the same kinds of questions (Leeuw, et, al 2008).

As a triangulation mechanism, the presence of a cross-section of people at the same time served as a reliability and validity check on the information people offered verbally, and also in cross-checking information gathered from the household interviews. This methodology used an interview guide with the flexibility to reframe and to ask relevant questions and obtain responses which enhanced and gave deeper insight into the nature of outcomes and impact of boreholes provided and insights from control communities.

### 1.6.6 Data Collection

Twenty-two Research Assistants recruited were trained from July 24th to 29th 2006, at the World Vision Ghana Central Sector Office, which was at that time located in Kumasi. Kumasi was considered a central point considering the various locations the Research Assistants were drawn from. The Research Assistants comprised twelve World Vision Ghana staff on annual leave, five students from the Christian Service University College, Kumasi on vacation attachment, one student from the University of Development Studies, Tamale on vacation attachment, one student from the University of Ghana, Accra on vacation attachment, one student from Kwaso Rural Development College on vacation attachment, and two school teachers from the Atebubu township.

The training was carried out to ensure consistent interpretation and application of the survey instruments to the intended respondents so as to avoid procedural biases which could produce wrong information to affect the survey results. Highlights of the content of the training are: discussion of content of survey instruments, translation of survey instruments into local dialects, process of survey instruments administration to respondents; community entry protocols; community behaviour protocols. Field guidelines discussed included the process for selection of respondents; formation of focus groups, community meetings; and key informants interviews. Other topics included Research Assistants' role assignments; assignments of Team Leaders and Field Supervisors and their roles; Field survey timetable discussion; and logistics support.

Pre-testing of the survey instruments was carried out on July 28th in three communities in the Atebubu District. The pre-test process represented a live test of the survey instruments to ensure that the instruments meant the same thing to all respondents as well as to the author. The feedback was used to refine the instruments for the actual data collection activity. The pre-test helped to evaluate the adequacy of the survey instruments to solicit all the information needed, to estimate the length of time it takes interviews to be conducted and, to also determine the effectiveness of the eight Research Assistants who worked along the Survey Supervisor. Further, through the pre-test the Survey Supervisor/Author was able to assess whether the respondents will understand all that the survey was about; whether respondents would feel comfortable answering questions; whether the wording of survey instruments were clear; and whether the response categories of the survey instruments were compatible with the respondent's experience as it related to impact of boreholes provision in their communities or otherwise.

The twenty-two Research Assistants (RAs) were grouped into two data collection teams to collect the data from the Atebubu and Afram Plains Districts. The field data collection was carried out concurrently for four weeks from 2$^{nd}$ through to 29$^{th}$ August, 2006 in the two Districts. The field teams each had a Team Leader, a Supervisor and an Assistant Supervisor. Their work was coordinated on a daily basis by the author/ Survey Supervisor. All field questionnaires were numbered and edited in the field on a daily basis by the Team Supervisors and their Assistants. Team Supervisors also ensured safe custody of all the data collected.

The Author/Survey Supervisor participated in the data collection in communities in both Districts by administering questionnaires and holding community meetings for two weeks each in both Districts. He ensured that all field protocols were adhered to. He also met each evening with field teams to listen to the challenges they were facing and discussed their experiences to ensure quality data collection. The rationale for using two teams was to ensure that the data were captured within a specific timeframe to reflect the actual ground situation prevailing in the two Districts. This was also to enable uniformity in data validation, and ascertain the reliability of data used for the subsequent data analyses.

The realities that emerged in course of the survey related to the very poor nature of routes to the communities sampled. This delayed the arrival of the data collection teams in the remotely located communities. Thus most households had gone to their farms by the time the survey teams arrived. The teams therefore at times had to wait for people in the households to return from their farms in the late afternoons and interviews stretched into late evenings. Also, where household heads were absent, data collectors skipped to other households to collect data because every household in a community sampled qualified to be interviewed.

#### 1.6.6.1 Communities Entered For Data Collection

Forty-one (41) programme communities and twenty (20) control communities in the Atebubu District were entered for data collection, while thirty-nine (39) programme communities and fourteen (14) control communities in the Afram Plains District were also entered for data collection. These communities are listed in Table 1.2 as follows.

**Table 1.2: Programme communities entered for data collection**

| # | ATEBUBU DISTRICT PROGRAMME COMMUNITIES | # | AFRAM PLAINS DISTRICT PROGRAMME COMMUNITIES |
|---|---|---|---|
| 1. | Abease | 1. | Abotanso |
| 2. | Adjaraja | 2. | Abotanso no.1 |
| 3. | Afrefreso | 3. | Abotanso no.2 |
| 4. | Akokoa | 4. | Agordeke |
| 5. | Asanteboa | 5. | Agyattakrom |
| 6. | Aseibu | 6. | Akwamu |
| 7. | Atwadua | 7. | Amankwakrom |
| 8. | Beposo | 8. | Amaria |
| 9. | Boanyo | 9. | Ameyawkrom |
| 10. | Bolga Nkwanta | 10. | Asanyanso |
| 11. | Bolga Village | 11. | Asikasu |
| 12. | Boniafo | 12. | Asokore |
| 13. | Bresuano | 13. | Atakora |
| 14. | Bye-bye | 14. | Asukese no.1 |
| 15. | Cherepo | 15. | Atta kwabeng |
| 16. | Daman Nkwanta | 16. | Battor |
| 17. | Denteso | 17. | Bebuso |
| 18. | Dobidi | 18. | Domeabra |
| 19. | Dobidi Nkwanta | 19. | Dunkro |

**Table 1.2: Programme communities entered for data collection - (continuation)**

| # | ATEBUBU DISTRICT PROGRAMME COMMUNITIES | # | AFRAM PLAINS DISTRICT PROGRAMME COMMUNITIES |
|---|---|---|---|
| **20.** | Duabone | **20.** | Forifori |
| **21.** | Duabone 2 | **21.** | Forifori Old Town |
| **22.** | Fakwasi | **22.** | Hwidiem |
| **23.** | Famfour | **23.** | Koranteng Abotan |
| **24.** | Jato Zongo | **24.** | Kwabena Gare |
| **25.** | Kobre | **25.** | Kwaekese |
| **26.** | Kofi Basare | **26.** | Kwasi Addai |
| **27.** | Kojo Boffour | **27.** | Kwasi Fante |
| **28.** | Komfourkrom | **28.** | Maame Krobo |
| **29.** | Konkoma | **29.** | Nkubeta |
| **30.** | Kumkumso | **30.** | Nsuogyaso |
| **31.** | Kwaease | **31.** | Nyamebekyere |
| **32.** | Kyenkyenkura | **32.** | Odumase |
| **33.** | Mempeasem | **33.** | Odumasua |
| **34.** | New Boniafo | **34.** | Sakyikrom |
| **35.** | New Konkrompe | **35.** | Semanhyia |
| **36.** | Nyamebekyere | **36.** | Takoratwene |
| **37.** | Old Konkrompe | **37.** | Tease |
| **38.** | Praprabon | **38.** | Yaw Ayebeng |
| **39.** | Sanwakyi | **39.** | Yaw Fori |
| **40.** | Tintare | | |
| **41.** | Watro | | |

**Table 1.3.: Control communities entered for data collection**

| # | ATEBUBU DISTRICT CONTROL COMMUNITIES | # | AFRAM PLAINS DISTRICT CONTROL COMMUNITIES |
|---|---|---|---|
| **1.** | Akyeremade | **1.** | Asaaseboma |
| **2.** | Boase Akura | **2.** | Dotopon |
| **3.** | Kachawura | **3.** | Sikasu |
| **4.** | Old Boniafo | **4.** | Owiredu Akura |
| **5.** | Sabidi | **5.** | Appiabra |
| **6.** | Tigamgam | **6.** | Gezeri |
| **7.** | Yaw Tuffour | **7.** | Wongwong |
| **8.** | Abrewankor | **8.** | Kwadwo Gare no.2 |
| **9.** | Abuoso | **9.** | Suntre |
| **10.** | Kafano | **10.** | Obomeng-Asikam |
| **11.** | Brodie Kwae | **11.** | Isaac Akura |
| **12.** | Ebuase | **12.** | Foso |
| **13.** | Kokofu | **13.** | Atuobikrom |
| **14.** | Old Yaw Nkrumah | **14.** | Donkorkrom Teacher’s Village |
| **15.** | Yabraso | | |
| **16.** | Kupua | | |
| **17.** | Amanfro | | |
| **18.** | Namsa | | |
| **19.** | Bompa | | |
| **20.** | Buma | | |

### 1.6.6.2 Research Instruments Administered

Structured household questionnaires were administered to households selected per community. Questions asked respondents were structured in the form of Likert scale (“strongly agree – strongly disagree,”) and in conventional ‘Yes’ or ‘No’ formats. Acquiescence bias (that is the tendency of respondents to choose certain response categories irrespective of the questionnaire’s content, especially with “agree – disagree,” and “yes – no,” instruments) and social desirability bias (respondent’s being prone to distorting responses in ways that make their condition look better), were checked to minimize response error which can compromise the accuracy of answers obtained. This was done through explaining the appropriateness of each question in context of the impact of the boreholes provided on poverty reduction to respondents.

A Focus Group Discussion Guide for programme communities developed was used during focus group discussions. A Focus Group Discussion Guide for control communities was also used during discussions with Focus groups in control communities. An In-depth Interview guide was administered to selected persons in the sampled communities. Unstructured questions were used during community meetings and this enabled free expression of the impact experiences of respondents in respect of the boreholes provided in their communities, or the experience of the lack of boreholes as existed in control communities.

### 1.6.7 Data Analyses

#### 1.6.7.1 Types of Analyses Undertaken

The field data collection was followed by data editing of the completed questionnaires to detect and correct errors. This task was undertaken by the author and the field supervisors before data entry was carried out. Four data entry clerks and the author were trained in computer assisted data entry software - SPSS version 12.0 applications. Data entry followed for almost four months because the four Data Entry clerks were volunteers who worked alongside the author only on weekends. Data entry was followed by data cleaning and evaluation of data entered to prepare for analyses.

Parametric data analysis methods were employed because the data collected were ordinal and interval. Quantitative data analyses were carried out through the use of SPSS and EXCEL computer softwares and results generated by application of descriptive and inferential statistics methods. To obtain the descriptive statistics for the categorical variables frequencies in the form of pie charts, histograms, bar charts and tables were used. These showed how many people gave each response for the analysis and subsequent interpretation of the results generated.

To obtain further descriptive results, content analysis methods were adopted to analyse the qualitative information gathered (Linda and Rist, 2009). For this study, the content analysis involved systematic analysis of qualitative information gathered from respondents during the field survey in the study area. This study adopted and combined both the conceptual and relational analysis types of content analysis to examine the qualitative data gathered. These content analysis methods employed facilitated the compilation of common themes from within the expressions of respondents. These thematic expressions captured were pertinent to the objectives set for this study, and were in relation to the three intermediary variables adopted for the study: health and hygiene, livelihoods and income, and education. These thematic expressions are embodied as quotes in the fourth chapter of this study to complement the quantitative results.

The Chi-Square test has been applied in two ways in this study: as a descriptive statistic to inform about the strength of association between two variables or their independence status, and also as an inferential statistic to inform about the probability that any association emerging are likely to be due to chance factors.

Three assumptions are stated in relation to the use of the Chi-Square test employed as follows: (1) variables are independent of each other; (2) measurement is in terms of frequency of occurrence; and (3) where two variables are involved they are assumed to be independent of each other under the null hypothesis. The Chi-square test was employed in this study's data analyses to test the hypotheses stated and to explore the relationship between boreholes provision and each of the three intermediary variables (health and hygiene; livelihoods and income earnings; education). This gave indications of whether the variables were associated or independent. Also the Chi-Square statistic test of independence was applied to test the study hypotheses because the sample size used was more than 30 ($n>30$).

The Chi-Square formula applied was: $X^2 = (O – E) / E$

Where: O = observed value; E = expected value.

In terms of the Decision Rule, the planned cut off for the associated probability (significance level or Alpha) was 0.05. This is based on a probable Type I Error level or the degree of probable error of significance = 0.05 or 5%. So the decision rule was to reject the null hypothesis if probability level/asymptotic P <0.05.

The level of statistical significance adopted for this study is 0.05 because the expected results from the tests are anticipated to be significant at that level, and also that level of significance is generally accepted by the community of social scientists for studies of this nature. This indicates the likelihood that results obtained are due to chance factors (Krueger and Neuman, 2006; Marija, 2008). Thus, having stated that the results would be significant at the 0.05 level implies that: (i) the study results are due to chance factors only up to 5%; (ii) the odds of such results based on chance alone are 0.05 or 5%. (iii) the author is 95% confident that the results are due to a real relationship in the population, and not chance factors (Kreuger and Neuman, 2006).

Cross tabulation was used to establish existing relationships between the provision of boreholes and the three intermediary variables underpinning the hypotheses being tested and the results established.

Logistic regression analysis of the independent and dependent variables was carried out to show the direction (positive or negative) of variables and to show the extent to which the dependent variables have been influenced, determined or established by the independent variable, and its implication for determining how the sample results adequately or otherwise represents the population of interest studied.

#### 1.6.7.2 Units of Enquiry and Data Analyses

For this study, the units of enquiry adopted were the community, households and individuals. The units of analysis adopted for this study were the ‘household’ and 'individuals'. These units of enquiry and analysis flowed from the research problem, and formed the basis to collect and analyze data from the specific target populations in the Atebubu and Afram Plains Districts.

**1.6.7.3 Independent and Dependent Variables**

In this study "boreholes provision" is the independent variable while "poverty reduction" is the dependent variable. The proposition being advanced in this study is that, the provision of boreholes (independent variable) has been the major contributor to poverty reduction (dependent variable) through three intermediary variables – health and hygiene, livelihoods and income, and education quality. Thus, the study examines how poverty reduction in rural communities in the Atebubu and Afram Plains Districts emerged due to the provision of boreholes in those communities and which has impacted the three intermediary variables.

**1.6.7.4 Intermediary Variables:** the conceptual basis for the three intermediary variables chosen for this study is stated as follows.

**1.6.7.4.1 Health and hygiene**

Health is a state of complete physical, mental and social well-being and not merely the absence of disease or infirmity (UNICEF, 2011; Nussbaum, 2005). Hygiene, on the other hand, refers to personal cleanliness, which is of great importance in the prevention of many kinds of body infections, especially skin, eyes, and lungs (Werner, David, 2002). While the availability of water usually has a high influence on personal hygiene, poor personal and environmental hygiene causes diarrhea and dysentery. Potable water is therefore needed in much quantities for washing hands with soap after visiting toilets, for bathing and laundry.

According to Todaro and Smith (2003), the devastating effects of poor health in developing countries do harm the productivity of adults. Studies show that a large part of the effect of health on raising earnings is due to productivity differentials and that healthier people do earn higher wages. As a prime consideration in this study, health is deemed as central to well-being and a pre-requisite for increases in productivity, and that improved health help households escape some of the vicious cycles of poverty in which they are trapped. Health is also an important factor in school attendance and in the formal learning process of children. The provision of boreholes in rural communities therefore has important implications for the health and education of the rural poor.

**1.6.7.4.2 Livelihoods and Income**

In terms of labour productivity, improved access to water infrastructure facilities can free-up significant amounts of time as rural households, especially women and young girls, spend a large part of their day on collection of water. Easy access to potable water results in time-savings that can be used for economically productive activities (Wodon, 2008). The livelihoods of rural dwellers are strongly dependent on the natural resources of water, soil, and forests as they earn their living from farming. Livelihoods are the sum of ways in which people make a living. It is also the ability of people to meet, on a sustained basis, basic needs to live (World Bank, 2011b). In this study, the main source of household cash income is net earnings from self-employment – basically from agricultural activities. The reference period for income data is a year.

A nation's manpower-base is the totality of persons who could produce the goods and services if there were a demand for their labours and they desired to participate in such activity. In this study therefore, the economically active, also called the working force – is that part of the manpower in the study area which actually engages, or attempts to engage, in the production of economic goods and services for gain to earn income consistently. As people obtain and build assets they create wealth and improve the quality of their live to gradually reduce poverty (Weeks, 1999).

Labour mobility in the study area is seen as any change in a person's status that involves his or her economic activity, or more specifically jobs, which includes entering or leaving the labour force, shifting employment status, changing occupation, and moving from one geographic area to another to take advantage of perceived opportunities for self improvement for emergence out of poverty as orchestrated by the provision of boreholes or otherwise.

**1.6.7.4.3 Education quality**

For centuries, education has been the most important and useful means of long-term enhancement of human well-being. It is also the tool for empowering people, engineering their capacities and developing their capabilities. Education releases people from poverty and enable them acquire and create wealth, as well as enjoy basic human substantive freedoms. Yet, when in dire constraints due to the lack of potable water in their rural communities, adults tend to inadvertently compromise on children's education by making their children go in search of water for their households than be in school (World Bank, 2011c; UNDP, 2006; and World Bank, 2006a). Becoming educated is probably the most dramatic and significant socio-economic change that can be introduced into a person's life. It is also a vehicle for personal success used by generations after generations of people in developed countries, and which developing countries have also embraced.

While it is an indisputable fact that education constitutes one of the most single powerful vehicles of emergence out of poverty along the generational spectrum within households and in communities, it also opens doorways, creates unlimited opportunities and enable people to aspire to achieve their ultimate potentials in life (Hanushek, et al, 2007a; Mertaugh, et al, 2009; Mulkeen and Chen, 2008; and Serge, 2009). Thus, in poor rural communities with no boreholes, participating effectively in school is out of the question. Waterborne/related illness also incapacitates children so much that they are unable to attend school. Even when they are in school, they are pulled-out by parents to respond to the urgent need to go in search of water for their households (World Bank, 2010c; UNDP, 2006). Having access to potable water therefore could reduce involuntary absenteeism and improve the educational performance of children.

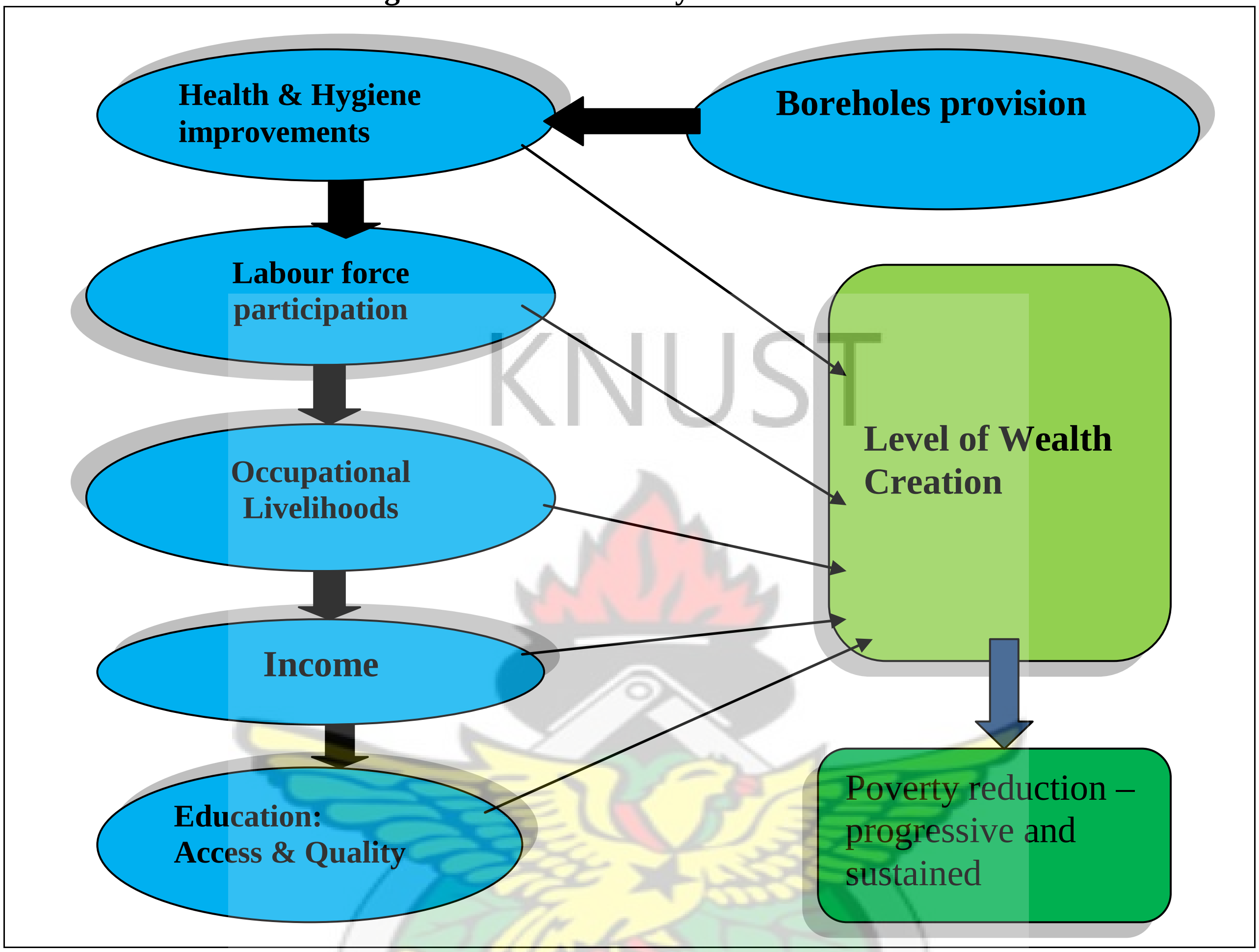
In relation to poverty reduction, the economic function of education is to increase people's capacity to make decisions and choices that enable them live decently and move out of poverty. This study relates to all the determinants of education which include three broad categories: measures of educational input, concerned with access and actual enrolment in school and with enrolment expectations; measures of educational progression – in terms of education quality; measures of educational output, which relate to eventual educational status, such as educational attainment, and also educational expectations – gainful employment to distance one's self from poverty. Education quality therefore has important influences on job opportunities (Stockwell, 1976).

Life chances are also directly related to achieved characteristics in terms of the socio-demographic characteristics such as education, occupation, labour force participation, and income – over which a person can exercise some degree of control. For example, the better educated a person is the higher his/her occupational status tends to be, and thus the higher the level of income will likely be. Therefore, for the investment in education to pay-off for households, it must lead to higher levels of labour force participation and more productive occupation, with the ultimate life chances of poverty reduced or eradicated from a person's life (Weeks, 1999).

Figure 1.4 graphically depicts the inter-relationships assumed between the three intermediary variables and their link to wealth creation and progressive and sustained poverty reduction as explored through this study.

In Figure 1.4, boreholes provision lead to Health and hygiene improvements, which lead to labour force participation, which lead to occupational livelihoods income earnings, which can be used for children's education: access and quality. Each intermediary variable is linked to the level of wealth creation which also determines the rate of poverty reduction.

**Figure 1.4: Intermediary Variables Framework**




**Source: Author's Construct, 2013**

### 1.6.8 Reliability Check

In terms of construct validity or determining the extent to which the survey instruments measured the intended objectives of the study and also to determine the reliability of quantitative data collected the Cronbach alpha method was applied. The reliability statistics generated gave a Cronbach alpha value of 0.87 for the household questionnaire administered in programme communities. By implication, the instruments employed were reliable and valid, and could explain about 87 percent of the variables in the study. Similarly, the Cronbach alpha value for the household questionnaire for control communities was 0.78. That implies the instruments used were also reliable and valid, and could explain about 78 percent of the variables in the study. These results confirm and aligns with Pallant's (2005) and Marija's (2008) indication that a survey instrument is reliable and valid when its Cronbach alpha exceeds 0.5 or fifty per cent.

In this study, because respondents in programme communities were to state what the situation was before, design bias was minimized through the introduction of the control communities factor to compare, validate or refute what the actual situation in communities may have been like before boreholes were provided. This helped mitigate exaggeration and also minimized possible social desirability bias. Also measurement bias was minimized by building into the quantitative questionnaires questions for triangulation and response validation. Again, in terms of construct validity qualitative responses were used to triangulate and complement responses from the quantitative method used (Leeuw, et al, 2008).

### 1.6.9 Discussion and Conclusion

The discussion of the results of the study involved a logical analysis and interpretation of the findings from the study with reference to the objectives set for the study, literature reviewed, and the conceptual framework designed to guide the study. The findings led to the inferences made for the necessary conclusions to be drawn.

The conclusion of this study states the implications of the findings, and the extent to which the findings contribute more to understanding of the dynamics of poverty reduction in rural communities benefiting from boreholes. Based on the findings from the study, recommendations have been made for consideration and adoption for policy development and decision making, for the academia, and also for all stakeholders and actors in the water and poverty reduction sector.

## 1.7 Limitations of the study

To reduce sampling bias in this study the probability sampling method – the simple random technique was adopted to determine the sample size. However there was a bias in increasing the number of respondents in the control communities in the Afram Plains from 15 to 21 in order to obtain the sample size of 300 for that District.

Schools data on enrolment and participation rates were collected from the District Education Offices in Atebubu and the Afram Plains Districts but were put to limited use because of several gaps and inconsistencies. For example, no school attendance records were available at the District Offices to confirm the data on annual enrollment and actual school attendance by children in the study area. Data relating to the major occupational livelihood – farming, in the two districts spanning the period 1990 to year 2005, were unavailable. So the study had no data from official sources to confirm or refute respondent's assertions about agricultural outputs but relied on the triangulation technique built into the field instruments to validate information received from respondents. In this study, triangulation implied looking at the field data collected from several angles – which is a triangulation of measures. In this instance multiple measures of the same objectives were taken through integrating quantitative and qualitative methods of research and data. Because the two methods have different complementary strengths, the use of both in this study made the study more comprehensive.

Secondary data collected from the Ghana Health Service offices in both the Atebubu and Afram Plains Districts could not be used to support or confirm the impact trends of prevalence of water borne/related diseases as obtained from survey respondents because they were found to be inconsistent and had several gaps.

## 1.8 Delimitations of the study

This study is limited to only communities where World Vision successfully drilled boreholes, and related communities where borehole drilling attempts failed, as control communities. This study is also limited, only to rural communities in both Districts. The scope of this study is further limited to assessing the impact of the provision of boreholes in two Districts of similar physical geographical features separated only by distance, but in terms of "adverse geography" were both heavily infested with guinea worm and other water-borne/related diseases. The study is also limited, specifically, to assessing the impact of eradication of guinea worm, as the main water borne disease, from rural communities in the Atebubu and Afram Plains Districts and how it impacted poverty reduction.

Despite the existence of other confounding variables such as enhanced agricultural policies, credit administration, farm prices, general healthcare delivery, removal of schools from under trees, school feeding programmes and other anti-poverty measures, the study is limited to assessing only how the boreholes provision programme impacted health and hygiene improvements, facilitated improved livelihoods and income earnings, through time gains and, revived effective school attendance by children for improved quality education, all towards the reduction of poverty in the long-term.

# Chapter Two

# LITERATURE REVIEW

## 2.0. Introduction

This chapter consists of literature reviewed in relation to potable water availability through boreholes, and specifically as it relates to poverty reduction. The literature reviewed also relates to: water availability through boreholes provision and associated challenges; water and diseases, as well as health and hygiene practices; water and livelihoods; water and quality education delivery; and boreholes sustainability. Poverty and its definitions, measurement, and poverty reduction strategies related to potable water provision were also reviewed.

## 2.1. Global, Regional and National perspectives on boreholes provision

According to Foster and others, heavy use of groundwater was not made possible until there had been advances in geological knowledge, well drilling, and pump technology, which for most regions dated from the 1950s. Currently, groundwater is the world's most extracted raw material with a global withdrawal of about 600-700 cubic kilometers per year (Foster, et al, 2006).

According to MacDonald (2005a), the rapid expansion in groundwater use occurred during 1950 - 1975 in the industrialized nations and during 1970 - 90 in most parts of the developing world. He indicated that global groundwater provides about 50% of current potable water supplies, 40% of the direct use by industry, and 20% of water-use in irrigated agriculture. He further indicated that, as compared to surface water, groundwater use often brings large economic benefits, because of local availability, reliability against drought, and good quality requiring virtually no treatment (MacDonald, 2005a).

In MacDonald's view, there are still at least 1.1 billion people across the world without access to safe drinking water. Many of these people live in rural areas and are among the poorest and most vulnerable to be found anywhere in the world (MacDonald, 2005b). Apart from the suffering associated with time poverty caused by water-related diseases, the lack of potable water has compromised and retarded social and economic growth in many rural communities globally (Iyer, et al, 2006; UNDP, 2006). Boreholes provision therefore offer opportunity for millions of rural people to realize their full potential in life, and non-provision constitutes a deprivation which according to the World Bank (2011b), holds back human progress, and consigns millions of people to poverty and insecurity.

There is therefore the need to create the enabling platforms such as potable water infrastructure that empowers people to achieve their aspirations and facilitate their progressive emergence from poverty (McKay and Aryeetey, 2007; Sachs, 2005). Not having access to potable water infrastructure thus retards people's ability to break free from the poverty trap and also limits the potential of several generations of children and youth, currently attributed to place-of-birth disadvantage (UNDP, 2006; World Bank, 2005).

Holding about four hundred million rural population, Sub-Saharan Africa's major problem is how to facilitate a reduction in the dependence on, and the utilization of surface water sources through the provision of boreholes (World Bank, 2010f). Currently, it is estimated that boreholes constitute the major source of potable water for Africa's rural communities, with about forty percent of the population served (World Bank, 2006b; Wodon, 2008). In many parts of Sub-Saharan Africa, groundwater is the only feasible way of providing safe, reliable water supplies and hence contributing to poverty reduction. Groundwater is found in many kinds of rocks (aquifers), the majority of which are replenished by rainfall. Much of this groundwater is of high quality, and requires little or no treatment to make it fit for human consumption.

In Sub-Saharan Africa, it is estimated that 300 million people have no access to safe water supplies and approximately 80% of these live in rural areas. As shown in Table 2.1, the World Bank also similarly indicated that as at 2005, approximately 43% of Africa's population in rural areas had access to improved water sources such as wells and boreholes, whilst concurrently, 42% of the same population were patronizing surface water sources. Four per cent of the remaining 15% were served with piped water and 11% patronized stand posts (World Bank, 2010e).

**Table 2.1: Water supply coverage in Africa, by source and % of population**

| **Period** | **Piped Supply** | | **Stand posts** | | **Well and boreholes** | | **Surface water** | |
|---|---|---|---|---|---|---|---|---|
| | Urban | Rural | Urban | Rural | Urban | Rural | Urban | Rural |
| **1990 – 1995** | 50 | 4 | 29 | 9 | 20 | 41 | 6 | 50 |
| **1995 – 2000** | 43 | 4 | 25 | 9 | 21 | 41 | 5 | 41 |
| **2001 – 2005** | 39 | 4 | 24 | 11 | 24 | 43 | 7 | 42 |

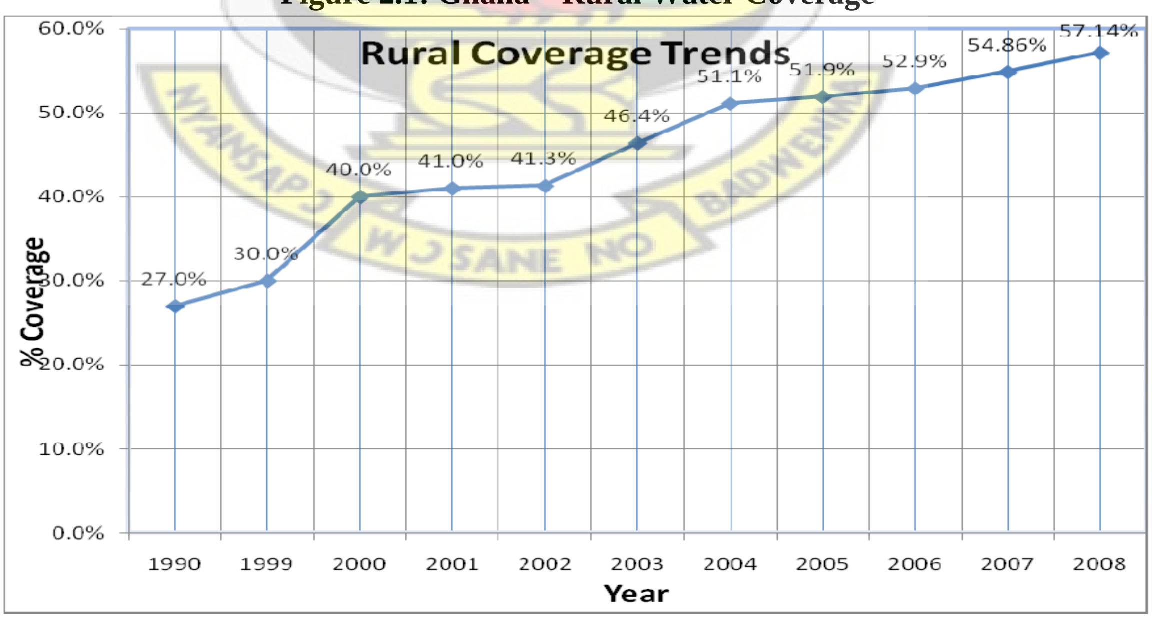
**Source: World Bank, 2010e: 301**

The good water facilities being enjoyed by the 15% should be the ultimate standard. The implications being that without safe water being near to rural dwellings the health and livelihoods of households can be severely compromised and children's education suffer through involuntary absenteeism as the daily tasks of searching for water for their households take precedence over all other domestic concerns (World Bank, 2010e; Blackden and Wodon, 2006).

Over much of Africa, groundwater is the only realistic water supply option for meeting dispersed rural demand. Alternative water resources can be unreliable and difficult or expensive to develop. Surface water is prone to contamination, often seasonal, and needs to be piped to the point of need (La Frenierre, 2009; Coulombe and Wodon, 2007; Quentin, 2007). Figure 2.1 depicts the progressive trend in rural water infrastructure provision through boreholes from about 27.0 per cent coverage in 1990 to 57.14 per cent by 2008. Current data available indicate coverage of 76 per cent (WHO/UNICEF JMP, 2010). Should this trend continue it will serve as a strong basis for eventual poverty reduction through wealth creation and utilization, improved quality of life and vigorous economic growth, which may impact gross domestic product growth, and development (World Bank, 2010g:27).



**Figure 2.1: Ghana – Rural Water Coverage**




**Source: World Bank (2010g: 27)**

Underdevelopment of potable water infrastructure in Sub-Saharan Africa has also led to underutilization of economic potential such as job creation and employment and income earnings to facilitate a break from poverty. The issue being that the non-availability of water infrastructure such as boreholes and poor water management institutional structures, deeply affect Africa's poor (World Bank, 2010e; Entsua-Mensah, et al, 2007).

As a very important asset for survival and livelihoods activities, the lack of access to potable water for use in households constitute a major constraint to progressive poverty reduction, community growth and development in rural Africa (Singh, 2009; World Bank, 2006b; Olabisi, 2009; Gleitsmann, et al, 2007).

In Ghana, many rural communities rely mainly on rainwater, rivers, streams, ponds, springs and lakes for their domestic water needs, and also to facilitate their occupations. However, most of these surface water sources are polluted and constitute the major source of water-borne diseases which are of common prevalence in rural communities. Due to erratic rainfall patterns rain harvesting cannot be undertaken all year round. Also the non-perennial nature of many of the rivers and streams in rural areas make them unreliable as they cannot supply the water needs of communities daily.

Therefore in the effort to find alternative sources of water supply which is sustainable for rural communities, groundwater was found to be a reliable source both in terms of quantity and quality. As a result, the proportion of the rural inhabitants depending on boreholes and wells rose significantly in 1984 and in 1986 almost 7,800 boreholes were provided in many rural communities (Mba and Kwankye, 2007; Govt. of Ghana, 2007).

The Community Water and Sanitation Agency (CWSA) was mandated in 1998 by an Act of Parliament to ensure the provision of potable water and sanitation services to rural communities and small towns in Ghana. As at 1998, 11,500 boreholes and 60,000 hand-dug wells have been provided countrywide and providing sources of potable water to almost fifty-two percent of the rural population in Ghana, as compared to forty-one percent in 1984. While the 2000 Population and Housing Census results indicated 44% of rural inhabitants depending on groundwater (boreholes and wells), the CWSA indicated a rise in national coverage of potable water supply in rural communities and small towns to 46% by 2004 (GSS, 2007; McKay and Aryeetey, 2007; NDPC, 2007).

Additionally, several NGOs and the international donor community have provided boreholes across the country in the effort to eradicate guinea worm and control other water-borne/related diseases (Mays, 2007). It is also well- documented that the lack of access to potable water contributes to poverty prevalence through the high economic cost of poor health (World Bank, 2010a; 2010d; NDPC/Govt.of Ghana/UNDP, 2010).

## 2.2 Water and Health & Hygiene Practices

The chronic ill-health contracted from patronage of surface water sources in rural communities not served with potable water infrastructure such as boreholes continue to undermine rural labour productivity, income earnings and wealth creation for investment for economic growth and emergence out of poverty. It also slackens, to the point of inertia, community organizing and virtually halts growth and development of rural communities (Hemson, 2009; Coulombe and Wodon, 2007; Jamison, et al, 2006).

When through the lack of basic needs people suffer extreme deprivations such as incapacitate and limit all possibilities of attaining well being and emergence from poverty, it becomes a permanent lifetime disadvantage and a tragedy (World Bank, 2005; Nussbaum, 2005). Conversely, when people are given potable water it supports and sustains their health. This maintains and empowers them to engage in productive livelihoods and earn income progressively to climb out of poverty (UNDP, 2006; World Bank, 2006d; Jamison, et al, 2006).

Very essential to poverty reduction and human development is the construction of infrastructure especially relating to potable water provision for improving health. The effect of the lack of potable water on health has been extensively documented and relates to illnesses of serious gravity contracted through the ingestion of water of very poor quality. Such illnesses include diarrhoea and dysentery, which are the major causes of infant and child mortality in developing countries (Bartram, 2008; World Bank, 2006d; Fay, et al, 2005).

The lack of potable water poses very heavy economic and social burdens when rural populations are infected and incapacitated by waterborne and water-related diseases. The disabling effects of these diseases negatively impact children's total health and their education, as well as the productive capacity of adults to make a living, and thus entrenching them in poverty. For instance, in Nigeria, it was reported that guinea worm infestation caused sixty percent of most absenteeism in schools in 2001 (World Bank 2010e; Selim and McCleery, 2005; Cairncross and Valdmanis, 2006).

In relation to health, the average person needs a minimum of five litres of water per day to survive in a moderate climate at an average activity level (UNDP, 2006). However, the daily minimum amount of water needed for drinking and cooking, bathing and sanitation is estimated at 25-50 litres by the World Health Organization (WHO/UNICEF, 2010; UNWWD, 2010; UNDP, 2006). Due to the lack of potable water in many rural communities water-related diseases may be caused by drinking water contaminated by human or animal waste or insects which breed in water and also water-borne diseases such as guinea worm and schistosomiasis.

Women and children also often suffer neck, knee, and shoulder injuries or long term spinal damage from carting water long distances by head poterage. Many inhabitants of remote rural communities also live in insecure physical environment and endure high prevalence of waterborne/related diseases (La Frenierre, 2009; Bartram, 2008; WHOSIS, 2008).

While the effect of safe water utilization is well known, illnesses of very serious nature contracted through the ingestion of water of poor quality, such as diarrhoea, have been indicated as the major cause of infant mortality. The United Nations has indicated that every year, around 10.8 million children die before their fifth birthday and, of these, four million die before they reach one month old, and some 92 percent of all deaths of children under-five years occur in just forty-two lower-income countries (World Bank, 2006c; UNDP, 2006; UNWWD, 2006).

However it is also estimated that 63 percent of all deaths of children under-five can be prevented using current knowledge and methods including better water supply and domestic hygiene, because there are obvious links between childhood sickness and mortality, inadequate domestic water and sanitation, and unsatisfactory hygiene practices (Bartram, 2008; Pruss-Ustun, et al, 2008; Gleitsman, et al, 2007). Also, waterborne/related illnesses often constitute a substantial economic liability to rural households that affects the productive capability of adults, as well as the health and education of children (World Bank, 2010e; Robilliard, 2009; Jamison, et al, 2006).

UNICEF and WHO have indicated that the problem of lack of access to potable water has reached such endemic proportions that about 2.2 million deaths per annum occur from unsanitary water, ninety percent of these are children under the age of five. For instance, it has been indicated that in 2003, 769,000 children under five years old in sub-Saharan Africa died each year from diarrhoeal diseases (Fay, et al, 2005). During the same period in south Asia, about 683,000 children of the same age category died each year from diarrhoea (WHO/UNICEF, 2006). Nearly 10% of the total burden of disease globally can be attributed to lack of access to safe water and poor hygiene, and the diseases associated with that claim about 3.6 million lives annually (Eckstein, 2009; Pruss-Ustun, et al, 2008; Bartram and Hutton, 2008). Access to improved water therefore is crucial because it often results in significant health, economic, and social gains.

The evidence assembled, therefore, indicates that the high morbidity and mortality trends attributable to the lack of potable water and the ingestion of water of poor quality supports the breeding of water borne/related diseases, especially diarrhoea, which excessively weakens their victims. Many children die from diarrhoea and its related infections but adults most often are left debilitated and so incapacitated that they are unable to attend to their livelihood occupations until after several weeks of treatment.

This further contributes to their already vulnerable and impoverished economic levels and makes occupational poverty pervasive in rural communities in developing countries (Sentlinger, 2011; UNICEF, 2010; McFerson, 2010).

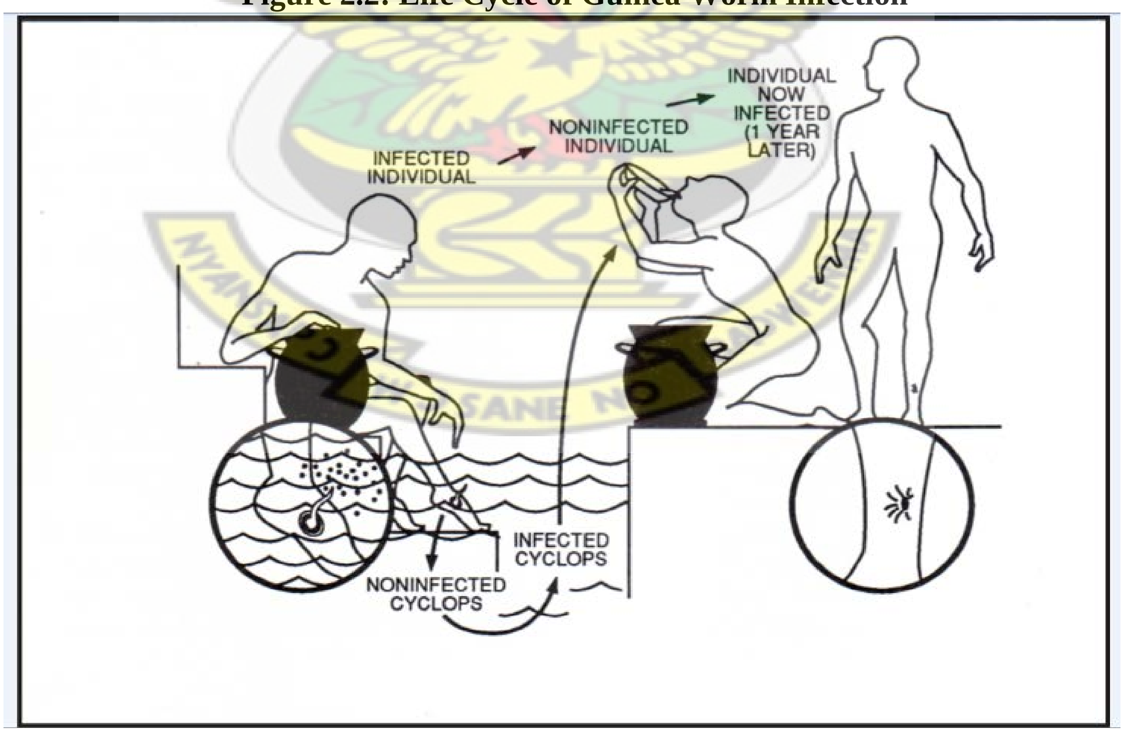
Again, adults spend much money seeking healthcare to treat their children and themselves when they experience diarrhoea episodes. This also results in the depletion of the meager financial resources they have and which they could have saved and invested to gradually lift themselves out of poverty. Recurring diarrhoea episodes also weakens school children who often absent themselves from school until they recover well. In sum, virulent diarrhoea episodes, such as is common and often experienced in many rural areas in the tropics, negatively impacts livelihoods and fosters poverty in four main ways: firstly, through child mortalities and related expenses; secondly, through physical incapacitation and energy depletion of victims and related costs of medical care; thirdly, through depletion of livelihoods working capital; and fourthly, limits effective participation in school by children when affected (UNICEF, 2011; World Bank, 2006d).

Trachoma is another water-related disease which is the leading cause of preventable blindness in the world. It has an estimated 146 million cases, six million of which have caused actual blindness. The disease is directly related to poverty, illiteracy and unhygienic crowded living conditions, particularly in dry dusty areas. Studies have however shown that with improved hygiene, access to potable water, and improved sanitation, trachoma can be eradicated from the earth (UNWWD, 2010; UNDP, 2006; UN Water, 2006).

Among the several other waterborne and water-related diseases which directly and indirectly impact poverty escalation, the most incapacitating is the guinea worm, also technically known as dracunculiasis. It is a water-borne parasite which infects nearly five million people every year (primarily in African countries) who are exposed when they drink water contaminated with the worm's larvae. This disease is caused by a microscopic parasite that enters its victims, through an intermediate host called cyclops, when they drink contaminated water as depicted in Figure 2.2.

The female worm eventually migrates painlessly, from the digestive system to a place just under the surface of the skin in any part of the body. There, it slowly and silently matures, and grows to a length of up to three feet. At maturity, which takes about a year after initial infection, the worm produces larvae that cause a burning blister in preparation to emerge. Eventually a full-grown adult worm emerges in a lengthy and painful process that can last more than two months, and thus totally incapacitates its victim (WHO/UNICEF, 2010).

**Figure 2.2: Life Cycle of Guinea Worm Infection**




**Source: UNICEF Sourcebook 1990:146**

At the point of emergence from the body, the disease's cycle of transmission is renewed once the blister bursts and a worm is exposed. It ejects thousands of microscopic larvae, contaminating the environment and infecting drinking water sources until it is completely removed. As shown in Figure 2.2, a person seeking relief from the burning blister by immersing the affected area in a water source spreads the larvae. One or more worms may emerge together from a victim's body and though the disease is rarely fatal, it can cause permanent disability and pose as a long-term liability amounting to a life cycle disadvantage. This may largely be a consequence of secondary infection of the open wound opened by the emerging worms from the victim (Pruss-Ustun, et al, 2008; Cairncross and Valdmanis, 2006).

People do not develop immunity to guinea worm, and infections reoccur year after year as people continue to patronize contaminated surface water sources. Even up to the 21st Century, modern medicine has not found a cure for the disease. In the traditional treatment, the worm was wrapped around a small stick and slowly pulled out of the flesh over a period of weeks or months, while in modern times the practice of physical extraction of the worm has been adopted by health authorities (World Bank, 2010a; WHO/UNICEF, 2010; UNDP, 2006).

Further, according to United Nations and the World Health Organization, the social and economic consequences of the guinea worm disease are very enormous. Children who are affected are unable to attend school for several months at a time while the worms incubate and emerge. Children who are not themselves infected do assume greater responsibilities at home and with farm work to help their households when their parents are incapacitated with the disease. The economic impact on families and entire villages can thus be devastating (UNDP, 2010; WHO/UNICEF, 2010; UNWWD, 2006).

Societies where the disease has been prevalent have borne enormous costs in terms of loss of social and economic freedoms, and time losses which have acted together to determine the destiny of entire populations for several decades as they lived in pervasive, cyclical, and generational poverty (McFerson, 2010; Bartram, 2008; Jamison, et al, 2006). Due to the fact that infection by the guinea worm larvae and the subsequent emergence of mature worms are a seasonal phenomenon, in highly endemic areas nearly the entire population of a community may become incapacitated. Therefore most often, a year's harvest for families and sometimes for an entire community can be lost when people are simultaneously incapacitated by guinea worm infestation within their households. Thus, opportunistic poverty created by guinea worm infestation also brings along with it occupational poverty. As at 2006, the UNDP indicated that Sub-Saharan Africa loses about 5% of GDP or some $28.4 billion annually on account of guinea worm and other diseases of poverty (UNDP, 2006).

However, the United Nations, UNICEF and WHO are all of the view that ensuring a safe drinking water source for only one year with simple, low cost interventions can interrupt the transmission cycle of guinea worm. All it takes is for community people in affected areas to be informed about the cause of the disease and they be motivated to drink safe water from boreholes exclusively for one year to interrupt the annual cycle of guinea worm transmission (UNDP, 2010; WHO/UNICEF, 2010; UNWWater, 2006). It is now common knowledge that a borehole fitted with a hand pump is the most secure and safe source of potable water for many rural communities where the guinea worm disease is prevalent (Mba and Kwankye, 2007; World Vision, 1993; 1996; 2003).

### 2.2.1 Access to Potable Water

According to the World Health Organization (WHO), access to potable water is measured by the number of people who have a reasonable means of getting an adequate amount of water that is safe for drinking, and all other essential household activities inclusive of personal hygiene practices (WHOSIS, 2008). However, it is estimated that more than one billion people in low and middle-income countries lack access to safe water for drinking, personal hygiene and domestic use, and it is estimated that these numbers represent more than 20% of the world's population (World Bank, 2010e; UNDP, 2010; Davidson and Esubalew, 2009).

Having access to potable water implies having sufficient quantities of water to meet personal hygiene, drinking and other domestic needs. This minimum quantity however vary depending on whether it is a rural and whether warm or hot climate. The quality of water recommended is that which is physically, chemically and bacteriologically safe for human consumption. Distance from the water point is also important in determining basic water requirements. Thus, the African Water Development Report (AWDR, 2006) describes basic water need of human beings to be 20 to 50 litres of uncontaminated water daily.

To properly conceptualize water accessibility and how it facilitates poverty reduction or otherwise, it should be assessed within the framework of basic indicators. The WHO has established basic indicators for measuring water accessibility at four main levels of water accessibility, as shown in Table 2.2. These indicators are: (1) Optimal access; (2) Intermediate access; (3) Basic access and, (4) No access. These are indicative of how far water is accessible from households, and basically reflect the extent to which accessibility challenges such as distance and time are problematic to sustainable well-being and livelihoods in rural communities (Davidson and Esubalew, 2009; Pruss-Ustun, et al, 2008).

**Table 2.2: WHO Standards – Indicators of Access to Water**

| Time spent to fetch water | Distance travel to fetch water | Water supply accessibility | Level of Health Concern |
|---|---|---|---|
| More than 30 minutes | More than 1000m | No access | Very high |
| 5 to 30 Minutes | Between 100 and 1000m | Basic access | High |
| Within 5 minutes | Within 100m | Intermediate access | Low |
| Water supplied through multiple taps continuously | Water supplied through multiple taps continuously | Optimal access | Very low |

**Source: Pruss-Ustun, et al, 2008:18**

Generally, the lack of potable water is one of the biggest problems that many poor rural communities face every day, and as depicted in Plates 1and 2, water hunting involves the risky and painful processes of scooping water from holes which becomes a normal feature of life in rural communities, especially during the dry seasons in Ghana and other places in Sub-Saharan Africa.

**Plate 1: Scooping water from a hole, Kupua Community - Atebubu District**

**Source: Fieldwork, 2006**

**Plate 2: Fetching water from a hole, Suntre Community - Afram Plains District**

**Source: Fieldwork, 2006**

**Plate 3: Scooping water in a Community, Meatu District, Tanzania**

**Source: WHO/UNICEF, 2007**

The main reason for the poor access to safe water is the inability by Governments in developing countries to finance and to adequately maintain the necessary water infrastructure (Selim and McCleery, 2005). To illustrate the point further, in Plate 3, Bob Metcalf captures the reality of Mwamanongu Village's water source in Meatu District, Shinyanga Region, Tanzania, where water most often comes from open holes dug in the sand of dry riverbeds (WHO/UNICEF, 2007).

### 2.2.2 Borehole Sustainability

In assessing the sustainability of water infrastructure in this study, the term 'sustainability' implies whether or not a facility continues to work over time. For a water facility, the implication is that water continues to be available for the period for which it was designed, in the same quantity and at the same quality as it was designed. It further implies that, for example, if a person can pump water from a borehole in 15 or 20 years time and the water comes out at the same rate and quality as the day the borehole was commissioned, then it is a sustainable water supply facility, provided that at some time the facility had not become dysfunctional to warrant complete rehabilitation (Abrams, 2011; Koestler and Koestler, 2008; Fosenka, 2008).

It has been noted that even in countries that are successful in expanding rural access to improved water sources, sustainability has become a major problem. The recurring problem in rural water systems is the lack of technical and financial capacity to maintain assets. This situation leads to rapid deterioration of rural water points to a point where they no longer provide the intended service, and populations are forced to return and rely on surface water sources (World Bank, 2010d; Skinner, 2009; Harvey, 2005).

It has been estimated that on average, one in three rural water points needs rehabilitation, and for a significant number of countries the share rises to at least one in two such as is found in the Democratic Republic of Congo, Madagascar, Malawi, Nigeria, and Tanzania (World Bank, 2010e). It has also been noted that inadequate maintenance of rural water systems reflects both institutional weaknesses and inappropriate technology choice. Besides, weak institutional capacity, insufficient maintenance is worsened by inadequate attention to technology choice, low pump density, restrictive maintenance systems, and lack of a supply chain to adequately supply borehole spare parts (Fisher, 2011; Estache and Maria, 2007; Harvey and Reed, 2007).

Studies conducted by Montgomery and others have indicated that the large percentage of non-functioning boreholes in Africa depicts the lack of adequate operation and maintenance, and the lack of sustainability services in rural communities. For instance, in a survey of 11 countries in Sub-Saharan Africa, the percentage of functioning water systems in rural areas ranged from 35-80% (Montgomery, et al, 2009). A study in South Africa also documented that as many as 70% of the boreholes in the Eastern Cape were not functional. Again, in a survey of 7,000 wells and boreholes in Tanzania, on average, 45% were in operation, and only 10% of systems that were 25 years or older were still functioning (World Bank, 2010e; 2006b).

This study critically examines sustainability strategies and processes built into the borehole drilling operations in the Atebubu and Afram Plains Districts by World Vision to ensure the sustainable provision of potable water to the rural communities served. The study also specifically assesses how these processes have facilitated and fostered poverty reduction or otherwise.

## 2.3. Water as a Human Right

Having access to potable water constitutes a basic human right. However it is estimated that over one billion people in developing countries globally still lack access, and the domestic water supply burden still lies on mostly women and children who trek and hunt for water for their households daily (WHO/UNICEF, 2010; La Frenierre, 2009; and Quentin, 2007).

It has been estimated that in order to ensure basic human needs, every individual needs 20 to 50 litres of water, free from harmful contaminants, each day (UNDP, 2006). This right to water was implicitly endorsed in the 1948 Universal Declaration of Human Rights (UNDHR). In 1977, the Mar del Plata Action Plan stated: ‘all peoples, whatever their stage of development and their social and economic conditions, have the right to have access to drinking water in quantities and of a quality equal to their basic needs'. In 2002 the United Nations Committee on Economic, Social and Cultural Rights (ICESCR) adopted the General Comment on the right to water. The Committee emphasized every government's legal responsibility to fulfill that right, and defined 'water' as a social, cultural and economic good in addition to being an economic commodity (Coulombe and Wodon, 2007; Mays, 2007).

The right to water applies primarily to water of acceptable quality and quantity for personal and domestic uses, implying an emphasis on affordable water supply. The need for access to water for farming and other productive uses is recognized, but while water is required for a range of different purposes, for example, to secure economic production and livelihoods, priority in the allocation of water must be given to the right to water for personal and domestic uses to facilitate reduction in poverty levels in rural communities (World Bank, 2010c; UNDP, 2010; Selim and McCleery, 2005).

Due to the lack of water, communities are unable to mobilize resources (human, financial and physical) to construct good school infrastructure to accommodate children in school (Serge, 2009; Mulkeen and Chen, 2008; Filmer, 2007). Teachers found in these rural areas are untrained and many are volunteers. The rural schools in communities without boreholes are characterized by low enrolment and high level of involuntary absenteeism culminating in high dropout rates (Mertaugh, 2009; Abadzi, 2007; Lockheed and Lewis, 2006).

Water is a very important asset for poor rural economies in sub-Saharan Africa. Therefore striving to achieve continual potable water availability to build stable rural communities is quintessential for advancing water infrastructure development for poverty reduction. Also, water infrastructure development has long been recognized as being cardinal in fostering educational attainments worldwide, and also at national level (World Bank 2010c; 2010e; Hanushek and Woessmann, 2007a).

In terms of education being a basic human right, potable water availability is cardinal to the promotion of beneficial educational outcomes. For example, gaining employment, productivity gains, increased income and capacity to exercise choice in employment, and the ability to specialize and diversify opportunities, are all direct economic benefits for poverty reduction resulting from access to education and quality education delivery. All these can be ascribed to both direct and indirect benefits resulting from the provision of potable water infrastructure (Fredriksen, et al, 2010; Psacharopoulos and Patrinos, 2007).

The converse and tragic scenario holds in the situation where the lack of potable water in rural communities directly compromises excellent educational outcomes and rather limits and constrains children to follow and inherit the paths of endemic and generational poverty they find their parents consigned to. In such constraining physical environment, issues such as time poverty, very low school enrolment levels, low school attendance, and lack of basic substantive freedoms are obvious and prevalent. These elements compound and entrench rural children in poverty and stretch the phenomenon of place-of-birth disadvantage to its ultimate limits of lack of opportunity and choice (Molinas, et al, 2010; Patrinos, et al, 2007; World Bank, 2006a; 2005). Also in discussing the limitations the lack of access to quality education poses to children’s potential in future lucrative occupations, Kingdon and Soderbom (2008), are of the view that education facilitates entry into lucrative occupations and that the benefit of quality education or otherwise ameliorates economic inequality or exacerbates it.

## 2.4. Water and Agriculture

Agriculture has been identified as the most water-demanding sector in rural livelihood occupations. Also it is the major source of employment, and a major contributor to the national gross domestic product (GDP) of many countries in Sub-Saharan Africa (Singh, 2009; MOFA, 2007). However, to consider the role of water in agricultural production in this study, it is necessary to understand the impact of improved water supply on the socio-economic livelihood, circumstances of rural households, and how these relate to poverty reduction in rural communities. This study therefore diverts from the traditional discussions on the availability of water for crops production and examines the critical role potable water availability plays in the labour productivity and poverty reduction equation.

It is being emphasized in this study that potable water availability is crucial in attracting labour for farm activities and also in facilitating effective labour performance on farms to promote increased cultivation and subsequent increased production. Affirming Singh's (2009) view of the crucial importance of agriculture in rural areas where the principal occupation of the population is farming, practical necessity demands that there should be water for domestic use, as well as for drinking on the farm by farm hands, and for their food preparation. This is to facilitate the process and sustenance of the application of all efforts or labour to positively influence consistent increase in agricultural production as a livelihood occupation (Singh, 2009; Poulton, 2009).

## 2.5. Poverty and Poverty Reduction

### 2.5.1 Overview of Poverty and Defining Poverty

In defining poverty, it has become clear that poverty is not merely an issue or problem relating to low level of income but also related to non-income aspects as well. It is a phenomenon of many dimensions covering aspects such as social, economic, environmental, physical/infrastructural, institutional/political as well as cultural, ethnic and gender (Prahalad, 2010; Collier, 2007; World Bank, 2006b).

In relation to the explanation above, poverty implies not only the lack of adequate income due to constraints posed from diverse sources, but also the lack of any other assets on which a person might draw for sustenance, and also use to command economic resources for daily use (World Bank, 2011b; Sachs, 2008). To understand the nature of poverty and what causes it is very crucial because it tends to determine the responses to poverty.

While people need food, shelter, potable water, and clean air, they also need an environment that supports their livelihoods development progressively for generating income and growing wealth to improve the quality of their lives and for investments. Therefore if these basic support systems are wholly or largely absent, or compromised by the lack of potable water, and water borne/related diseases abound, it promotes poverty prevalence (Prahalad, 2010; London, 2009; and Sachs, 2005).

Poverty is also often viewed as a deprivation of common necessities that determine the quality of life, including food, clothing, shelter and safe drinking water.  It also includes the deprivation of opportunities for quality education, to obtain better employment to escape poverty, and to enjoy the respect of fellow citizens. Thus, the acute deprivation of people of any of these or a combination of these basic human survival necessities do precipitate poverty, which if not resolved early, eventually becomes endemic, systemic, cyclical and generational (Sachs, 2008; Singh, 2009; and World Bank, 2008; 2006b).

The cycle of poverty is also defined as a phenomenon where poor families become trapped in poverty for at least three generations (Marger, 2008; Sachs, 2008; Myers, 2004). These families have either limited or no resources and are caught-up in a chain of disadvantages that collectively work in a circular process making it virtually impossible for individuals to break the cycle. This occurs when impoverished people do not have, and are unable to command the resources necessary to get out of poverty such as financial capital, health and education. Thus poverty-stricken individuals experience disadvantages as a result of their poverty, which in turn increases their poverty, which by implication constrains the poor to remain poor throughout their lives (Prahalad, 2010; Coulombe and Wodon, 2007; Nussbaum, 2005; and Sachs, 2005).

In recent years, new literature in relation to the concept of poverty has emerged. These are based mainly on the philosophical concept propounded by Nobel Prize laureate, Amartya Sen (1999). His ideation of poverty is based on the issue of human welfare captured in the concept of capability – the ability of people to live the kind of life they value. Applying this concept of poverty has created awareness that has led to the recognition that poverty is intrinsically multidimensional in nature, and consists of the failure of several kinds of basic capabilities also as indicated by Myers (2004) and Nussbaum (2005). This recognition challenges the hitherto prevalent concept that poverty was simply and singularly, a matter of low income. This realization therefore requires new approaches to poverty assessment and measurement, which embraces integrated approaches of quantitative and more extensive non-traditional qualitative methodologies utilization to capture the realities of poverty (African Development Bank, 2011; World Bank, 2011b; and Hemson, 2009).

### 2.5.2 The Freedom-centered perspective of poverty reduction

Human development requires the removal of major sources of lack of freedom such as poverty, poor economic opportunities, as well as systematic social deprivation, among others. The freedom-centered perspective of poverty reduction resonates with these aspirations and other theories on "quality of life" which also focus on the well being of human lives especially the improved choices one has acquired over a period of time in addition to the capacities acquired and income that a person earns (Singh, 2009; Sen, in UNDP, 2007; and Sachs, 2005).

Sen (1999) and Nussbaum (2005), are of the view that while substantive and instrumental freedoms are not only the primary ends of development, they should be counted among its principal means. It is, therefore necessary to understand the empirical connection that links freedoms of different kinds to one another. For example, where freedoms of different kinds can strengthen one another to promote economic security and social opportunities (in the form of education and health facilities) facilitate economic participation. Economic means and facilities (in the form of opportunities for participation in production and marketing or trade) can also help to create personal wealth. Basically, there is a fundamental relationship between incomes and achievements, between commodities (capacity or assets acquired) and capabilities, between an individual's economic wealth and a person's ability to live as he/she likes (Nussbaum, 2005).

Thus, Sen is of the view that poverty reduction, as a development tool, has to be more concerned with enhancing the lives people lead and the freedoms they enjoy (Sen in UNDP, 2007). This viewpoint of Sen, involves both the processes that allow freedom of actions and decisions, and the actual opportunities that people have, given their local, personal and social circumstances. Both processes and opportunities have importance of their own, and each aspect relates to seeing poverty reduction as freedom.

In this study, evidence on the impact of the extensive provision of potable water infrastructure in the form of boreholes in the study area has been employed to investigate and establish the reality of poverty reduction in rural communities as a process of emerging substantive freedoms, and how that facilitates acquisition of instrumental freedoms towards progressive poverty reduction.

**2.5.3 Measurements of Poverty**

Poverty can be measured in absolute or relative terms. Sachs has indicated that absolute poverty implies that households cannot meet basic needs for survival. Further measurement indicators include chronic hunger, inability to access healthcare, lacking safe drinking water and sanitation facilities, parents' inability to afford cost of education for their children, and living in bad shelter. Relative poverty, he indicates, refers to household income level below a given proportion of average national income (Sachs, 2005). Further, the World Bank (2008) indicates extreme poverty as people living on less than US$ purchasing power parity (PPP) 1 per day, and moderate poverty as less than $2 a day. On that basis the Bank estimated that in 2001, 1.1 billion people had consumption levels below $1 a day and 2.7 billion lived on less than $2 a day.

Examining the period 1981-2001, the percentage of the world's population living on less than $1 per day has halved. Most of this improvement occurred in East and South Asia. Also in East Asia the World Bank reported that the poverty headcount rate at the $2-a-day level was estimated to have fallen to about 27 percent in 2007, down from 29.5 percent in 2006 and 69 percent in 1990 (World Bank, 2006a; World Bank, 2007).

In contrast, Sub-Saharan Africa experienced a rise in extreme poverty which rose from 41 percent in 1981 to 46 percent in 2001. This combined with growing population, increased the number of people living in poverty from 231 million to 318 million. World Bank data as indicated on Table 2.3 shows that the percentage of the population living in households with consumption or income per person below the poverty line has decreased in each region of the world since 1990. Notably, in Sub-Saharan Africa, poverty reduced from 46.07% as at 1990 to 41.09% in 2004 (World Bank, 2007; 2006c).

**Table 2.3: Poverty levels comparison across continents**

| Region | 1990 | 2002 | 2004 |
|---|---|---|---|
| **East Asia and Pacific** | 15.40% | 12.33% | 9.07% |
| **Europe and Central Asia** | 3.60% | 1.28% | 0.95% |
| **Latin America and the Caribbean** | 9.62% | 9.08% | 8.64% |
| **Middle East and North Africa** | 2.08% | 1.69% | 1.47% |
| **South Asia** | 35.04% | 33.44% | 30.84% |
| **Sub-Saharan Africa** | 46.07% | 42.63% | 41.09% |

**Source: World Bank, 2007: 3**

### 2.5.4 Poverty Reduction Strategies

According to Lazarus, while the World Bank and the IMF require countries to produce a Poverty Reduction Strategy Paper (PRSP) as a condition for debt relief through the Highly Indebted Poor Country (HIPC) initiative and other monetary aid, the PRSPs are intended to help aid recipient countries meet the Millennium Development Goals (MDGs). They also show details of a country's plan to promote growth and reduce poverty through implementation of specific economic, social and structural policies over a period of three years or longer (Lazarus, 2008). PRSPs provide lending organizations, like the World Bank and the IMF assurance that aid receiving countries will utilize aid to pursue development outcomes that have been elaborated in the PRSPs and approved by lenders.

Poverty Reduction Strategy Papers are essentially about prioritizing budget allocations in order to achieve poverty reduction objectives. As such, the development of PRSPs presents an important opportunity for those working for water supply improvements, which historically is poorly prioritized and inadequately funded by governments. The PRSP must be based on an analysis of the multiple causes of poverty and target integrated strategies on addressing these causes. For example, when poor people are directly asked about poverty in the majority of cases they identified the lack of access to water as one of the key causes of poverty, and, improving access to water as one of the top priorities in reducing poverty (Calaguas and O'Connell, 2003).

In their discussion on "Water Supply and Sanitation in Poverty Reduction Strategy Papers in Sub-Saharan Africa" Mehta and Fulgelsnes, strongly indicated that the importance of water supply for poverty reduction is inadequately represented in the development of poverty reduction strategy papers (PRSPs) in Sub-Saharan Africa. They are of the view that, the nature of the opportunity presented by the PRSP and HIPC initiatives for the Water Supply and Sanitation sector in Sub-Saharan Africa is so important that the water sector has to engage in the PRSP process and ensure it receives adequate attention in PRSP documentation (Mehta and Fulgelsnes, 2003).

Further, the African Development Bank (ADB) is of the view that the provision of adequate water is vital to improving living conditions, and also to ensure health and quality of educational opportunities, and that increased access to water and hygiene promotion do create improvements in people's health through better hygiene practices. It also has an indirect positive effect on educational opportunities and the empowerment of women. Easy access to safe water sources also frees women and children from spending several hours every day drawing and carrying water home. They estimate that as much as one-quarter of household time in rural Africa is spent on fetching water (ADB, 2011).

Safe water provision underpins every effort towards economic growth and poverty reduction. For instance, income benefits for both households and government may result from a reduction in the costs of health treatment and gains in productivity. Labour productivity gains stem from time saved from collecting water, the availability of water as an input to the productive sector, and a decline in water-related illnesses. The benefits of improved water and the priority given to them by the poor in Sub-Saharan Africa therefore justify the inclusion of water supply in all PRSPs (Mehta and Fulgelsnes, 2003).

## 2.6 The Gaps in Literature Reviewed

The literature reviewed as shown in this chapter of the study, could not reveal a rural water supply programme through boreholes provision of the scale, magnitude and timeframe, similar to what is being studied for comparative review despite the plethora of literature on water and sanitation. Even the magnitude of poverty studies carried-out by the Poverty Group of the World Bank in 60 countries in 1999, which formed the basis, subject and content of the 2000-2001 World Bank annual reports, and also a major landmark study by the UNDP as captured in its 2006 Human Development Report, could not specifically identify, capture and document the extensive contribution of boreholes provision in bringing about massive poverty reduction as explored in this study.

There is also not much evidence on how boreholes have served as a catalyst for sustainable improvement in rural livelihoods, particularly in restoring health, fostering hygiene practices, and facilitating improved incomes, wealth creation and investments, as well as improvements in quality education attainment in rural communities. Furthermore, the literature reviewed and captured in this chapter showed little contribution nor specific attribution to boreholes provision as the most powerful guinea worm eradication panacea, and which has singularly contributed so much to poverty reduction and the spontaneous improvement in the quality of life of rural populations.

A review of poverty reduction strategies revealed water supply (especially through boreholes provision) as a vital missing policy element which could have been employed as instruments for poverty reduction. Also, official government analysis of poverty reduction trends in Ghana, as captured in the Ghana MDGs implementation reports for 2006 and 2008 also fail to account for boreholes provision as a vital catalyst accounting for the accelerated poverty reduction in Ghana from the 1990s to date.

The study did not encounter any literature on how, in spatial terms, the provision of boreholes specifically served as a platform facilitating the regaining of people's substantive freedoms that empowered them for gradual emergence out of poverty. Therefore as a contribution to the advancement in knowledge, this study specifically seeks to fill these critical gaps identified during the review of literature. Also, based on the results from the study, a new approach of using boreholes provision as a key developmental strategy tool to facilitate and accelerate poverty reduction in rural communities will be recommended.

# Chapter Three

# THE STUDY AREA

## 3.0 Introduction

As already indicated in Chapter 1 section 1.2 of this study in relation to the Problem Statement, the extenuating factors of adverse geography existing in the Atebubu and Afram Plains (the study area), made World Vision provide boreholes. Thus the two Districts were chosen for this study, not for comparative analyses but to examine the scale of the said existing problems prior to the provision of boreholes, and the magnitude of the impact made after boreholes provision. The control factor introduced into the study helped to determine what the actual situation could have been like without boreholes being provided in the study area.

This Chapter also provides details of the physical and socio-economic profiles of the two Districts to show where the survey was carried out to collect primary data for this study. The results obtained from the two Districts are discussed subsequently in Chapters four and five, and conclusions arrived at and recommendations given in Chapter six of the study.

## 3.1 The Study Area in Regional Context

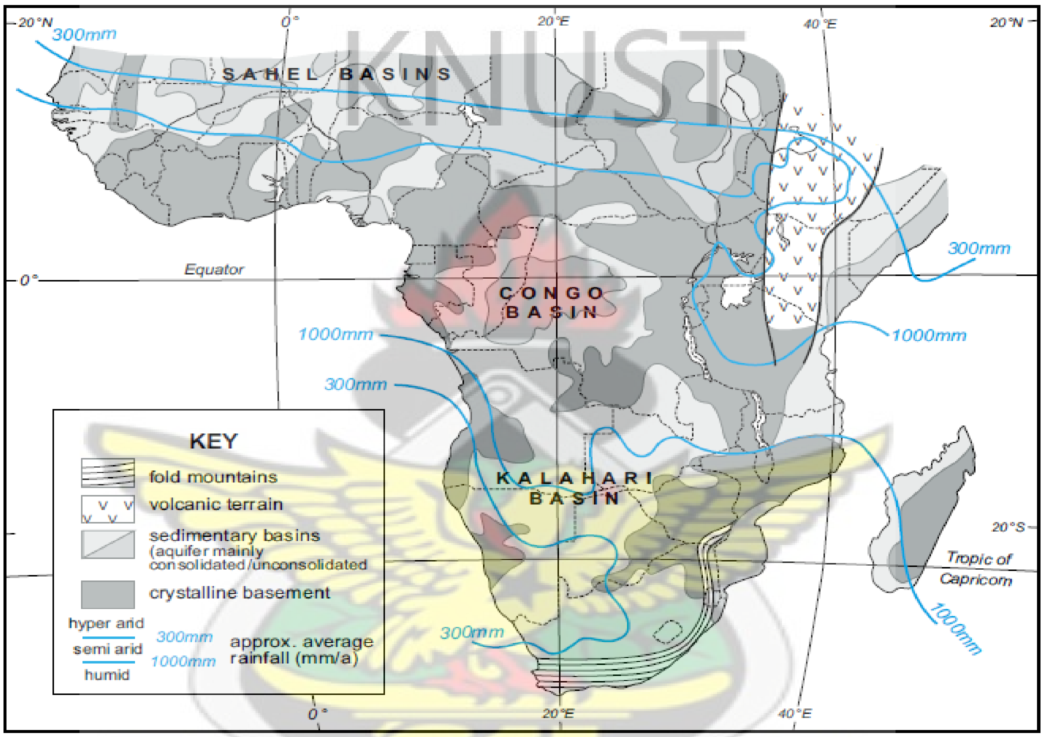
To position this study in its geographical context, the Republic of Ghana is located in West Africa as shown in Map 1. It is about 750km from the equator on the Gulf of Guinea, between latitudes 4˚ and 11½˚ North and longitudes 3˚ West and 1˚ East, and on the Greenwich Meridian. Occupying a land size of 238,537sqkm, northwards, Ghana is bordered by Burkina Faso, the Republic of Togo eastwards, the Ivory Coast to the west, and to the south by the Atlantic Ocean. Ghana has 10 administrative regions with its capital city as Accra. The 2010 national census results indicated the Country has a population of 24,223,431 (Ghana Statistical Service, 2012; Govt. of Ghana, 2007; Foster, et al, 2006).

As already indicated in Chapter two of this study, in Sub-Saharan Africa about 80% of the 300 million people who live in rural areas are without access to potable water sources (McDonald, 2005b). This scenario evokes a helpless, disempowering condition of acute adverse geography, in which the study area – the Atebubu and Afram Plains, are located. This chapter examines and describes the existing situation as at when the survey was conducted.

In many countries in Africa, Foster, et al, (2006), have indicated that during the 1970s, the introduction of deep drilling machinery facilitated boreholes delivery and spontaneous growth of rural communities as populations increased. Currently, in several communities in rural Africa boreholes equipped with reliable hand pumps constitute the most reliable water supply infrastructure that enables communities to function effectively. Currently there is very high dependence, estimated at over 75%, on boreholes patronage to meet household water needs, promoting livelihoods occupations, and enabling children's regular school attendance in Africa south of the Sahara, which includes the study area.

Map 1 depicts the various geological formations yielding ground water in Sub-Saharan-Africa and which serves as the basis for exploration for providing boreholes to rural communities of which the study area forms a part. The crucial function of ground water and its vital utility value to rural communities cannot be underestimated. This is because successful boreholes provision helps to meet rural household needs in terms of its ability to curtail health and hygiene challenges in the rural communities.

**Map 1: Hydro geological map of Sub-Saharan Africa showing areas with sedimentary basins suitable for boreholes provision**




**Source: Foster, et al, 2006:2**

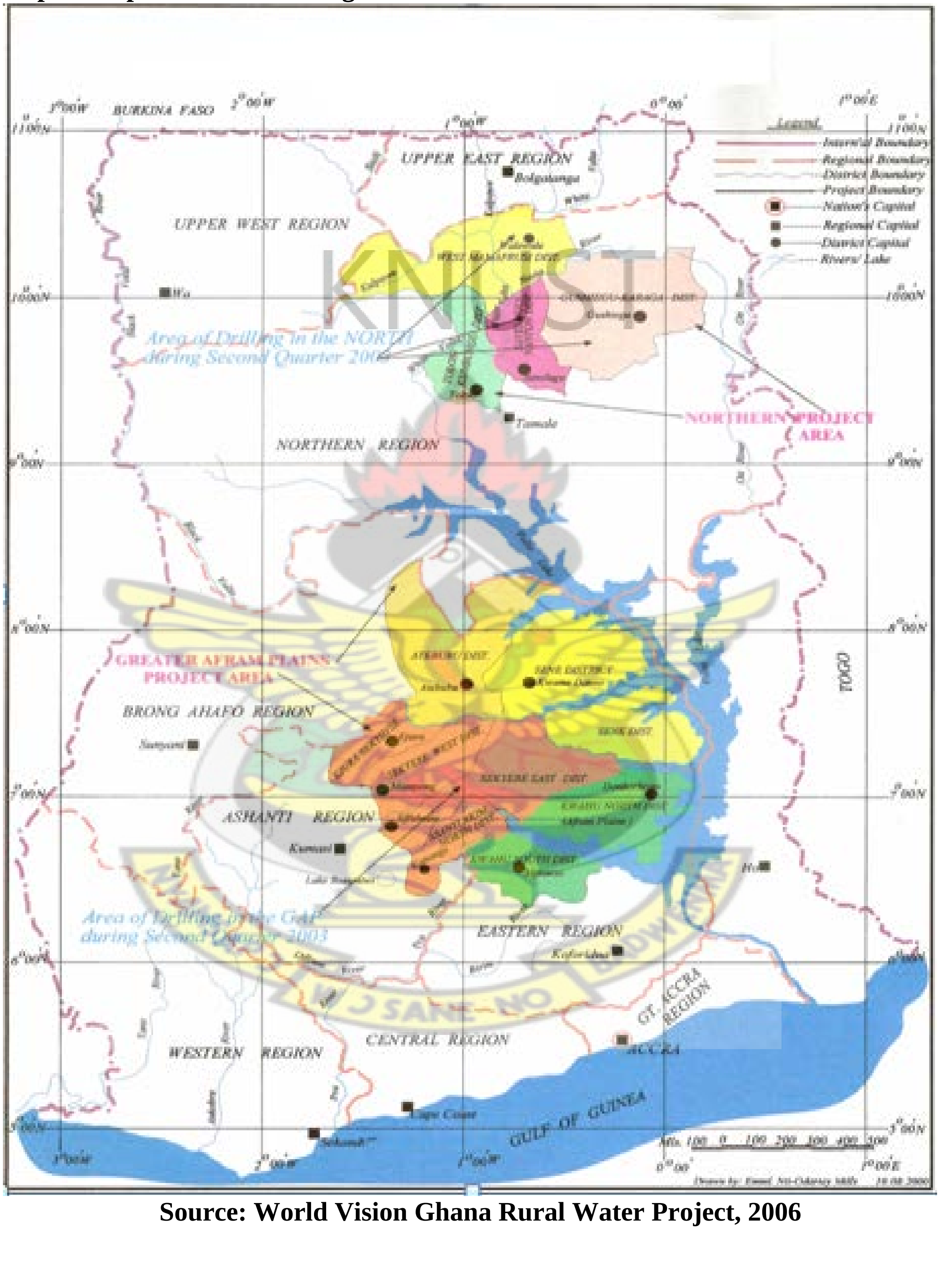
Groundwater also provided improvements in socio-economic opportunities by preventing continual reliance on polluted surface sources associated with several waterborne/related diseases. Thus, introducing boreholes to the Atebubu and Afram Plains Districts constituted a major intervention and the platform needed to eradicate guinea worm which incapacitated and immobilized the populations in many rural communities. Also the boreholes provided have very high domestic utility value including consistently providing potable water for the all-important multiple domestic uses which include drinking, and personal hygiene purposes such as face-washing, bathing, laundry, and cleaning (Davidson and Esubalew, 2009; Gleitsman, et al, 2007).

## 3.2 Overview of the Atebubu and Afram Plains Districts

The basis which informed and justified the choice and the adoption of the Atebubu and Afram Plains Districts for this study include: distance and location in terms of rurality; geological formation conducive for boreholes drilling, which is the Voltaian type; ecology, in terms of similar vegetation types; climate, in terms of similar temperatures and rainfall regimes. In terms of population, both districts host heterogeneous ethnic groups, and are migration destinations. Both districts are recipients of environmental refugees because both districts have fertile lands supportive of agrarian livelihoods. There is also the commonality of adverse geography, with both districts having the highest caseloads of guinea worm infestation as at 1987 (GHS/GWEP, 2007).

Put in context, the Atebubu and Afram Plains Districts are located within a broader geographical domain termed as the Greater Afram Plains of Ghana as shown in Map 2. The Project area is bordered on the east by the Lake Volta and includes portions of three administrative Regions – Ashanti, Brong Ahafo, and Eastern. The Atebubu and Afram Plains Districts were also chosen for this study because they were considered to be the poorest in the Brong Ahafo and Eastern Regions respectively (GSS, 2000). Both districts lacked basic socio-economic infrastructure when compared with other districts. The geographical location of this study is primarily rural and the two districts share almost the same climatic types, geological formations (Govt. of Ghana, 2007), and vegetation type.

**Map 2: Map of Ghana showing location of Atebubu and Afram Plains Districts**




**Source: World Vision Ghana Rural Water Project, 2006**

However, in terms of geographical space and locations, the two districts are almost 312 kilometres apart. Atebubu district is in a north-eastern location while Afram Plains District is in a south-eastern location.

In terms of ecology, Atebubu district's climate and vegetation aligns more with that of the Northern Region of Ghana while the Afram Plains District is characterized by more of the forest ecology of the Eastern Region of Ghana but portions have Savannah type of climate/vegetation due to massive deforestation attributed to perennial bush fires, which is of common occurrence in the whole of the Greater Afram Plains. The magnitude of rainfall received annually in the Atebubu and the Afram Plains Districts ranges from 1400 to 1500mm (Dickson and Benneh, 2004).

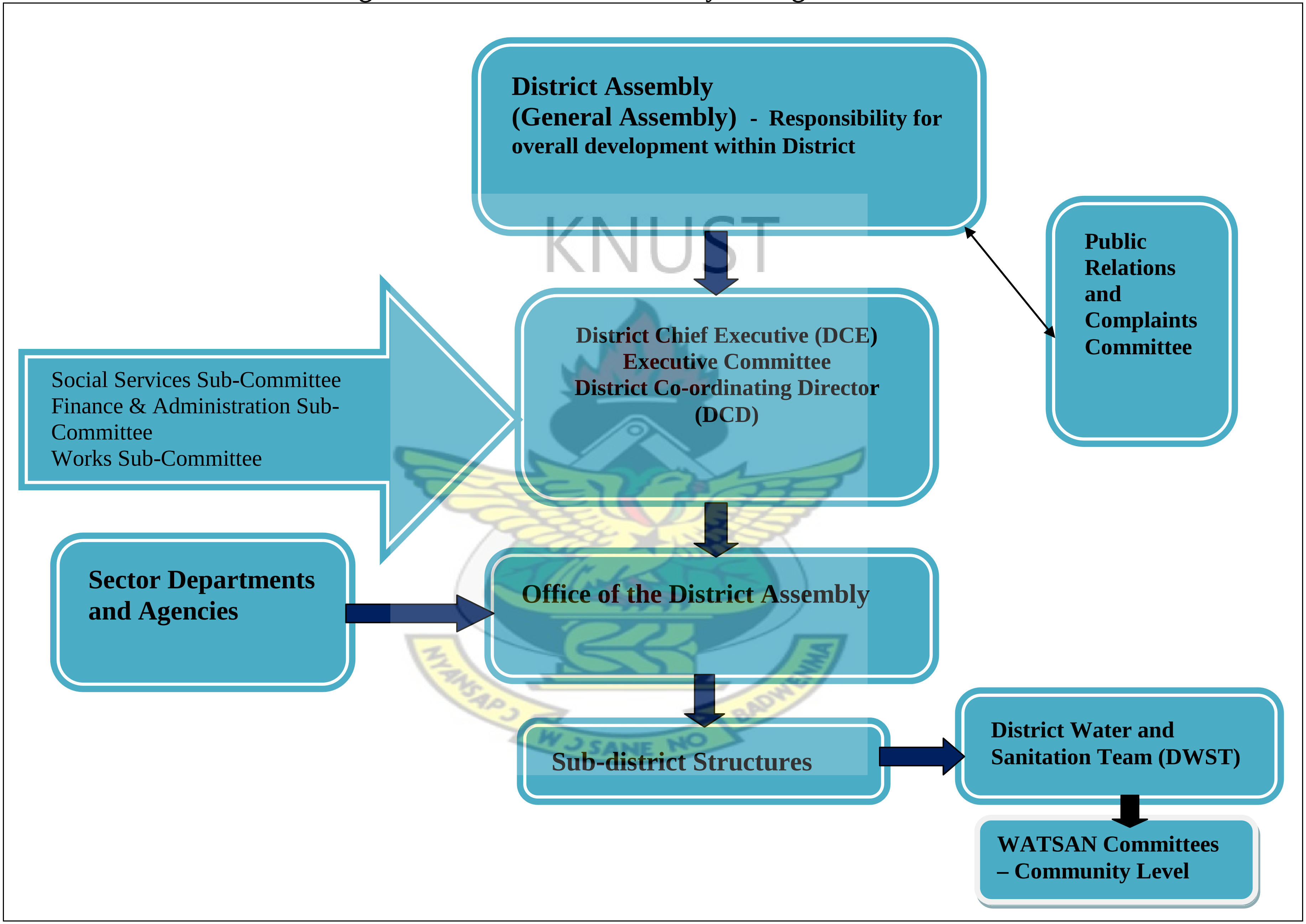
Under the influence of the South West Trade Winds, both districts experience the monsoon rains from May to August each year. The two Districts both have dry Guinea savannah woodland landscape typically characterized by baobab and acacia plants which are suited to the long dry season, along with thorny bushes and grasses. The two Districts also have few non-perennial rivers and streams which easily dry up during the dry season spanning November to March. This type of living environment fosters conditions of adverse geography characterized by the prevalence of water- borne/related diseases such as guinea worm, trachoma, schistosomiasis, and diarrhea. The extensive patronage of surface water sources infested with waterborne/related disease vectors and parasites is in itself a causative factor of ill-health which entrenches rural inhabitants in opportunistic and occupational poverty (Bartram, 2008; Mba and Kwankye, 2007, Jamison et al, 2006). Despite the presence of the Lake Volta and its estuaries, many water sources dry up during the dry season and communities in these districts had no alternative but to depend on contaminated surface water sources most often infested with guinea worm and other waterborne and water-related diseases (World Vision Ghana, 2007a; 2007b).

Therefore at the inception of the borehole drilling operations by World Vision in 1990, these two Districts had the highest level of guinea worm caseloads in the country, with over 3,000 cases per each District (Ghana Health Service, 2007). As already indicated, conducting this study in these two districts with similar geographical and geological terrain characteristics, was not for purpose of comparison, but to ascertain and verify the magnitude and impact effectiveness of World Vision Ghana's borehole provision programme which was meant to provide potable water to the poverty-stricken rural communities to eradicate guinea worm and other water borne/related diseases.

Government's decentralization process in Ghana came with the devolution of power from the central government to lower levels of administration in the form of District Assemblies (DAs). The theoretical foundation implies that services are more effectively delivered by administrative levels closer to the population being served, however, most often it is not the conceptual aspects but the actual implementation that are flawed (Selim and McCleery, 2005).

As shown in Figure 3.1, within the decentralization process District Assemblies have overall responsibility for all development within their Districts. District Assemblies formulate and implement development plans, programmes and strategies for the effective mobilization of resources for overall development in their districts under the Local Government Act, 462, 1993.

**Figure 3.1: The District Assembly Management Structure**




**Source: ILGS, 2012: 22 - Modified**

The District Assembly is the highest political, administrative and deliberative authority in the District. It guides, directs and supervises all other administrative authorities in the District. It also exercises deliberative, legislative and executive function and is responsible for the preparation and approval of annual budgets. As shown in Figure 3.1 the structure of the District Assemblies is as follows: the General Assembly; the Executive Committee and sub-Committees; and, the Office of the District Assembly (Local Govt. Atebubu-Amantin District Assembly Establishment Instrument, 2004).

The District Planning and Coordinating Unit (DPCU) is responsible for planning and monitoring and the preparation of District Water and Sanitation Plans (DWSP). The policy on community management of water supply in rural and small towns places considerable responsibility on District Assemblies to ensure that water facilities are well-managed and sustained. District Water and Sanitation Teams (DWSTs) represents the District Assemblies in water and sanitation activities and ensure integration of water and sanitation in the district planning agenda. The District Assemblies support community level structures to function so that they are able to manage rural water and sanitation effectively (ILGS, 2012).

One of the key principles for decentralized water management under the National Community Water and Sanitation Programme (NCWSP) is community ownership and management (COM). For decentralized Water management the NCWSP has established structures at the District and Community Levels as follows:

At the District level, a 3-member District Water and Sanitation Team (DWST) – established by each District Assembly to serve as the technical arm of the District

Assembly for the delivery of water and sanitation facilities/services. The team comprises a Technical, Community Development, and Hygiene and Sanitation expertise.

At the Community level, a Water and Sanitation Committee (WATSAN Committee), established and trained in each community, which is provided with a borehole with a hand pump, as the source of water. The key role of the WATSAN Committee is to operate and manage the water facility on behalf of the community and carry out repairs on the water facility.

It is necessary to note that since the survey was carried out to collect data for this study in 2006, other Districts have been created out of the Atebubu and Afram Plains Districts. The Atebubu District has been divided into two Districts as the Pru and Atebubu-Amantin Districts, while the Afram Plains District has been divided into the Kwahu-North Afram Plains, and the Afram Plains South Districts. In respect of location, time and distances, nothing has changed in respect of the data collected for the study. The data collected still represents the two original Districts as they were before being divided. The divisions of the two Districts are for purposes of national political administration convenience but do not affect the geographical status quo. Also, in terms of potable water provision the mandate of all the District Assemblies still remain the same – that is, “to ensure the provision of adequate and wholesome supply of water throughout the entire District in consultation with the Ghana Water Company.”(Local Govt. Atebubu-Amantin District Assembly Establishment Instrument, 2004:4).

## 3.3 Physical Background – Atebubu District

### 3.3.1 Location

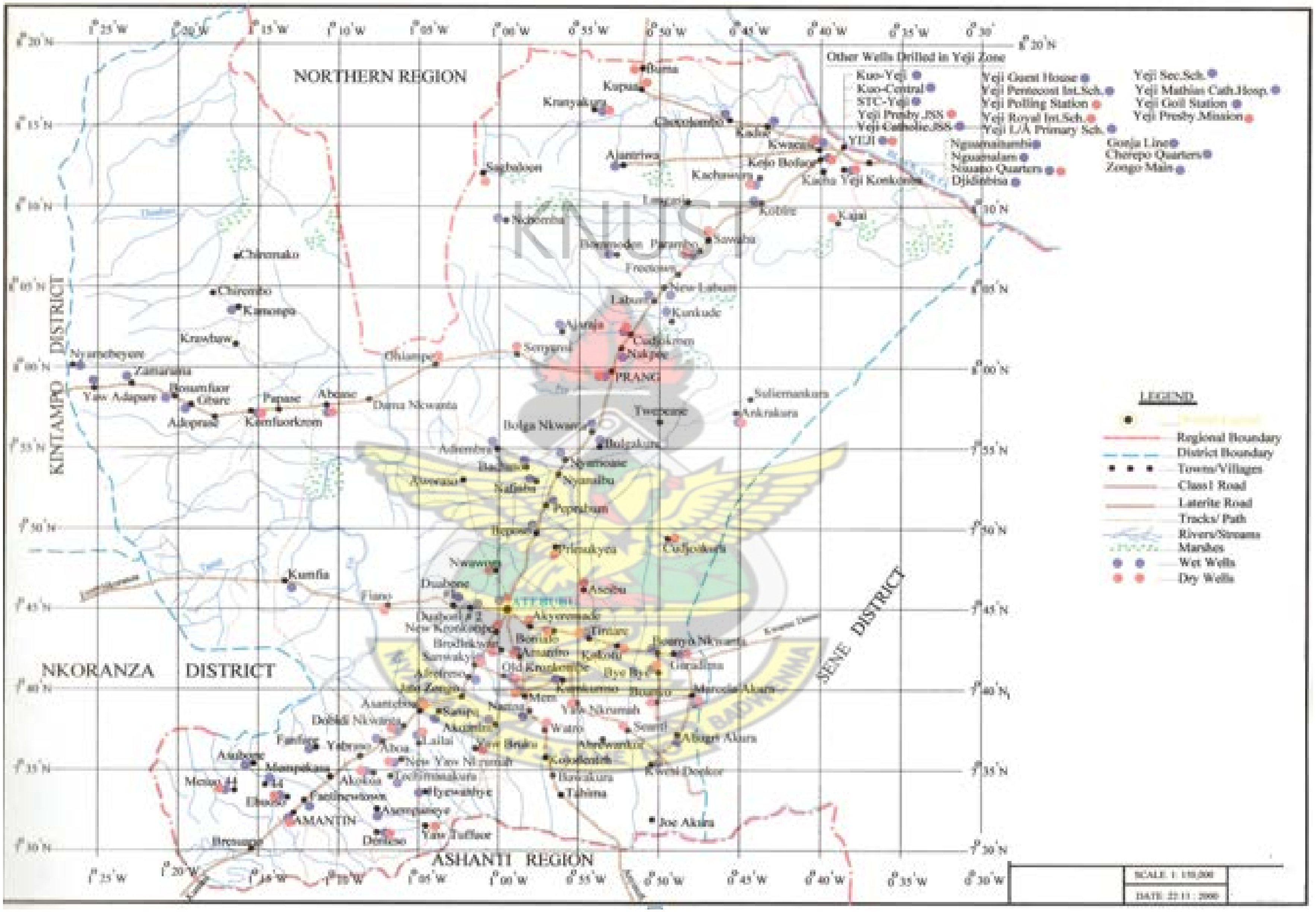
As shown in Map 3, the Atebubu District is located between latitudes $7^0$ $23^0$N and $8^0$ $22^0$N and longitudes $0^0$ $30^0$ W and $1^0$ $26^0$W. It shares boundaries with the Pru District to the North and the Sene District to the East, both in the Brong Ahafo Region. To the South, it is bounded by three Districts in the Ashanti Region, namely Ejura-Sekyedumase, Sekyere East and Sekyere West Districts. To the West, bounded by the Nkoranza and Kintampo Districts. The District Capital (Atebubu) is about 158km from Sunyani, the regional capital. The District has a land surface area of about 5,990 square kilometers (Govt. of Ghana, 2007; World Vision Ghana, 2007a).

### 3.3.2 Geology and Soils

The rocks underlying the District are part of the "Voltaian formation" which covers about two-fifths of the surface area of Ghana. The rocks belonging to this formation are mainly sedimentary and exhibit horizontal alignments, which are very suitable for boreholes provision. Stones, slate, mudstones and limestone are the principal examples of the rocks. Soils in the District belong to a group called "groundwater lateritic soils".

Though this formation has a demerit of posing difficulty in terms of underground water exploitation, it has so far supported the provision of several boreholes in this District as evidenced in this study (Govt. of Ghana, 2007). Most of the soils are fine-textured, ranging from fine sandy loams to clayey loams, and are mostly poorly-drained but has a plain landscape with rolling and undulating land surface with a general elevation of between 60 - 300 meters above sea level, and located in the Voltaian Basin.

**Map 3: District Map of Atebubu showing communities entered for survey**




**Source: World Vision GRWP, 2000**

The District's landscape is mostly drained by the Pru, Nyomo and Bresuo rivers. The water table in the District is however very low, resulting in the drying of water bodies including shallow hand-dug wells especially during the dry season (Govt. of Ghana, 2007; Foster, et al, 2006). This had significant adverse water scarcity implications for inhabitants prior to the provision of boreholes which this study investigates.

### 3.3.3 Climate and Vegetation

The Atebubu District experiences the tropical continental or interior Savanna type of climate; which is a modified form of the wet semi-equatorial type of climate. The total annual rainfall is between 1400mm to 1500mm and occurs in two seasons. The first rainy season begins in May whilst the second rainy season begins in late September. Mean annual temperatures range between $26.5^0$ C and $27.2^0$ C (Dickson and Benneh, 2004). The Atebubu District is at the transitional zone between two major climatic regions in Ghana, and thus the District comes under the total influence of the North-East Trade Winds (Harmattan) from November through to April, and the South-West Monsoon winds from late April through to July. This climatic pattern experienced in the District had serious implications in terms of potable water availability. Prior to boreholes provision, especially during the harmattan season when most surface water sources dry up and the inhabitants had to trek for several kilometers and hours hunting for water from the environment to meet their domestic needs (World Vision Ghana, 2007a).

This situation was characterized by time poverty and compounded by ill-health that was directly attributable to patronage of poor quality surface water and fatigue with the concomitant effects of poor livelihoods development, low productivity, and low incomes (Davidson and Esubalew, 2009; La Frenierre, 2009; Quentin, 2007). These created pervasive poverty which was prevalent in the District. These constraints constitute the main elements of this study.

The District falls within the interior wooded Savanna. However, owing to its transitional nature, the area does not totally exhibit typical Savanna conditions. Thus, the Savanna is heavily wooded, though most of the trees are not as tall and of large size as those in the moist deciduous forest. Common tree species found outside the few dotted fringe forest include the baobab, the dawadawa, acacia and the shea nut trees, which have adapted to the environment (Dickson and Benneh, 2004; World Vision Ghana, 2007a). The vegetation and soils of the District are very fertile and support agrarian livelihood occupations, and with the provision of boreholes they offer great poverty reduction potentials. This also explains why the District is a major migration destination for many environmental refugees from northern Ghana.

## 3.4 Socio-Economic Characteristics

### 3.4.1 Population Characteristics

The Ghana 2000 Population and Housing Census gave the population of the Atebubu District as 163,330 and comprising 83,112 males and 80,218 females. Children (0-14 years) formed 40.9% of the total population. Those in the active labour force bracket (15-64 years) formed 56.3% and the aged (65+) constituted 2.8%.

The District's population derives a lot of benefits from the Savanna woodlands, including housing, hunting and fuel wood for energy requirements. For instance, an estimated 24.1% of houses are roofed with thatch (grass); and about 66.6% and 31.7% of households use firewood and charcoal respectively as sources of energy for cooking. However, these often lead to overexploitation of the vegetation, which consequently resulted in degradation of the physical environment and poor crop yields which compromises livelihoods incomes (World Vision Ghana, 2007a).

The soils, vegetation and climate of the district constitute suitable ecological conditions for both arable farming and livestock rearing, and the vast nature of the Atebubu District (5,990km$^2$) also indicates the availability of abundant land for farming and establishing other allied agrarian livelihoods for continual poverty reduction. This study examines why and how the conditions of adverse geography prevented natural resources utilization prior to boreholes being provided, and the impact of boreholes provision in facilitating the needed freedom platforms, catalysts and enabling environment for effective occupational livelihoods engagement to spontaneously build capacity to reduce poverty.

### 3.4.2 Education

As compared to the national primary school net attendance ratio of 75%, the District had a low standard of education, as majority of the school-age population were primary (47%) and Junior Secondary (45%), who cannot read and write properly (UNICEF, 2009; World Vision Ghana, 2007a). Obviously, illiteracy and quasi-illiteracy greatly contributes in entrenching rural communities in poverty as people are unable to embrace the benefits of basic current scientific knowledge and technology application to improve their well being (UNESCO, 2005a).

As at year 2000, the average enrolment for primary schools in Atebubu District was 21.3 and that of the JSS was 39.4, as compared to the national average of 72% (UNICEF, 2009). The data indicated primary average class enrolment fell short of the standard average of 36. This indicates low school patronage, high absenteeism and very high school drop-out rate in the district. For instance, the drop-out rate between the Primary and the JSS was indicated as 17.3 per cent; 14.8 per cent for boys and 19.7 per cent for girls (World Vision Ghana, 2007a).

The high dropout rate has been attributed to reasons such as high illiteracy rate among parents and guardians who fail to appreciate the need for education for their children; and the high poverty rate among the inhabitants of this District. This factor causes some parents to withdraw their wards from school in order to support them in their economic activities. Many families have preference for farming to education and in rural communities, such as is typical in this District, some parents believe that investment in farming is more lucrative than investment in their children's education. This is also because of the lack of role models with higher education to be emulated by the younger generation (World Vision Ghana, 2007a).

This poor attitude of some parents in the District leads to children dropping out of school and eventually repeats the poverty experience of their parents. It is hoped that parents will take advantage of time gains due to boreholes being near to their households and allow their children to attend and effectively participate in school. This will further create opportunity for the children to advance from primary to secondary and tertiary levels of education, and acquire knowledge and professional skills to be engaged in gainful employment. The income they would earn may eventually help them distance themselves from poverty their life time (UNESCO, 2005b).

### 3.4.3 Health

The District has one hospital located at Atebubu (the District capital) and two health centres at Amantin and Akokoa. There are also two Clinics at Jato Zongo and Kumfia. Three Community-based Health and Planning Centres (CHPs) have been established at Nyomoase, Garadima and Mem to provide door step Primary Health Care Services. District health management is based in six sub-districts located at Amantin, Nyomoase, Atebubu, Jato Zongo, Kumfia and Garadima. There are also eight static points and eighty-seven outreach points offering Public Health and Reproductive and Child Care Health Services throughout the District (World Vision Ghana, 2007a).

However there is yet a lot more to be done to ensure efficient health delivery in all parts of the District. The fact that a major percentage of the District's population is currently engaged in agriculture-related activities calls for more concerted effort in making effective health delivery a reality. The impressive and well-spread health infrastructure in the Atebubu District constitutes major post-borehole provision infrastructure improvement. Prior to boreholes provision most of these health facilities were non-existent and people were helpless as they could not treat pervasive cases of water borne/related diseases such as guinea worm infestations, trachoma, diarrhea and dysentery, which were prevalent and endemic and reoccurred during the annual dry seasons. The lack of potable water and poor sanitation and hygiene practices are a major cause of illnesses in children, and the situation is bad in many of the rural communities in the District and the provision of health facilities by the District Assembly indicate the priority it gives to the well-being of its inhabitants (World Vision Ghana, 2007a).

For an agrarian District such as Atebubu, there was need to eradicate guinea worm infestation if the District was to emerge out of poverty and contribute significantly towards the growth of national gross domestic product. While in 1996 the district chalked a great feat at reducing guinea worm infestation to the lowest figure of 83 cases, the incidence however increased and was attributed to the massive in-migration from endemic areas in the Northern Region.  In 1999 for instance, 1,409 cases were recorded in the District. However, the provision of boreholes in many farming communities in the District since year 2000 has curtailed the incessant recurrence of the guinea worm menace which incapacitated people in several farming communities.

The prevalence of guinea worm denied the rural population the opportunity to engage actively in their various livelihood occupations to earn income, and this resulted in very high poverty in the District. Even though individual preferences for traditional surface sources of water and apathy also played a major role in the re-introduction and re-occurrence of guinea worm infestations, reports from the Guinea Worm Eradication Programme (GWEP) have indicated that the situation improved where boreholes were available (Ghana Health Service, 2007; Mba and Kwankye, 2007). This study therefore investigates the issue of potable water supply leading to guinea worm eradication to establish the impact of boreholes provision in this District.

### 3.4.4 Economic Activities

For the Atebubu District the major source of household income is farming. This reflects the fact that it is the major pre-occupation of the people of the District. About 70% of the economically active labour force is engaged in various agricultural activities. Low-level agro-based industrial activities are carried out in the many hamlets of the District and they take the form of the processing of agricultural produce. Being an agrarian based economy, income levels of the labour force are not static. The seasonal and market value of their produce are influenced and determined by the nature of work the labour force is predominantly engaged in (GSS, 2000).

### 3.4.5 Water Provision

Potable water facilities have been provided by non-governmental organizations (NGOs), particularly World Vision Ghana, and the Government of Ghana (through the District Administration) which has improved the quantity and quality of water available in rural communities in the Atebubu District. Two hundred and fifty boreholes with hand pumps are spread over the District, out of which 196 were provided by World Vision Ghana (World Vision Ghana, 2007a).



### 3.4.6 Occupation

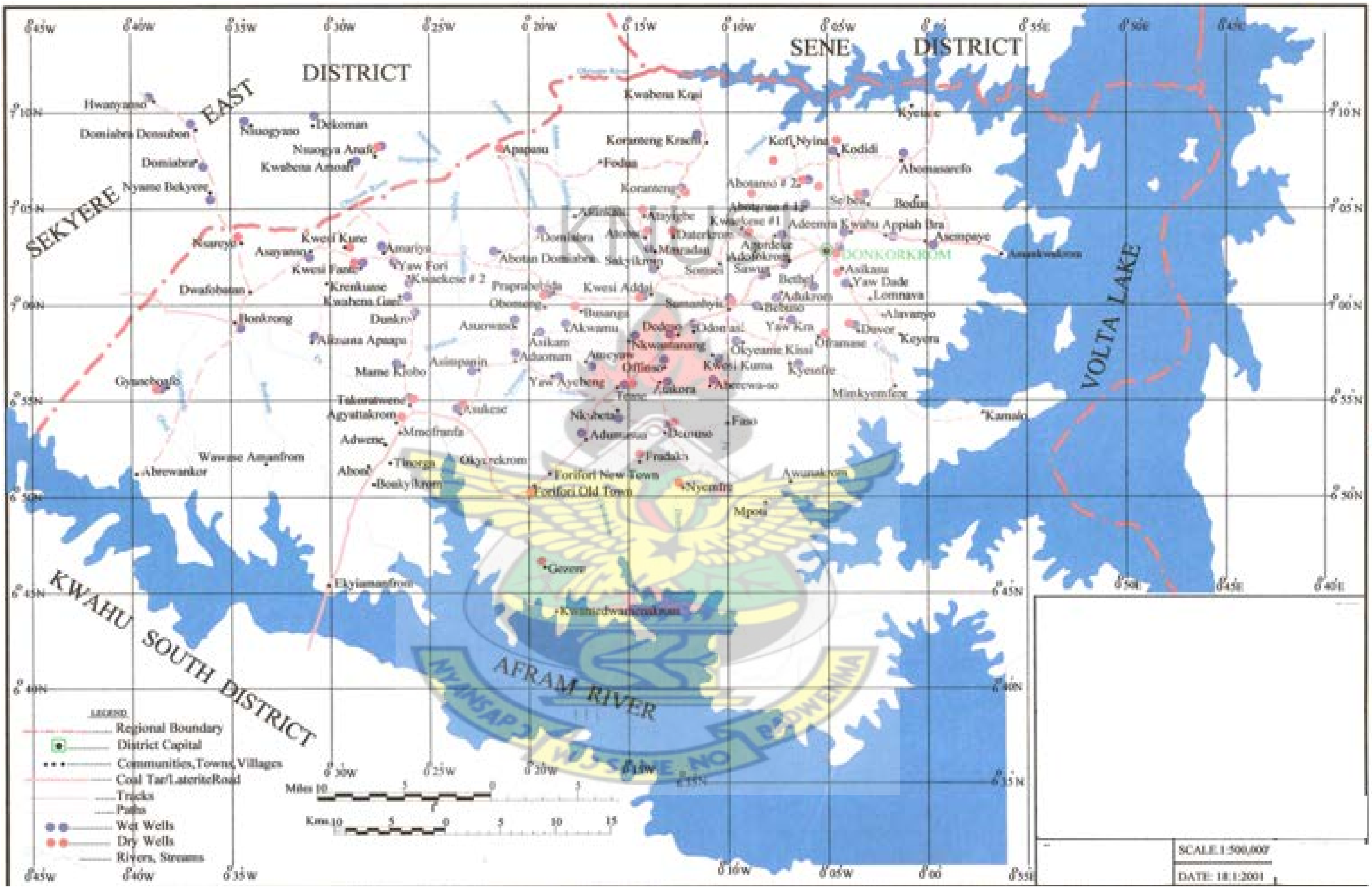
Farming is the major pre-occupation of the majority of the inhabitants in the Atebubu District. However, there are other people engaged in service occupations such as Banking, Teaching, and Nursing and Local Government administration (World Vision Ghana, 2007a). Therefore the need for water is very crucial for continual increase in productivity levels towards poverty reduction.

## 3. 5 Physical Background – Afram Plains District

### 3.5.1. Location

The Afram Plains District is located in the northern part of the Eastern Region of Ghana. With an estimated land area of 5,040 km square, it is the largest District in the Eastern Region. As shown in Map 4, it lies within Latitudes 6°45'N and 7°13'N and longitudes 0°55'East and 0°45'West. The District capital is Donkorkrom. The District shares boundaries in the south with Kwahu South, Fanteakwa, Manya Krobo and the Asuogyaman Districts, and the Asante Akyem North and Sekyere East in the east and

**Map 4: District Map of Afram Plains showing communities entered for survey**



**Source: World Vision GRWP, 2001**

with Kpando and Jasikan Districts in the west. It is also bounded on the north by the Sene District (World Vision Ghana, 2007b).

### 3.5.2 Climate

The Afram Plains District experiences the equatorial climate of the Guinea Savannah zone characterized by two main wet seasons. The first is the main wet season, starting in April and usually ending in the second week of July. The second and minor rainy season occurs in September through to October, and followed by a long dry season from November to the end of March or early April. The mean annual rainfall ranges between 1400 – 1500 mm, decreasing from south to north (Dickson and Benneh, 2004). Generally, the hottest months are February and March with mean temperatures of 36.8$^{o}$C and 36.6$^{o}$C respectively. The coldest months are December and January with mean temperatures of 19.9$^{o}$C and 20.1$^{o}$C respectively.

The climatic type in this District supports the breeding of water borne and water-related diseases characteristic of the tropics, such as guinea worm, schistosomiasis, malaria, dysentery and typhoid (World Vision, 2003; Mba and Kwankye, 2007). Further, the prevalent climate poses as ‘adverse geography’ militating against poverty reduction (Prahalad, 2010; Senge, 2008; Yunus, 2007; and Sachs, 2005, Gourou, 1966). These resistance factors to poverty reduction also constitute the subject matter of this study in relation to boreholes provision in rural communities.

Helpless inhabitants of rural communities in the Afram Plains District had no choice but to patronize the contaminated surface water sources during the dry season, leading to infections with guinea worm that incapacitated people and drove them deep into opportunistic and environmentally precipitated poverty (Robilliard, 2009; Bartram, 2008; and Pruss-Ustun, et al, 2008).

### 3.5.3 Vegetation and Drainage

The Afram Plains form part of the Transitional Savannah Agro-ecological Zone which lies between the Guinea Savannah Zone to the north and the semi- deciduous Forest zone to the south. Most plants in this district shed part of their leaves during the dry season. The vegetation and soils of the District support extensive agricultural activities and are considered as one of the major 'food baskets' in Ghana. It therefore holds great poverty reduction potentials and constitutes a destination point for many migrant farmers from within Ghana. The drainage system consists of many streams which are tributaries of the Afram and Obosum rivers. People in the District rely on these streams for their households water requirement, however they are seasonal and either dry up completely or gather into shallow ponds during the dry season. Only the major rivers – the Afram, Obosum and the Volta flow throughout the year. This situation therefore provides a major justification for the provision of boreholes to resolve the potable water scarcity in the District (World Vision Ghana, 2007b).

### 3.5.4 Geology and Soils

Upper Voltaian sandstones constitute the geology of the Afram Plains District, with over 70% of the soils developed from these sandstones. In general the soils are described as deep to very deep (100-200cm), non-gravelly and well to moderately well-drained with undulating topography (Govt. of Ghana, 2007; World Vision Ghana, 2007b; Dickson and Benneh, 2004).

## 3.6 Socio-Economic Activities

### 3.6.1 Population Characteristics

The 2000 Population and Housing Census of Ghana indicated a population of 135,928 for the Afram Plains District. There were 72,674 males and 63,254 females resident in the Afram Plains during the period of the Census. The Census recorded 685 settlements (towns and villages). The whole District is rural with Donkorkrom, the District capital, as the only town with more than 5,000 people, as indicated by the census. Forty-one per cent of the people live in communities with between 100 to 500 inhabitants while 33.0% live in scattered hamlets with less than 50 people. The census gave a mean household size of 5.4 for the District (GSS, 2005).

The District is populated with migrants mostly from the Kwahu South District and the Volta and Northern Regions of Ghana. These have been attracted to the District by the existing opportunities to engage in agriculture for a livelihood. Though the major ethnic groups in the District are the Akans and the Ewes, the migrants from northern Ghana also constitute an increasing mix of the District's current population (World Vision Ghana, 2007b).

### 3.6.2 Livelihoods

With the total potential agricultural land in the district estimated at 430,067 hectares, about 90% of the households in the Afram Plains District are engaged in agriculture as their principal livelihood occupations. This accounts for up to 90% of all household income, with rain-fed crop production being the major agricultural and economic activity of the inland areas of the District. The major crops produced in the district include maize, yam, cassava, groundnuts and pepper. Other crops include rice, cocoyam, cowpeas, cashew nuts and oil palm. All these crops are grown both for domestic consumption and for sale and account for the vast majority of farm produce sold from the district. Annual crop production is characterized by shifting cultivation which relies mainly on family labour for most of its activities, and extra hired labour brought in during peak periods of farming. Within the farm-household labour is allocated among members in a variety of ways often relating to gender roles.

This study therefore investigates the pre-borehole situation, as well as the post-borehole provision scenario in relation to the prevalence of poverty in rural communities, now served with boreholes. Control communities in the District were also studied to determine what the poverty situation was like without boreholes.

### 3.6.3 Water and Sanitation

The total number of boreholes fitted with hand pumps in the District is 391, out of which 167 were provided by World Vision Ghana. These are recorded as serving a total of 416 communities. Information from the Afram Plains District Water and Sanitation Office indicates that less than 40% of the population has access to potable water. Access to water supplies is difficult, especially towards the end of the dry season. Such a condition promotes heavy reliance on poor quality surface water sources which give cause for contracting water-borne/related diseases which this study investigates.

### 3.6.4 Education

Four levels of education exist for schools in the Afram Plains District. These levels are at Kindergarten/Nursery, Primary, Junior Secondary School (JSS) and Senior Secondary School (SSS) levels. There are 55 nursery schools, 143 Primary, 41 JSS and 5 Senior High Schools in the District. As at 2006, there were 5,680 pupils enrolled at the nursery level, 21,415 at the Primary level, 4,186 pupils enrolled at the JSS and 1,316 at the SSS. However, 46% of the teachers in the District were untrained (World Vision Ghana, 2007b). Basic Education Certificate Examination (BECE) results in the District since 2004 have been improving gradually. From 2004 the pass rate of 35.2% has risen to 50.1% by 2006. This indicates the need for much improvement in quality education delivery towards future reduction in poverty (World Vision Ghana, 2007b).



### 3.6.5 Health

In relation to the availability of health services, there is only one mission hospital which is located in the District capital at Donkorkrom, three Health Centres, and 15 Community-based Health and Planning Services (CHPs) compounds. There is the need to improve on the number of health service outlets to cater for the health needs of this District with a large population, most of whom are engaged in agriculture for their livelihoods.

### 3.6.6 Infrastructure

The Afram Plains District has about 690 km of feeder roads with only 270 km graveled. There is only one central trunk road in the District stretching from Ekye Amanfrom to Agodeke covering a distance of 100 kilometres. The Electricity Company in Donkorkrom receives power from the bulk supply point at Nkawkaw, a distance of 120 kilometres. The District has four markets which operate up to three days a week. These markets are located in Donkorkrom, Ekye Amanfrom, Maame Krobo and Tease. The marketing of farm produce is usually carried out through middlemen and women from outside the District, and transportation of goods to the market centres are usually done by tractors (World Vision Ghana, 2007b).

# Chapter Four

# BOREHOLES PROVISION AS A KEY FACILITATOR OF POVERTY REDUCTION

## 4.0 Introduction

This chapter presents the analysis and discussion of the data collected from the Atebubu and Afram Plains Districts through an integrated approach of combining quantitative and qualitative methods. The discussion attempts at length to depict the situation before and after borehole provision in the two districts. Being a programme intervention/control study, data from the control communities were also analysed and used to complement the evidence for the discussion. To facilitate a better appreciation of the specific variables analyzed, the results of the study in this chapter have been arranged under three main themes relating to borehole provision and poverty reduction as follows: (1) Health and Hygiene (2) Livelihoods Incomes/Wealth Creation, and, (3) Education. However, as there are logical interrelationships between these intermediary variables, some aspects of the discussions will be cross-cutting under each of the headings.

The study assessed the duration respondents have stayed in their community, and almost sixty-four per cent (64.3%) of the population surveyed indicated a duration of 10 years and above. Also, 25.9% indicated having stayed between 1 to 3 years; 6.2% have stayed 4-6years and 3.4% have stayed 7-10 years in their communities. A marginal 0.2% had stayed in their communities for less than one year.

Thus, overall, 99.8% of respondents have stayed for three years and beyond in the communities served with boreholes surveyed. The aggregate length of stay of respondents is more than sufficient to enable the boreholes impact their lives since the maximum length of time it takes for guinea worm to be eradicated when an infected person consistently patronizes the borehole is about twelve months. The overall insight gained indicates that the majority of respondents have stayed long enough in their communities to have been impacted by the potable water from the boreholes.

Length of stay in a community is a very important factor for determining impact of boreholes on communities and their inhabitants. Thus, the data gathered for this study indicates that the respondents, though randomly selected, did qualify to participate in the study and have been around long enough to have been impacted by the potable water from the boreholes. This further lends credibility and validates the study's results.

## 4.1 Findings from the Study

Results from the study identified the following findings in programme and control communities.

### 4.1.1 Access to boreholes

In terms of access, the results show that in programme communities boreholes provision have created "Intermediate" access (potable water being accessible within 5 minutes) and "Basic" access (potable water being accessible within 30 minutes). For instance, "Availability of water from boreholes all year round" was indicated by 83.5% of respondents in the Atebubu District and 93.8% of respondents from the

Atebubu District. Meanwhile the prevalent situation in the control communities remained as "No" access and indicated as such by 100.0% of respondents.

### 4.1.2 Health and hygiene

The results for health and hygiene are shown in Table 4.1. In relation to health, 96.9% of respondents indicated complete eradication of guinea worm from their communities and directly attributed that to boreholes provided, resulting in freedom from the incapacitating disease and improved health. Boreholes provided also facilitated improved personal hygiene practices, especially bathing and laundry. For instance, improved personal hygiene was indicated by 96.1% of respondents.

**Table 4.1: Results - Health and hygiene**

| # | Intermediary variable | Results | |
|---|---|---|---|
| | | **Programme Communities** | **Control Communities** |
| | **Health and hygiene** | | |
| 1. | Complete eradication of guinea worm from their communities and directly attributed that to boreholes provided. | 96.9% | |
| 2. | Improved personal hygiene | 96.1% | |
| 3. | Boreholes provided facilitating time savings in community. | 97.3% | |
| 4. | Water borne/related diseases such as diarrhoea, guinea worm, skin diseases, and schistosomiasis in high occurrence. | | 76.3% |
| 5. | High patronage of surface water sources (rivers and streams), and water not treated before drinking. | | 79.0% |
| 6. | Very poor personal hygiene practices. | | 86.8% |

In relation to water safety, 73.4% and 90.4% of respondents from programme communities in the Atebubu and Afram Plains Districts respectively indicated not treating the water fetched from the boreholes before drinking. The reason they gave was that the water from the borehole was clean and safe. As to where they stored water fetched from the boreholes, 98.8% and 98.7% of respondents in both the Atebubu and Afram Plains Districts respectively indicated water pots, metal barrels, and plastic containers as their water storage receptacles. These they indicated they keep clean due to the health and hygiene education given them by District Health and World Vision programme staff.

### 4.1.3 Livelihoods and Incomes

As captured in Table 4.2, in relation to livelihoods and income earnings boreholes provision facilitated growth in occupational livelihoods, increased earnings from

**Table 4.2: Results - Livelihoods and Incomes**

| # | Intermediary variable | Results | |
|---|---|---|---|
| | | Programme Communities | Control Communities |
| | **Livelihoods and Incomes** | | |
| 1. | Boreholes provision resulting in farms expansion. | 88.6% | |
| 2. | Boreholes provision resulting in increased incomes and progressive wealth creation. | 89.2% | |
| 3. | Availability of boreholes contributing a significant proportion of household income. | 86.4% | |
| 4. | Increased agricultural food crops production. | 90.6% | |
| 5. | Boreholes helping to increase earnings on income from livelihood occupations. | 92.1% | |
| 6. | Ability to manage household and family life better. | 91.3% | |
| 7. | Boreholes provision positively affecting farming and other occupational activities. | 91.3 % | |
| 8. | Boreholes directly or indirectly contributing to economic activity. | 81.2% | |
| 9. | Ability to earn income from one's occupation that enabled one to improve livelihoods during the past 5 years. | 85.8 % | |
| 10. | Improved quality of life and having enough food to serve family all year round. | 96.3% | |
| 11. | Poor occupational livelihoods portrayed endemic poverty, with people living with very limited options. | | 100% |
| 12. | The effect of spending long hours hunting for water causing low farm productivity, low farm output and low incomes. | | 81.6% |

**Source: Fieldwork, 2006**

occupations, and served as the basis for wealth creation as follows: boreholes provision resulting in farms expansion was indicated by 88.6% of respondents; boreholes provision resulting in increased incomes and progressive wealth creation was indicated by 89.2% of respondents; and, availability of boreholes contributing a significant proportion of household income was indicated by 86.4% of respondents.

Increased agricultural food crops production was indicated by 90.6% of respondents; and, provision of boreholes helping to increase earnings on income from livelihood occupations was indicated by 92.1% of respondents. Boreholes provision positively affecting farming and other occupational activities was indicated by 91.3 % of respondents, and boreholes directly or indirectly contributing to economic activity were indicated by 81.2% of respondents. Ability to earn income from one's occupation that enabled one to improve livelihoods during the past 5 years was indicated by 85.8 % of respondents. This establishes the crucial role boreholes play in the agricultural labour productivity equation.

### 4.1.4 Education Quality

In relation to quality education delivery the results are shown in Table 4.3. Boreholes provided facilitating improvements in quality education delivery was indicated by 91.3 % of respondents. Boreholes in or near community enabling water to be fetched before and after school hours were indicated by 89.8% of respondents.

Time of day water was accessed from boreholes: Morning – 93.7%; Evening - 71.7%; Night – 2.8%. Boreholes provision encouraging girl-child education was indicated by 79.3% of respondents. Boreholes helping to check frequent involuntary absenteeism at school were indicated by 83.9% of respondents. Boreholes helping to check high level of dropouts were indicated by 79.0 % of respondents. Boreholes helping to improve punctuality were indicated by 87.7 % of respondents. Boreholes helping to provide water to drink at school were indicated by 86.9 % of respondents.

**Table 4.3: Results – Education Quality**

| # | Intermediary variable | Results | |
|---|---|---|---|
| | | **Programme Communities** | **Control Communities** |
| | **Education** | | |
| 1. | Boreholes provided facilitating improvements in quality education delivery. | 91.3 % | |
| 2. | Boreholes in or near community enabling water to be fetched before and after school hours. | 89.8% | |
| 3. | Time of day water was accessed from boreholes: | | |
| | Morning: | 93.7% | |
| | Evening: | 71.7% | |
| | Night: | 2.8%. | |
| 4. | Boreholes provision encouraging girl-child education. | 79.3% | |
| 5. | Boreholes helping to check frequent involuntary absenteeism at school. | 83.9% | |
| 6. | Boreholes helping to check high level of dropouts. | 79.0 % | |
| 7. | Boreholes helping to improve punctuality. | 87.7 % | |
| 8. | Boreholes helping to provide water to drink at school. | 86.9 % | |
| 9. | Very poor school attendance by their children. | | 62.4%, |
| 10. | Lack of teachers in schools in communities. | | 81.6% |

**Source: Fieldwork, 2006**

Results from the study relating to other benefits from borehole provision are as captured in Table 4:4. These include creation of platforms and enabling environment for overcoming some aspects of adverse geography in the study area. This is depicted in the improved quality of life and demonstration effects such as having enough food to serve family all year round which was indicated by 96.3% of respondents and the ability to manage household and family life better due to boreholes available as indicated by 91.3% of respondents.

In relation to boreholes sustainability for continual water availability, the study's results showed that 90.5% of respondents indicated local water governance institutions have been established for boreholes maintenance and repairs in their communities and assuring potable water availability all year round.

**Table 4.4: Results - Other benefits**

| # | Intermediary variable | Results | |
|---|---|---|---|
| | | **Programme Communities** | **Control Communities** |
| | **Other benefits** | | |
| 1. | **Boreholes sustainability:** Local water governance institutions established for boreholes maintenance and repairs in communities and assuring potable water availability all year round. | 90.5% | |
| 2. | Substantive freedoms unavailable - predominance of daily survival issues in communities. | | 97.4% |
| 3. | Living in very poor houses. | | 84.7% |
| 4. | Poverty reflected in their poor physical structures. | | 91.7% |
| | **Gender Freedoms** | | |
| 5. | Indication that men do not fetch water for their households. | 92.4% | |
| 6. | Women bear the responsibility for fetching water for their households. | 62.2% | |
| 7. | Children assisting in fetching water for domestic use. | 55.9% | |
| 8. | Time gains – Women now have much time to engage in economic activities. | 80.6% | |
| 9. | Lack of major development infrastructure. | | 78.7 |
| 10. | Lack of electricity in households. | | 78.2 |

**Source: Fieldwork, 2006**

Boreholes provided also facilitated the emergence of substantive freedoms, including mobility and gender freedoms, eliminated time poverty and facilitated time gains. Time savings in community because of the availability and easy access to boreholes was indicated by 97.3% of respondents. Specifically, 80.6% of respondents indicated that women now have much time to engage in economic activities.

The counterfactual evidence from the 34 control communities sampled in both districts depicts a dismal scenario as shown in Tables 4.1 to 4.4 which is virtually the opposite of the improved scenario in the programme communities. For instance, water borne/related diseases such as diarrhoea, guinea worm, skin diseases, and schistosomiasis were in high occurrence as indicated by 76.3% of respondents. There was high patronage of surface water sources – rivers and streams, and water not treated before drinking, as indicated by 79.0% of respondents. Poor occupational livelihoods portrayed endemic poverty, with people living with very limited options as indicated by 100% of respondents. Also 62.4%, of respondents indicated very poor school attendance by their children.

The lack of teachers in schools in their communities was indicated by 81.6% of respondents. Personal hygiene practices are very poor, as indicated by 86.8% of respondents. Water hunting was prevalent with the effect of spending long hours hunting for water causing low farm productivity, low farm output and low incomes were indicated by 81.6% of respondents. Substantive freedoms were unavailable as the predominance of daily survival issues was the major pre-occupation in their communities were indicated by 97.4% of respondents. Also, 84.7% of respondents indicated living in very poor houses, and another 91.7% indicated poverty reflected in their poor physical structures.

In relation to the construction of development infrastructure, for many of the respondents not much has changed. Results from the survey revealed that major development infrastructure such as access routes and electricity in rural communities in the Atebubu and Afram Plains Districts have not improved much. This was confirmed by 78.7% of respondents who indicated the study area still having inaccessible routes similar to what was prevailing before boreholes were provided. Also, 78.2% of respondents categorically indicated not having electricity in their households.

### 4.1.5 Gender Freedoms

In terms of the gains in gender freedoms in the Atebubu and Afram Plains Districts, the study found that women and children suffered most from the onerous task of ensuring availability of water for their households daily. Prior to the provision of boreholes the water burden was indescribable and adversely affected women and children's health directly as the mode of conveying water to households is by head poterage as indicated by 95.2% of respondents.

In this study 92.4% of respondents indicated that men do not fetch water for their households, while 62.2% of respondents indicated it is women who bear the responsibility for fetching water for their households. Also 55.9% of respondents indicated that children assist in fetching water for domestic use. Both women and children had to travel long distances searching for water, but the quality of water they eventually brought home was very poor, and not much in terms of quantity to sustain family life beyond a day. Their condition in those times was described as follows:

> "For two or three days, we couldn't bath the children because with the little water you have, you think of using it to cook before you even think of bathing. There were also days we couldn't cook because there was no water. The search for water took a greater part of our lives in the dry season. Sometimes we didn't even have enough energy after we had returned to go and collect firewood for cooking. We ended up sleeping on empty stomachs." (51 year old female respondent – Domeabra community)

Another respondent also indicated the serious nature of the lack of potable water in the community where she lives:

> "The situation also created tension at home, especially when your husband, knowing very well that there is no water to cook, asks whether you won't cook, you don't take it lightly." (58 year old female respondent- Semanhyia community)

Another respondent also described the post-borehole situation for women by indicating:

> "The access to clean water from the borehole has reduced the distance we used to walk in search of water. The most important thing that has happened to me and my family members is that we no longer suffer from the incapacitating

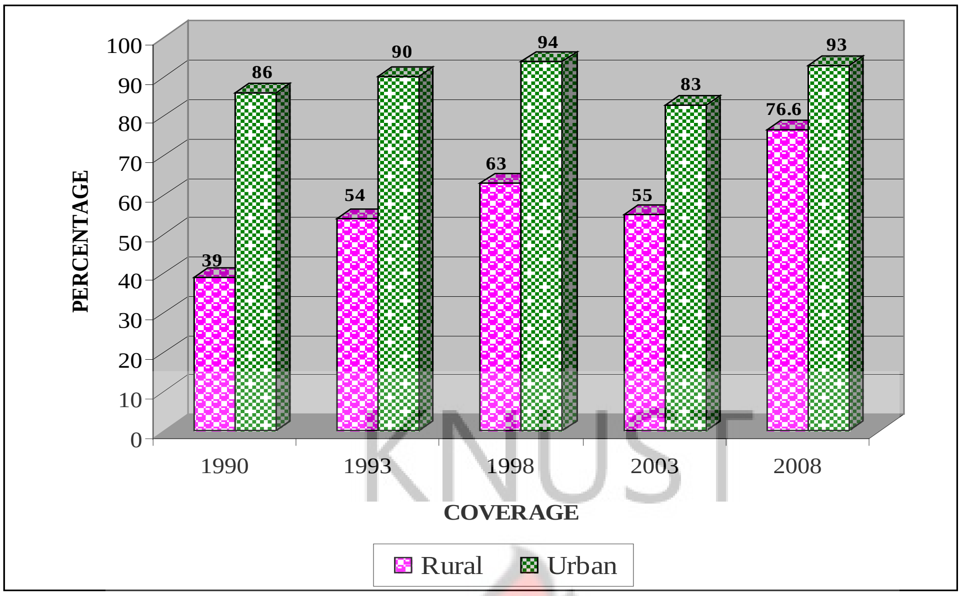
guinea worm infections." (49 year old female respondent- New Kokrompe community)

Prior to boreholes provision women had limited time on hand to engage in viable livelihoods occupations to earn them income and were living in chronic poverty. They also lived under very unhygienic conditions that constantly affected their health and well being. However with the provision of boreholes, 80.6% of respondents indicated that women now have much time at their disposal to engage in economic activities. Their health also has improved, and hygiene practices made better with the continual availability of water in unlimited quantities from the boreholes provided. These outcomes are also confirmed by the studies by the World Bank and others (World Bank, 2010a; RWSN, 2010; and WEDC, 2008).

### 4.1.6 Trends In Poverty Reduction In The Study Area

The proportion of Ghana's population using improved water sources was 56% in 1990 and increased significantly to 83.8% by year 2008. Specifically, the rural population served with improved drinking water was only 39% as at 1990 but has since increased to 76.6% by year 2008, as shown on Figure 4.1 (NDPC/Govt. of Ghana/UNDP, 2010). This significant achievement has long term poverty reduction implications and has contributed much towards poverty reduction in Ghana from the 1991/1992 levels of almost 51.7 per cent (GSS, 2000) to 28.5 per cent in 2005/2006. Also the proportion of the population living below the extreme poverty line declined from 36.5% to 18.2% over the same period (GSS, 2007). However in Control communities for this study, 96.1% of respondents indicated the presence of endemic poverty.

**Figure 4.1: Access to improved water sources**




**Source: NDPC/Govt. of Ghana/UNDP, 2010:46**

Table 4.5 shows the trends in poverty incidence in the two regions where the Afram Plains and Atebubu Districts are located (Eastern and Brong Ahafo), from 1991 through to 2006. Figures in the Table indicate that from 1991 through to 2006, the percentage of the population in the two Regions living under extreme poverty levels dropped from 35.0% to a significant 6.6% for the Eastern Region; and from 46.0% to 14.9% for the Brong Ahafo Region.

**Table 4.5: Trends in poverty incidence by Region, 1991 - 2006**

| **Regions** | **19991/92** | **1998/99** | **2005/2006** | **1991/92** | **1998/99** | **2005/2006** |
|---|---|---|---|---|---|---|
| | **Extreme Poverty (%)** | | | **Poverty (%)** | | |
| **Eastern** | 35.0 | 30.4 | 6.6 | 48.0 | 43.7 | 15.1 |
| **Brong Ahafo** | 46.0 | 18.8 | 14.9 | 65.0 | 35.8 | 29.5 |

**Source: GSS, 2007/NDPC, 2007:46**

Also, within the same timeframe the proportion of the population classified as living in poverty in the two regions also decreased sharply from 48.0% to 15.1% and 65.0% to 29.5% for the Eastern and Brong Ahafo Regions respectively. In part, the significant reduction in poverty levels in the two regions could be attributed mainly to the extensive provision of boreholes in the two districts within the period 1991 to 2006.

For instance, the Ghana Statistical Service indicated that by 1998/99 around two-thirds of rural households had access to potable water. In contrast, as at 1991/92, on average, only around 50% of rural households had access to potable water. This represents a large change in the proportion of rural households with access to potable water over what was only a seven-year period. Further, analysis indicated that much of the change in rural areas reflects increased use of water from boreholes and less use of rain water and from surface water sources (GSS, 2000).

In this study, types of household assets owned are used as proxy indicators of poverty levels existing in communities. As shown in Table 4.6, almost eighty per cent (80.4%) of respondents indicated they owned radio sets, 59.8% owned bicycles, 54.4% owned bed and mattresses; and 62.1% owned some furniture.

**Table 4.6: Poverty levels after provision of boreholes**

| # | Proxy poverty indicator | % of Respondents | Poverty level |
|---|---|---|---|
| 1. | Radio sets | 80.4 | Low |
| 2. | Bicycles | 59.8 | Low |
| 3. | Bed & mattresses | 54.4 | Low |
| 4. | Furniture | 62.1 | Low |
| 5. | Fowls | 67.3 | Low |
| 6. | Sheep | 68.8 | Low |
| 7. | Tractor | 1.3 | High |

**Source: Fieldwork, 2006**

Also, 67.3% and 68.8% owned fowls and sheep respectively. Ownership of household assets is a proxy indicator of progression from poverty and in this instance the progression has been gradual with steady assets accumulation. However, only 1.3% of respondents indicated that they owned a tractor, which is a very high cost capital asset but vital for farming in the Atebubu and Afram Plains districts. The 59.8% who indicated ownership of bicycles is significant because mobility in the two Districts is key to being able to access farms and local markets for transactions relating to economic exchange to earn income. Owning and using a bicycle in rural communities therefore plays a significant role in mobility to earn income.

The type of house and especially the type of roof are also often used as an indicator for wealth or poverty assessment of a household. The use of brick or cement blocks as building material, as well as metal or tiles as roofing material can be considered as an indicator of relative wealth. Contrary to that, mud walls, as well as straw or thatch roofs, are considered as an indicator of poverty (Estache and Maria, 2007; Leeuw, et al 2008). In terms of spatial analysis Table 4.7 show the physical structure differentials in types of house respondents live, in the study area. In both Districts the results indicate a gradual shift from the prevalent 'mud house with thatch roof' typically associated with poverty (54.1% and 57.6% in the Atebubu and Afram Plains respectively) to living in 'mud house with metal roof' (27.7% 34.8% respectively) and 'cement block house with metal roof'(10.2% and 8.2% respectively), showing the pattern of emergence from poverty and the progressive reduction in poverty in communities served with boreholes.

**Table 4.7: Type of house as indicator of poverty level**

| District | Mud house with thatch roof (%) | Mud house with metal roof (%) | Cement block house with thatch roof (%) | Cement block house with metal roof (%) | Others (%) |
|---|---|---|---|---|---|
| Atebubu | 54.1 | 34.8 | 2.3 | 8.2 | 0.6 |
| Afram Plains | 57.6 | 27.7 | 4.0 | 10.2 | 0.5 |

**Source: Fieldwork, 2006**

Almost seventy-eight per cent (77.8%) of in-depth interview (IDI) respondents indicated having been able to improve their houses as a result of continual water availability from boreholes and economic gains obtained. The subsequent improvement in the quality of life was indicated by 98.3% of IDI respondents. Also, a significant 61.3% of IDI respondents indicated having been able to roof their houses with iron sheets instead of thatch after boreholes have been provided in their communities. In contrast, in Control communities, 84.7% of respondents indicated living in very poor shelter, whilst for another 91.7% of respondents, poverty vividly reflected in their poor physical structures.

These results therefore are indicators of some of the demonstration effects on how the provision of boreholes has facilitated poverty reduction in the Atebubu and Afram Plains Districts.



## 4.2 Boreholes Provision and Improved Health and Hygiene

This section discusses boreholes provision as it relates to health and personal hygiene practices as an intermediary variable for poverty reduction. This is in special reference to the impact on water-borne/related diseases eradication in rural communities, as well as its effect on improved health and occupational livelihoods in the Atebubu and Afram Plains Districts.

Results from the study indicate that through the impact of boreholes provided water-borne parasitic diseases have almost become an issue of no public health significance in the Atebubu and Afram Plains Districts. This achievement has brought immense social and economic benefits to the beneficiaries and directly contributed to poverty reduction. Two survey respondents recalled:

> "The most common diseases in this community used to be guinea worm and diarrhoea. Before the boreholes were provided the source of our water were hand-dug holes and we used to spend a lot of time water hunting during the dry season. After the boreholes were provided we use ten minutes or less to fetch water." (47 year old male respondent- Tease community)

> "Now that we have the borehole guinea worm has vanished from the community so we do not lie down sick for eight months as before, losing

> much time and being totally incapacitated. Now we have much time for our work and the women have water and time to bath the children." (44 year old male respondent- Semanhyia community)

The importance of good health to poor people cannot be overemphasized because physical health is vital for all types of livelihoods, especially agriculture, on which poor people so much depend. Therefore they worry immensely about the prospect of illness, which is costly in terms of being incapacitated, lost time and earnings. The incidence of waterborne diseases such as guinea worm infection, diarrhoea, acute stomach ailments, schistosomiasis, and trachoma were common prior to the provision of boreholes, and this was problematic to the inhabitants of both the Atebubu and Afram Plains districts. A survey respondent observed:

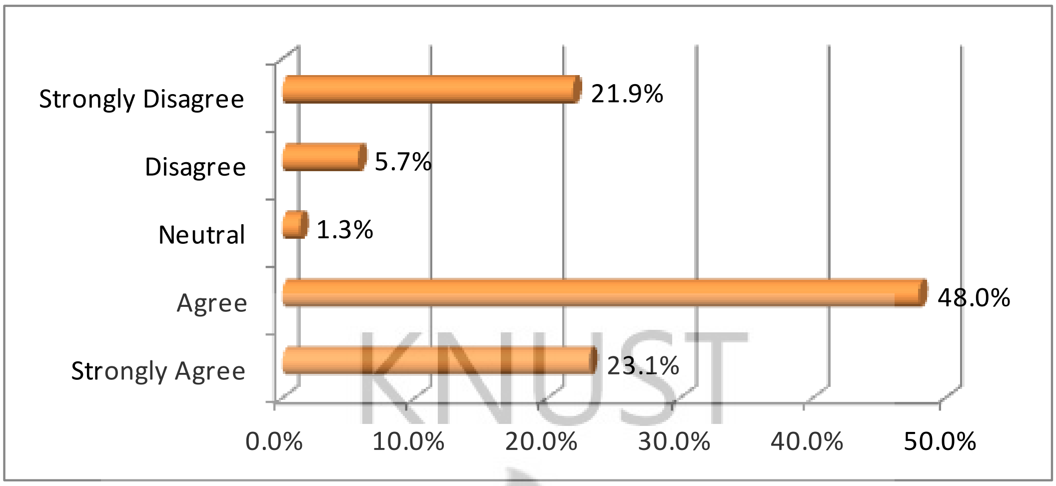
> "Before the provision of boreholes by World Vision in this community people experienced frequent stomach pains, and guinea worm disease was prevalent. Our source of water was from the stream and when we drink the water without boiling it gave guinea worm, and also stomach pains." (51 year old male respondent- Yaw Fori community)

Another respondent also indicated:

> "Since the boreholes were provided, they have helped us a lot since all the diseases (guinea worm, yaws, scabies, and stomach pains) are no more." (55 year old male respondent- Odumase community)

Almost ninety-four per cent (94.4%) of population surveyed indicated very poor personal hygiene in their households prior to boreholes being provided. They indicated bathing was very irregular and skin diseases were prevalent. Almost ninety-one per cent (90.8%) of respondents also indicated poor health prior to the provision of boreholes. In Control communities, 71.1% of respondents (Strongly Agree 23.1%, Agree 48.0%) indicated very poor hygiene issues as existent in their households as shown in Figure 4.2.

**Figure 4.2: Very poor personal hygiene prevalent in households in Control communities**




**Source: Fieldwork, 2006**

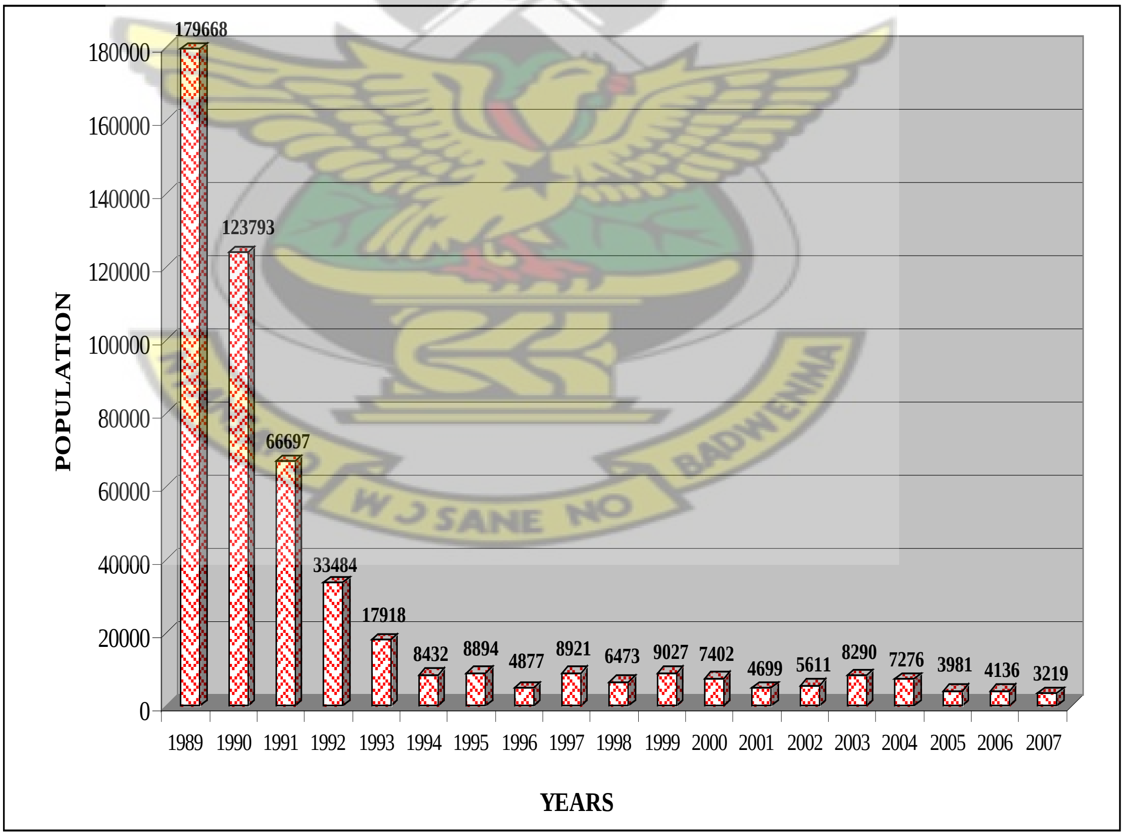
In the Atebubu and the Afram Plains, guinea worm infestation incapacitated whole communities due to the lack of potable water. This disempowered people and caused both opportunistic and occupational poverty which was cyclical and pervasive in households. The lack of physical well-being led to low incomes, low purchasing power, low capacity in terms of assets to withstand vulnerabilities and therefore people were vulnerable to calamities, which further lead to exposure to extreme forms of poverty. To buttress the significance of vulnerabilities and risks people faced prior to boreholes being provided in the study area, a survey respondent indicated:

> "We sometimes had to fetch water at night and sometimes got bitten by snakes. We have to walk through bushes searching for water." (48 year old female respondent- Yaw Fori community)

In the Atebubu and Afram Plains Districts, guinea worm incapacitation did not allow for wealth creation and assets acquisition for well-being. Poverty was pervasive and households lived under acute conditions of illness (mostly from guinea worm infestation) and deprivations. However, the boreholes provision programme has completely changed this hopeless scenario to one of hope and freedoms to fully utilize one's time and capabilities to achieve life aspirations.

When World Vision started its boreholes drilling programme in 1990 the total caseload of people infected with guinea worm country-wide was 123,793 as shown in Figure 4.3. However, as at 2006, when the survey was conducted, the national caseload of guinea worm recorded had declined drastically to 4,136. This indicates how the provision of boreholes in the Atebubu and Afram Plains Districts, in part, contributed to the massive reduction in guinea worm occurrence. As a result physical health, social freedoms and economic empowerment have simultaneously emerged in the study area, and evident are its massive poverty reduction effects (GHS/GWEP, 2007; GSS, 2000).

**Figure 4.3: Annual Incidence of Guinea Worm Disease in Ghana, 1989-2007**




**Source: Ghana Health Service/GWEP, 2007**

Table 4.8 shows a significant and progressive decline in guinea worm in eight districts in year 2003, with a slight increase in the two districts under study.

**Table 4.8: Guinea worm cases in eight Districts - 1996-2003**

| # | Region | District | 1996 | 1997 | 1998 | 1999 | 2000 | 2001 | 2002 | 2003 |
|---|---|---|---|---|---|---|---|---|---|---|
| 1. | Eastern | Kwahu South | 0 | 3 | 5 | 3 | 1 | 0 | 0 | 0 |
| **2.** | **Eastern** | **Afram Plains** | **54** | **65** | **81** | **169** | **85** | **71** | **30** | **11** |
| 3. | Ashanti | Asante Akim | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 4. | Ashanti | Sekyere East | 0 | 0 | 15 | 0 | 20 | 18 | 4 | 2 |
| 5. | Ashanti | Sekyere West | 0 | 5 | 6 | 11 | 9 | 5 | 5 | 4 |
| 6. | Ashanti | Ejura Sekyedumase | 7 | 66 | 29 | 35 | 8 | 6 | 6 | 4 |
| 7. | Brong Ahafo | Sene | 17 | 9 | 103 | 161 | 94 | 16 | 16 | 39 |
| **8.** | **Brong Ahafo** | **Atebubu** | **83** | **907** | **1063** | **1409** | **1006** | **443** | **443** | **85** |

**Source: Ministry of Health/Carter Center, April** 2003

As shown in Plates 4 and 5, many households in rural communities in both the Atebubu and Afram Plains Districts rely mainly on surface water sources for their water requirement. Most of these sources are contaminated and constitute a major cause of water-related morbidity, especially guinea worm and diarrhoea. Thus, before boreholes were provided, a significant proportion of the households consumed water of poor quality. The water was from sources which are indicative of a substantial risk to the health of the members of the households. However, in terms of quality and quantity, groundwater has been found to be a reliable source for rural communities (Entsua-Mensah, et al, 2007; Mba and Kwankye, 2007).

In both the Atebubu and Afram Plains Districts, the most prevalent diseases before boreholes were provided were guinea worm, malaria, diarrhoea, dysentery,

**Plate 4: Surface water patronage – Sabidi Community, Atebubu District**

**Source: Fieldwork, 2006**

**Plate 5: Surface water patronage – Asaaseboma Community, Afram Plains District**

**Source: Fieldwork, 2006**

cholera, acute stomach aches, intestinal worms, skin diseases (yaws, ring worms, scabies), schistosomiasis, typhoid, trachoma, whooping cough/ acute respiratory infections, and, hernia. After boreholes provision, the diseases prevailing in the study area are malaria, acute respiratory infections, diarrhoea, eye infections, pneumonia, intestinal worms, rheumatism, urethral discharges, cholera, and, hernia (World Vision, 2003; World Vision Ghana, 2007a, 2007b).

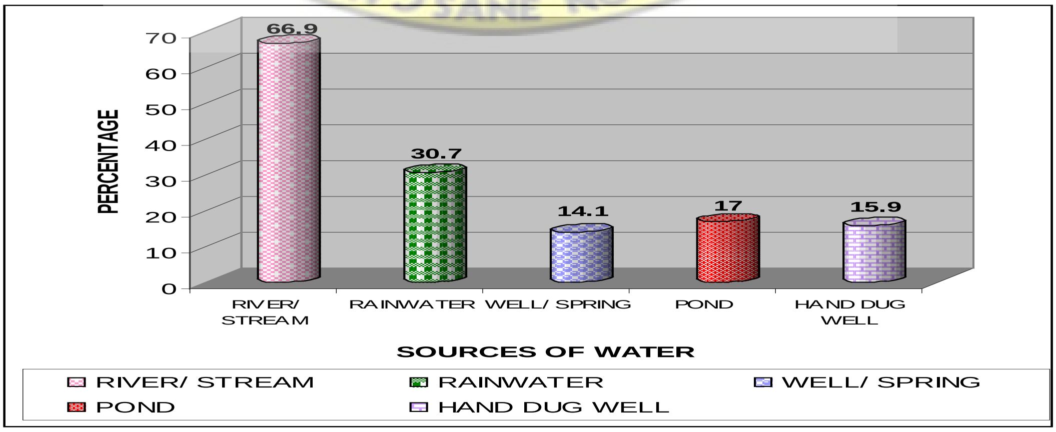
At a Community Meeting, a respondent indicated:



> "Before the boreholes were provided we used to wash in the same dam and fetch to drink, all these contributed to the causes of our illnesses such as diarrhoea." (56 year old male respondent – Afrefreso community)

As to the sources of water before boreholes were provided in the Atebubu and Afram Plains Districts, 66.9% of population surveyed indicated they patronized rivers and streams during the rainy season as depicted on Figure 4.4. In addition, 30.7% also used to depend on rain water. Comparatively, 79.9% of respondents from households in the Control communities indicated they patronize rivers and streams. This indicates the very high risk Control communities are continually exposed to and in contracting water-borne and water-related diseases that often incapacitates them for several months and keep them in cyclical opportunistic poverty.

**Figure 4.4: Sources of water before boreholes were provided in communities**




**Source: Fieldwork, 2006**

Continual potable water availability is therefore of extreme importance in rural communities as indicated by 92.2% of IDI respondents in Programme communities who indicated that they no more worry as to where to go searching for water due to the availability of boreholes. An interviewee recalled her plight at the peak of the dry season, particularly, around mid-March through to early April and how the need for water affected all aspects of their lives as follows:

> "During that period, when ponds and dams dried up, only strong, able bodied women could go and hunt for water for domestic use. We left around 3:30 am and returned around 10:30am. For us the women, we had to bath at the riverside before we filled our containers with water for domestic use. Looking at the number of children I have, how much water at all could I fetch for cooking, bathing and other domestic needs? On our way home, we stopped and rested for part of the journey. The heat and the distance made us so thirsty that we started drinking the water even before we got home." (45 year old female respondent- Kwasi Fante community)

About ninety-six per cent (96.1%) of respondents from households in Programme communities indicated that they now have access to more than 20 litres of potable water daily for each person to meet their needs. This represents a major break from the past when prior to boreholes provision they had to walk for water for several hours searching for water as indicated by 94.8% of respondents. Thus, potable water availability from boreholes in households facilitated improvement in physical health as indicated by 96.6% of respondents. The health regained has been channeled into gainful economic activities for income generation to reduce poverty in households.

In respect of reliefs boreholes have brought to the Atebubu District, a Government official indicated:

> "The result of this health-centered intervention has been a remarkable transformation in the communities in the Atebubu District. The provision of clean water from the boreholes provided by World Vision has had a positive impact on various aspects of rural life. Life has changed for the better. Government officials and teachers used to refuse transfers to the District because water was scarce. With the provision of the boreholes, the situation

has changed. Trained teachers are now available in our schools. Life is much easier for all of us." (53 year old male respondent- Akokoa community)

As shown in Table 4.9, in both Districts the health status of infants and children in their communities was described as 'poor' prior to boreholes provision and indicated by 50.3% and 57.0% of respondents in the Atebubu and Afram Plains Districts respectively. Also 32.4% and 29.8% in both Districts respectively, described the situation as 'very poor'. Others, representing 17.3% and 13.2% in both Districts respectively, did not know what the condition was before boreholes were provided.

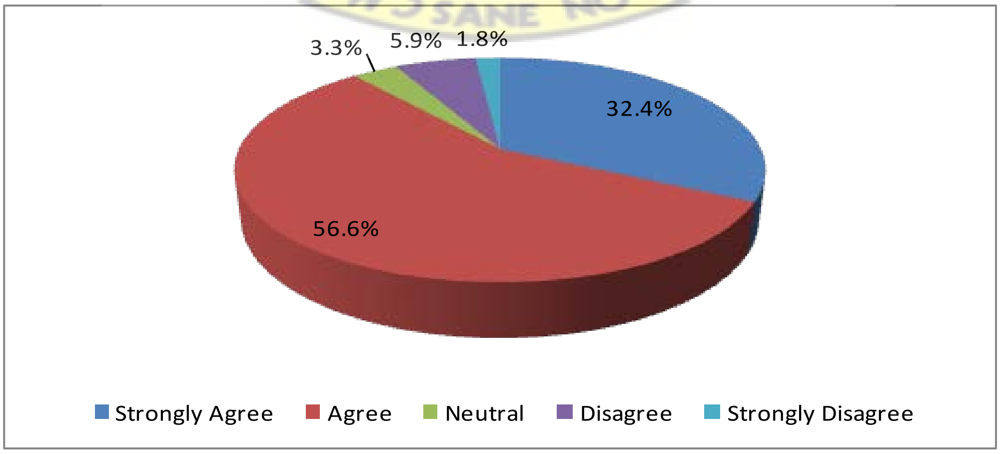
**Table 4.9: Description of infant and child health before the provision of boreholes**

| Response | Atebubu (%) | Afram Plains (%) |
|---|---|---|
| **Very poor** | 32.4 | 29.8 |
| **Poor** | 50.3 | 57.0 |
| **Don't know** | 17.3 | 13.2 |
| **Total** | 100 | 100 |

**Source: Fieldwork, 2006**

However, Figure 4.5 shows an improved situation after boreholes were provided as indicated by 89.0% of respondents (32.4% Strongly Agree, while 56.6% Agree) from Programme communities to the situation.

**Figure 4.5: Boreholes provision helping to improve infants and child health in households**



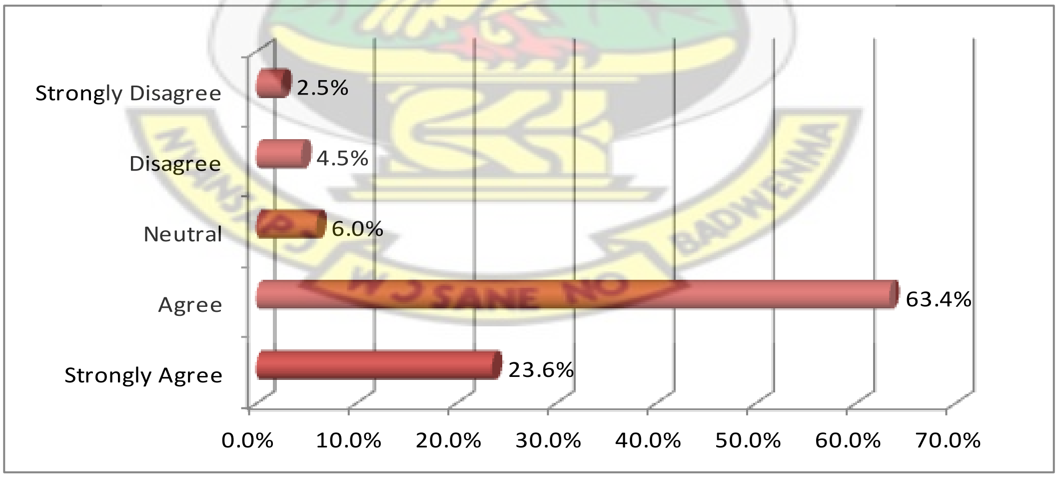

**Source: Fieldwork, 2006**

This shows the vast improvement in the health of infants and children in the Atebubu and Afram Plains Districts. This also has implied consequences of saving time and financial resources to reduce poverty. Time spent by women to seek medical care for their children are now channeled into occupational livelihood activities to increase output and earn more income.

Again, funds formerly used to cater for children's ill health are now saved and used to improve the quality of life in households or invested into income earning activities. The sum of these efforts fosters improved quality of life and simultaneously supports gradual poverty reduction. However in Control communities 36.7% of respondents indicated the presence of infant and child mortality in their households.

In Figure 4.6, 87.0% of respondents (Strongly Agree 23.6%, and Agree 63.4%) indicated that there was poor health, and people were unable to access good health care before the provision of boreholes in their communities.

**Figure 4.6: Presence of poor health and inability to access good healthcare before the provision of boreholes in communities**




**Source: Fieldwork, 2006**

A survey respondent also indicated:

> "This borehole is a real blessing. If you saw the water we drank at first, you will feel sorry for us. Now because there's clean water, guinea worm has been eradicated from this community. Yaws and scabies have also disappeared. If

> you mention yaws, the children will not know what you are talking about." (49 year old male respondent- Abease community)

From Table 4.10, 87.4% of the respondents (Strongly Agree – 38.4%, 28.3%; while 48.3%, 61.5% Agree, in the Atebubu and Afram Plains respectively) indicated that provision of boreholes have contributed to improve health in their households. This has important implications for improved ability gained and time gains, to engage in livelihood occupations to earn income to reduce poverty. The reality of the situation is captured from a survey respondent, who indicated:

> "The scourge of the dreaded water-borne disease they call, ('mfa') guinea worm did not spare even children. It was very serious here. Most people, including children, had guinea worm and suffered a lot. The children used to cry a lot. They cried so much that out of frustration we vowed that we'll never give birth again. The lack of clean water, coupled with the scourge of ('mfa) guinea worm affected every aspect of our everyday lives. Farm activity was low and the harvest was poor." (34 year old female respondent- Atta Kwabeng community)

**Table 4.10: Provision of boreholes assisting to improve health in households**

| Response | Atebubu (%) | Afram Plains (%) |
|---|---|---|
| **Strongly Agree** | 38.4 | 28.3 |
| **Agree** | 48.3 | 61.5 |
| **Neutral** | 4.9 | 2.1 |
| **Disagree** | 5.9 | 6.0 |
| **Strongly disagree** | 2.5 | 2.1 |
| **Total** | 100 | 100 |

**Source: Fieldwork, 2006**

Table 4.11 shows 95.3% of respondents (Strongly disagree 55.3%, and Disagree 40.0% ) in programme communities indicating the non-existence of guinea worm in their communities, while in the control communities, 46.9% (Strongly Agree 19.3%

and Agree 27.6%) affirmed the prevalence of guinea worm in their communities. Only 3.4% of the respondents from the programme communities were in agreement that guinea worm was still prevalent in their communities. The study found that some of the guinea worm infected persons from the programme communities were people who had recently migrated into the communities as at the time of the survey. Others were people who still fetched water from their old sources of water due to proximity as they live closer to the old water sources.

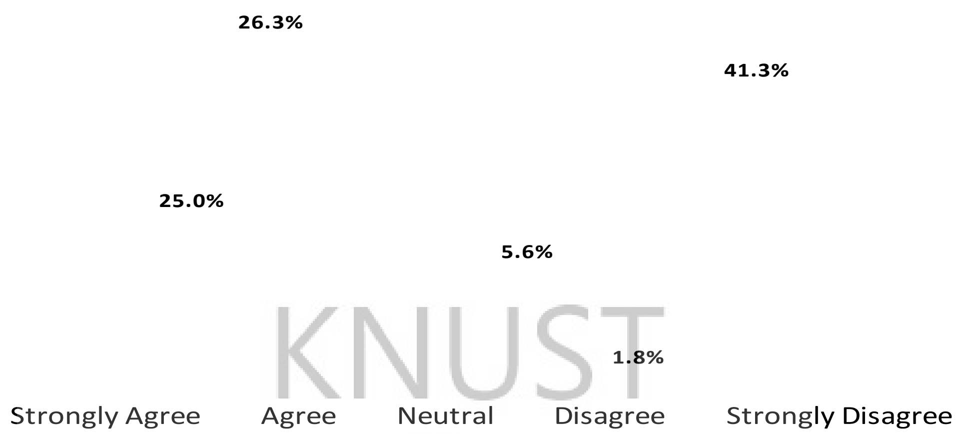
**Table 4.11: Prevalence of guinea worm in community**

| Response | Programme (%) | Control (%) |
|---|---|---|
| **Strongly Agree** | 0.3 | 19.3 |
| **Agree** | 3.1 | 27.6 |
| **Neutral** | 1.3 | 8.9 |
| **Disagree** | 40.0 | 25.1 |
| **Strongly disagree** | 55.3 | 19.1 |
| **Total** | 100 | 100 |

**Source: Fieldwork, 2006**

In Figure 4.7, 67.6% of respondents (Strongly Agree 26.3%, Agree 41.3%) indicated that before the provision of boreholes there was total incapacitation of members of their households as a result of guinea worm infection. This incapacitation lasted for about eight months and during such times people were unable to work at their farming occupations to earn income. This condition entrenched them in continual poverty.

**Figure 4.7: Guinea worm incapacitation before the provision of boreholes**



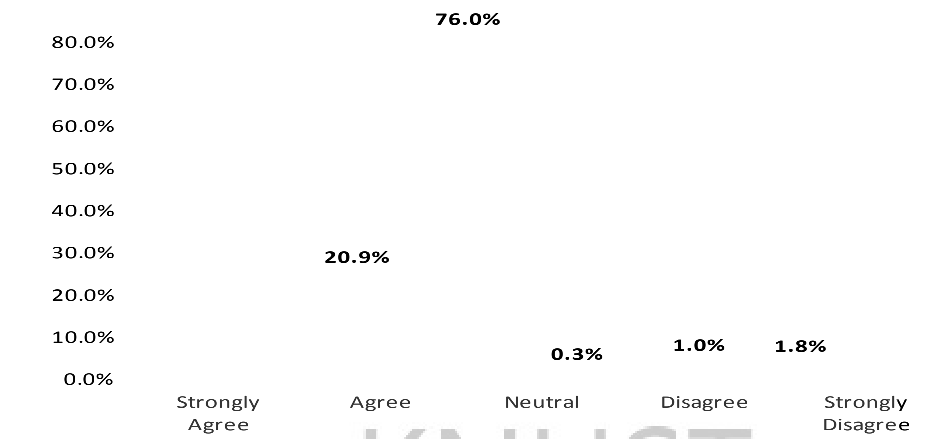

**Source: Fieldwork, 2006**

According to a survey respondent,

> "The most frequent diseases were guinea worm and diarrhoea but since the boreholes were provided those diseases have ceased. Also we had to go and wait for the water to come into a hole we have dug before getting water especially during the dry season. This is true when one goes for water in the early morning, he/she would return home in the evening, so you don't get time to do any work to get money to take care of your household, and poverty looks at you in your eyes." (52 year old female respondent-Tease community)

In Figure 4.8, 96.9% of respondents (20.9% Strongly Agree, while 76.0% Agree) indicated the non-existence of guinea worm in their community as at the time the survey was carried out. This again is a major indicator and proof of the effectiveness of the provision of boreholes in eradicating guinea worm and enabling people in communities regain their health. They also regained their social and economic freedoms and are able to work and engage in occupations to earn income to reduce their poverty. In contrast, 47.2% of respondents in Control communities indicated guinea worm presence in their communities as at the time the survey was conducted.

**Figure 4.8: Guinea worm eradicated from community**



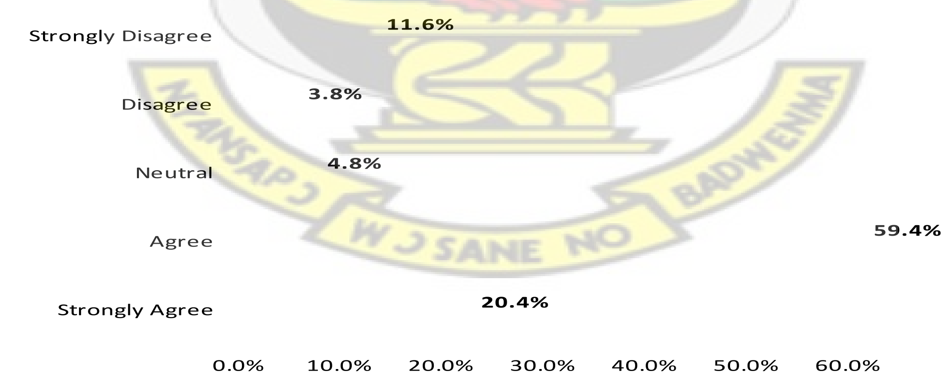

**Source: Fieldwork, 2006**

A survey respondent described the prevalent situation as follows:

> "Guinea worm disease was a very serious problem in this community, but since the borehole was provided it has vanished." (58 year old male respondent- Bebuso community)

In Figure 4.9, 79.8% of respondents (Strongly Agree 20.4%, Agree 59.4%) indicated borehole provision contributing to eradication of guinea worm from their households.

**Figure 4.9: Boreholes provision contributing to guinea worm eradication from households**




**Source: Fieldwork, 2006**

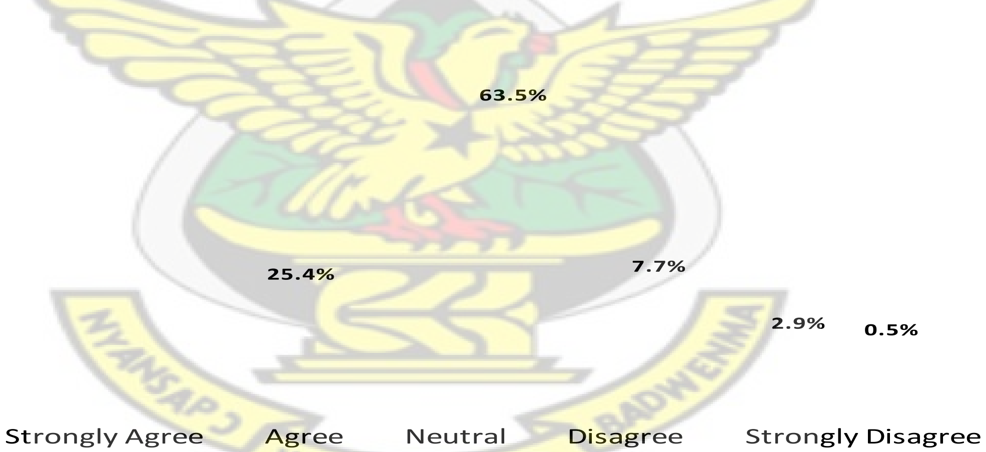
This again is also a major indicator and proof of the effectiveness of the provision of boreholes to eradicate guinea worm completely and enable households regain their social and economic freedoms and be able to actively engage in livelihood occupations to earn income, create wealth, and invest in the lives of their children's education. These lead directly and indirectly to improvement in the quality of life and eventual poverty reduction. A survey respondent put this in practical perspective by indicating:

> "In terms of benefits we get from the boreholes, the boreholes give us clean water regularly and about 80% of people in this community use borehole water because it is hygienic and also close to their homes. Also guinea worm and other water-related diseases were prevalent before the construction of the boreholes. Now guinea worm is no more infecting us and making us sick and unable to work on our farms for many months each year. The borehole has really improved our health." (62 year old male respondent- Kyenkyenkura community)



In Figure 4.10, 88.9% of respondents (Strongly Agreed 25.4%, Agree 63.5%) indicated that poor personal hygiene was common prior to the provision of boreholes in Programme communities. This contributed much to the ill-health of many rural inhabitants and their inability to work to earn much income to break from poverty.

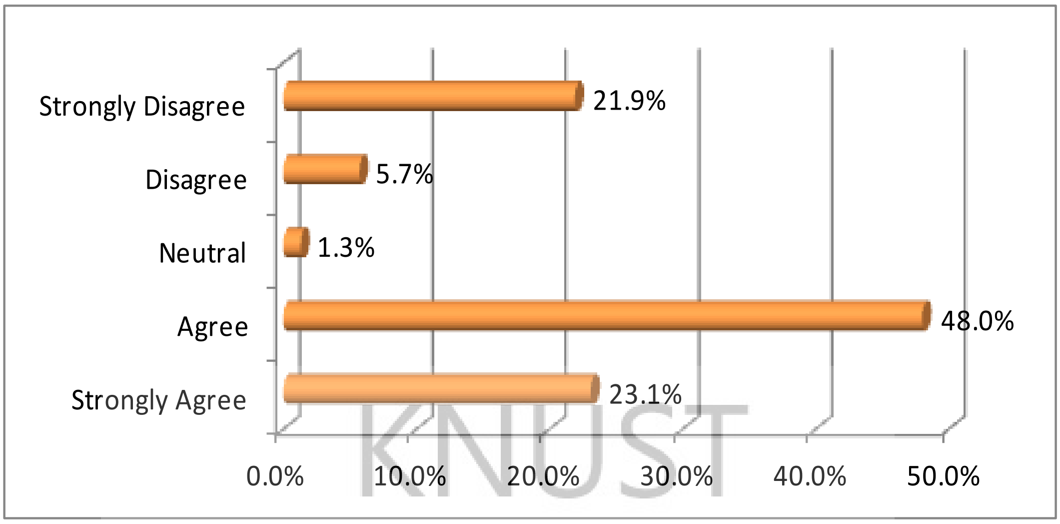
**Figure 4.10: Poor hygiene conditions before borehole provision in communities**




**Source: Fieldwork, 2006**

In Control communities, 71.1% of respondents (Strongly Agree - 23.1%; Agree – 48.0%) indicated the existence of very poor hygiene practices and conditions as depicted in Figure 4.11.

**Figure 4.11: Very poor personal hygiene prevalent in Control communities**




**Source: Fieldwork, 2006**

In Table 4.12, 87.9% of survey respondents (Strongly Agree 27.3%; Agree 60.6%) were in agreement that the provision of boreholes has helped to improve personal hygiene in their households. Also, a survey respondent indicated:

> "Now you can work from morning to evening but you can still have water to drink while working and more than enough water to bath in the evening." (59 year old male respondent - Amankwakrom community)

**Table 4.12: Boreholes provision helping to improve personal hygiene in households**

| Response | Frequency | Percentage |
|---|---|---|
| Strongly agree | 328 | 27.3 |
| Agree | 727 | 60.6 |
| Neutral | 52 | 4.4 |
| Disagree | 70 | 5.8 |
| Strongly disagree | 23 | 1.9 |
| Total | 1200 | 100.0 |

**Source: Fieldwork, 2006**

A survey respondent also indicated:

> "The availability of clean water from the boreholes continue to have a lot of impact on the lives of the people. Now, if you want to fetch water ten times in a day, you can do it and not get tired because the water is just here. We all have enough water to bath, cook and drink, we also have enough time for our farming activities and we are getting more produce from our farms. (57 year old male respondent- Sakyikrom community)

In Table 4.13, 95.6% of survey respondents (19.6% Strongly Agree and 76.0% Agree) affirmed that the provision of boreholes in their communities is promoting regular face washing among both children and adults in households. This practice led to the eventual eradication of trachoma as a disease from Atebubu and the Afram Plains Districts. The health and time gains have contributed to improved labour productivity, economic empowerment and eventual reduction in poverty.

**Table 4.13: Boreholes provision promoting regular face washing among children and adults in households**

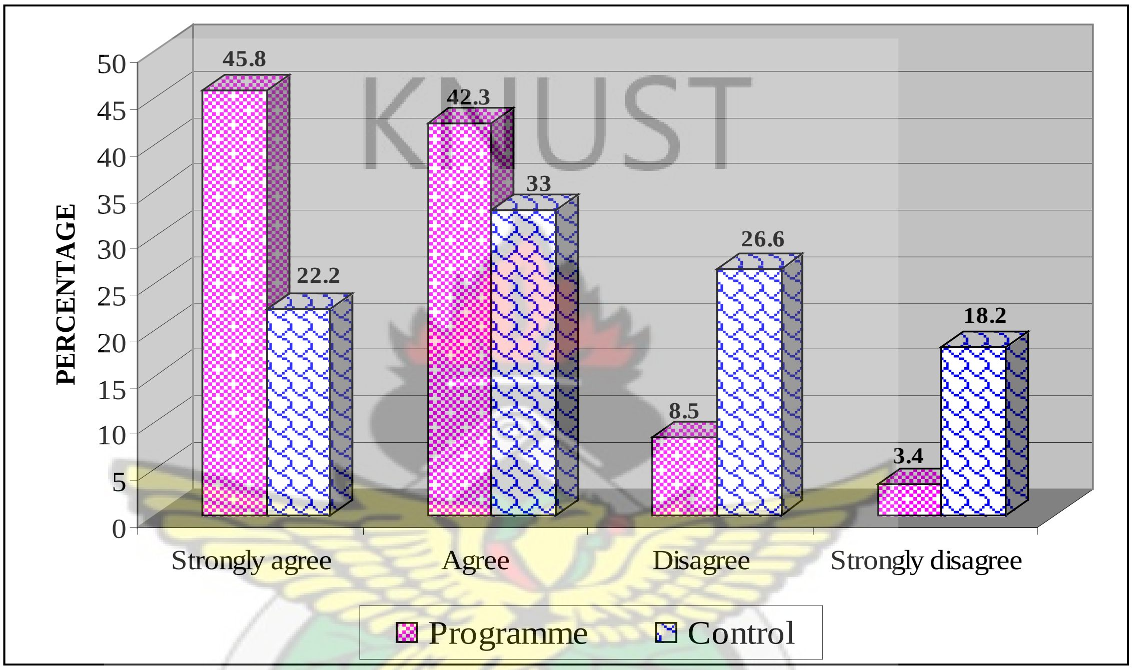
| Response | Frequency | Percentage |
|---|---|---|
| Strongly agree | 235 | 19.6 |
| Agree | 912 | 76.0 |
| Neutral | 10 | 0.8 |
| Disagree | 13 | 1.1 |
| Strongly disagree | 30 | 2.5 |
| Total | 1200 | 100.0 |

**Source: Fieldwork, 2006**

In terms of personal hygiene practices, Figure 4.12 indicates that 45.8 percent of the respondents from the programme communities as against 22.2 percent from the control communities strongly agreed that there was access to water for regular washing of hands after visiting the latrine, 42.3 percent from the programme communities and 33 percent from the control communities agreed, whereas 3.4

percent and 18.2 percent from the programme and control communities, respectively strongly disagree. This implies that many respondents from the programme communities had access to water for regular washing of hands after visiting latrine. The difference may be attributed to the availability of borehole water in the programme communities.

**Figure 4.12**: **Access to water for regular washing of hands after visiting latrine**




**Source: Fieldwork, 2006**

In furtherance of domestic hygiene practices, results of the study also indicate that materials parents in both community types used in cleaning their children after defecating include toilet papers, rags, scrap paper and water, leaf and water, water and hand as well as corn cob. However, 64.3% of respondents from the programme communities indicated they clean their hands with water and soap after cleaning their children during defecating. Correspondingly, 58.5%, of respondents from the control communities indicated the use of water and soap after cleaning their children during defecating. Boreholes provision therefore facilitates the availability of water to enhance the hand washing practice in programme communities.

With respect to the personal hygiene practice of hand washing before eating, Table 4.14 show 96.8% of the respondents from the programme communities (Strongly agree 38.6% and 58.3% Agree) indicating that they have regular access to water for washing of hands before eating. Similarly, 76.4% of respondents in control communities also indicated they have access to water for washing of hands before eating.

Hand washing being a key cultural practice in the study area, the differentials, as far as relates to this study is in the quantities of water available to respondents on both sides of the divide. Obviously, boreholes availability makes more water available for use by programme communities' residents to facilitate the personal hygiene practice of hand washing before eating. Thus, boreholes provision in the study area serves as an enhancing factor for hand washing before eating which help prevent diarrhoeal diseases.

**Table 4.14: Access to water for regular washing of hands before eating**

| **Response** | **Programme (%)** | **Control (%)** |
|---|---|---|
| **Strongly agree** | 38.6 | 26.6 |
| **Agree** | 58.3 | 49.8 |
| **Disagree** | 2.2 | 17.2 |
| **Strongly disagree** | 0.9 | 6.4 |
| **Totals** | 100 | 100 |

**Source: Fieldwork, 2006**

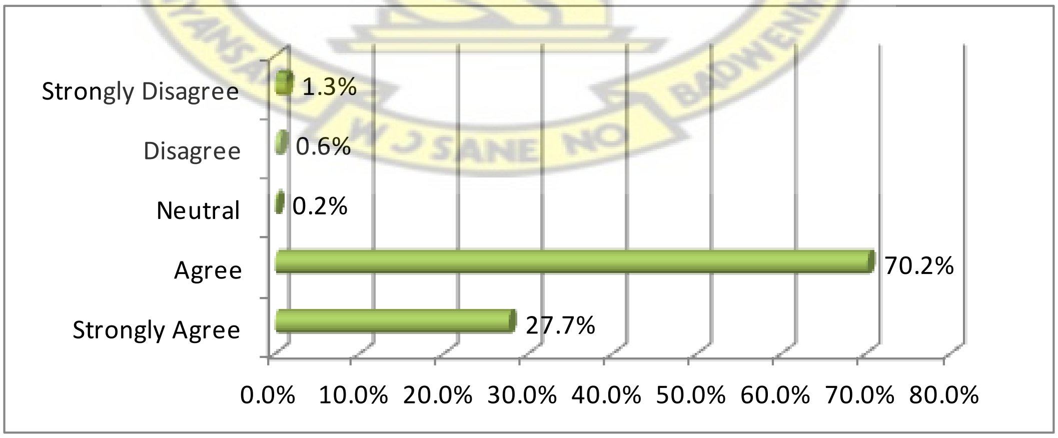
## 4.3 Boreholes Provision and Livelihoods Incomes/Wealth Creation

In terms of the type of occupational livelihood engagements constituting the main income sources for the population surveyed, farming was indicated by 84.9% of respondents. Though respondents further indicated several other secondary occupations such as trading, carpentry, hair dressing and tailoring, this study underscores the fact that farming as an occupational livelihoods engagement forms the basis of people emerging from poverty in the Atebubu and Afram Plains Districts.

Of the respondents, 77.3% indicated that they were engaged in these occupations throughout the year, and 89.1% of the respondents indicated they earn income directly from their work.

Results from the study, as indicated by 91.0% of respondents established that the provision of boreholes in communities facilitated economic growth for poverty reduction as people in households regained their health and had time to work consistently at their livelihood occupations. As households patronized the boreholes provided, they regained their health and time loss due to incapacitation from water borne/related diseases ended. Time gained after recovery was employed massively in occupational livelihoods leading to improvements in the quality of life as indicated by 97.9% of respondents (27.7% Strongly Agree and 70.2% Agree) as depicted in Figure 4.13. Thus, consistent improvements in quality of life in households facilitate gradual reduction in poverty.

**Figure 4.13: Boreholes provision facilitating improvements in quality of life**




**Source: Fieldwork, 2006**

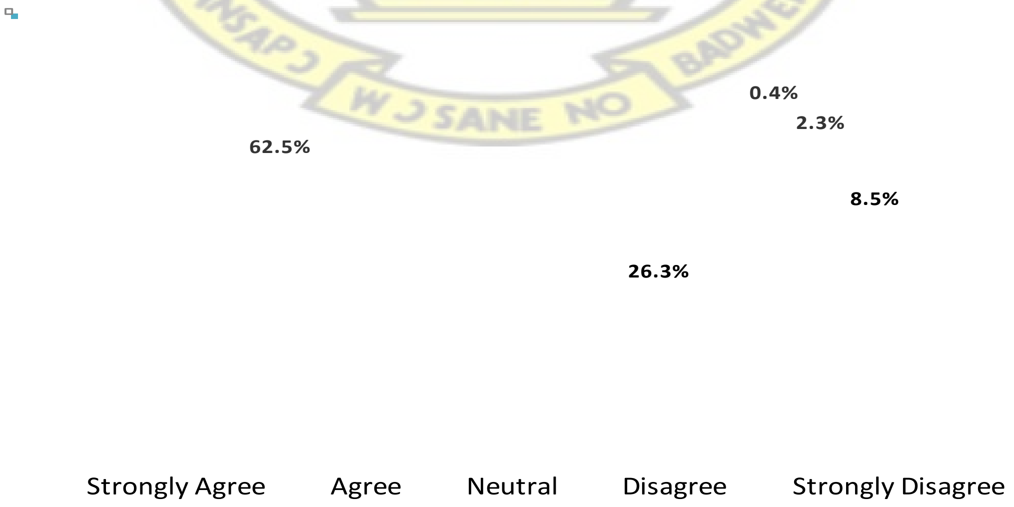
Time gains also resulting from stoppage of searching for water were also put into livelihood ventures. This created employment and the returns on employment in the form of improved labour productivity, which led to improved livelihoods engagements, improved incomes, wealth creation, improved quality of life, and in the gradual reduction in poverty.

In relation to time savings and its utilization as a result of the boreholes provided, an in-depth interview respondent indicated:

> "The boreholes provided have influenced the lives of the people in this District because as a Chief, I move from village to village and I see people patronize the boreholes. The boreholes save a lot of time because women, for example, are usually engaged with household activities, they go as far as 3 to 4 miles to fetch water but with the borehole in their community they can use about 10 minutes to fetch water. This saves them much time to engage in other useful activities for the benefit of their households." (71 year old male respondent-Tease community)

With boreholes provided in these rural communities, the inhabitants in the Atebubu and Afram Plains Districts have emerged out of the poverty trap as described by Sachs (2005). Spontaneous physical expansion of communities is evident as demonstration effect from application of increased income earned and wealth created. For instance, as shown in Figure 4.14, 88.8% of respondents (Strongly Agree 26.3%; Agree 62.5%) indicated absence of borehole adversely affected the farming activities of their households.

**Figure 4.14: Absence of boreholes affected farming activities of households**




**Source: Fieldwork, 2006**

Two survey respondents indicated what the situation was like before and after boreholes provision as follows:

> "When one goes for water in the morning around 6am he would come home at about 9pm. This badly affected our farm work because we spent all our time fetching water." (47 year old male respondent - Nkubeta community)

> "The borehole has reduced our problems with fetching water and now our lives have improved. We have good health and much time now to work on our farms." (52 year old male respondent - Atta Kwabeng community)

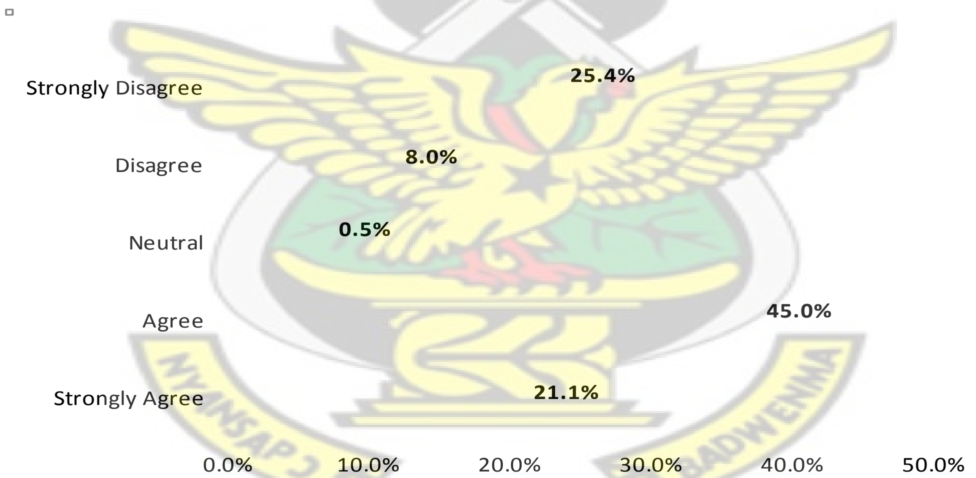
Respondents indicated people walking over long distances for water before the provision of borehole water. This created time poverty in all communities and constrained people's ability to effectively engage in livelihood activities and earn income. Wealth creation was virtually non-existent. In Control communities, up to 100% of respondents indicated the presence of poor occupational livelihoods as at the time of the survey. Also 97.4% of respondents indicated very low level of economic activities in their communities.

As many as 71.3% of respondents indicated they hire farm hands to assist with work on their farms. The number of days they engage farm hands ranged from 1 to 60 days in a year. Thus farmers needed water badly in order to be able to hire farm hands to assist with farm activities. The hired hands needed water to drink and food cooked for them, and the provision of boreholes resolved these issues permanently. Time gained as a result of not going in search of water by adults, was utilized on farm activities. This resulted in high labour productivity and high farm outputs. This further facilitated the emergence of vibrant local markets in some communities which brought about a major increase in agro-commerce and allied service industries.

Subsequently, incomes increased and wealth creation spontaneously led to physical demonstration effects such as acquisition of means of mobility, especially bicycles, construction of new houses, renovation of old houses, re-roofing of houses with aluminum sheets instead of thatch, ability to afford basic needs and provide for basic needs of households. The sum of the demonstration effect is improved quality of life and poverty reduction in the study area.

In Figure 4.15, 66.1% of respondents (Strongly Agree 21.1% and Agree 45.0%) indicated that before the provision of borehole in the community, there was no water to drink on farms. This was a major limiting factor for the many people engaged in agriculture as occupational livelihoods. Without potable water to drink while working they could not do much farm work and their aggregate annual productivity was low and likewise their farm outputs. Income earnings from farming activities were therefore very low and could not sustain them year round.

**Figure 4.15: Lack of water for drinking on farms before boreholes were provided in community**




**Source: Fieldwork, 2006**

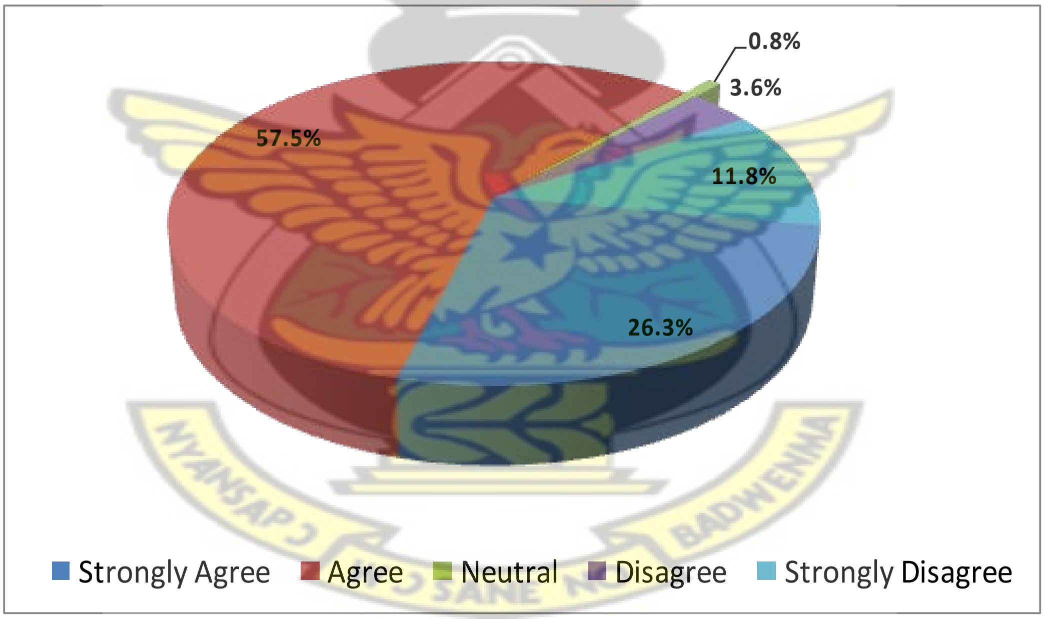
The Chairman of a WATSAN Committee spoke about the impact of the water on their farming activities, he indicated:

> "Those days, you had to ask the women to fetch water over a four-day period for the hired farm hands. Besides that, we are now enjoying good health because we no longer suffer from ('mfa') guinea worm and we have been able to expand our farms also." (56 year old male respondent - Asanyanso community)

In Figure 4.16, 83.8% of respondents (26.3% Strongly agree and 57.5% Agreed) indicated that before the provision of boreholes farm output was very low. This had serious implications for income earnings as households have to store enough farm produce as food to last or sell what they have for cash and later purchase food stocks when necessary. With low farm outputs these obligations become difficult to fulfill.

For instance, respondents indicated an income range of GHC50 to 6,500 as their new annual income. This indicates improvements far over and above the period before boreholes were provided when they earned virtually nothing due to incapacitation with guinea worm disease.

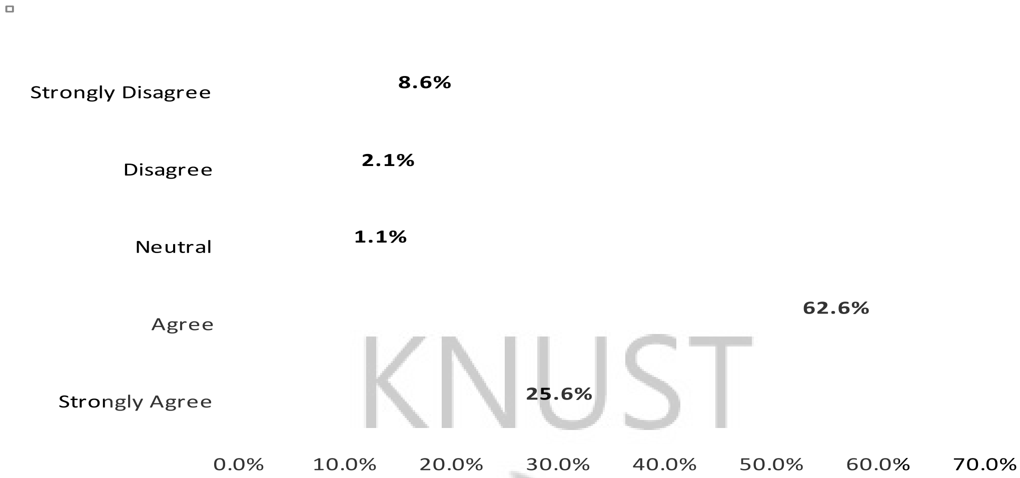
**Figure 4.16: Very low farm output before boreholes were provided in community**




**Source: Fieldwork, 2006**

In Figure 4.17, 88.2% of respondents (25.6% Strongly Agree; 62.6% Agree) affirmed borehole provision contributing to increased farm acreages and earnings. This makes livelihood occupations in agriculture very rewarding in rural communities and stimulates wealth creation towards poverty reduction.

**Figure 4.17: Boreholes provision contributing to increased farm acreages in communities and earnings in households**




**Source: Fieldwork, 2006**

A survey respondent indicated:

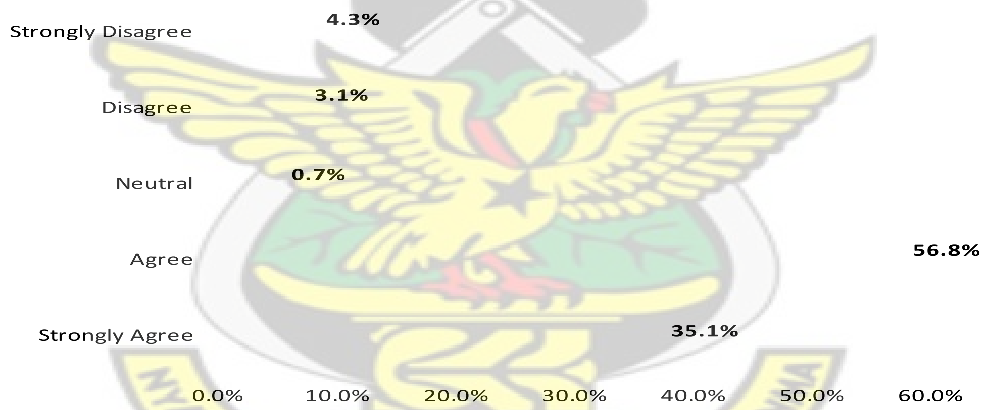
> "The borehole in our community has improved our work on our farms. Now we have more time to work and increase the size of our farms. It has completely eradicated guinea worm and now we have health to work to get more produce to sell on market days to get money." (49 year old male respondent - Odumasua community)

Results from the study further revealed poverty reduction indicators with almost seventy-six per cent (75.8%) of survey respondents asserting that boreholes provided directly contribute to their economic activities and improved their livelihoods. Almost ninety-seven per cent (96.8%) of respondents also indicated time savings in community because of the availability and easy access of water from boreholes. This indicator portrays the critical essence of time in the lives of people. Time savings are used for engaging in much livelihood occupations for income generation and wealth creation enterprises. Almost eighty-five per cent (84.7%) of respondents indicated practical linkages between household water availability and the ability of households to generate income all year round due to easy access to boreholes and time savings.

Also, 85.0% of respondents indicated that boreholes being available in communities were contributing significantly to household incomes. Further, 70.0% of respondents indicated their ability to purchase clothing for themselves and household members as a result of their livelihoods income earning activities due to the provision of boreholes.

In further relating the provision of boreholes to improved livelihood occupations and incomes, as shown in Figure 4.18, 91.9% of respondents (35.1% Strongly Agree and 56.8% Agreed) from the programme communities indicated a high level of poverty before the provision of boreholes.

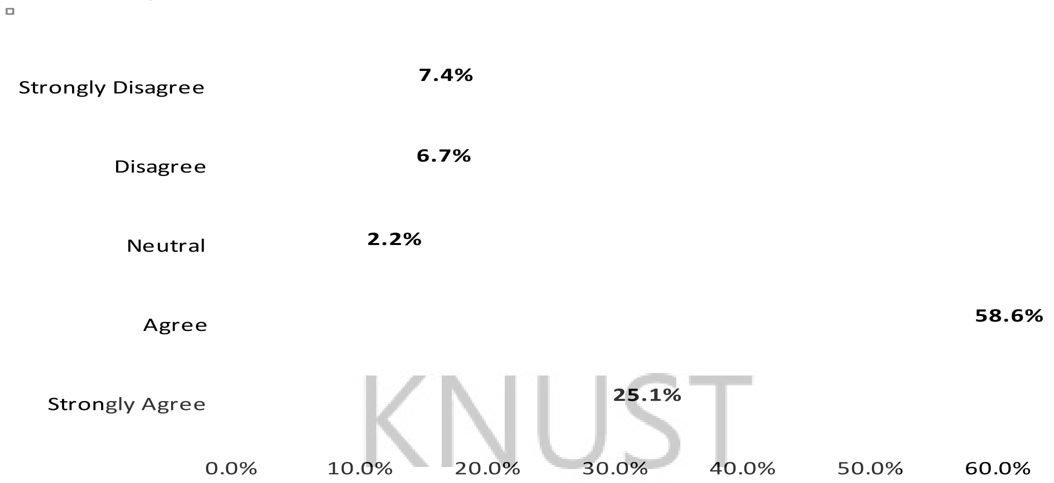
**Figure 4.18: High level of poverty before boreholes were provided**




**Source: Fieldwork, 2006**

However, as shown in Figure 4.19, 83.7% of respondents (25.1% Strongly Agree and 58.6% Agreed) from the Programme communities indicated low poverty levels after the provision of boreholes. The results of the study revealed that the provision of boreholes have contributed in reducing poverty in people's lives through improved health, increased farm production, increased income, ability to afford basic needs and ability to cater for families better, and daily access to potable water in as much quantities as needed.

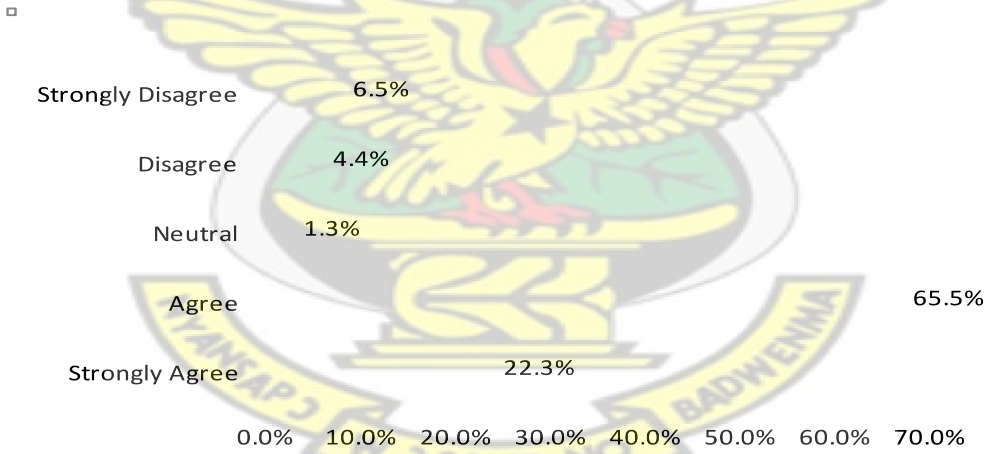
**Figure 4.19: Low level of poverty after boreholes were provided**




**Source: Fieldwork, 2006**

In Control communities, 87.8% of respondents (22.3% Strongly Agree, and 65.5% Agree) indicated living a life of very limited options as depicted in Figure 4.20.

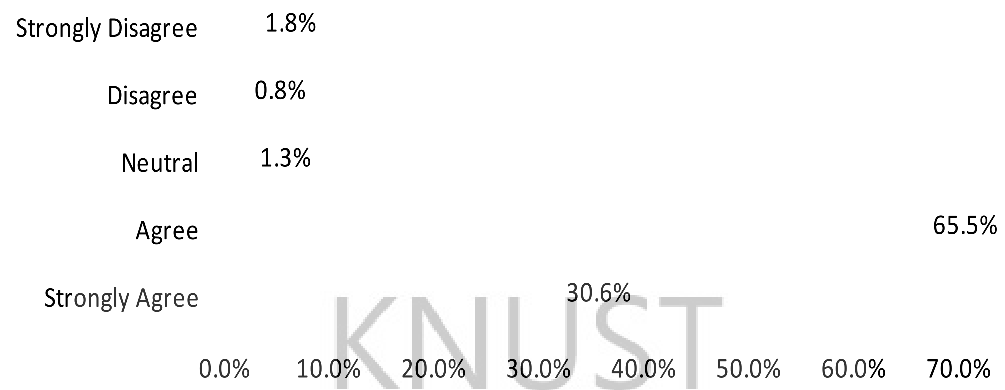
**Figure 4.20: Living a life of limited options in Control communities**




**Source: Fieldwork, 2006**

Again, 96.1% of control respondents (Strongly Agree 30.6% and Agree 65.5%), indicated the presence of endemic poverty in their communities as shown in Figure 4.21.

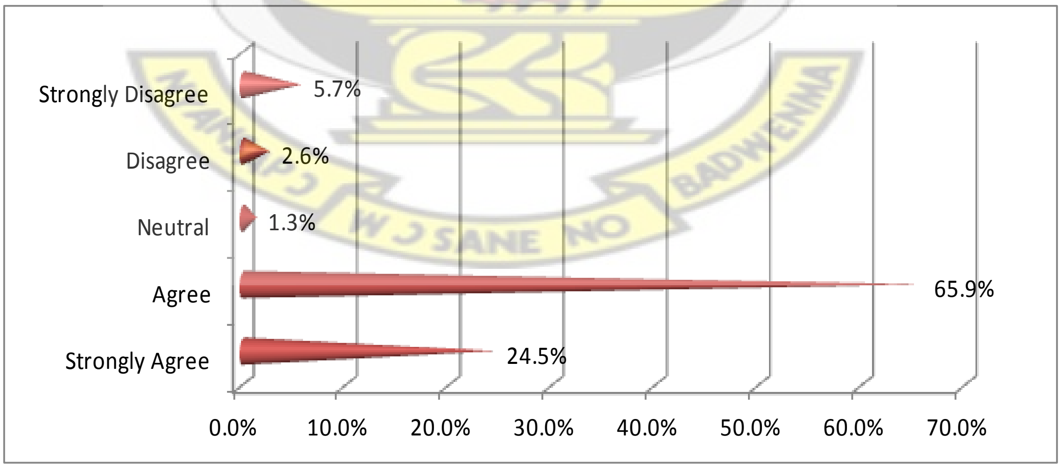
**Figure 4.21: Poverty prevalent in Control communities**




**Source: Fieldwork, 2006**

While 97.4% of respondents in control communities indicated the presence of daily survival issues as a major problem in their communities, low level economic activities was also indicated by 90.4% of respondents (Strongly Agree 24.5% and Agree 65.9%), as depicted in Figure 4.22. This has implication of further fostering endemic poverty.

**Figure 4.22: Low level of economic activities in households in Control communities**




**Source: Fieldwork, 2006**

Table 4.15 shows that 92.6% of the respondents (Strongly Agree 36.1% and Agree 56.5%) indicated that the absence of boreholes in their communities affected their occupational activities negatively and brought about economic constraints. The provision of boreholes has however reversed that trend and caused positive transformations and improvements in their livelihood occupations.

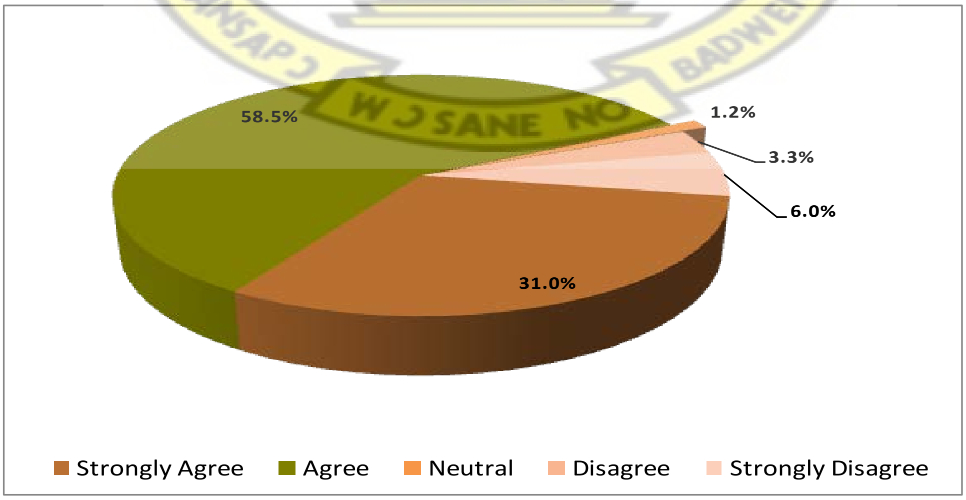
**Table 4.15: Absence of boreholes affecting occupational activities**

| Response | Frequency | Percent |
|---|---|---|
| Strongly agree | 433 | 36.1 |
| Agree | 678 | 56.5 |
| Neutral | 63 | 5.3 |
| Disagree | 17 | 1.4 |
| Strongly disagree | 9 | 0.7 |
| Total | 1200 | 100.0 |

**Source: Fieldwork, 2006**

In Figure 4.23, 89.5% of respondents (Strongly Agree 31.0% and Agree 58.5%) indicated the prevalence of low household incomes before boreholes were provided. This shows the direct relationship between the absence of boreholes and prevalence of poverty in rural communities since the marginal incomes could not sustain and provide the basic needs of households.

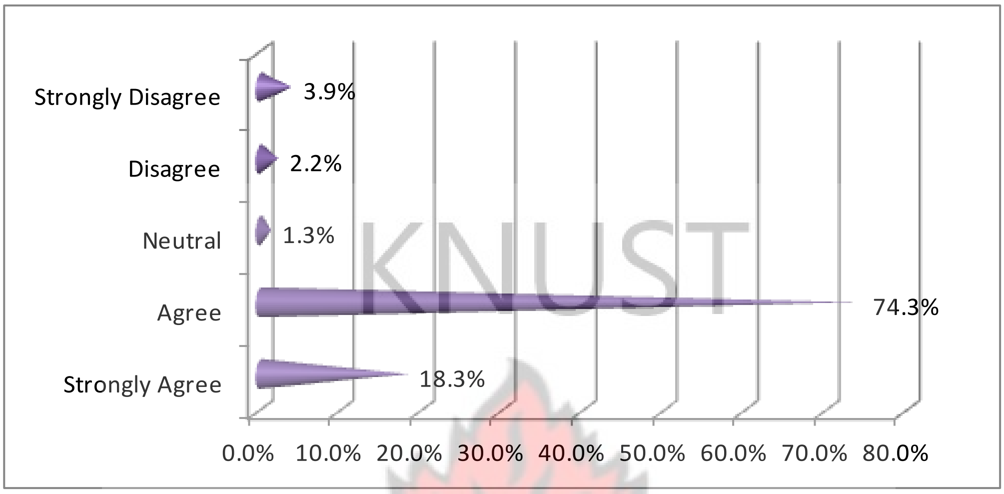
**Figure 4.23: Low households incomes before boreholes provision**




**Source: Fieldwork, 2006**

In Control communities poor incomes were prevalent as indicated by 92.6% of respondents (18.3% Strongly Agree, and 74.3% Agree) as depicted in Figure 4.24.

**Figure 4.24: Poor incomes prevalent in Control communities**




**Source: Fieldwork, 2006**

In Table 4.16, 88.1% of respondents (Strongly Agree 28.6%, and Agree 59.5%) indicated boreholes provision has resulted in increased incomes and gradual wealth creation in households. This led to improved quality of life and progressive poverty reduction.

**Table 4.16: Boreholes provision resulting in increased incomes and progressive wealth creation in households**

| Response | Frequency | Percentage |
|---|---|---|
| Strongly agree | 343 | 28.6 |
| Agree | 714 | 59.5 |
| Neutral | 7 | 0.6 |
| Disagree | 25 | 2.1 |
| Strongly disagree | 111 | 9.2 |
| Total | 1200 | 100.0 |

**Source: Fieldwork, 2006**

In this study 86.4% of survey respondents affirmed that the availability of potable water from boreholes was contributing a significant proportion of household incomes. For instance, in Table 4.17 76.9% of respondents indicated an income range from GHC50 to 6,500 as their new annual income after boreholes were provided in their communities.

**Table 4.17: Income earned from work annually after boreholes provision**

| # | Respondents income (GHC) | Percentage |
|---|---|---|
| 1. | 50 | 2.5 |
| 2. | 100 | 6.3 |
| 3. | 150 | 3.3 |
| 4. | 200 | 6.5 |
| 5. | 250 | 3.3 |
| 6. | 300 | 8.7 |
| 7. | 350 | 2.3 |
| 8. | 360 | 0.6 |
| 9. | 370 | 0.4 |
| 10. | 400 | 7.9 |
| 11. | 450 | 1.8 |
| 12. | 500 | 9.8 |
| 13. | 550 | 0.9 |
| 14. | 600 | 4.4 |
| 15. | 640 | 0.3 |
| 16. | 650 | 1.1 |
| 17. | 700 | 4.8 |
| 18. | 800 | 2.7 |
| 19. | 900 | 2.3 |
| 20. | 970 | 0.3 |
| 21. | 1000 | 2.5 |
| 23. | 1200 | 1.7 |
| 24. | 1300 | 0.4 |
| 25. | 1400 | 0.3 |
| 26. | 1500 | 0.8 |
| 27. | 1600 | 0.5 |
| 28. | 2700 | 0.1 |
| 29. | 2800 | 0.2 |
| 30. | 3500 | 0.1 |
| 31. | 6500 | 0.1 |
| | | **76.9%** |

**Source: Fieldwork, 2006**

While 9.8% earned about GHC500per year, 8.7% earned about GHC300, and another 7.9% earned about GHC400 yearly. The respondents indicated these earnings were significant improvements far over and above the period before boreholes were provided when they earned virtually very little due to incapacitation from guinea worm disease and cyclical indebtedness.

Labour constitutes the greatest asset of households in rural communities, so making it productive by providing boreholes is one of the best pathways to reduce poverty. Thus boreholes provision enhances the opportunities to earn incomes through labour utilization and also by developing human capital to take advantage of emerging opportunities through the utilization of substantive freedoms gained. In this respect respondents further indicated some other income earning activities established as a result of boreholes provided as petty trading, charcoal burning, hairdressing, baking, animal rearing, local textiles manufacturing, drug store, chop bar, corn milling, and soap making. They indicated these as secondary occupations they engaged in to generate extra income apart from their primary occupation as farmers but which previously they could not undertake for lack of potable water, time and financial capital. In relation to that a survey respondent indicated:

> "Now it does not take time at all to get water because the time we spend in fetching water has reduced drastically. We easily get water from the boreholes. We now have time for our farm work and do other things. Formerly we could not work well at the farm but now we use the extra time to work well on our farms." (39 year old male respondent – Jato Zongo community)

From Table 4.18, 76.4% of survey respondents (25.3% Strongly Agree and 51.1% Agree) indicated that their households experienced economic insecurity due to poverty as a result of very low farm output prior to the provision of the boreholes.

**Table 4.18: Economic insecurity in households due to very low farm output before the provision of borehole**

| Response | Frequency | Percentage |
|---|---|---|
| Strongly agree | 304 | 25.3 |
| Agree | 613 | 51.1 |
| Neutral | 66 | 5.5 |
| Disagree | 148 | 12.3 |
| Strongly disagree | 69 | 5.8 |
| Total | 1200 | 100.0 |

**Source: Fieldwork, 2006**

In agreement with the condition of economic insecurity prior to boreholes being provided, a survey respondent further indicated:

> "Before the borehole was provided it took us from 4.00am to 11.00am to search for and fetch some water home. In the dry season we have no choice but to engage in water hunting or keep vigil around some water holes until we can get some muddy water to scoop out. Formerly, we could not go to farm or work because of the search for water. And we sometimes had to walk for hours before we could get water. We could not work to earn much income." (47 year old female respondent – Duabone community)

Table 4.19 shows that 89.3% of survey respondents (33.3% Strongly Agree, while 56.0% Agree) indicated that water from the borehole was contributing to economic activity and improving their occupational livelihoods.

**Table 4.19: Boreholes provision contributing to economic activity and improving occupational livelihood of households**

| Response | Frequency | Percentage |
|---|---|---|
| Strongly agree | 399 | 33.3 |
| Agree | 672 | 56.0 |
| Neutral | 37 | 3.1 |
| Disagree | 59 | 4.8 |
| Strongly disagree | 33 | 2.8 |
| Total | 1200 | 100.0 |

**Source: Fieldwork, 2006**

From Table 4.20, 85.0% of survey respondents (30.1% Strongly Agree; 54.9% Agree) indicated increased agricultural food crops production in the community since the provision of boreholes.

A survey respondent indicated:

> "The provision of boreholes has freed us from guinea worm which used to incapacitate us and prevented us from engaging in farming activities for several months each year. We have now expanded our farm sizes to increase our food crops production due to our fitness." (49 year old male respondent - Tintare community)

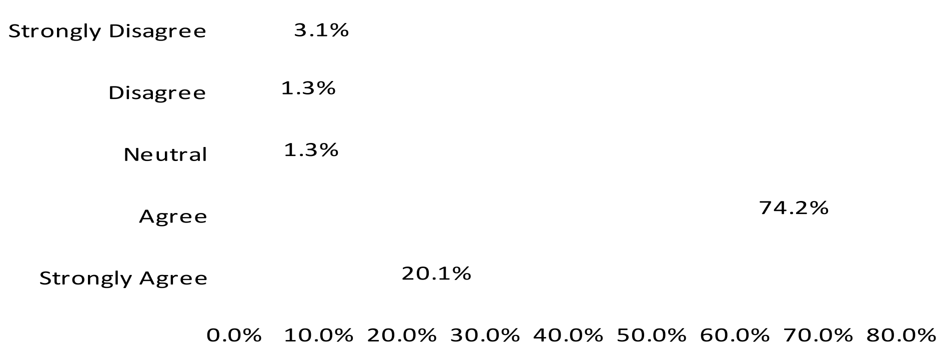
**Table 4.20: Increased agricultural food crops production in community after the provision of boreholes**

| Response | Frequency | Percentage |
|---|---|---|
| **Strongly agree** | 361 | 30.1 |
| **Agree** | 659 | 54.9 |
| **Neutral** | 42 | 3.5 |
| **Disagree** | 97 | 8.1 |
| **Strongly disagree** | 41 | 3.4 |
| **Total** | **1200** | **100.0** |

**Source: Fieldwork, 2006**

In contrast to the evidence presented in Table 4.20, in Control communities, 94.3% of respondents (Strongly Agree 20.1% and 74.2% Agree) indicated the existence of poor occupational livelihoods with virtually little income as shown in Figure 4.25.

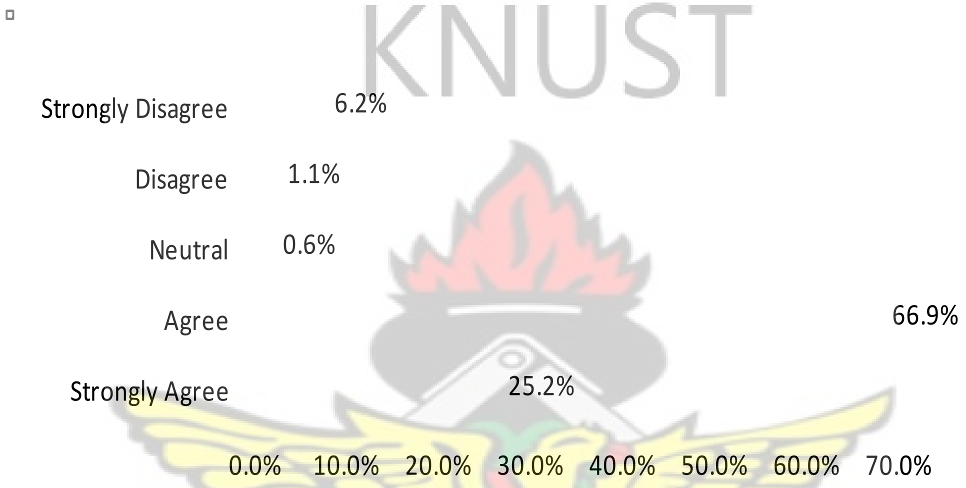
**Figure 4.25: Poor occupational livelihoods in Control communities**




**Source: Fieldwork, 2006**

Again, 92.1% of survey respondents (25.2% Strongly Agree, and 66.9% Agree) affirmed that boreholes provided were helping to increase earnings on income from livelihood occupations as depicted in Figure 4.26. This confirms the impact boreholes provision has made towards developing occupational livelihoods to generate income to reduce poverty gradually in households in the Atebubu and Afram Plains Districts.

**Figure 4.26: Boreholes provision helping to increase earnings on incomes from livelihoods**




**Source: Fieldwork, 2006**

## 4.4 Boreholes Provision and Poverty Reduction through Participation in Education

Quality education is often out of reach of poor families who face formidable barriers of access and cost in trying to send children to school. Issues confronting and compounding effective quality education include non-availability of trained teachers and very poor teacher-pupil contact time ((Mulkeen and Chen, 2008). The lack of potable water in rural communities has also been a major contributory factor to high level of absenteeism at school (Abadzi, 2007; Hanushek and Woessmann, 2007b).

Potable water provision in rural communities is among the most powerful drivers of poverty reduction and for human development through education. It creates opportunity, and helps create a crucial cycle of improving health and creating wealth (Psacharopoulos and Patrinos, 2007; Patrinos, 2007; and UNDP, 2006). Drawing some parallels with the study area, it is obvious that but for the provision of boreholes in the Atebubu and the Afram Plains Districts, many children would have been deprived of access to education and having quality education. Further, they would have been consigned to generational poverty attributable to place-of-birth disadvantage (World Bank, 2005; 2006a). In relation to this fact a survey respondent indicated:

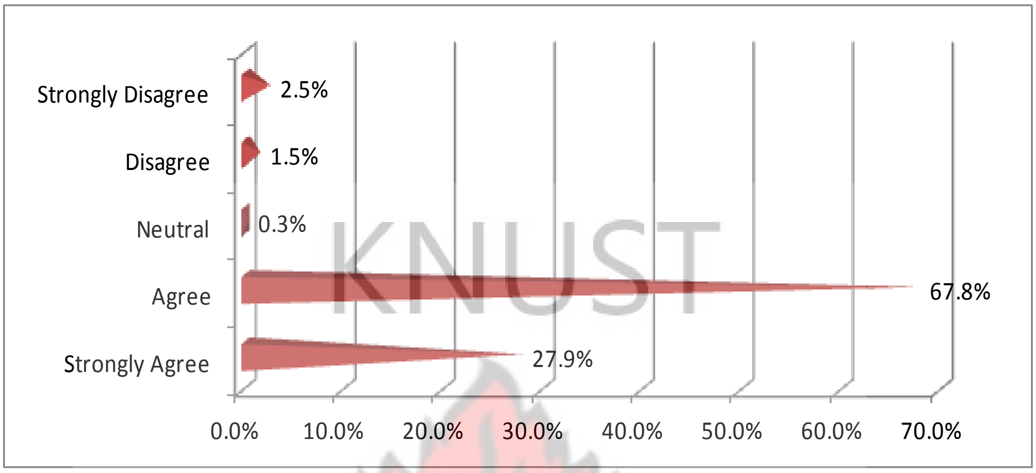


> "Now having boreholes in our community our children go to school undisturbed without going to search for water." (40 year old male respondent – Forifori community)

Results from the study indicate that, 91.1% of respondents had children and dependants ranging in age from 1-9 in Primary school. Should this trend continue and quality of education be assured, there is hope for future poverty reduction within households in the Atebubu and Afram Plains. The results further show that 77.6% of the respondents had children in Junior Secondary School, and 38.0% had children in Senior Secondary School, Technical and Commercial Schools. The trend indicates low participation and a high attrition at the higher levels of education and this may not facilitate major breakthroughs for eventual poverty reduction since higher manpower compensation levels are mainly associated with higher education in the Ghanaian society (Republic of Ghana, 2009; McKay and Aryeetey, 2007).

As depicted in Figure 4.27, results from the study show 95.7% of respondents (Strongly Agree 27.9% and 67.8% Agree) indicating that prior to boreholes being provided in the study area school attendance by children was adversely affected by time spent searching for water over long distances each day. This had implications of high level involuntary absenteeism from school and directly compromising quality education delivery.

**Figure 4.27: School attendance adversely affected by time spent searching for water**




**Source: Fieldwork, 2006**

Table 4.21 depicts the trends in school enrollment in the Atebubu and Afram Plains Districts where the study was carried out. The trends in both districts show increased enrolment which can be attributed to the availability of boreholes in rural communities which has freed children to attend school. While school enrolment data captured for the Afram Plains indicate a 71% improvement over its 1992 enrolment level, data available for Atebubu from 1998 indicate a 29% improvement.

**Table 4.21: Trends in school enrolment, Afram Plains and Atebubu Districts**

| **DISTRICTS** | **SCHOOL ENROLMENTS** | | | |
|---|---|---|---|---|
| | **1992** | **1998** | **2006** | **%** |
| **Afram Plains** | 1,350 | - | 4,651 | 71 |
| **Atebubu** | - | 11,165 | 15,725 | 29 |

**Source: Ghana Education Service - District Education Offices, 2006**

In respect of school attendance an in-depth interview respondent had this to say:

> "Children were most often sent by their parents to fetch water, a chore which caused most children to be absent from school most of the time. Now only the undisciplined children do not go to school. There are enough teachers, and

> school attendance has increased. If a child does not go to school, I will not blame that on lack of water." (65 year old male respondent – Abease community)

Results from the study have revealed that, time spent by school children, in both the Atebubu and the Afram Plains Districts, in fetching water, has reduced drastically. Children are now able to enroll and go to school on time. During the survey a teacher indicated:

> "Before boreholes were provided, we were having serious problems because the children could not go to school after fetching water. Now the situation has changed completely, and we are very relieved. Now children in this community go to school daily and also on time." (57 year old male respondent – Nyamebekyere community)

For millions of poor households, there is a direct opportunity cost between time spent in school and time spent collecting water (La Frenierre, 2009; Blackden and Wodon, 2006; and UNDP, 2006). A survey respondent described the situation as follows:

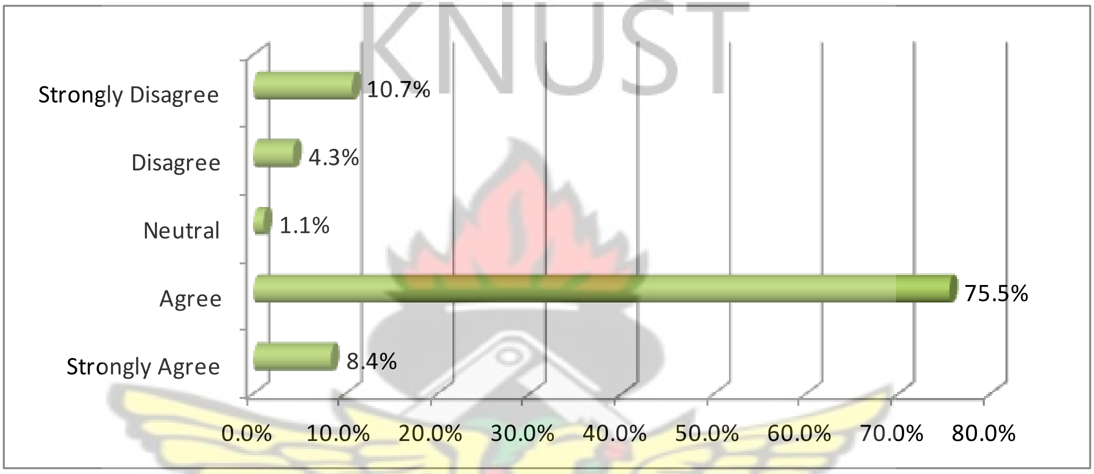
> "There has been significant improvement in school enrolment and attendance because school children no longer walk long distances to fetch water. In addition, clean water has tremendously improved the health of school children and their families." (48 year old male respondent – Kumkumso community)

Of the respondents surveyed, 73.3% indicated boreholes have empowered parents to pay school bills and purchase school uniforms for their children. This made schooling attractive to children and encouraged them to stay in school and complete each cycle of basic education than dropping out. Also, 79.5% of respondents indicated that prior to boreholes provision there was very low retention in school leading to very poor academic performance and the basic cause of inability to progress on the educational ladder, while 93.6% of respondents stressed poor school attendance was prevalent before boreholes were provided. Improvement in school attendance since the provision of boreholes was also indicated by 95.8% of respondents. A survey respondent indicated:

> "With the borehole at our doorstep in the Community, our children now go to school early and also very regularly." (42 year old female respondent – Old Kokrompe community)

As shown in Figure 4.28 83.9% of respondents (Strongly Agree 8.4% and 75.5% Agree) indicated they preferred children attending school instead of sending them to go searching for water. The opportunity cost also faced especially by children in households is very substantial in relation to time spent in search of and to fetch water.

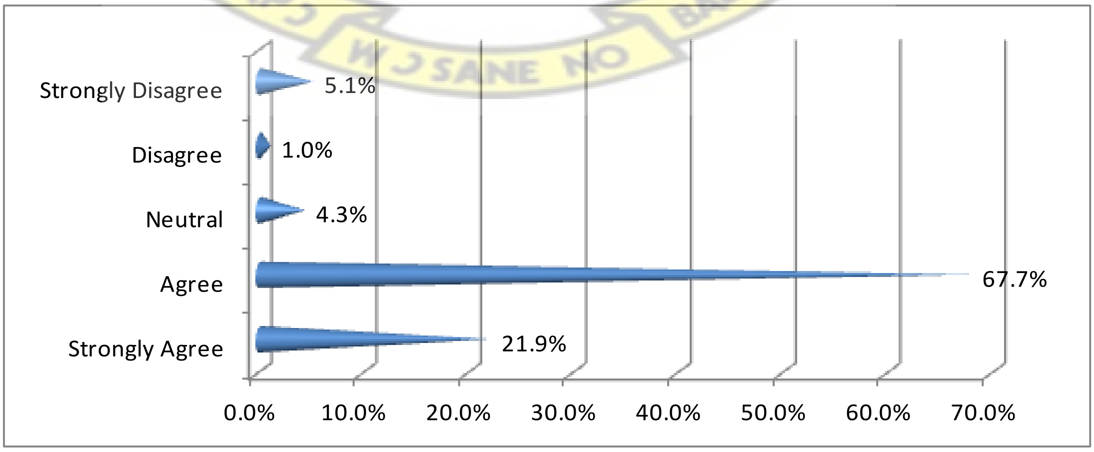
**Table 4.28: Preference for children attending school**




**Source: Fieldwork, 2006**

Further, Figure 4.29 shows 89.6% of respondents (Strongly Agree 21.9% and 67.7% Agree) indicating that boreholes provided in or near communities have enabled water to be fetched for households before and after school hours.

**Figure 4.29: Boreholes enabling water fetching before and after school hours**

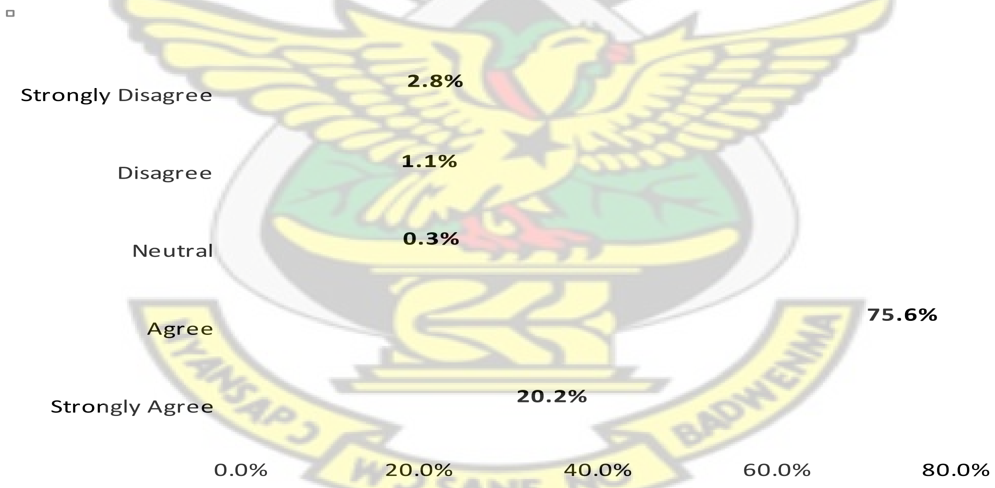



**Source: Fieldwork, 2006**

The substantial time savings enable children attend school regularly and participate effectively. This improves the effective contact time with teachers. With effective teaching the quality of education delivery improves and children are able to move on to the higher levels of the education system and ultimately flow into the highly paid levels of the job market and distance themselves from poverty, within all possible probabilities.

As indicated in Figure 4.30, 95.8% of respondents (Strongly Agree 20.2% and 75.6% Agree) indicated boreholes provision in their communities as having improved and continue to improve school attendance. This is a high impact poverty indicator on future poverty reduction.

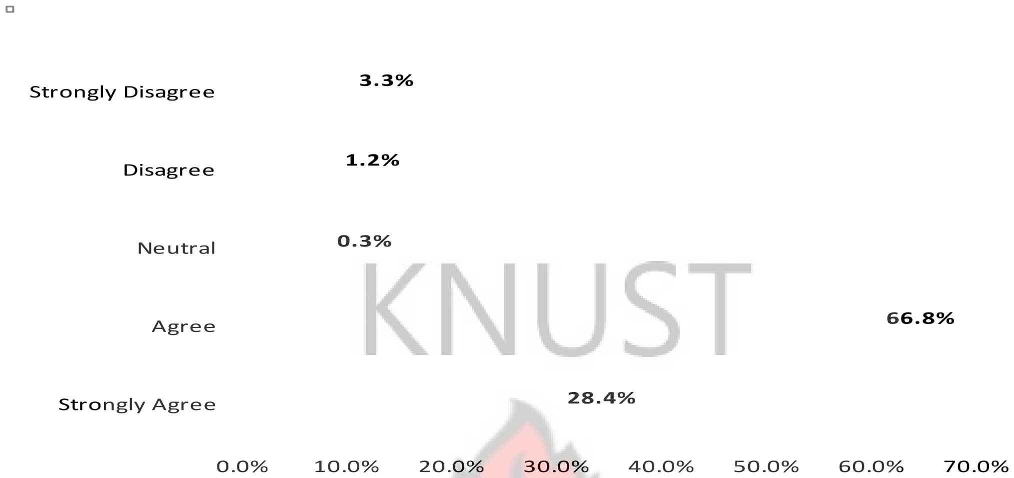
**Figure 4:30: Boreholes provision facilitating improved school attendance in communities**




**Source: Fieldwork, 2006**

As to whether borehole provision was enabling children to be regular and punctual at school, 95.2% of respondents (Strongly Agree 28.4% and 66.8% Agree) as shown in Figure 4.31 gave affirmative indication. This is a major indicator of the potential of improvement in quality education, towards poverty reduction and should the trends as indicated in Figure 4.31 continue, improvements in the consistency of punctuality and regularity in school attendance will eventually lead to improved progression of children to the higher levels of the education system.

**Figure 4.31: Boreholes provision enabling children to be regular and punctual at school in communities**




**Source: Fieldwork, 2006**

This will prepare and equip them to join the labour force and earn incomes that would distance them from poverty as affirmed in studies by Hanushek and Woessmann, 2007b; and Patrinos, et al, 2007. However in Control communities, 62.4% of respondents indicated very poor school attendance in their communities.

Also, as depicted in Figure 4.32, as at the period the survey was carried out 70.9% of respondents (Strongly Agree 20.6% and 50.3% Agree) indicated the availability of teachers in their communities after boreholes were provided. This is a positive indication for improvement in quality education to empower children to ultimately distance themselves from poverty.

The basic assumption being that trained teachers in the communities facilitates better teaching and learning. It also provides increased contact hours with pupils, which enable teachers do effective teaching and complete the school curricula (Abadzi, 2007; Patrinos, 2007). This brings much hope for potential poverty reduction in the lives of children living in the Atebubu and Afram Plains Districts.

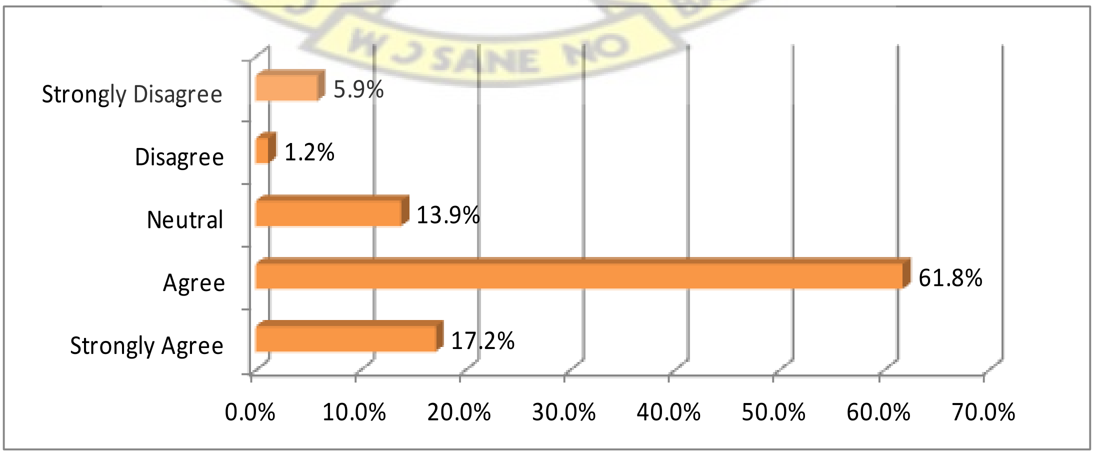
**Figure 4.32: Availability of teachers in community with the provision of boreholes**


**Source: Fieldwork, 2006**

Thus, trained teachers in schools are a direct function of quality education, in the same way as good classrooms and availability of teaching and learning materials (World Bank, 2010f; Serge, 2009; Mulkeen and Chen, 2008). However in Control communities, 81.6% of respondents indicated the lack of teachers in their communities with the implication of children being possibly entrenched in poverty in future.

Also as depicted in Figure 4.33 results from the study show 79.0% of respondents with the opinion (17.2% Strongly Agree, and 61.8% Agree)

**Figure 4.33: Boreholes helping to check children dropping out of school**




**Source: Fieldwork, 2006**

that boreholes provided has helped to check the drop-out of children from school. Thus high level retention of children in school is a positive indication of improvement in quality education delivery. Children being regular at school facilitate effective continuous learning and build their capacity to advance beyond basic education. This constitutes their first steps towards reducing poverty from their lives should they remain consistent in moving upwards in the education system.



## 4.5. Access to Potable Water through Boreholes as an Enhancing Factor for Poverty Reduction

As already indicated in Table 2.2, according to the World Health Organization (WHO), when time spent is between 5minutes or travel distance is within 100m to access potable water, it implies "Intermediate Access" as depicted in Plate 6.

This is the minimum normal access compatible enough to facilitate normal human well-being. This is conducive and facilitates fast improvements in human well being and substantive freedoms. A survey respondent indicated:

> "The distance from this community to the borehole site is just about 1 km. This is a very short distance for us. You can even put your food on fire and ran to fetch water and return before the food finished cooking. We use less than an hour to go fetch water from the borehole and return home." (47 year old female respondent – Watro community)

**Plate 6: "Intermediate Access" – Water fetching from borehole – Afrefreso Community, Atebubu District**

**Source: Fieldwork, 2006**

In assessing the time taken to access water seasonally, Table 4.22 shows 69.0% and 88.7% of respondents in programme communities the Atebubu and Afram Plains Districts respectively being able to access water within 30 minutes in the wet season, while 32.5% and 54.0% of respondents in control communities in both Districts respectively also could access water within 30minutes. The lesser time spent by the majority of the respondents from the programme communities may be due to the availability of boreholes.

**Table 4.22: Time taken to fetch water - wet season**

| District | Below 30 minutes (%) | | 30mins-1hour (%) | | 1-2hrs (%) | | 2-3hrs (%) | |
|---|---|---|---|---|---|---|---|---|
| | Programme | Control | Programme | Control | Programme | Control | Programme | Control |
| **Atebubu** | 69.0 | 32.5 | 19.3 | 32.4 | 7.9 | 18.9 | 3.8 | 16.2 |
| **Afram Plains** | 88.7 | 54.0 | 9.6 | 31.0 | 1.7 | 15.0 | - | - |

**Source: Fieldwork, 2006**

Comparatively, Table 4.23 shows that 41.8% and 70.6% of the respondents in programme communities in both the Atebubu and Afram Plains Districts respectively indicating the being able to access water during the dry season. In comparative terms only 10.8% and 39.0% of the respondents in control communities in both Districts respectively could access water during the dry season. The trend in terms of geographical variations between the Atebubu and Afram Plains Districts indicates that water scarcity is more acute in the Afram Plains than in the Atebubu District.

**Table 4.23: Time taken to fetch water – dry season**

| District | Below 30 minutes (%) | | 30mins-1hour (%) | | 1-2hrs (%) | | 2-3hrs (%) | |
|---|---|---|---|---|---|---|---|---|
| | **Programme** | **Control** | **Programme** | **Control** | **Programme** | **Control** | **Programme** | **Control** |
| **Atebubu** | 41.8 | 10.8 | 26.3 | 29.7 | 18 | 29.7 | 13.9 | 29.7 |
| **Afram Plains** | 70.6 | 39 | 17.5 | 31 | 7.3 | 31 | 4.6 | - |

**Source: Fieldwork, 2006**

The time taken to fetch water in both wet and dry seasons shows that majority of the respondents from the programme communities spent lesser times in fetching water than those in the control communities. The difference can be attributed to the availability of boreholes in the programme communities.

Results from the study further show that 92.1% of the respondents from the programme communities indicated that time wasting for searching and queuing for water prior to boreholes being provided have been eliminated, while only 7.9% respondents indicated that the time wasting in queuing for water has not been eliminated. However, it was revealed that communities which still experience long queues in fetching water were those which have some of their boreholes broken down or those which have their population outnumbering the capacity of the boreholes due to in-migration.

When water is accessible within 5 - 30 minutes or within 100m up to 1000m reach, it implies “Basic Access” as depicted in Plates 7 and 8. From the study it is evident that “Intermediate and Basic access” are the current prevailing standard in the study area. Plate 9, depict the existing situation in a control community in the Afram Plains District, with a level of “No access” with adverse effects on the rural populations and children’s school attendance. “No access” implies water cannot be accessed within 30 minutes, and the water source is more than 1000m away from the household. At a Community Meeting a respondent indicated “No access” as the type of access they had before boreholes were provided as follows:

> “Before boreholes were provided in this community, some people had to go to different places far away from this community to search for water.” (53 year old male respondent – Semanhyia community)

**Plate 7: ‘Basic Access’ - Watro Community - Atebubu District**

**Source: Fieldwork, 2006**

**Plate 8: 'Basic Access' - Ameyawkrom Community, Afram Plains District**

**Source: Fieldwork, 2006**

**Plate 9: " No Access" - Appiabra Community, Afram Plains District**

**Source: Fieldwork, 2006**

In Control communities, 81.6% of respondents indicated the effect of spending long hours searching for water as: lateness to farm, delays in farming activities, delays in daily activities, lateness to school by children and increasing children's absenteeism from school, time poverty due to long hours wasted instead on farm, and time wasting and stress. They indicated further that the time wasted caused low farm productivity, low farm outputs and low incomes. Another 89.5% of respondents indicated the lack of access to potable water adversely affected their domestic lives.

As indicated by the results of this study and as depicted in Plate10, the implication of access for effective school participation is obvious where a borehole is within reach, and children can easily access it and fetch water for their households and still get to school on time. The time savings enable children attend school regularly and be punctual as well. Households, and especially children, can also fetch water after school and store for early morning use and get to school early.

For instance, results from this study show that 95.2% of respondents indicated that before boreholes were provided children spent long hours daily searching for water for their households. However, as a result of boreholes provision there is much teacher-child contact hours in teaching and learning which facilitates a high number of children to graduate to the higher levels of the education system. Within possible probabilities these children will enter the labour force at higher levels of income earnings and escape poverty for the rest of their lives.

**Plate 10: "Intermediate Access" – School-aged children at a borehole – Daman Nkwanta Community, Atebubu District**

**Source: Fieldwork, 2006**

In contrast, where there is "No Access" and implying much longer time being spent to access water, children and teachers both lose much time in fetching water, come back exhausted and school attendance is compromised. Similar to results obtained in studies by Abadzi and others, children's attention during teaching time at school is weakened as they experience tiredness from the burden of drawing water (Abadzi, 2007; Mulkeen and Chen, 2008; Mertaugh, et al, 2009; Molinas, et al, 2010).

Other children succumb to water-borne and water-related illnesses and thus become absent from school several days intermittently, during the school calendar year. The performance of such children usually falls below average. Some are repeated and some drop-out of school and never return (Fredriksen, 2010; UNDP, 2006). The high attrition rate of children due to lack of access to potable water eventually consigns them to low literacy levels and lack of ability to achieve higher education and acquire job skills. Such children grow into adults and mostly end up in low levels of the labour force, earn low incomes and find themselves unable to break out from poverty (Sachs, 2005; Pruss-Ustun, et al, 2008; Prahalad, 2010).

## 4.6. Boreholes Sustainability and Poverty Reduction

Borehole sustainability is critical for poverty reduction and human well-being and it calls for strong, local level water governance institutions to mobilize communities to continually keep their boreholes functioning to reap the unlimited benefits of potable water availability in their communities. The study's results show that 90.8% of respondents indicated that their Community boreholes were "currently working", as at the time of the survey. This is a practical evidence of high level impact and a major sustainability indicator of community ownership of boreholes. It also indicates the ability to operate and maintain their boreholes to assure continual availability of water to support improvement in health and hygiene practices, and free people to engage in their livelihood occupations to earn income progressively to reduce poverty.

From the Community Meetings held during the field survey for this study, and listening to community members recount their past experiences of the gruesome physical and mental fatigue, water borne/related illnesses, social and economic deprivations they have endured, then it is understandable why they would not compromise and lose the substantive freedoms they have gained as a result of boreholes provided in their communities.

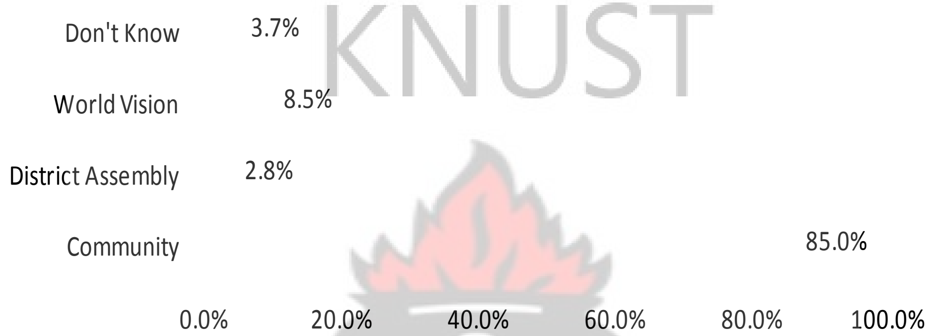
Freedoms that are empowering children access and enjoy quality education, and thereby offering them hope and a future out of poverty; freedoms and benefits that now cement marriage bonds in these communities, freedoms of celebrating and worshipping God, freedoms of strengthened social cohesion, freedoms from incapacitating and debilitating water-borne/related diseases; and freedoms of mobility. Also the freedoms of improved economic potentials, capacity for wealth creation, enhanced and seemingly unlimited opportunities for capability development to the utmost of one's potential have all been made possible through the provision of boreholes in these rural communities.

With these benefits evident, it cannot be overemphasized that borehole sustainability is central to sustaining all the substantive freedoms gained, and the chain of processes facilitating progressive poverty reduction. Thus, in this study the rural communities served were found prepared to do anything possible to keep their boreholes running, barring aquifer failure. This palpable evidence buttresses Harvey and Reed's assertion that, in terms of boreholes sustainability, 'a non-functioning hand pump is a stark symbol of unfulfilled expectations and unchanging poverty' (Harvey and Reed, 2004: 84). By implication, wherever boreholes are functioning consistently over a long period in rural communities, there must be obvious evidence of progressive poverty reduction.

Several opinions have been expressed to indicate that, on its own, a borehole hand pump is not able to assure continual potable water availability until there is active community involvement, which is central to the whole process. Ensuring continuous flow of potable water requires active community participation and studies have shown that community level management of boreholes has proven to be the best approach, but it should go with motivation incentives to the local water governance committee (Fisher, 2011; Pruss-Ustun, et al, 2008; Mays, 2007; Schouten, 2006).

Unlike the scenario indicated in Chapter Two section 2.2.2 of this study which depicted a very high rate of non-functioning boreholes scattered in countries in Sub-Saharan Africa, this study, however, revealed that boreholes sustainability has been a high priority for communities served in the Atebubu and Afram Plains Districts. For instance, in this study, 85.0% of respondents indicated their communities owned the boreholes as depicted in Figure 4.34. This indicates high level awareness of their responsibility to sustain the boreholes to ensure availability of potable water for their households.

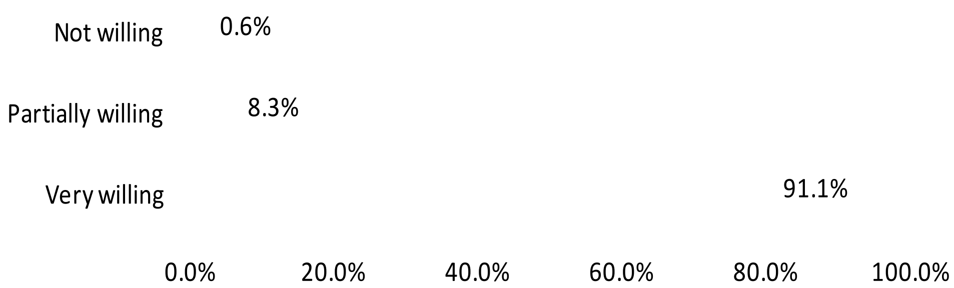
**Figure 4.34: Ownership of boreholes in communities**




**Source: Fieldwork, 2006**

In terms of commitment, 99.4% of respondents (Very willing 91.1% and partially willing 8.3%) indicated willingness on the part of community members to sustain boreholes as depicted in Figure 4.35. Meanwhile, 86.4% of respondents indicated their households contribute funds as levies for borehole maintenance, which they view as very important for the continual operation of boreholes in their communities.

**Figure 4.35: Community's willingness to sustain boreholes**




**Source: Fieldwork, 2006**

Results from the study further showed 86.5% of respondents indicated that trained Pump Maintenance Technicians (PMTs) were available and firmly in charge of boreholes repair and maintenance as depicted in Plate 11.

At the same time 62.3% of respondents indicated generational capacity building of PMTs to replace those who migrated from their communities. Again, 87.8% of respondents indicated borehole sustainability was on-going through the maintenance and repairs activities of local PMTs. Plate 12 shows a typical borehole maintenance activity. Also prompt access to pump parts was indicated by 88.7% of respondents, while 85.1% indicated the availability of trained PMTs to service boreholes in communities. Thus, each community provided with a borehole had the ability to facilitate repairs at all times of the year, if only they have the right spare parts in stock or know where to acquire them.

Also, 84.8% of respondents indicated that the formation and training of WATSAN Committees – (which are the local water governance institutions) has greatly promoted the sustenance of boreholes in communities, while 84.9% of respondents indicated borehole monitoring by WATSAN Committees as having been supportive to borehole maintenance. Almost seventy-five per cent (75.1%) of respondents indicated WATSAN Committees being still functional in their communities as at the time of the survey. Local chiefs or tribal leaders often have a major influence within communities and their involvement may be the difference between success and failure. In this study, 92.9% of respondents indicated that boreholes sustainability has also thrived much through community leadership mobilization efforts.

**Plate 11: Boreholes Installation and Training of Pump Maintenance Technicians**

**Source: Fieldwork, 2006**

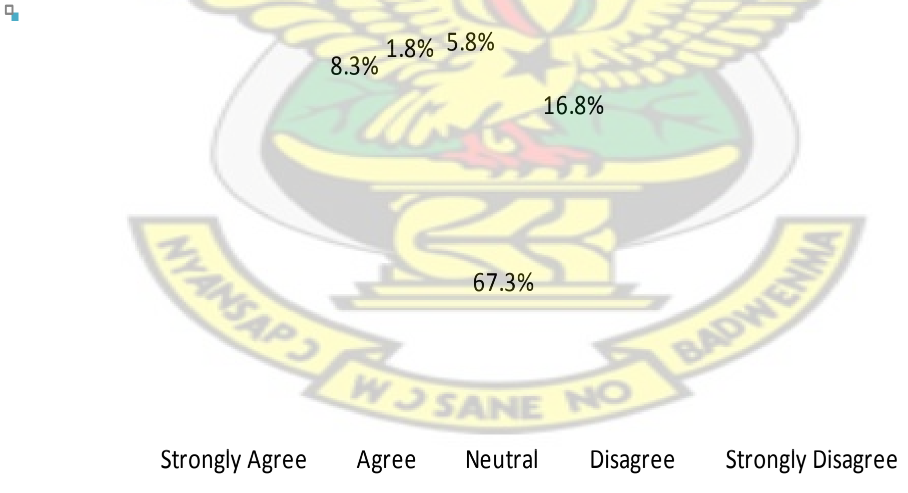
**Plate 12: Borehole Maintenance by Hand pump Technicians**

**Source: Fieldwork, 2006**

In terms of utility friendliness, 83.0% of respondents indicated that the standardization of hand pumps – (use of the Indian Mark II Modified) has enabled Pump Maintenance Technicians (PMTs) master the repair and maintenance of the boreholes. For 90.3% of respondents, due to effective hand pump maintenance, potable water is available all year round from the boreholes and were of the view that should such practice continue, potable water availability is assured.

Also, 84.1% of respondents (Strongly Agree 16.8% and Agree 67.3%) indicated that potable water availability from the boreholes has enabled households to generate income and created wealth to reduce poverty as depicted in Figure 4.36. This has actually gone a long way to improve the quality of life and fostering effective poverty reduction in the study area.

**Figure 4.36: Boreholes provided facilitating wealth creation and reducing poverty in households**




**Source: Fieldwork, 2006.**

Comparative analysis estimates indicate that as at 2006, 60.2% of hand pumps fixed on boreholes in Nigeria were non-functioning. The main reason assigned for these hand pump failures was lack of maintenance of the hand pumps after installation. So with continued usage, serious wear and tear occurred until they finally ceased functioning (Eduvie, 2006). In this study however, 83.3% of respondents in communities provided with boreholes surveyed gave indication that the boreholes were promptly repaired by the trained Pump Maintenance Technicians when they break down. This has helped to prevent people from reverting to old sources of surface water and resulting in sustained poverty reduction. For instance, the following views were expressed by two respondents during the field survey as follows: A survey respondent indicated:

> "We have had the boreholes for almost 12 years now since World Vision drilled them and you can be assured that all the diseases that used to worry us and incapacitate us have vanished because we use the boreholes always and sustain them." (52 year old male respondent – Maame Krobo community)

A survey respondent observed:

> "When our borehole breaks down we have some people in this Community trained by World Vision who repair them. They dismantle the equipment and get them repaired." (47 year old male respondent – New Kokrompe community)

It is obvious that for poverty reduction to be sustained, boreholes sustainability will have to be a prime concern to all community members who have to support the water governance institutions established to function effectively. In that respect 96.8% of respondents indicated boreholes sustainability as being quintessential for sustainable livelihoods, improving the quality of life, and facilitating reduction in poverty in their households.

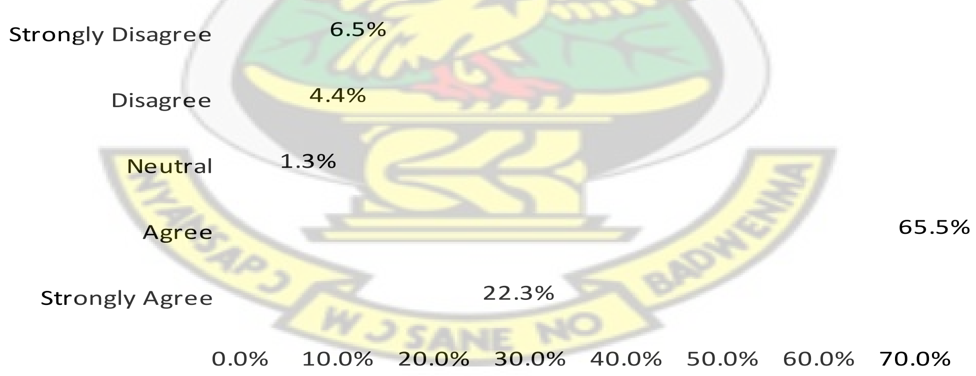
As boreholes continue to function well and people in households continue to patronize them, their health also improves. This avails them of unlimited substantive freedoms from which they will continue to direct more time and energy into their occupational livelihoods to earn income. This will further result in wealth creation and improved quality of life, and eventually, in sustained, progressive poverty reduction.

## 4.7. Boreholes Provision as Platforms for Resolving Issues of Adverse Geography for Poverty Reduction

Results from the study give indication that the provision of boreholes and the resultant eradication of waterborne/related diseases, especially guinea worm in programme communities surveyed proved availability of freedoms regained and employed to facilitate reduction in poverty. Conversely, 87.8% of respondents in Control communities (Strongly Agree 22.3% and 65.5% Agree) indicated living a life of limited options as depicted in Figure 4.37.

Sachs (2005), has indicated that geographical determinism is a false accusation based on geographical disadvantage which claims that geography single-handedly and irrevocably determines the economic outcome of people and their countries.

**Figure 4.37: Living a life of limited options in Control communities**

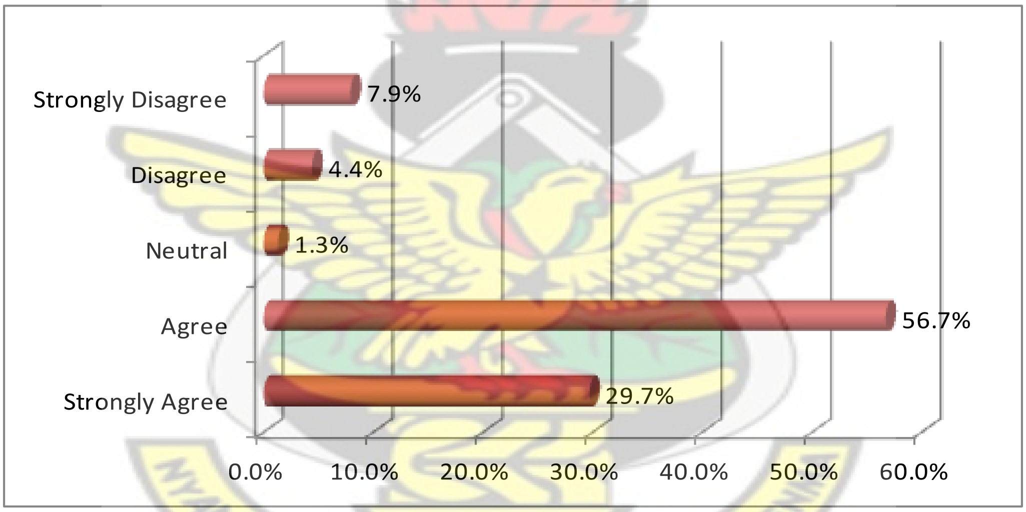



**Source: Fieldwork, 2006**

However, in terms of solutions, he is of the view that these constraints require countries to only undertake extra investments that other more fortunate countries will not have to make. In his opinion therefore, adverse geography presents challenges that can be solved, but only at much higher cost (Sachs, 2005).

Again, Sachs is of the view that the solutions to counteract geographical determinism, lies in the adoption and use of practical and proven technologies. For instance, water-borne disease such as guinea worm, being eradicated through the provision of improved water infrastructure such as boreholes. The results from this study as depicted in Figure 4.38, show inhabitants in Control communities living at the mercy of the physical environment as indicated by 86.4% of respondents (Strongly Agree 29.7% and 56.7% Agree). This condition continues to define the limitations to their freedoms, their hopes and their aspirations.

**Figure 4.38: Inhabitants live at the mercy of the physical environment in Control communities**

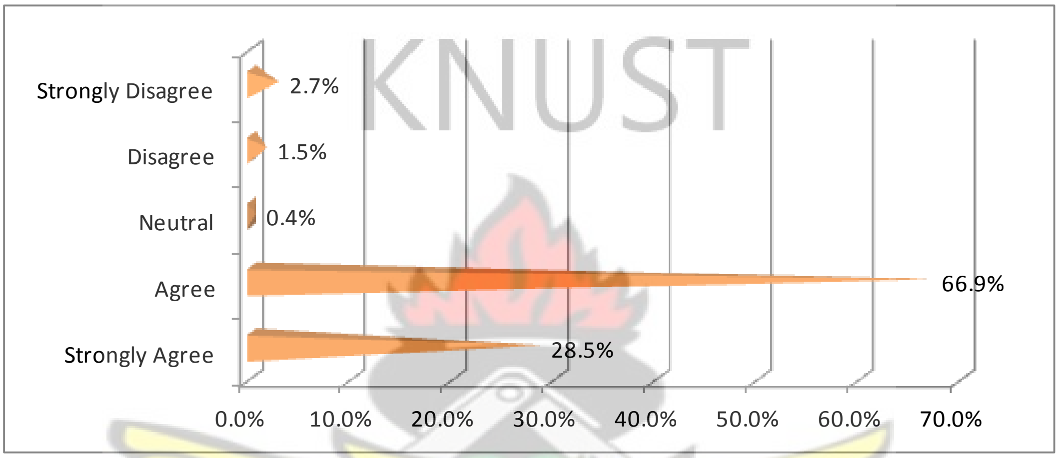



**Source: Fieldwork, 2006**

In contrast, as depicted in Figure 4.39, 95.4% of respondents in programme communities (Strongly Agree 28.5% and 66.9% Agree) affirmed that the borehole investments have led to the eradication of guinea worm and other water borne/related diseases and facilitated the restoration of substantive freedoms and from the effects of the severe physical environment in the Atebubu and Afram Plains Districts.

This has led to health regained and time gains which people have utilized to create wealth and reduced poverty in their lives. This provides much evidence that the arguments of adverse geography, geographical determinism, or place-of-birth disadvantage, are no longer tenable in justifying the perpetuation of the poverty trap due to geographical location.

**Figure 4.39: Boreholes provided facilitating freedoms from the effects of the physical environment**




**Source: Fieldwork, 2006**

From Table 4.24, 78.6% of the respondents (28.9% Strongly Agree and 49.7% Agree) from the programme communities indicated that the socio-cultural factors including taboos that inhibited women's freedom to access surface water have been eliminated through the provision of boreholes.

**Table 4.24: Elimination of socio-cultural factors inhibiting women's freedom to access water with the provision of boreholes**

| Response | Frequency | Percentage |
|---|---|---|
| **Strongly Agree** | 347 | 28.9 |
| **Agree** | 596 | 49.7 |
| **Neutral** | 40 | 3.3 |
| **Disagree** | 143 | 11.9 |
| **Strongly disagree** | 74 | 6.2 |
| **Total** | 1200 | 100.0 |

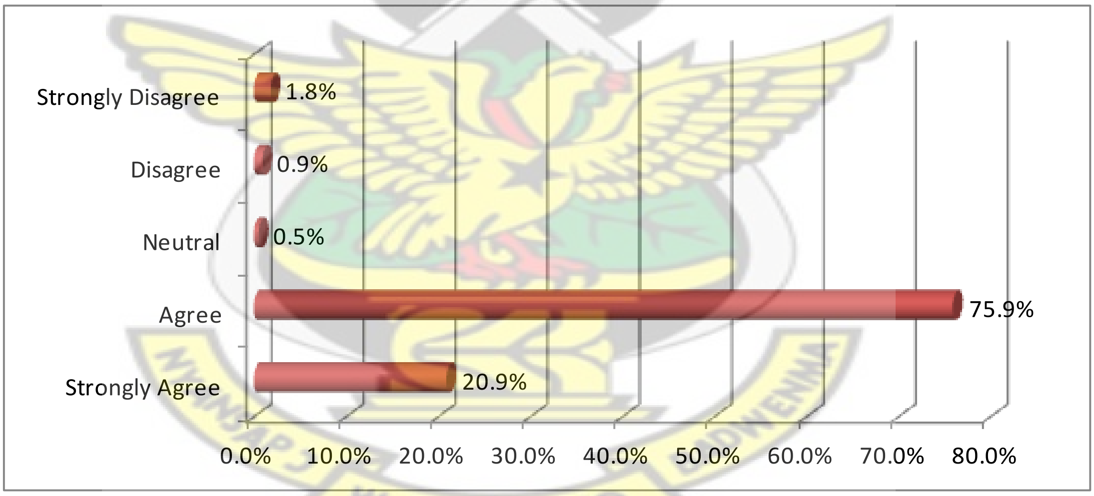
**Source: Fieldwork, 2006**

A female respondent at Semanhyia, Afram Plains District, indicated:

> "We can now fetch water from the water site during our menses."
> (37 year old respondent, Semanhyia Community).

For instance, as many as 96.8% of respondents (Strongly Agree 20.9% and 75.9% Agree) indicated having gained intangible values such as substantive freedoms, dignity, hope, and options in life as shown in Figure 4.40. The provision of boreholes in the Atebubu and Afram Plains districts created the platform for individual and community empowerment to enable the households emerge out of poverty in a sustainable way. The empowerment gained implies the expansion of freedom of choice and actions which were previously not available.

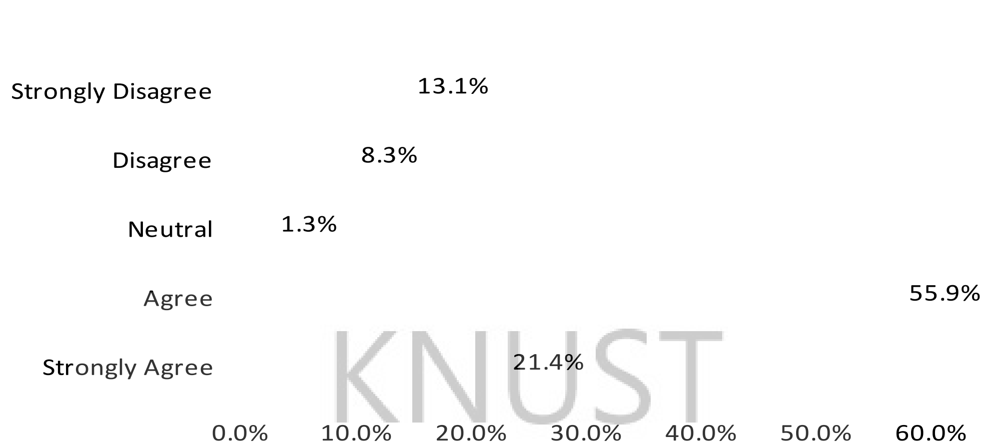
**Figure 4.40 Intangible values – freedoms gained from boreholes provision**




**Source: Fieldwork, 2006**

In contrast, in Control communities, 77.3% of respondents (Strongly Agree 21.4% and 55.9% Agree) indicated experiencing limited freedoms in relation to the limited time they have available, as depicted in Figure 4.41.

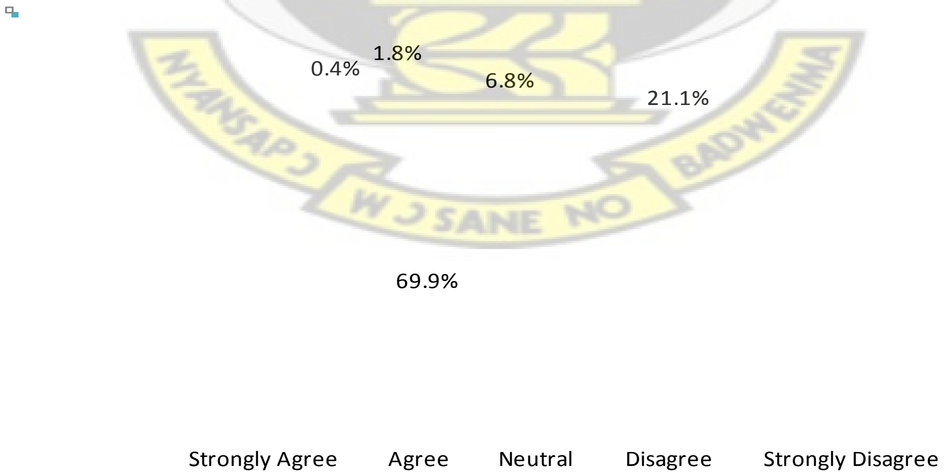
**Figure 4.41: Limited freedoms in relation to limited time available in Control communities**




**Source: Fieldwork, 2006**

Again, 91.0% of respondents (Strongly Agree 21.1% and 69.9% Agree) indicated that boreholes provision have created an enabling environment for economic enterprises development in households as depicted in Figure 4.42. These enterprises include agro-processing facilities such as milling of cereals – maize, rice, millet, and root crops processing. There are also agro-based foods processing for sale.

**Figure 4.42: Boreholes provision creating enabling environment for economic enterprises development in households**




**Source: Fieldwork, 2006**

Through the existence of vibrant local markets in some communities, people in the study area have much opportunity to engage in constant economic exchange to earn income consistently, resulting in a gradual reduction in poverty in the study area.

Excessive time demands for searching for water often lead to exhaustion, reduced the time available for rest, and also limited choices. Time-poverty also contributed to income poverty. It reduced the time available for participation in income generation, limited the scope for women to take advantage of market opportunities and impeded their ability to expand their capabilities and skills, reducing future economic returns, and thus, their ability to emerge out of poverty (World Bank, 2008; Blackden and Wodon, 2006). However these challenges have been permanently resolved with the provision of boreholes in their communities.

In terms of the development of other infrastructure facilitating poverty reduction in the study area, the ground situation in the study area has shown some, but not much improvement as compared to the situation before boreholes were provided.

The Atebubu District, for instance, has only one first class road which was constructed after the provision of boreholes. That road links Kumasi to Atebubu, through to Yeji. However, the road network to farmlands and communities are still deplorable and most often inaccessible in the rainy season. The situation in the Afram Plains District has also not improved much, as captured in the section 3.6.6 under 'Infrastructure' in Chapter four of this study relating to the Study Area (World Vision Ghana, 2007a; 2007b). This was confirmed by 78.7% of respondents, who indicated the study area still had inaccessible routes similar to what was prevailing before boreholes were provided. Also, 78.2% of respondents in both Districts indicated not having electricity in their households as yet.

# Chapter Five

# THE INTER-RELATIONSHIPS BETWEEN BOREHOLES PROVISION AND POVERTY REDUCTION

## 5.0 Introduction

In this Chapter inferential statistical methods are employed to further analyze and discuss data collected for this study. The results are interpreted to infer the relationships between borehole provision and the three intermediary variables employed to assess the impact on poverty reduction in the Atebubu and Afram Plains Districts.

## 5.1 Types of Analyses Undertaken

The sample selected for the study was carried out through simple random sampling methodology. As such, parametric data analyses methods were employed in the analyses of the data collected from the population surveyed using SPSS version 12 software. The parametric methods employed for the analyses are the Chi Square statistic for hypotheses testing, Cross-tabulations were generated to indicate the strength of association between the variables, and multiple regression based on logistic regression analysis of the independent and dependent variables. Logistic regression was carried out to show the direction (positive or negative) of variables and to show the extent to which the dependent variables have been influenced, determined or established by the independent variable and its implication for determining how the sample results adequately or otherwise represents the population of interest studied.

### 5.2 Cross tabulations

In this study cross tabulation has been used to establish existing relationship between the provision of boreholes and the three intermediary variables underpinning the hypotheses being tested and the results established as follows.

#### 5.2.1 Health & Hygiene

The results in Table 5.1 show 86.7% of respondents indicated an existing strong relationship between improved health as a result of boreholes provision and improved infants and child health also resulting from patronage of boreholes provided. The Pearson Chi-Square test gave an $X^2$ value of 143.415 with 2 degrees of freedom and indicates there is a very strong relationship between the two attributes of Health. Further, the Significance or probability level/Asymptotic value of 0.000 rounded up to 0.001, implies that the associated probability level is smaller than the pre-selected significance of 0.05, and therefore the null hypothesis is rejected at the 0.05 level.

Further, strength of existing relationship is shown by the Symmetric measures computed as Ordinal by Ordinal Gamma analysis with a value of 0.814; Asymptotic Standard Error of 0.036; an approximate T value of 6.309 and an approximate Significance level of 0.001. The Gamma value of 0.814 indicates a very strong positive relationship between the independent and dependent variables. This means, as boreholes provision (the independent variable) increases, improved health of infants and children (the dependent variable) also increases.

**Table 5.1: Provision of boreholes assisting to improve health * Provision of boreholes helping to improve infants and child health. N = 1200**

| Variables | Provision of boreholes helping to improve infants and child health | | | Total |
|---|---|---|---|---|
| | Yes | No | Don't Know | |
| **Provision of boreholes assisting to improve health** | | | | |
| Count | 1040 | 64 | 96 | 1200 |
| Expected Count | 1040.0 | 64.0 | 96.0 | 1200 |
| % within provision of boreholes assisting to improve health | 86.7% | 5.3% | 8.0% | 100% |
| % within provision of boreholes helping to improve infants and child health | 100.0% | 100.0% | 100.0% | 100.0% |
| % of Total | 86.7% | 5.3% | 8.0% | 100% |

**Source: Fieldwork, 2006**

To understand how this fits the study data, the author examined the two variables in Table 5.1 and concluded that there is much support (86.7%) for the study hypothesis in these data, showing strongly that boreholes provision directly and positively impacts health for poverty reduction in rural communities.

### 5.2.2 Education Quality

The results in Table 5.2 show 95.8% of total positive response indicating an existing strong relationship between the availability of water from borehole all year round and boreholes provision improving school attendance when the two attributes were cross tabulated. The Pearson Chi-Square test gave an $X^2$ value of 46.094 with 2 degrees of freedom and indicates there is a strong relationship between the two attributes of Education. Further, the Significance or probability level/Asymptotic value of 0.000

rounded up to level of 0.001, implies that the associated probability level is smaller than the pre-selected significance of 0.05, and therefore the null hypothesis is rejected at the 0.05 level.

**Table 5.2: Availability of water from borehole all year round * boreholes provision improving school attendance. N = 1200**

| **Variables** | **Boreholes provision improving school attendance** | | | **Total** |
|---|---|---|---|---|
| | **Yes** | **No** | **Don't Know** | |
| **Availability of water from borehole all year round** | | | | |
| Count | 1150 | 47 | 3 | 1200 |
| Expected Count | 1150.0 | 47.0 | 3.0 | 1200 |
| % within availability of water from borehole all year round | 95.8% | 3.9% | .3% | 100.0% |
| % within boreholes provision improving school attendance | 100.0% | 100.0% | 100.0% | 100.0% |
| **% of Total** | 95.8% | 3.9% | .3% | 100.0% |

**Source: Fieldwork, 2006**

Strength of existing relationship between the two variables is shown by the Symmetric measures computed as Ordinal by Ordinal Gamma analysis. The results indicate a value of 0.724; Asymptotic Standard Error of 0.072; an approximate T value of 3.774 and an approximate Significance level of 0.001.

The Gamma value of 0.724 indicates an exceptionally strong positive relationship between the independent and dependent variables. It means that as boreholes provision (the independent variable) increases leading to the availability of water all year round, improvement in school attendance (the dependent variable) also increases. To understand how this fits the study data, the author examined the two variables in the Table and concluded that there is much support (95.8%) for the study hypothesis in these data, showing strongly that boreholes provision directly and positively impacts Education as a proxy indicator for poverty reduction in rural communities.

### 5.2.3 Income Poverty Reduction

The results in Table 5.3 show 92.6% of total positive response indicating an existing strong relationship between One's life being affected by borehole provided and Borehole provision contributing to reduce poverty through ability to provide for basic critical domestic needs when the two attributes were cross tabulated.

**Table 5.3: One's life being affected by borehole provided * borehole provision contributing to reduce poverty through ability to provide for basic critical domestic needs. N = 1200**

| **Variables** | **Borehole provision contributing to reduce poverty through ability to provide for basic critical domestic needs** | | | **Total** |
|---|---|---|---|---|
| | **Yes** | **No** | **Don't Know** | |
| **One's life being affected by borehole provided** | | | | |
| Count | 1111 | 82 | 7 | 1200 |
| Expected Count | 1111.0 | 82.0 | 7.0 | 1200.0 |
| % within one's life being affected by borehole provided | 92.6% | 6.8% | .6% | 100.0% |
| % within borehole provision contributing to reduce poverty through ability to provide for basic critical domestic needs | 100.0% | 100.0% | 100.0% | 100.0% |
| **% of Total** | **92.6%** | **6.8%** | **.6%** | **100.0%** |

**Source: Fieldwork, 2006**

The Pearson Chi-Square test gave an $X^2$ value of 38.334 with 2 degrees of freedom and indicates there is a very strong relationship between the two attributes of Income poverty. Further, the Significance or probability level/Asymptotic value of 0.000 rounded up to level of 0.001, implies that the associated probability level is smaller than the pre-selected significance of 0.05, and therefore the null hypothesis is rejected at the 0.05 level.

Strength of existing relationship is shown by the Symmetric measures computed as Ordinal by Ordinal Gamma analysis. It indicates a Gamma value of 0.574; Asymptotic Standard Error of 0.076; an approximate T value of 4.425 and an approximate Significance level of 0.001. The Gamma value of 0.574 indicates a strong positive relationship between boreholes provision (the independent variable) and the ability to provide basic critical domestic needs (the dependent variable). By implication, as provision of boreholes (the independent variable) increases, the ability to provide basic critical domestic needs (the dependent variable) also increases. Again, to understand how this fits the study data, the author examined the two variables in Table 5.3 and concluded that there is much support (92.6%) for the study hypothesis in these data, showing strongly that boreholes provision directly and positively impacts incomes for poverty reduction in rural communities.

## 5.3 Hypothesis Testing

In this study, the author tested the hypotheses to answer the research questions and also find empirical support for the theory as outlined in the conceptual framework and literature reviewed. The last characteristic required that the author use empirical data to test the hypothesis. In this study the hypotheses were tested against empirical evidence by using the Chi Square statistic. Based on the objectives set, theory from the literature reviewed and the conceptual framework developed, the study tested three hypotheses based on the following intermediary variables: Health and hygiene, Quality Education, and Income poverty.

The three hypotheses are:

1) Null hypothesis – $H_0$: Boreholes provision has not impacted health and hygiene for poverty reduction in rural communities.

Alternative hypothesis – $H_1$: Boreholes provision has impacted health and hygiene for poverty reduction in rural communities.

2) $H_0$: Boreholes provision has not promoted quality education for poverty reduction in rural communities.

$H_2$: Boreholes provision has promoted quality education for poverty reduction in rural communities.

3). $H_0$: Boreholes provision has not promoted income poverty reduction in rural communities.

$H_3$: Boreholes provision has promoted income poverty reduction in rural communities.

### 5.3.1 Boreholes provision and Health & Hygiene

1) Null hypothesis – $H_0$: Boreholes provision has not impacted health and hygiene for poverty reduction in rural communities.

Alternative hypothesis – $H_1$: Boreholes provision has impacted health and hygiene for poverty reduction in rural communities.

Assumptions:

(1). Availability of potable water all year round from boreholes provided guarantees water availability and improved household health and hygiene practices.

(2). Consistent patronage of boreholes promotes permanent guinea worm eradication.

(3). A healthy community population is able to work their way out of poverty, while a disease-burdened community population fosters endemic poverty.

The Observed N (observed number/value) is the actual or raw data/responses captured whereas the Expected N (expected number/value) is the anticipated/predicted data/responses. Residual is the difference between the two. Positive residual means that the observed number of people in those cells is larger than the predicted. The reverse is true for a Negative residual.

**Table 5.4: Borehole provision enabling one practice improved personal hygiene. N = 1200**

| Response | Observed N | Expected N | Residual |
|---|---|---|---|
| **Yes** | 1167 | 600.0 | 567.0 |
| **No** | 33 | 600.0 | -567.0 |
| **Total** | 1200 | | |

**Source: Fieldwork, 2006**

In Table 5.4, borehole provision enabling one practice improved personal hygiene response gave an $X^2$ value of 1071.630 in Table 5.7 with 1 degree of freedom and 0.000 (rounded up to 0.001) probability level/asymptotic (p) value.

**Table 5.5: Poor personal hygiene in community before the provision of borehole water N=1200**

| Response | Observed N | Expected N | Residual |
|---|---|---|---|
| **Yes** | 1133 | 400.0 | 733.0 |
| **No** | 59 | 400.0 | -341.0 |
| **Don't know** | 8 | 400.0 | -392.0 |
| **Total** | 1200 | | |

**Source: Fieldwork, 2006**

In Table 5.5**,** the poor personal hygiene in community before the provision of borehole water response gave an $X^2$ value of 2018.085 in Table 5.7 with 2 degrees of freedom and 0.000 (rounded up to 0.001) probability level/asymptotic (p) value.

**Table 5.6 Boreholes promoting regular face washing among children and adults in community N=1200**

| Response | Observed N | Expected N | Residual |
|---|---|---|---|
| **Yes** | 1147 | 400.0 | 747.0 |
| **No** | 43 | 400.0 | -357.0 |
| **Don't know** | 10 | 400.0 | -390.0 |
| **Total** | 1200 | | |

**Source: Fieldwork, 2006**

In Table 5.6, the boreholes promoting regular face washing among children and adults in community response gave an $X^2$ value of 2093.895 in Table 5.7 with 2 degrees of freedom and 0.000 (rounded up to 0.001) probability level/asymptotic (p) value.

As shown in Table 5.7 in all the results of the three responses selected to test the Health & Hygiene hypothesis using the Chi-Square technique, the associated probability level of 0.000 approximated as 0.001, is smaller than the pre-selected significance level of 0.05. This means that, in roughly one out of 1000 times over the long run, findings as big as these would be due to chance.

**Table 5:7 Test Statistics –Health & Hygiene**

| **Variables** | Borehole provision enabling one practice improved personal hygiene | Poor personal hygiene in community before the provision of borehole water | Boreholes promoting regular face washing among children and adults in community |
|---|---|---|---|
| **Chi-Square** | 1071.630 | 2018.085 | 2093.895 |
| **Df** | 1 | 2 | 2 |
| **Asymp. Sig.** | .000 | .000 | .000 |

**Source: Fieldwork, 2006**

Once the associated probability is smaller than the pre-selected significance (Type I Error Level) of 0.05, the null hypothesis stated for Health & hygiene ("boreholes provision has not impacted health and hygiene for poverty reduction in rural communities") is rejected at the 0.05 level, and the alternative or working hypothesis accepted.

### 5.3.2 Boreholes provision and Education

$H_0$: Boreholes provision has not promoted quality education for poverty reduction in rural communities.

$H_2$: Boreholes provision has promoted quality education for poverty reduction in rural communities.

Assumptions: (1) Education is key to poverty eradication over the long term. The foundation of beneficial education starts at the Basic education level. It involves access, retention in school, quality teaching, completion and the ability to progress to secondary and tertiary levels of education. The study assumes that effectiveness of schooling at the basic level holds the potential for poverty reduction. (2) When the illiteracy gap is bridged it empowers communities to sustain the initiatives that eventually break the poverty trap in their lives.

In Table 5:8, for Boreholes provision improving school attendance response, the results gave an $X^2$ value of 2111.795, (as shown in Table 5.11) with 2 degrees of freedom and 0.000 (rounded up to 0.001) probability level/asymptotic (p) value.

**Table 5.8: Boreholes provision improving school attendance**

| Response | Observed N | Expected N | Residual |
|---|---|---|---|
| **Yes** | 1150 | 400.0 | 750.0 |
| **No** | 47 | 400.0 | -353.0 |
| **Don't know** | 3 | 400.0 | -397.0 |
| **Total** | 1200 | | |

**Source: Fieldwork, 2006**

In Table 5.9, for borehole water provision helping to improve punctuality at school the results gave an $X^2$ value of 2480.420 (as shown in Table 5.11) with 3 degrees of freedom and 0.000 (rounded up to 0.001) probability level/asymptotic (p) value.

**Table 5.9: Borehole provision helping to improve punctuality at school.** N=1200

| Response | Observed N | Expected N | Residual |
|---|---|---|---|
| **not applicable** | 4 | 300.0 | -296.0 |
| **Yes** | 1045 | 300.0 | 745.0 |
| **No** | 57 | 300.0 | -243.0 |
| **Don't know** | 94 | 300.0 | -206.0 |
| **Total** | 1200 | | |

**Source: Fieldwork, 2006**

In Table 5.10**,** Borehole provision helping to check frequent absenteeism at school the results gave an $X^2$ value of 2378.707 (as shown in Table 5.11) with 3 degrees of freedom and 0.000 (rounded up to 0.001) probability level/asymptotic (p) value.

**Table 5.10: Borehole provision helping to check frequent absenteeism at school. N=1200**

| Response | Observed N | Expected N | Residual |
|---|---|---|---|
| not applicable | 5 | 300.0 | -295.0 |
| Yes | 1029 | 300.0 | 729.0 |
| No | 61 | 300.0 | -239.0 |
| Don't know | 105 | 300.0 | -195.0 |
| Total | 1200 | | |

**Source: Fieldwork, 2006**

As indicated in Table 5.11, in all the four responses selected to test the Education hypothesis using the Chi-Square technique, the associated probability level of 0.000 approximated as 0.001, is smaller than the pre-selected significance level of 0.05. This means that, in roughly one out of 1000 times over the long run, findings as big as these would be due to chance. Once the associated probability is smaller than the pre-selected significance (Type I Error Level) of 0.05, the null hypothesis stated for Education ("boreholes provision has not promoted quality education for poverty reduction in rural communities") is rejected at the 0.05 level and the alternative or working hypothesis accepted.

**Table 5.11: Test Statistics - Education**

| **Variables** | Boreholes provision improving school attendance | Borehole water provision helping to improve punctuality at school | Borehole provision helping to check frequent absenteeism at school |
|---|---|---|---|
| **Chi-Square** | 2111.795 | 2480.420 | 2378.707 |
| **Df** | 2 | 3 | 3 |
| **Asymp. Sig.** | .000 | .000 | .000 |

**Source: Fieldwork, 2006**

### 5.3.3 Boreholes provision and Incomes poverty reduction

$H_0$: Boreholes provision has not promoted income poverty reduction in rural communities.

$H_3$: Boreholes provision has promoted income poverty reduction in rural communities.

Assumptions: (1). Availability of boreholes at their door steps saves much needed time and enables community members to engage in productive livelihood activities to free them from poverty. (2) As households regain good health through consistent patronage of boreholes, they are able to increase their productivity and earn more income to break free from poverty.

In Table 5.12, for community members having low incomes before the provision of borehole response, the results gave an $X^2$ value of 1715.540 (as shown in Table 5:15) with 2 degrees of freedom and 0.000 (rounded up to 0.001) probability level/asymptotic (p) value.

**Table 5.12: Community members having low incomes before the provision of boreholes. N=1200**

| Response | Observed N | Expected N | Residual |
|---|---|---|---|
| **Yes** | 1074 | 400.0 | 674.0 |
| **No** | 112 | 400.0 | -288.0 |
| **Don't know** | 14 | 400.0 | -386.0 |
| **Total** | 1200 | | |

**Source: Fieldwork, 2006**

In Table 5.13: Availability of water from borehole contributing a significant proportion of household income results gave an $X^2$ value of 588 (as shown in Table 5:15) with 1 degree of freedom and 0.000 (rounded up to 0.001) probability level/asymptotic (p) value.

**Table 5.13: Availability of water from borehole contributing a significant proportion of household income N=1200**

| Response | Observed N | Expected N | Residual |
|---|---|---|---|
| **Yes** | 1020 | 600.0 | 420.0 |
| **No** | 180 | 600.0 | -420.0 |
| **Total** | 1200 | | |

**Source: Fieldwork, 2006**

In Table 5.14 for Borehole provision contributing to reduce poverty through (increased farm acreages and earnings) the results gave an $X^2$ value of 1645.085 (as shown in Table 5:15) with 2 degrees of freedom and 0.000 (rounded up to 0.001) probability level/asymptotic (p) value.

**Table 5.14: Borehole provision contributing to reduce poverty through increased farm acreages and earnings. N=1200**

| Response | Observed N | Expected N | Residual |
|---|---|---|---|
| **Yes** | 1059 | 400.0 | 659.0 |
| **No** | 128 | 400.0 | -272.0 |
| **Don't know** | 13 | 400.0 | -387.0 |
| **Total** | 1200 | | |

**Source: Fieldwork, 2006**

In Table 5.15, all the results of the three responses selected to test the Income poverty hypothesis using the Chi-Square technique, the associated probability level of 0.000 approximated as 0.001, is smaller than the pre-selected significance level of 0.05.

**Table 5.15: Test Statistics – Income Poverty**

| **Variables** | Community members having low incomes before the provision of borehole | Availability of water from borehole contributing a significant proportion of household income | Borehole provision contributing to reduce poverty through (increased farm acreages and earnings) |
|---|---|---|---|
| **Chi-Square** | 1715.540 | 588.000 | 1645.085 |
| **Df** | 2 | 1 | 2 |
| **Asymp. Sig.** | .000 | .000 | .000 |

**Source: Fieldwork, 2006**

Again, this means that, in roughly one out of 1000 times over the long run, findings as big as these would be due to chance. Once the associated probability is smaller than the pre-selected significance (Type I Error Level) of 0.05, the null hypothesis stated for Income poverty reduction ("boreholes provision has not promoted income poverty reduction in rural communities") is also rejected at the 0.05 significance level and the alternative or working hypothesis accepted.



### 5.4 Regression Analysis

Regression measures the relations between variables. It depicts the level of dependency between variables. The regression equation contains independent variables and dependent variables. A multiple-regression based on the logistic regression model was drawn in this study showing an independent variable (boreholes provision) influencing a dependent variable (poverty reduction), such that: $y=a+b_1x_1+ b_2x_2+......+ b_kx_k$

where: y =Independent variable; and $x_1$ to $x_k$ = dependent variables.

a = Constant.

b = Partial regression coefficient or coefficients of the Dependent variable.

A multiple regression correlation, R, was computed to determine if a significant relationship exists between the independent variable (borehole provision) and the dependent variable (poverty reduction). The multiple regression results indicated two things: first the results have a measure R square ($R^2$) which indicates how well the set of variables explains the dependent variable. Secondly, the regression results measured the direction and size of the effect of the each variable on the dependent variable. The effect was measured precisely and given a numerical value. The regression model, which is a multiple linear regression equation, contains a constant and coefficients ($b_{1,}$ $b_{2,}$ etc) one for each of the dependent variables, termed as partial regression coefficients. Since the study took a sample of the population then the sample partial regression coefficient are estimates of the unknown population coefficient which is designated with the Greek letter β (beta). By implication**,** the effect on the dependent variable is measured by a standardized regression coefficient or beta (β). Being similar to a correlation co-efficient, the beta coefficient for two variables equals the r correlation coefficient. An ANOVA table is generated showing an F test statistic which is used to test for the significance of R to reveal the level of significance. Where, F= regression mean squared/residual mean squared (Kreuger and Neuman, 2006).

Poverty, in simple terms, imply the lack of economic means to command needed resources to meet a person's daily basic needs. The analyses assessed the level of poverty reduction in rural communities in the Atebubu and Afram Plains Districts in relation to boreholes provided. The three intermediary variables used in the assessment were: 1) Health and hygiene; 2) Education; 3) Income Poverty.

In the effort to probe and to find out if borehole provision has actually reduced poverty through the intermediary variables listed, a prediction model was developed to try to predict the provision of boreholes fostering poverty reduction from a combination of the variables that measure specific socio-economic and health characteristics of the two Districts. The prediction model is stated in Table 5.16.

**Table 5.16: Predictors of Provision of Borehole Reducing Poverty**

| Variable Name | Description : borehole provision |
|---|---|
| **Hh** | Borehole provision enabling good health and improved personal hygiene practices. |
| **E** | Borehole provision improving school attendance and quality education delivery. |
| **Ip** | Availability of water from borehole contributing a significant proportion of household income |

**Source: Fieldwork, 2006**

Progression of validating the significances and selection of variables for prediction model: to arrive at the three variables used for the prediction model and to validate Significances obtained, a systematic process was followed and Table 5.16 shows the dependent variables selected for the analyses. The process followed is as follows:

The Chi Square used for the hypotheses testing gave initial values which were selected for a correlation analyses. Variables which showed very strong correlations were then picked and used in the Regression analysis. Table 5.17 reflects the values obtained for the Hypotheses testing and correlation coefficients obtained for the three variables used in the Prediction model for the Regression analysis.

**Table 5.17: Selection of Variables for Prediction Model**

| Variable Name | | Hypotheses Tests Chi Square Values | Pearson's Correlation Coefficients |
|---|---|---|---|
| **Hh** | Borehole provision enabling good health and improved personal hygiene practices. | 1071.630 | 0.113 |
| **E** | Borehole provision improving school attendance and quality education delivery | 2111.795 | 0.252 |
| **Ip** | Availability of water from borehole contributing a significant proportion of household income | 588.000 | 0.217 |

**Source: Fieldwork, 2006**

The Multiple regression equation that predicts provision of borehole reducing poverty from all of the variables is presented as:

Provision of Borehole Reducing Poverty (PBRP) = Constant+ $b_1$Hh + $b_2$E+ $b_3$Ip**.**

As the data is a random sample from the population, the assumptions are that:

i) the observations are dependent; (ii) the relationship between the boreholes provision (the Independent variable) and all the dependent variables: Health & hygiene, Education, and, Incomes poverty reduction is linear; (iii) For each combination of values of the dependent variables the distribution of the independent variable is normal with a constant variance.

A hypothesis is thus stated and tested that:

$H_0$: there is no linear relationship between the independent and dependent variables.

$H_1$: there is a linear relationship between the independent and dependent variables.

A summary of the results of the regression is stated in Table 5.18 as follows:

**Table 5.18: Regression Model Summary**

| Model | R | R Square | Adjusted R Square | Std. Error of the Estimate |
|---|---|---|---|---|
| 1 | .513 | .264 | .260 | .29930923452 |

**Source: Fieldwork, 2006**

**Predictors:** (Constant), availability of water from borehole contributing a significant proportion of household income, borehole provision enabling good health and improved personal hygiene practices, boreholes provision improving school attendance and quality education delivery. The R squared in Table 5.18 above indicates that 26.0% of the observed variables in poverty reduction due to the provision of boreholes are explained by the three dependent variables: Health and Hygiene, Education, and Incomes.

R is the correlation coefficient between the observed value of the independent variable and the predicted value based on the regression model. The observed value 0.264 or 26.4% is quite moderate indicating that the linear regression model predicts quite well a linear relationship which is significant. The analysis of variance is shown in Table 5.19.

**Table 5.19: Analysis of Variance (ANOVA)**

| Model | Sum of Squares | df | Mean Square | F | Sig. |
|---|---|---|---|---|---|
| Regression | 38.284 | 5 | 7.657 | 85.469 | .000 |
| Residual | 106.966 | 1194 | .090 | | |
| Total | 145.250 | 1199 | | | |

**Source: Fieldwork, 2006**

**a. Predictors:** (Constant), availability of water from borehole contributing a significant proportion of household income, borehole provision enabling good health and improved personal hygiene practices, boreholes provision improving school attendance and quality education delivery.

**b**. **Dependent Variable**: boreholes provision resulting in increased incomes and progressive wealth creation.

As shown in Table 5.19, the analysis of variance (ANOVA) tests the $H_0$: that there is no linear relationship between the dependent and independent variables. Thus, the sampled partial regression coefficient is 0 and the $R^2$ is also 0. The test of the null hypothesis is based on the F test (ratio of the regression mean square to the residual mean square). The study showed an F value of 85.469 and an observed significance value of 0.000 (≈0.001). The observed significance is less than 0.005, implying that the null hypothesis, stating that there is no linear relationship between the independent and the five dependent variables is rejected. The coefficient for the dependent variables are listed in the column labeled B in Table 5.20.

**Table 5.20: Regression Coefficients**

| Model | Unstandardized Coefficients | | Standardized Coefficients | | |
|---|---|---|---|---|---|
| | B | Std. Error | Beta | T | Sig. |
| (Constant) | -.136 | .070 | | -1.943 | .052 |
| Borehole provision enabling good health and improved personal hygiene practices | .143 | .057 | .067 | 2.530 | .012 |
| Boreholes provision improving school attendance and quality education delivery | .330 | .044 | .206 | 7.464 | .000 |
| Availability of water from borehole contributing a significant proportion of household income | .231 | .025 | .237 | 9.126 | .000 |

**Source: Fieldwork, 2006**

a. Dependent Variable: boreholes provision resulting in increased incomes and progressive wealth creation.

The estimated regression equation is stated as: Provision of Borehole Reducing Poverty (PBRP). Where, PBRP = Constant + $b_1$Hh + $b_2$E+ $b_3$Ip

$$\hat{Y}= (.136) +0.143Hh +0.330E+0.231Ip = 0.568$$

Where $\hat{Y}$= predicted PBRP = 0.568

From the multiple regression equation, the partial regression coefficient for a variable indicates how much the value of the dependent variable changes when the value of that independent variable increases by 1 and the values of other independent variables do not change. A positive coefficient means that the predicted value of the dependent variable increase when the value of the independent variable increases. The reverse is the same for a negative coefficient. The coefficient of Health and hygiene variable indicates that the predicted borehole provision reducing poverty, increases by 14.3%

for a change of 1 in the value of borehole provision improving health variable. The other coefficients as appearing on Table 5.20 are: the coefficient of Education variable which indicates that the predicted borehole provision reducing poverty, increases by 33.0% for a change of 1 in the value of borehole provision improving Education variable. The coefficient of Incomes variable indicates that the predicted borehole provision reducing poverty, increases by 23.1% for a change of 1 in the value of borehole provision improving Incomes variable. The study therefore revealed that all the variables applied in the logistic regression model have positive coefficients, which implies that the provision of boreholes, being a poverty reduction factor, increases with increasing values of the intermediary variables.

These results from the cross tabulations, the hypotheses tested and regression analysis are in alignment and endorses what the World Health Organization (WHO) has indicated as the estimated economic benefits of investing in safe drinking water and sanitation as manifested in several forms. For instance, health-care savings of US$7 billion a year for health agencies, and US$340 million for individuals has been estimated through research (UNICEF/WHO, 2012). About 320 million productive days are gained each year in the 15 to 59 age groups; and an added 1.5 billion healthy days for children under five years of age, which together represent productivity gains of US$9.9 billion a year. Also, time savings resulting from more convenient drinking water and sanitation services, totaling 20 billion working days a year are made, which give productivity payback of some US$63 billion a year; and a values of death averted based on discounted future earnings, amounting to US$3.6 billion a year (WHO, 2008). All these benefits when actualized through boreholes provision and effective sustainability practices to assure potable water availability all year round and sustained substantive freedoms which facilitates incomes earnings, wealth creation, improved quality of life and progressive reduction of poverty.

Again the United Nations (2013) has emphatically indicated that the fulfillment of basic human needs, socio-economic development, and all poverty reduction aspirations are all heavily dependent on water (United Nations, 2013).

According to MisMore (2013), there is a direct link established by research between a bucket of water fetched and education. The indication is that when girls walk for miles to fetch water there is not time to go to school or study, and that women and girls spend 40 billion hours a year collecting water in Sub-Saharan Africa.

The results from this study and the WHO (2008) estimates cited are more than enough evidence which confirms MisMore's assertion and confirms that boreholes provision offers the panacea to permanently resolve such a place-of-birth disadvantage over the long haul.

# Chapter Six

# SUMMARY, CONCLUSION, RECOMMENDATIONS

## 6.1 Summary

This study assessed the impact of 'boreholes provision as a key factor in facilitating poverty reduction in rural communities in the Atebubu and Afram Plains Districts of Ghana'. Prior to boreholes being provided in these two districts the major cause of poverty was identified as the lack of potable water. Poor health was common due to recurring infestation with water borne/related diseases contracted from patronage of surface water sources. These diseases, especially guinea worm, physically incapacitated both adults and children. It is imperative therefore that the ill-health and time poverty resulting from the long hours spent searching for water, combined to deny adults of basic substantive freedoms and compromised their ability to engage in productive livelihoods activities to earn income to facilitate their emergence from poverty.

Also, the tedium of searching for water in the physical environment affected the physical health and cognitive capacity of the children resulting in very poor learning experiences at school. They eventually ended up at the very low levels of the labour market or joined their parents in their community and repeat living the poverty experience.

However, the results of this study indicate that, boreholes provided in rural communities have helped minimize the tragedy of living with poverty. Consistent patronage of the boreholes created the platforms that facilitated time gains and the simultaneous emergence of health freedoms that empowered and enabled people gradually work their way out of poverty.

Children are also freed from the tedium and long distances they trek each day to fetch water for their households and are now able to attend school regularly with the hope of being taught well and be able to transit to the tertiary levels of education, earn high income on the job market, and not repeat the poverty experience of their parents.

The study further focused on how the provision of boreholes became the platform, catalyst, and enabler for wealth creation to reduce poverty in the study area through three intermediary variables: health and hygiene, livelihoods and incomes improvement, and quality education delivery.

The general objective of the study was to examine the extent to which boreholes provided in the Atebubu and Afram Plains Districts have facilitated poverty reduction. The specific objectives were to: (a) Investigate how borehole provision had facilitated improved health and hygiene practices, with specific reference to guinea worm eradication, for poverty reduction in the Atebubu and Afram Plains Districts; (b) examine how borehole provision had facilitated improved income earnings and wealth creation for poverty reduction in the Atebubu and Afram Plains Districts; (c) assess how borehole provision had facilitated quality education delivery for long term poverty reduction in the Atebubu and Afram Plains Districts; and, (d) use the findings from the study as a basis to develop and recommend an approach that can be adopted to promote sustainable poverty reduction in rural communities.

A conceptual framework based on the literature reviewed was designed to guide this study as depicted in Figure 1.3. The framework shows how the provision of boreholes in rural communities creates access to potable water sources. High and consistent patronage of the boreholes led to the eradication of water-borne and water-related diseases such as guinea worm, diarrhoea, and skin diseases such as yaws; and subsequently, improved physical health and personal hygiene practices such as bathing and laundry.

In relation to livelihoods for income generation and wealth creation the conceptual framework shows how time gains from accessing potable water from boreholes in or near communities are invested in high income earning occupational livelihoods activities. The framework further depicts how time gains for children reflected in improved punctuality at school, higher contact time with teachers and improved quality teaching. There is also the emergence of improved quality of life and the concomitant visible demonstration effects in assets acquisition, capability development, sustained economic capacity, and improved political participation.

These benefits derived from the provision and availability of boreholes served as major drivers for continual patronage to satisfy basic domestic water requirement, and encouraged the communities served to bear the responsibility of borehole maintenance to ensure continual potable water availability. Finally, the framework depicts how the communities provided with boreholes experience the positive incremental income earnings from occupational livelihoods which eventually facilitated reduction of poverty in their households and communities.

Results from the study indicate the following as major outcomes from the provision of boreholes in the Atebubu and Afram Plains programme communities. In terms of access, boreholes provided created Intermediate and Basic access to potable water in the communities. In relation to health and hygiene, consistent patronage of boreholes provided have facilitated the eradication of guinea worm and facilitated regaining of health, and also facilitated improved hygiene practices –

especially bathing and laundry. For instance, 96.9% of respondents indicated the complete eradication of guinea worm from their communities and attributed that specifically to the boreholes provided in their communities. Also, boreholes provided improving personal hygiene was indicated by 96.1% of respondents. These health and hygiene benefits facilitated the emergence of substantive freedoms including the freedoms of regained health, time gains, choice and mobility.

In relation to gender freedoms gained, 97.3% of respondents indicated much time savings because of the availability and easy access to boreholes in their communities, and no more going in search of water. Specifically, 80.6% of respondents indicated that women now have much time to engage in economic activities. The provision of boreholes also facilitated growth in occupational livelihoods, increased earnings from occupations and served as the basis for wealth creation as follows: boreholes provision resulting in farms expansion was indicated by 88.6% of respondents; boreholes provision resulting in increased incomes and progressive wealth creation was indicated by 89.2% of respondents; and, availability of boreholes contributing a significant proportion of household income was indicated by 86.4% of respondents.

In relation to education quality delivery, boreholes provision facilitated improvements through improved school attendance with children being punctual and regular; trained teachers now available in schools, and improved learning. Provision of boreholes helping to facilitate improved education was indicated by 91.3% of respondents. Boreholes in or near community enabling water to be fetched before and after school hours were indicated by 89.8% of respondents. Further, boreholes helping to check frequent involuntary absenteeism at school were indicated by 83.9% of respondents. Also, boreholes helping to check high level of dropouts were indicated by 79.0 % of respondents.

The results from the study also show that boreholes provision has created the platforms and an enabling environment for overcoming some aspects of adverse geography in the study area. This outcome is showing in the improved quality of life as indicated by 97.8% of respondents; and household level demonstration effects such as having enough food to serve family all year round as indicated by 96.3% of respondents. Ability to manage household and family life better due to boreholes available was also indicated by 91.3% of respondents. The study also revealed 90.5% of respondents indicating that local water governance institutions (WATSAN Committees) have been established in their communities for the specific purpose boreholes monitoring, maintenance and repairs, so as to assure potable water availability all year round.

The counterfactual evidence from Control communities depicts a dismal scenario which is virtually the opposite of the improved scenario in the Programme communities. For instance, water borne/related diseases such as diarrhoea, guinea worm, skin diseases, and schistosomiasis were in high occurrence as indicated by 76.3% of respondents. There was high patronage of surface water sources – rivers and streams, and water not treated before drinking, as indicated by 79.0% of respondents. Poor occupational livelihoods portrayed endemic poverty, with people living with very limited options as indicated by 100% of respondents. Also 62.4%, of respondents indicated very poor school attendance by their children. The lack of teachers in schools in their communities was indicated by 81.6% of respondents. Personal hygiene practices were very poor, as indicated by 86.8% of respondents.

Water hunting was prevalent with the effect of spending long hours searching for water causing low farm productivity, low farm output and low incomes, was indicated by 81.6% of respondents. Substantive freedoms were unavailable as the predominance of daily survival issues was the major pre-occupation in those communities, was indicated by 97.4% of respondents. Also, 84.7% of respondents indicated living in very poor houses, and another 91.7% indicated poverty reflected in their poor physical structures.

As depicted by the results, the study has in an in-depth manner delved into the issue of poverty reduction resulting from the extensive provision of boreholes in the Atebubu and Afram Plains Districts. The issue at stake was whether borehole provision has been a key factor in facilitating poverty reduction in the rural communities which benefited from the Programme in the two districts and what their situation could have been like without the boreholes, as typified by the counterfactual evidence obtained from the before-situation and the Control communities.

The study further revealed that in rural areas, the availability of boreholes is a crucial factor in the process of emergence from poverty. Access to boreholes provides freedom from the burden of carrying water from distant sources, freeing up the much needed time for livelihood activities and, in the case of children, for school attendance. Having enough water to cover drinking and domestic hygiene needs, also promotes better health and well-being of many households.

Adequate potable water supply from boreholes improves the prospects of new occupational livelihood activities, and is the crucial resource needed to step out of poverty. Access to reliable and safe water from boreholes facilitates increased farm expansion, improved labour productivity, and increased farm production. This further leads to increased earnings and wealth creation, and the chance to diversify investments. Diversification into other livelihoods activities therefore becomes possible with the improved incomes earned, and the high possibility of transition out of agriculture to more profitable enterprises becomes a reality.

The results of the study also indicate that boreholes provision has facilitated the wealth generating and creative potentials of rural populations in the Atebubu and Afram Plains Districts.

Again, the results from this study indicate the centrality of agriculture as the major occupational livelihood in the rural communities sampled. This fact essentially provides the basis for the provision of boreholes in rural communities, which indisputably constitute a major platform for facilitating agriculture-based livelihoods (MOFA, 2007).

The basis for boreholes provision also rests on the vital need to improve and continually assure the well-being of people in rural communities. This is carried out through the continual facilitation of the sustainability processes and measures that will guarantee the continual availability of potable water from the boreholes provided. It is being anticipated that consistent patronage of the boreholes will continue to foster excellent health to enable people engage in economic activities that leads to wealth creation, improved quality of life and poverty reduction.

In practical contrast, evidence obtained from Control communities in the study shows a situation with a prevalence of a vicious cycle of ill-health caused by water-borne and other water-related infections, and which led to weakness and reduced energy to work. The resultant low capability utilization in turn led to low productivity, low outputs, low income, low wealth creation and cumulative low economic capacity. This further led to poor households, which led to worsening weakness and illness.

This condition, which frustrated poverty reduction initiatives by households and their communities have also been indicated by Swisher (2009), and Singh (2009).

Also, the lack of boreholes in rural communities without any means of improved water facility limits people's ability for poverty reduction and exposes them to several dimensions of human insecurity and vulnerabilities, as indicated by 97.4% of respondents in the Control communities and confirmed by studies by the World Bank (2011c) and Hemson (2009). These characteristics were evident in the Control communities and especially the results further showed very high levels of deprivation, constraints and limitation to the hopes and aspirations of people in households as indicated by 96.1% of survey respondents.

## 6.2 Conclusion

The study has shown that poverty reduction through boreholes provision, in itself, does not emerge spontaneously except based on some intermediary factors acting as the catalysts fostering positive social and economic change in rural communities. Hence the employment of the three intermediary variables (health and hygiene, livelihoods and income, and education) used to assess the contribution of boreholes as they relate to poverty reduction in the Atebubu and the Afram Plains Districts, and as captured in the conceptual framework (Figure 1.3).

The general objective of the study was to examine the extent to which boreholes provided in the Atebubu and Afram Plains Districts have facilitated poverty reduction. The specific objectives were to: (a) investigate how borehole provision had facilitated improved health and hygiene practices, with specific reference to guinea worm eradication, for poverty reduction in the Atebubu and Afram Plains Districts; (b) examine how borehole provision had facilitated improved income earnings and wealth creation for poverty reduction in the Atebubu and Afram Plains Districts; (c) assess how borehole provision had facilitated quality education delivery for long term poverty reduction in the Atebubu and Afram Plains Districts; and, (d) use the findings from the study as a basis to develop and recommend an approach that can be adopted to promote sustainable poverty reduction in rural communities.

Three working hypotheses were stated to guide this study as follows:

1). Boreholes provision has positively impacted health and hygiene for poverty reduction in rural communities.

2). Boreholes provision has promoted quality education for poverty reduction in rural communities.

3).Boreholes provision has promoted occupational livelihoods income poverty reduction in rural communities.

The concept which undergirded this study was based on the postulate that there are clear linkages between boreholes provision which create the freedom platforms for wealth creation, and which leads to improvements in the quality of life and subsequently poverty reduction in rural communities. Also the multi-dimensional aspect of poverty requires strategic interventions that can handle as many facets of poverty simultaneously, reverse the trend and root causes of poverty, and set people on the road to recovery through their active engagements in livelihood occupations.

The results from this study strongly indicate that boreholes provision created the enabling platforms for rural people in the Atebubu and the Afram Plains Districts to avail themselves of the livelihoods resources in their physical environment to enable them have continued access to income, build and strengthen their economic capacity and facilitated the processes of poverty reduction.

In relation to regaining health and improved hygiene practices, the conclusion arrived at through this study indicate that the success of boreholes provision in rural communities show as palpable demonstration effects seen in the empowerment of programme beneficiaries' improved health, improved income earnings, wealth creation and investments. Thus, the quality of life in the communities provided with boreholes is a basic indicator of the impact boreholes provided have made in facilitating poverty reduction.

In relation to occupational livelihoods engagements and income earnings towards poverty reduction, the conclusion drawn from the results from the study is that boreholes provision is a reflection of how scientific knowledge application used in the siting and drilling of boreholes, and appropriate technology application (hand pumps) provided the platforms for resolving the problems, challenges and limitations posed by adverse geography to release the substantive freedoms needed to breakthrough poverty thresholds towards progressive poverty reduction.

Another fact that cannot be discounted is the enduring impact of empowerment of the populations freed from water borne diseases, (especially guinea worm), and also freed from searching for water. People now actively engage in several occupations of their interest from which they derive much income with several and diverse demonstration effects, evidenced in improved quality of life and resulting in reduced poverty.

In relation to education quality delivery, the conclusion drawn from the results of this study is that the provision of boreholes has served as a very powerful reversal tool to rectify place-of-birth disadvantages. As such, education as an opportunity equalizer in the long-term could lead to higher income earnings and the gaining of strong economic capacity as children access the higher levels of education, flow into high income levels of the job market, and eventually make poverty anachronistic.

Again, with boreholes available in rural communities in the study area, trained teachers accept postings to those communities. Children are able to attend school regularly due to time gains from not going searching for water. Thus with improved teacher-child contact education quality improves and children move on to the higher levels of education with hope by their parents that eventually, their children will also enter the national labour force and the job market well-equipped with good education to compete for jobs in the highly paid professions.

In terms of human development, this evidence on improved quality education constitute the palpable heritage for continual poverty reduction which will definitely outlast the boreholes provided in the rural communities in the Atebubu and Afram Plains Districts. This finding from the study is strongly confirmed by the World Bank's view indicating that University education must lead to poverty eradication, and that access to higher education should be interlinked with the solid economic growth and sharp declines in poverty (World Bank, 2011a).

Again, this study has revealed that borehole provision offers not only hope, but new opportunities to the younger generation of boys and girl-children in the rural communities, who hitherto have borne the tedium and gruesome ordeal of searching for water for their households. That is, in terms of positive probabilities, as they participate effectively in school due to time gains from access to boreholes in or around their communities, the ultimate horizons of attaining the highest levels of education are theirs to go for. As affirmed by King, this will facilitate the process and propel them to the highest paid levels of the job market, and thus facilitate making poverty history within their lifetime (King, 2011). Subsequently, they will also be able to provide better for their households, their communities, and also serve their country and wider humanity in many useful ways as capable, empowered citizens.

For individuals, for households, and for whole communities, access to potable water through boreholes is of vital importance and creates the needed freedom platforms necessary for establishing the foundations for pursuing the paths for economic empowerment, improvement in the quality of life, and ultimately for poverty reduction. Boreholes provision therefore plays a crucial role in facilitating time gains for reducing income poverty, and breaking lifecycle and place-of-birth disadvantages, limiting health costs, improving children's education, freeing children and women's time, and finally, living with hope of a better future, so far as the boreholes continue to function well.

Through the provision of boreholes, people in rural communities in Atebubu and the Afram Plains Districts have been empowered with the means to develop themselves and are now able to do what they want to do within the ultimate limits of their potentials. Breakthroughs have occurred and people have been liberated and empowered to enjoy and exercise their substantive freedoms with palpable demonstration effects as obvious proofs of improved quality of life, the physical expansion of their communities, and as shown in improved health and hygiene, and occupational livelihood incomes improvements and wealth creation.

As evidence of the boreholes provided in the Atebubu and Afram Plains Districts being sustainable, the study showed that locally trained pump maintenance volunteers are able to promptly repair and carry out maintenance work on boreholes by themselves, even several years after World Vision's boreholes drilling programme ended in the two Districts. The results from the study showed 90.8% of boreholes still operational as at the time of the survey. This further provides evidence supportive of long term progressive poverty reduction in the study area.

This study has proved that borehole provision has served as the essential platform, catalyst and the enabling factor for quality of life improvement and progressive reduction in poverty in rural communities. The results further indicate that the progressive trend in poverty reduction will continue if the performance of local governance institutions (WATSAN Committees) established to sustain the boreholes for continued water availability in the beneficiary communities are not compromised over time.

In terms of being replicable, the results from the study have revealed that the boreholes provision programme is a vital intervention that can be employed as a Poverty Reduction Strategy. This intervention can be replicated in other parts of the country and other countries to positively accelerate and impact poverty reduction within a minimum timeframe. The study also proposes this approach as a vital development model which if adopted, can be adapted in various geographical contexts to successfully implement poverty reduction programmes globally.

Access to the physical terrain through this survey revealed that major development infrastructure such as access routes and electricity in rural communities in the Atebubu and Afram Plains Districts have not improved much. This was confirmed by 78.7% of respondents who indicated the study area still had inaccessible routes similar to what was prevailing before boreholes were provided. Also, 78.2% of respondents indicated not having electricity in their households as yet. Thus other development factors which could have influenced the results of this study significantly were not paramount. As an impact study therefore, all the improvements revealed by the results of this study can be directly attributed to the boreholes provided in the study area and also the counterfactual evidence from the control communities proved the continual existence of endemic poverty in worsening levels in communities not served with boreholes.

As the author's contribution to knowledge, the new concept emerging from this study is the 'freedoms platform concept as applied in geography and rural development.'

In terms of its originality and relevance to the study, there is the emergence of new homogenous knowledge with its own features that can be used for policy formulation and implementation to cause great transformations for improvement in human lives. The concept offers a different perspective to the discourse and practices on potable water availability through the trilogy of variables adopted for this study.

For instance, as to what the stake is in boreholes provision, this study found and affirmed that it creates platforms for releasing substantive freedoms which facilitates progressive poverty reduction through - eradicating ill-health from the target population, provides time gains through good health due to consistent patronage of boreholes from not going searching for water, and improvement in gender status. Time gains as applied to occupational livelihoods to break poverty thresholds, improve quality of life and reduce poverty, enable children to be enrolled and be punctual and regular at school, and empowerment – which involves capacity enhancement, capability acquisition, instrumental freedoms attainment, and the triumph over place-of-birth disadvantage or adverse geographical factors posing limitations to human development and aspirations.

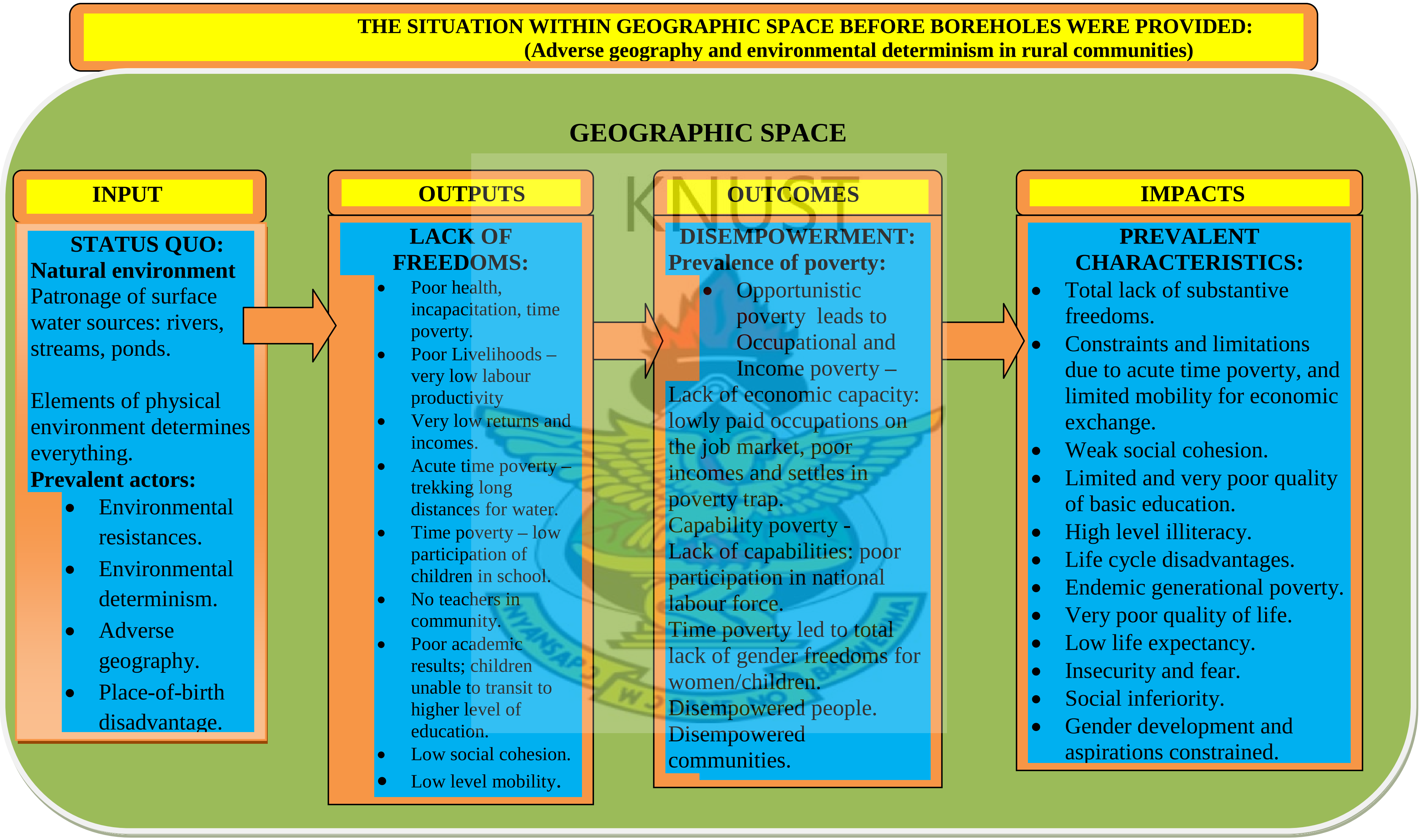
In terms of physical freedom, boreholes provision lead to eradication of waterborne/related diseases; people released from disease burden; released also from time loss due to disease; substantive freedom gained; health freedom gained, which is the key to everything else. In relation to time freedoms – time saved from trekking for fetching water is applied to occupational livelihood activities to earn income which facilitates emergence from poverty. Also, there are the economic and social freedoms through capacity and capabilities attained to foster improved quality of life for progressive reduction in poverty over the long haul.

The concept is further defined and depicted in two models as follows:

*The Freedoms Platform Concept in Geography and in Rural Development: Model 1* - Figure 6.1 depicts the situation within geographic space before boreholes were provided. As inputs, the prevalent *status quo* in community life was patronage of surface water sources, mainly rivers, streams and ponds, as sources of water for households. In this scenario, elements of the physical environment pre-determined the basic living conditions of human life with the prevalent actors also termed as environmental resistances (Zimmerman, 1964), environmental determinism (Gourou, 1966), adverse geography (Sachs, 2005), and place-of-birth disadvantage (World Bank, 2006a).

The basis of this model is that poor health and hygiene in rural communities, in part, is due to the lack of potable water for domestic use. Among the many water borne/related diseases associated with poor health in rural households are guinea worm, diarrhoea, trachoma and schistosomiasis. Poor hygiene practices attract diarrhoea, typhoid and several skin diseases. These diseases incapacitate the rural population and deplete their labour capacity, productivity and cause their inability to acquire and sustain income earnings. The result manifests as entrenchment in opportunistic poverty (Robilliard, 2009; Bartram, 2008; Pruss-Ustun, 2008; World Bank, 2006b).

**Figure 6.1: The Freedoms Platform Concept in Geography and Rural Development: Model 1**




**Author's Construct, 2011**

In terms of outputs, the model depicts that the acute lack of potable water causes lack of freedoms with manifestations as poor health, incapacitation with water borne/related diseases, with time poverty resulting. As a result of poor health, poor occupational livelihoods activities show in very low labour productivity with very low returns and incomes.

There is also low social cohesion and low level mobility for economic and social exchanges. Acute time poverty manifests with the extensive trekking to search for water daily. Time poverty is also reflected in the very low participation of children in school as they go trekking extensively for water for their households. There are no trained teachers in communities for lack of potable water resulting in poor academic performance, and children are unable to transit to higher levels of education.

Outcomes on the model are depicted as a phenomenon of disempowerment, characterized by prevalence of income and capability poverty. Opportunistic poverty resulting from incapacitation from debilitating water-borne/related diseases leads to occupational livelihoods income poverty. Income poverty also show as a total lack of economic capacity as associated with lowly paid occupations on the job market and poor incomes. Capability poverty indicates the lack of specialized skills, resulting in poor participation in the national labour force and job market. Acute time poverty led to total lack of gender freedoms for women and children. Disempowered people are evident and shown as people who are unable to take initiatives to improve their well being. Disempowered communities are depicted as people lacking capacity in its various forms (economic, technical, and social mobilization) to mobilize and organize to improve on and extricate themselves from the constraints they live in.

On the model, impacts manifest as prevalent issues characterized by total lack of substantive freedoms, endemic opportunistic poverty, constraints and limitations due to acute time poverty, limited mobility for economic exchange, and weak social cohesion. Also, there is very limited access to education and very poor quality basic education. Community life is commonly associated with high level illiteracy, and life cycle disadvantages resulting from illnesses due to lack of potable water. The quality of life is very poor and associated with low life expectancy. Insecurity and fear pervades everyday life. There is also social inferiority and gender development and aspirations are virtually non-existent.

In its practical application and relevance to this study, in the pre-borehole provision situation poverty in rural communities show the lack of potable water infrastructure in rural communities. There is the prevalence of waterborne and water-related diseases such as guinea worm, trachoma and diarrhoea in communities, while water hunting and trekking over several kilometers in search of water, is a daily phenomenon.

In linking health and hygiene to poverty reduction, it should be noted that health and hygiene are enablers. Improved health and hygiene checks frequent dairrhoea, dysentery, and other concomitant physical weakness and incapacitation. According to Cairncross and Valdmanis (2006) it also checks infant and child mortality which caused associated pain to parents and slowed down occupational livelihood activities. As enablers, improvement in domestic health and hygiene releases people from physical incapacitation and downtime. It enables gradual activation of livelihood occupations, increases labour productivity, facilitates increase in livelihoods expansion, and increase mobility for livelihoods transactions at local markets organized in key communities. All of these lead to income earnings and wealth creation and diversification of livelihoods investments, and improvement in the quality of life and sustained poverty reduction among rural populations. The absence of these enablers therefore constitutes a tragedy living under the extreme poverty limitations in communities not having boreholes.

On the model, the immediate direct outputs included: human incapacitation from waterborne and related diseases infestations, especially guinea worm; very low or negligible labour productivity; very low output and returns on livelihood occupations; high level of involuntary absenteeism from school; very low punctuality and irregular school attendance; and, children often sick and unable to attend school. The obvious outcomes, as depicted on the model, are community populations experience bad health and time poverty due to incapacitation from water borne/related diseases; low labour productivity and livelihood occupations very vulnerable; people living in condition of chronic poverty with lack of economic capacity and lack of substantive freedoms; poor education quality with very poor academic results by children; children unable to transit to higher levels of education; and the prevalence of time poverty.

On the model the impact of lack of potable water infrastructure in rural communities are the prevalence of pervasive poverty; total lack of economic capacity; lack of freedoms, with very limited options; rural population consigned to daily survival livelihood activities which are low or no skills-based due to poor levels of education; yearly additions to the national quasi-illiteracy pool – accumulation of low level manpower due to poor educational quality.

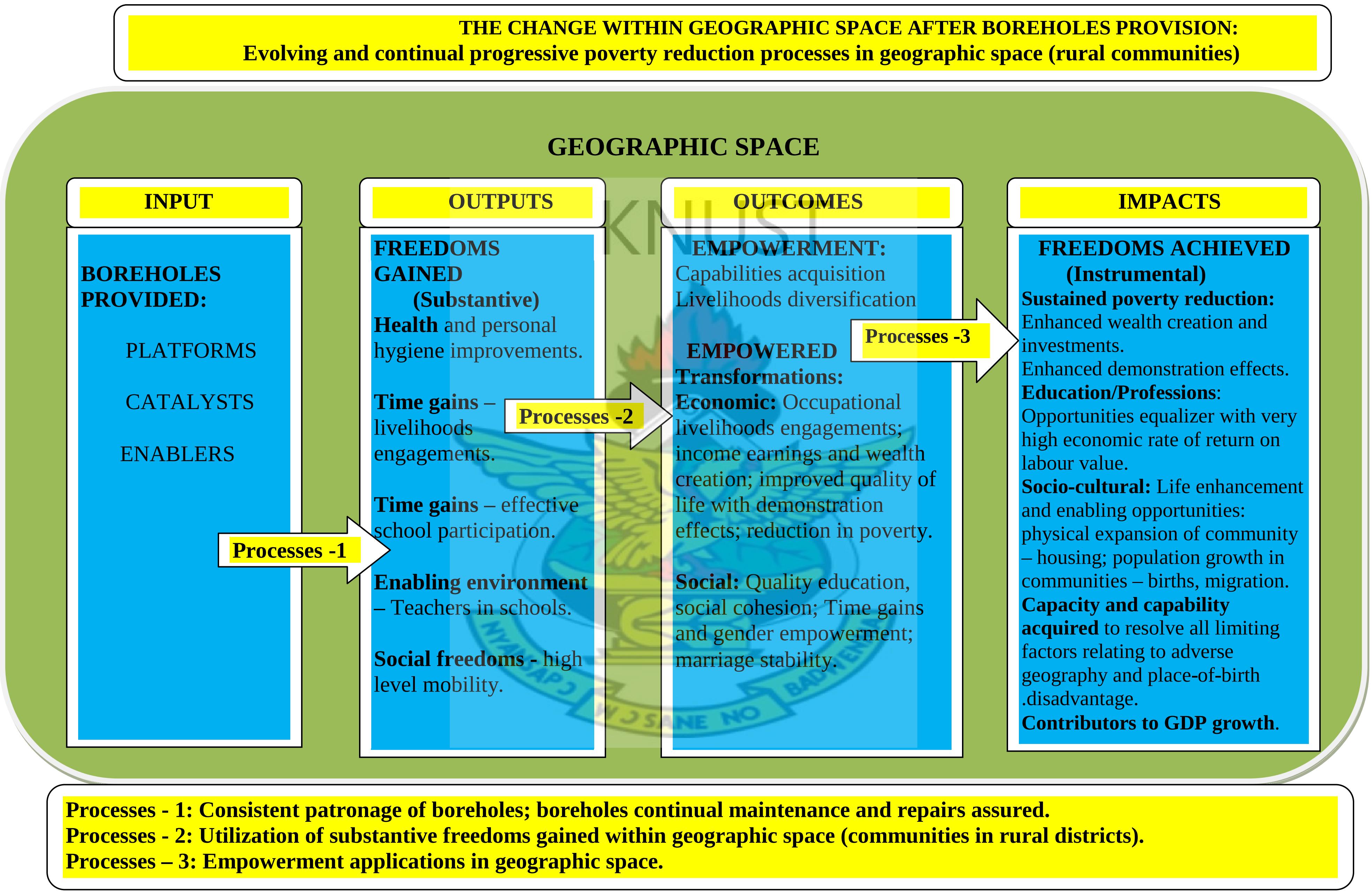
The three key assumptions therefore, which undergird this model are: (1) no interventions yet to provide access to potable water infrastructure such as boreholes. Water hunting is pervasive. (2) occupational livelihoods mainly dependent on prevalent climate and resources in the natural physical environment; (3) total lack of community organization to advocate for boreholes.

The concept show the inter-relationships between the lack of potable water (no boreholes in a community) and the very high prevalence of water borne/water-related diseases as a result of the patronage of traditional unprotected surface water sources in rural communities. The subsequent incapacitation leads to low labour productivity and very low output resulting in low economic returns to individuals and their households virtually no wealth creation. This reinforces and worsens the poverty status manifesting in abysmally low purchasing power, inability to provide basic domestic life-sustaining needs e.g. food and healthcare. The low economic capacity further result in chronic and endemic poverty which is characterized by physical constraints such as cycle of indebtedness and the lack of substantive freedoms.

*The Freedoms Platform Concept in Geography and in rural development: Model 2* - The second model, as shown in Figure 6.2, depicts the change within geographic space in rural communities due to boreholes provided as an intervention to solve the problem of lack of potable water sources. The inputs are boreholes provided, which serve as platforms, catalysts, and enablers.

The underlying processes are the consistent patronage of boreholes; and boreholes continual maintenance and repairs. Boreholes thus become the platforms, catalysts and enablers for freedoms acquisition which show as outputs.

**Figure 6.2: The Freedoms Platform Concept in Geography and Rural Development: Model 2**




**Author's Construct. 2011**

On the model, Outputs show as substantive freedoms gained with the following elements: health and personal hygiene improvements through consistent patronage of water from boreholes, health-freedoms gained with eradication of water borne diseases (such as guinea worm). Health regained is channeled into expansion of occupational livelihood activities. Time gains – from recovery from ill-heath, and not trekking in search of water, are used to strengthen and expand occupational livelihoods engagements for income generation, high level economic exchange at local markets and wealth creation.

Furthermore, in its practical application to this study, the Inputs are boreholes provided in rural communities, with boreholes sustainability practices established for assurance of potable water availability all year round. Regular boreholes maintenance and repairs practices assured. The activities associated with the intermediary variables are the high patronage of boreholes and utilization of potable water for drinking and domestic hygiene practices at household level. The outputs include: eradication of debilitating and waterborne/ related diseases such as guinea worm, trachoma and diarrhoeal diseases; effective and uninterrupted borehole performance.

The Outcomes are: good health regained and time gains invested in livelihoods activities; emergence of new economic opportunities; increased labour productivity and livelihoods expansion; improved economic capacity and wealth creation; engagement in new social and economic investments; and, improved quality of life and emergence of higher standard of living. The Impact show as: demonstration effects of improved quality of life; reduced poverty levels and sustained economic capacity; and emerging freedoms with plenitude of options for further advancement.

There is also expansion and diversification of occupational livelihoods, increased labour productivity, improved economic capacity in the form of increased earnings, wealth creation and investments in household assets, and thus improved quality of life and progressive poverty reduction become evident.

Time gains – with boreholes in or around communities, children gain time fetching water for their households and are able to attend and effectively participate in school. Children's attendance in school became regular and punctual. Children's attention deficits reduce; also children's involuntary absenteeism drastically reduces. Children dropping out of school also decrease and teacher-child contact hours improve and lead to effective teaching. Improvements in children's academic output and achievements are evident. Children are able to transit to the tertiary levels of the education structure and this creates the potential for entry into the job market at gainful levels, and acquiring the economic capacity to eventually distance them from poverty.

For the investment in education to yield fruitful dividends for rural households, and society more generally, it must lead to higher levels of labour force participation and more productive occupations. As a person's education increases, so does the chance of being in the higher paid levels of the labor market (Hanushek, et al, 2007a; World Bank, 2006a). With education, a person is able to acquire the skill-set that may be demanded by the labor market (World Bank, 2009a; World Bank, 2006b). Basic education however constitutes a critical part of the human development process which begins in early childhood and therefore a society that ignores this potential mortgages their children's future to live out of poverty. Also, when this potential is compromised in the early stages of human life, children will grow to inherit the poverty status of their parents and consequentially, making poverty a generational phenomenon (Mulkeen and Chen, 2008; World Bank, 2010f; World Bank, 2006b; and Hanushek and Woessmann, 2007b).

Enabling environment – boreholes in communities attracts trained teachers to accept postings to rural communities to stay and teach and thus teacher-child contact hours increase. In relation to social freedoms, there is high level mobility within community and to other communities for economic and social exchanges.

Underlying processes: Utilization of substantive freedoms gained within geographic space leading to outcomes. On the model, the Outcomes are captured as: EMPOWERMENT and EMPOWERED: EMPOWERMENT refers to capabilities acquisition which entails utilization of financial capacity gained to acquire skills to improve and diversify livelihood occupations to become less vulnerable to the dictates and influences of the physical environment. Also, there is livelihoods diversification through new skills and capabilities acquired.

With post-borehole provision and livelihoods and income facilitating poverty reduction in rural communities, the Inputs are boreholes provided in rural communities, with boreholes sustainability practices established for assurance of potable water availability all year round. Regular boreholes maintenance and repairs practices are assured. The Outputs include increased labour productivity; increased livelihoods expansion; improved and increased incomes; savings accruing from and on all livelihoods initiatives; wealth creation. The Outcomes are: demonstration effect of wealth creation on improved quality of life; construction of new and better houses and roofed with metal sheets; ability to provide for basic domestic needs-all year round (e.g. food and clothing); able to afford health bills; able to afford children's school fees; purchased bicycle as means of mobility and status symbol. Intangibles are social and economic freedoms regained. The impact show as: demonstration effects of improved quality of life; reduced poverty levels and sustained economic capacity; and emerging freedoms with plenitude of options for further progression.

EMPOWERED refers to the transformations that have occurred in economic and social forms as evidenced in demonstration effects. Economic transformations show as occupational livelihoods engagements; stable but increasing income earnings and building economic capacity leading to wealth creation and also, as improved quality of life with demonstration effect and reduction in poverty. Thus, boreholes provision directly confronts the challenges that affect effective wealth creation for poverty reduction, and subsequently produces intergenerational effects to lift families out of the poverty trap in the long term.

Social transformations involve education quality improvements, social cohesion, time gains and gender empowerment, especially, girl-children empowered to fully participate in school. There is also stability in marriages in communities that foster occupational livelihoods development and achievements for poverty reduction.

The underlying processes involve: Empowerment applications in geographic space leading to impacts. The impacts refer to the instrumental freedoms achieved which lead to: sustained poverty reduction manifesting as improved literacy levels, technical capacity acquisition, enhanced wealth creation and investments. Also as enhanced demonstration effects showing the capacity and ability to access and pay for all basic needs, and also as, sustained improvement in quality of life. Socio-cultural issues such as life enhancement and enabling opportunities include physical expansion of community – housing; population growth in communities through births, and in-migration.

Then also we have: capacity and capability acquired to resolve all limiting factors relating to adverse geography and place-of-birth disadvantage; and then, the rural labour force become contributors to the annual national gross domestic product (GDP) growth.

Quality education leading to acquired professions show as opportunities equalizer with very high economic rate of return on the value of labour. Post-borehole provision and the education factor as facilitating poverty reduction in rural communities with inputs are boreholes provided in rural communities, with boreholes sustainability practices established for assurance of potable water availability all year round. Regular boreholes maintenance and repairs practices assured.

Additionally, the activities influencing the intermediary variables include: school-aged children in rural communities actively participating in school due to time savings from water hunting; school-age children consistently patronize boreholes; construction of new school structures and rehabilitate old ones in rural communities; construction of teachers' accommodation in rural communities. The outputs include: time gains facilitate improved punctuality and regular school attendance; improved health of children for sustained school attendance; enabling environment conducive for quality education delivery created; potable water from boreholes available; accommodation for teachers built; child involuntary absenteeism from school ceased; drop-outs ceased; improved teaching and learning.

Further, the Outcomes are: improved academic achievements of children. Children able to pass well national basic school examinations and transit to higher levels of education. Improved absorption by students in new and renovated schools; children eager to patronize and participate in school. More teachers accept posting to schools in the rural communities. Higher retention rates; improved teacher-child contact hours; effective and quality teaching emerges. The Impact show as: Quality education delivery positively impact children in rural communities; excellent final examination grades, and higher graduation rates to the tertiary levels of education system.

In terms of opportunities equalization, there are: transitions into professions and for developing skilled labor for entering highly paid livelihood occupations; and, professional capacities, competencies and specialized skills established and practiced within national and international labor systems for high compensations.

There is also reduced poverty levels and sustained economic capacity supporting progressive poverty reduction. Also, high standard of living, substantive and instrumental freedoms gained and plenitude of options for supporting poverty reduction in rural communities. The key assumptions supporting the effectiveness of the model are: Effective community level health and hygiene education carried-out in communities served with boreholes to facilitate buy-in and willingness of local population to patronize boreholes consistently. Effective capacity building of local people as hand pumps technicians to handle regular maintenance and repairs of boreholes. Community ownership of boreholes.

To appreciate the models further, Sen (1999), has indicated that human beings are born with certain potential capabilities, and the purpose of development is to create an environment in which all people can expand their capabilities, so that opportunities can be enlarged for both present and future generations (UNDP, 1994). Within geographic space, boreholes provision has provided the needed platforms and facilitated the development of these potential capabilities.

Boreholes provision has also provided the enabling environment, in which people in rural communities can, through health and time gains, expand their capabilities and embrace emerging opportunities to build their economic capacity to gradually emerge from poverty. These further ensure that the detrimental phenomenon termed as environmental resistances, environmental determinism, adverse geography and place-of-birth disadvantage are no more limiting, but addressed and converted into human advantage within every sphere of geographic space. Boreholes provision thus constitutes a critical infrastructure which is relevant to the attainment of substantive freedoms for progressive poverty reduction.

The implication of access for effective school participation is obvious where boreholes are within reach, and children and teachers can easily access it for their households and still get to school on time and attend school regularly. Households, and especially children, can also fetch water after school and store for early morning use and get to school early. There is much teacher- student contact hours in teaching and learning, and which would result in a high number of children graduating to higher levels of the education ladder, and possibly enter the labor force at higher levels of income earnings (within all possible probabilities), and escape poverty for the rest of their lives.

The model further reveal a segment of the national population considered as critical contributors to the annual performance of the national economy. Their performance, in terms of productivity and output, through the platform of boreholes provided, directly impacts the national gross domestic product (GDP) generation at the grassroots level. GDP being a vital aspect of generating the overall Gross National Income (GNI), the model thus brings to the fore the invisible but salient factors or interventions in rural communities, which at the micro-level constitute the basic platforms for stimulating growth, both in spatial and socio-economic dimensions and contributes in several ways to reducing poverty.

These conducive processes, involving borehole provision, and effective borehole sustainability practices, enabled the rural population in Atebubu and the Afram Plains Districts to be freed, and be able, over a long period, to contribute their utmost to earn their livelihoods within current resource availability in their immediate environment. By so doing, they continue to contribute dynamically to the on-going daily economic and social exchange processes within geographic space – rural communities, which aggregate into annual gross domestic product (GDP) growth. This also has consequences on the improvement of quality of life within geographic space, and as such, of much relevance to the study of Economic and Social Geography within the rural context.

In the hypotheses testing, in all the three instances, by applying the Chi Square test, the null hypotheses were rejected at the 0.05 level of significance and the alternative or working hypotheses accepted. This proves that the obvious improvements witnessed in the study area relating to health and hygiene, improved income earnings through improved occupational livelihood engagements, and, improvements in quality education delivery can confidently be attributed to the boreholes provided with 95% certainty and aggregating to drive reduction in poverty progressively.

Again, all the variables applied in the logistic regression model yielded positive coefficients scores, which implies that the provision of boreholes, being a poverty reduction factor, increases with increasing values of the intermediary variables.

While no major problems were encountered during the field data collection in the communities sampled that could substantially bias the results obtained from the study, the gaps identified in the data obtained from the Ghana Health Service, Ghana Education Service and MOFA offices made the author to rely much on information on poverty trends from the Ghana Statistical Service (GSS) publications, annual reports of the National Development Planning Commission, and the Ghana MDGs implementation reports to know the trends in the water sector performance and how they have impacted poverty reduction in the study area for the comparative impact analysis to draw appropriate conclusions.

The following exceptions to the study have been noted and explained as follows: in relation to the ethical issue of the author being a World Vision staff as at the time the survey was conducted and he engaging some World Vision staff on annual leave as research assistants – the explanation being that these were experienced resource persons who knew well the rugged and remote research terrain and were helpful to lead the other research assistants into the sampled communities so as to save travel time and cost in carrying out the survey. Their inclusion was not to bias the results of the survey in any aspect.

Also the high positive responses obtained from respondents does not reveal biases in either the design and execution of the survey but rather confirms the realities of the positive impact of boreholes provision in the programme communities sampled, as well as the conditions of extreme deprivation respondents in the control communities were experiencing. It further depicts the effective local operations differentials in terms of continual management of boreholes after World Vision's activities ended. The results obtained from this study strongly affirm similar results obtained and observations made during the World Vision GRWP Phase III end-of-project evaluation (World Vision, 2003).

## 6.3 Recommendations

From the foregone analyses, discussions, and all the research questions for the study adequately answered, the following recommendations are being proposed for consideration by the academia, development practitioners and all other stakeholders and actors in the water supply and poverty reduction sectors.

Objective 1: Borehole provision and improved health and hygiene practices, with specific reference to guinea worm eradication for poverty reduction - There is the need to pursue health for building economic capacity towards wealth creation for poverty reduction. Providing boreholes in rural communities facilitates health-gains and frees up much time for adults to pursue livelihood occupations and builds the economic strength to eventually emerge from poverty. The Government of Ghana, through the Ghana Health Service and its development partners should therefore pursue the implementation of the conceptual framework for effective health delivery in Ghana, as outlined by the Ministry of Health. The fundamental concept in that policy document states that, "improved health promotes intellectual capacity and productivity in the population, both of which are needed for social and economic development" (MOH, 2007:24). When this concept is implemented in relation to boreholes provision in communities, rural inhabitants will also benefit to enable them build the appropriate economic capacity and social capital to create wealth, further reduce poverty, and contribute incrementally to national GDP growth.

Objective 2: Borehole provision improved income earnings and wealth creation for poverty reduction – as the results from this study indicate, the positive impact evident in communities provided with boreholes as relating to reduced poverty levels is quite overwhelming and points to the need to put boreholes provision at the centre of poverty reduction strategies development and execution. Specifically, the provision of boreholes to rural communities should be seriously considered in rural areas where, for several years to come, it will not be economically feasible for government institutions to provide pipe-borne water. This should be mandatory for District Assemblies' to implement.

Objective 3: Borehole provision and quality education delivery for long term poverty reduction – the goal of achieving universal primary education should be addressed by Government and the donor community to build the foundations of younger generations to systematically and intentionally climb out of poverty. As indicated by the World Bank (2009:51), "the challenge of education is providing quality education that prepares young people to compete effectively in the global economy." With this in mind, the Government of Ghana and the donor community should pursue this agenda by being intentional in providing boreholes in rural communities to serve as platforms for quality education delivery towards poverty reduction in the long run.

In terms of the approaches that can be adopted to promote sustainable poverty reduction in rural communities – the Community Water and Sanitation Agency (CWSA) should be resourced by Government at the District level to ensure that all communities served with boreholes have the needed technical backstopping to ensure effective borehole repairs and maintenance for sustainable access. This will go a long way to ensure boreholes serve rural populations to sustain the freedom platforms created and needed to facilitate progressive reduction in poverty.

To further benefit the inhabitants of rural communities, this study recommends for adoption by development practitioners and stakeholders in the water and poverty reduction sector, the practical application of the new model for poverty reduction, 'the freedoms platform concept in geography and in rural development' as it emerged from this study. This new development paradigm if adopted will ensure a realistic planning and execution of poverty reduction programmes, and also facilitate the empowerment of rural households to eventually emerge from poverty over the long haul.

In terms of further research, the evidence so far produced from this study indicate the reality of extensive poverty reduction as a direct result of the provision of boreholes. The results from the study are quite convincing to warrant further study to ascertain how the gains in poverty reduction have been translated into or facilitated comprehensive economic and social development in the rural communities which benefited from the boreholes provision programme in the Atebubu and Afram Plains Districts. This study if undertaken by the academia, might reveal another model of rural development strategy which can be adopted and replicated to promote the well-being of many rural communities.

Other areas needing further study include how gender freedoms gained have been sustained through the provision of boreholes. Also, the very broad area of emerging demographics of borehole provision in rural communities need to be studied to generate more knowledge on what development practitioners should know and further expect in terms of the dynamics of freedoms attainment and utilization in geographic space.

In relation to quality of life improvements resulting from boreholes provision in rural communities, there is the need for academia and development practitioners to establish a Quality of Life Sustainability Index (QLSI) to track and measure progress in human lives in relation to their emergence from poverty. This Index will also serve as a prime tool for assessing the causes of poverty and poverty levels/status in rural communities. This tool will also assist communities and District Assemblies to initiate and implement effective Community Development Action Plans (CDAPs) to redress poverty in their Districts.

Finally, community leadership should consult with community members to develop and implement incentives to support WATSAN Committees to enable them perform their assigned task of ensuring effective operation and maintenance and sustainability of boreholes. WATSAN Committees should also be empowered by community leaders to educate community members to do away with taboos and fully patronize the boreholes for improvement in their health.

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# APPENDICES

# APPENDIX A: HOUSEHOLD QUESTIONNAIRE – PROGRAMME COMMUNITIES

## BOREHOLES PROVISION AS A KEY FACTOR IN FACILITATING POVERTY REDUCTION IN RURAL COMMUNITIES: A STUDY OF THE ATEBUBU AND AFRAM PLAINS DISTRICTS OF GHANA

## RESPONDENT IDENTIFICATION SECTION

**INTERVIEWER: Begin by introducing yourself-for example: `I am here to interact with you on the impact of borehole(s) provided by World Vision on your household. The questions will take a short time and we would like to speak with the head of the household.**

| | **EA CODE: Region/District/locality/EA Type** | | 007 | Respondent's First Name: | |
|---|---|---|---|---|---|
| 001 | Region: | | 008 | Respondent's Last Name: | |
| 002 | District Name: | | 009 | Respondent's HH QN. Number: | |
| 003 | Community Name: | | 010 | Respondent's HH Roster Line Number: | |
| 004 | House Number: | | 011 | Name of HH Head | |
| 005 | Household Number: | | 012 | Line Number of HH Head | |
| 006 | Questionnaire Number: | | | | |

| | **INTERVIEWER'S VISIT** | | | | |
|---|---|---|---|---|---|
| 021 | Interviewer's Name | | | | |
| 022 | Date(dd-mm-yy) | | | | |
| 023 | Time (Start/End) | | | | |
| 024 | Result** | | | | |
| 025 | Next Visit | | | | |
| ****Results Codes:** 1. Complete 2. Not Found 3. Postponed 4. Refused 5. Partially complete 6. Incapacitated 7. Other (Specify) ………………….. | | | | | |
| 031 | Language of Interview** | | | | |
| 032 | Native Language of Respondent** | | | | |
| 033 | Translator Used? (Yes = 1, No = 2) | | | | |
| **** Language Codes:** 1. English 2. Twi/Fante/Other Akan 3. Ga 4. Ewe 5. Hausa 6.Dagbani 7. Other (Specify) …………… | | | | | |

| **EDITING/DATA ENTRY** | | | | | |
|---|---|---|---|---|---|
| 041 | Field Supervisor | | 047 | Survey Manager | |
| 042 | Date(dd-mm-yy) | | 048 | Date(dd-mm-yy) | |
| 043 | Status** | | 049 | Status** | |
| 044 | Office Editor | | 050 | Data Entry Clerk | |
| 045 | Date(dd-mm-yy) | | 051 | Date(dd-mm-yy) | |
| 046 | Status** | | 052 | Status** | |
| **Status Codes:** 1. Complete 2. Additional Visits Required 3. Other (Specify) ………………………………………………. | | | | | |

## SECTION A: BACKGROUND

**Region: ____________________** **District:_____________________**

**House No: _______________** **Household No.___________________________________Name of Respondent:-**

**Household Member Listing Form - Name of Respondent:- ___________________________** ***(Ask for the Local name of respondent too)***

| Household member No. | First name of household member | Relation to household head (A) | Sex 1. M 2. F | Date of Birth (DMY) | Age (yr) | Marital Status (B) | Work Status (C) | Highest level of Education (D) | Read/Write (Literacy) (E) |
|---|---|---|---|---|---|---|---|---|---|
| 01 | | | | | | | | | |
| 02 | | | | | | | | | |
| 03 | | | | | | | | | |
| 04 | | | | | | | | | |
| 05 | | | | | | | | | |

| A | B | C | D | E |
|---|---|---|---|---|
| 1. Head | 1. Single | 1. Farmer | 0. None | 1. Read |
| 2. Spouse | 2. Married mono | 2. Pastoralist | 1. Primary 1-6 | 2. Write |
| 3. Child | 3. Married poly | 3. Regular wage earner | 2. Middle/JSS | 3. Both |
| 4. Other relative | 4. Divorced/separated | 4. Casual employee | 3. SSS/Technical | 4. Neither |
| 5. No relation | 5. Widowed | 5. Business/trade | 4. University/College | |
| 6. Grand-child | 88 Not Applicable-Chn | 6. Fisherman | 5. Non-formal | |
| | | 7. Domestic/house work | 6. Islamic | |
| | | 8. Student/pupil | 7. Other (Specify) | |
| | | 77 Other (Specify) | | |
| | | 88 Not Applicable | | |

| # | QUESTIONS | RESPONSE OPTIONS |
|---|---|---|
| 1. | To which ethnic group do you belong? | 1. Ashanti<br>2. Other Akan<br>3. Ga/Adangbe 4. Ewe<br>5. Guan 6. Mole-Dagbani<br>7. Other (Specify) …………… |
| 2. | What is your religion? | 1. Christian – Catholic, Protestant, Pentecostal)<br>2. Muslim 3. Traditional 4. No Religion<br>5. Other (Specify) ………….. |
| 3. | How long have you lived continuously in this Community? | Years ……….<br>1. Always (Since birth)<br>2. Visitor |
| 4. | How old were you at your last birthday? | Age in completed years ……….. |
| 5. | What is your marital status now? | 1. Married 2. Divorced 3.Widowed 4. Separated |
| 6. | What type of house do you live in? | 1. Mud house with thatch roof<br>2. Mud house with metal roof<br>3. Cement block house with thatch roof<br>4. Cement block house with metal roof<br>5. Other (specify) …………… |
| 7. | Who owns this house? | Self-owned 2. Family 3. Rented 4. 7. Other (Specify) |
| 8. | Do you have the following items?:<br>Radio … Television … Tape Recorder…<br>Bicycle… Tractor …… Electricity ……Vehicle ……<br>Bed with mattress …… Kerosine lantern ……….<br>Rechargeable Lamps (Solar/Electric) ..…. Chair … Table | 1. Yes<br>2. No |

| # | QUESTIONS | RESPONSE OPTIONS |
|---|---|---|
| 9. | Have you ever attended school? | 1. Yes<br>2. No |
| 10. | If Yes, what is the highest level of school you attended**?** | 1. Koranic. 2. Primary 3. Middle/JSS<br>4. Secondary/Technical/ Commercial/SSS.<br>5. Higher (specify) ………… |
| 11. | What is the highest grade/class completed at that level? | Grade/Class ………………. |
| 12. | Can you read and understand a letter or newspaper easily, with difficulty, or not at all? | 1. Easily<br>2. With difficulty<br>3. Not at all |
| 13. | How many children/ dependants of school going-age do you currently have in: | 1. Koranic 2. Primary 3. Middle/JSS<br>4. Secondary/Technical/ Commercial/SSS,<br>5. Higher (specify) ………… |
| 14. | Are you currently working? | 1. Yes<br>2. No |
| 15. | Are you doing any job for which you are paid in cash or kind? | 1. Yes<br>2. No |
| 16. | What is your main occupation?<br>Probe: What kind of work do you mainly do? | 1. Farmer 2. Fisherman/Fishmonger<br>3. Merchant/Trader 4. Mechanic 5. Carpenter<br>6. Tailor/Seamstress 7. Hairdresser 8. Other skilled Trade<br>9. Daily Labourer 10. Teacher 11. Civil Servant<br>12. Apprentice 13. Unpaid Family Worker 14. Student/Pupil<br>15. Housewife 16. Unemployed 17. Other (Specify) |
| 17. | Do you hire farm hands to work on your farm? | 1. Yes<br>2. No |
| 18. | Apart from your main work, what other work do you do?<br>(Probe for secondary occupation?) | 1. Farmer 2. Fisherman/Fishmonger<br>3. Merchant/Trader 4. Mechanic 5. Carpenter<br>6.Tailor/Seamstress 7. Hairdresser 8. Other skilled Trade<br>9. Daily Labourer 10. Teacher 11. Civil Servant<br>12.Apprentice 13. Unpaid Family Worker 14. Student/Pupil<br>15. Housewife 16. Unemployed 17. Other (Specify) |

| # | QUESTIONS | RESPONSE OPTIONS |
|---|---|---|
| 19. | Do you do any work relating to agriculture? | 1. Yes<br>2. No |
| 20. | Do you usually do this work throughout the year, or do you work seasonally, or only once in a while? | 1. Throughout the year<br>2. Seasonally/Part of the year<br>3. Once in a while |
| 21. | Do you earn cash for your work? | 1. Yes<br>2. No |
| 22. | Is there water available in your household which can be used always for hand washing after visiting the latrine and before eating? | 1. Yes<br>2. No |
| 23. | Before borehole provision what were your water sources during the raining season?<br>** (Multiple Response) | 1. River/stream 2. Rain water<br>3.Well/spring 4. Pond<br>5.Unprotected hand dug-out well<br>6.Dug out well fitted with pump |
| 24. | Before borehole provision what were your water sources during the dry season?<br>** (Multiple Response) | 1. River/stream 2. Rain water<br>3.Well/spring 4. Pond<br>5.Unprotected hand dug-out well<br>6.Dug out well fitted with pump |
| 25. | Who owns the boreholes provided in this Community? | 1. The Community 2. District Assembly<br>3. World Vision 4. Other NGOs/Church<br>5. Other(Specify) ……………… |
| 26. | Who maintains the boreholes provided in this Community? | 2. The Community 2. District Assembly<br>3. World Vision<br>4. Other NGOs/Church<br>5. Other(Specify) ……………… |

| # | QUESTIONS | RESPONSE OPTIONS |
|---|---|---|
| 27. | How long does it take to get to the borehole site, get water and come back in the wet season? | 1. 0 – 30minutes 2. 30 mins – 1hour 3. 1 to 2 hours 4. 2 – 3 hours 5. More than 3hours 6. Don't know |
| 28. | How long does it take to get to the borehole site, get water and come back in the dry season? | 1. 0 – 30minutes 2. 30 mins – 1hour 3. 1 to 2 hours 4. 2 – 3 hours 5. More than 3hours 6. Don't know |
| 29. | Who usually fetches water in your households? | 1. Women 2. Men 3. Children in the household (girls/boys) 4. Children –boys 5. Children – girls |
| 30. | How do you convey water? | 1. Human (head poterage) 2. Bicycle 3. Tractor services 4. Cart/wheel barrow 5. Animals |
| 31. | How are funds raised for maintenance of the boreholes in this community? | 1. Cash collected at fetching point 2. Community levy 3. In kind (Specify) ……….. 4. Other (Specify) ………… |
| 32. | How has the boreholes provided affected time used in fetching water as compared to previously when there were no boreholes? | 1. Reduced fetching time drastically 2. Increased fetching time |
| 33. | Since boreholes were provided in this community have you been able to earn income from your occupation that has enabled you improve on your well being? | 1. Yes 2. No |
| 34. | On the average how much income did you earn annually from your major livelihood activities before boreholes were provided? | |
| 35. | On the average how much income do you earn annually from your major livelihood activities since boreholes were provided in this community? | |
| 36. | Has boreholes directly or indirectly contributed to your economic activity and thus increased income and reduced poverty in your household? | 1. Yes 2. No |
| 37. | Do you hire farm hands? | 1. Yes 2. No |
| 38. | If "Yes", where do they access water for drinking as they work on your farm?<br>• From boreholes - water fetched from the boreholes in the mornings as they go to farm.<br>• From surface streams around the community or the farm area. | <br>1. Yes 2. No<br>1. Yes 2. No |

| # | QUESTIONS | RESPONSE OPTIONS |
|---|---|---|
| 39. | Has boreholes provided in this community contributed to improved health in households? | 1. Yes 2. No |
| 40. | Has children's school attendance improved since boreholes were provided in this community? | 1. Yes 2. No |
| 41. | Do you see the provision of boreholes as an intentional effort to:<br>• reduce guinea worm and help to free your community from poverty?<br>• Free you from water-borne/related diseases?<br>• Eradicate illiteracy? | <br>1. Yes 2. No<br>1. Yes 2. No<br>1. Yes 2. No |
| 42. | Are all community members using water from the borehole? | 1. Yes 2. No<br>77. Don't know |
| 43. | How many boreholes are currently working in this community? | 0. None 1. All<br>2. Some (Specify)……… |
| 44. | Have you been able to acquire or do any of the following specific things as a result of your income earning activities related to provision of the boreholes in this community?<br>• Built a house<br>• House expansion or improvement<br>• Roofed house with iron sheets<br>• Purchased a tractor<br>• Purchased a Corn mill<br>• Purchased a bicycle for yourself<br>• Purchased bicycles for your children<br>• Purchased clothing for self and household members<br>• Contribute regularly to levies for borehole maintenance and repairs<br>• Pay for medical care<br>• Pay children's school fees and provide school logistics at JSS or SSS level | <br>1. Yes 2. No<br>1. Yes 2. No<br>1. Yes 2. No<br>1. Yes 2. No<br>1. Yes 2. No<br>1. Yes 2. No<br>1. Yes 2. No<br>1. Yes 2. No<br>1. Yes 2. No<br>1. Yes 2. No<br>1. Yes 2. No |
| 45. | How do you relate the absence of boreholes to the level of poverty before and after boreholes were provided for your community? | Before: 1. High Level 2. Low Level<br>After: 1.Low Level 2. High Level |
| 46. | Has the provision of boreholes contributed to reducing poverty in your life and in this community? | 1. Yes 2. No |

| # | QUESTIONS | RESPONSE OPTIONS |
|---|---|---|
| 47. | Has poverty been reduced with the provision of boreholes and its patronage through:<br>• Eradication of guinea worm?<br>• Increased farm acreages and earnings?<br>• Ability to access health and education for their children?<br>• Ability to provide for basic critical domestic needs? | 1. Yes 2. No<br>1. Yes 2. No<br>1. Yes 2. No<br>1. Yes 2. No |
| 48. | Has your community and your personal life improved since the provision of the boreholes as follows:<br>• Time savings for doing other beneficial activities to improve livelihood<br>• Roofing of house with iron sheets instead of thatch<br>• Improved personal hygiene – bathing and washing of clothing<br>• Improved health<br>• Guinea worm disease completely eradicated from this community<br>• Have No more worries as to where to go searching for water | 1. Yes 2. No<br>1. Yes 2. No<br>1. Yes 2. No<br>1. Yes 2. No<br>1. Yes 2. No<br>1. Yes 2. No |
| 49. | In what way has the provision of boreholes in your community reduced poverty?<br>• Increased acreage of farms cultivated annually?<br>• Increased crop output?<br>• Increased income after sales due to increased farm produce?<br>• Promoted other economic activities in the community?<br>• Ability to cater for our families better? | 1. Yes 2. No<br>1. Yes 2. No<br>1. Yes 2. No<br>1. Yes 2. No<br>1. Yes 2. No |
| 50. | In this community borehole water is mostly used for the following purposes:<br>• Domestic activities<br>• Construction of buildings<br>• Religious purposes<br>• Economic activities | 1. Yes 2. No<br>1. Yes 2. No<br>1. Yes 2. No<br>1. Yes 2. No |

| # | QUESTIONS | RESPONSE OPTIONS |
|---|---|---|
| 51. | Labour for accessing water for household?<br>• Do you use available household members to access water? (women, children, men on bicycles) | 1. Yes 2. No |
| 52. | Has the boreholes provided enabled you have options and better choices in life? | 1. Yes 2. No |
| 53. | Has the risks associated with searching for water been reduced with the provision of the boreholes?<br>If yes, mention some of the risks eliminated | 1. Yes 2. No |
| 54. | Has your health generally improved with the provision of the boreholes?<br>If yes, how? ………………………………………………………………………… | 1. Yes 2. No |
| 55. | What are the causes of Guinea worm infection? | 1. Drinking untreated water infected with the Guinea worm cyclops<br>2. Stepping into water infected with the Guinea worm cyclops<br>3. People infected step into rivers and streams and infect the water<br>**4.** The gods' curses on our community |
| 56. | Has the provision of boreholes in anyway improved infants and child health?<br>If Yes, how? ……………………………………………………………… | 1. Yes 2. No 77. Don't Know |

| # | QUESTIONS | RESPONSE OPTIONS |
|---|---|---|
| 57. | Are these evident as a result of the availability of boreholes in this community:<br>• Time savings in community because of availability and easy access to borehole.<br>• Women now able to discharge their domestic obligations and responsibilities without much constraints.<br>• School attendance: improved punctuality and regularity in school attendance.<br>• Improved health: elimination of guinea worm and diarhoeal diseases.<br>• Economic change – farms expanded and output increased, emergence of water-related agro-processing micro-industries.<br>• Increased incomes and progressive wealth creation. | 1. Yes 2. No<br>1. Yes 2. No<br>1. Yes 2. No<br>1. Yes 2. No<br>1. Yes 2. No<br>1. Yes 2. No |
| 58. | Have you ever been infected with the Guinea worm disease? | 1. Yes 2. No |
| 59. | If Yes, how long did it take for guinea worm to be eradicated when you started drinking water from the boreholes? | 1. One year<br>2. Less than one year<br>3. More than one year<br>77 Don't Know |
| 60. | Is Guinea worm still prevalent in this community? | 1. Yes 2. No |
| 61. | Do you have access to about one bucket (size 34) of safe drinking water per person per day to meet your basic water needs? | 1. Yes 2. No |
| 62. | After the provision of the boreholes in this community, has water been easily accessible and available to meet the needs of your household throughout the year? | 1. Yes 2. No |
| 63. | How many boreholes do you have in this community? | 1. One 2. Two 3. Three<br>4. Four |
| 64. | Is your community borehole promptly repaired when it breaks down? | 1. Yes 2. No |

| # | QUESTIONS | RESPONSE OPTIONS |
|---|---|---|
| 65. | Is water a production input in this community for many households? | 1. Yes 2. No |
| 66. | Does the availability of water from the boreholes contribute a significant proportion of your household income? | 1. Yes 2. No |
| 67. | Do you hire farm hands to work on your farm(s) each year? | 1. Yes 2. No |
| 68. | Has agricultural food crops production increased in this household since the provision of the boreholes? | 1. Yes 2. No<br>77. Don't Know |
| 69. | Is there a direct relationship between boreholes provided, the availability of labour to work on your farm, and agricultural productivity? | 1. Yes 2. No |
| 70. | Has the provision of boreholes contributed to attracting migrant farm labour into this community to support your farming activities? | 1. Yes 2. No |
| 71. | Has the provision of boreholes improved the quality of life in your community as follows:<br>• Time savings<br>• Higher earnings on income from livelihood occupations.<br>• Provided employment.<br>• Facilitated improved education. | <br><br>1. Yes 2. No<br>1. Yes 2. No<br>1. Yes 2. No<br>1. Yes 2. No |
| 72. | Has the provision of boreholes promoted:<br>• Increased rate of contracting new marriages?<br>• Decreased divorces?<br>• Improved marriages. | <br>1. Yes 2. No<br>1. Yes 2. No<br>1. Yes 2. No |
| 73. | Has the provision of boreholes promoted job creation in this community? | 1. Yes 2. No |
| 74. | How willing are you to support maintenance and repairs of boreholes provided in this community? | 1. Very willing 2. Partially willing 3. Unwilling |

| # | QUESTIONS | RESPONSE OPTIONS |
|---|---|---|
| 75. | Have the boreholes provided in this Community helped to restore human freedoms such as: | |
| | • Freedom from water-borne/related diseases. | 1. Yes 2. No |
| | • Freedom from effects of the harsh physical environment | 1. Yes 2. No |
| | • Freedom of mobility to engage in social and economic exchange | 1. Yes 2. No |
| 76. | What time of day water is collected and why? …………………………….. ……………………………………………………………………………….. | 1. Morning 2. Afternoon 3. Evening. 4. Night |
| 77. | Has the provision of borehole increased the availability and widened the distribution of basic life-sustaining goods such as food, shelter, health, and protection in this community? | 1. Yes 2. No |

| # | **Opinion Statement** | **Response Options** |
|---|---|---|
| 1. | Poor marriages prevalent before boreholes were provided. | 1. Strongly Agree 2. Agree 3. Neutral 4.Disagree 5. Strongly Disagree |
| 2. | No teachers in community schools before boreholes were provided. | 1. Strongly Agree 2. Agree 3. Neutral 4.Disagree 5. Strongly Disagree |
| 3. | Poor school attendance and high dropout rates before boreholes were provided | 1. Strongly Agree 2. Agree 3. Neutral 4.Disagree 5. Strongly Disagree |
| 4. | Low enrolment for girl-children in schools boreholes were provided. | 1. Strongly Agree 2. Agree 3. Neutral 4.Disagree 5. Strongly Disagree |
| 5. | Poor shelter and non-safe dwellings constructed before boreholes were provided. | 1. Strongly Agree 2. Agree 3. Neutral 4.Disagree 5. Strongly Disagree |
| 6. | Boreholes provided helping to improve infants and child health. | 1. Strongly Agree 2. Agree 3. Neutral 4.Disagree 5. Strongly Disagree |
| 7. | Presence of poor health and inability to access good healthcare before the provision of boreholes. | 1. Strongly Agree 2. Agree 3. Neutral 4.Disagree 5. Strongly Disagree |

| # | Opinion Statement | Response Options |
|---|---|---|
| 8. | Boreholes provision facilitating improved school attendance in community | 1. Strongly Agree 2. Agree 3. Neutral 4.Disagree 5. Strongly Disagree |
| 9. | Presence of poor health and inability to access good healthcare before the provision of boreholes. | 1. Strongly Agree 2. Agree 3. Neutral 4.Disagree 5. Strongly Disagree |
| 10. | Boreholes provision facilitating improved school attendance in community | 1. Strongly Agree 2. Agree 3. Neutral 4.Disagree 5. Strongly Disagree |
| 11. | Absence of boreholes affected occupational activities. | 1. Strongly Agree 2. Agree 3. Neutral 4.Disagree 5. Strongly Disagree |
| 12. | Economic insecurity due to very low farm output before the provision of boreholes. | 1. Strongly Agree 2. Agree 3. Neutral 4.Disagree 5. Strongly Disagree |
| 13. | Boreholes contributing to improving livelihoods and economic activity. | 1. Strongly Agree 2. Agree 3. Neutral 4.Disagree 5. Strongly Disagree |
| 14. | Increased agricultural food crops production in community since the provision of boreholes | 1. Strongly Agree 2. Agree 3. Neutral 4.Disagree 5. Strongly Disagree |
| 15. | Preference for children attending school than going searching for water for households | 1. Strongly Agree 2. Agree 3. Neutral 4.Disagree 5. Strongly Disagree |
| 16. | Boreholes provided helping to check children dropping out of school | 1. Strongly Agree 2. Agree 3. Neutral 4.Disagree 5. Strongly Disagree |
| 17. | Boreholes provided facilitating wealth creation and reducing poverty in households | 1. Strongly Agree 2. Agree 3. Neutral 4.Disagree 5. Strongly Disagree |
| 18. | High infant and child mortality stopped with the provision of boreholes in this community | 1. Strongly Agree 2. Agree 3. Neutral 4.Disagree 5. Strongly Disagree |
| 19. | Poor health - guinea worm cases high, prevalent and endemic in community before the provision of boreholes. | 1. Strongly Agree 2. Agree 3. Neutral 4.Disagree 5. Strongly Disagree |
| 20. | Very poor personal hygiene: skin diseases prevalent before the provision of boreholes. | 1. Strongly Agree 2. Agree 3. Neutral 4.Disagree 5. Strongly Disagree |
| 21. | Living a life of very limited options before the provision of boreholes. | 1. Strongly Agree 2. Agree 3. Neutral 4.Disagree 5. Strongly Disagree |
| 22. | Incapacitation with guinea worm before the provision of boreholes. | 1. Strongly Agree 2. Agree 3. Neutral 4.Disagree 5. Strongly Disagree |
| 23. | Limited opportunities – disease ridden for months before the provision of boreholes. | 1. Strongly Agree 2. Agree 3. Neutral 4.Disagree 5. Strongly Disagree |

| # | Opinion Statement | Response Options |
|---|---|---|
| 24. | Limited freedom in relation to time available for other uplifting endeavours before the provision of boreholes. | 1. Strongly Agree 2. Agree 3. Neutral 4.Disagree 5. Strongly Disagree |
| 25. | Intangible freedoms gained from boreholes provision | 1. Strongly Agree 2. Agree 3. Neutral 4.Disagree 5. Strongly Disagree |
| 31. | Guinea worm incapacitation currently prevalent in households. | 1. Strongly Agree 2. Agree 3. Neutral 4.Disagree 5. Strongly Disagree |
| 32. | Presence of Guinea Worm in community | 1. Strongly Agree 2. Agree 3. Neutral 4.Disagree 5. Strongly Disagree |
| 33. | Boreholes provision contributing to guinea worm eradication from households | 1. Strongly Agree 2. Agree 3. Neutral 4.Disagree 5. Strongly Disagree |
| 34. | Hygiene conditions before borehole provision in communities | 1. Strongly Agree 2. Agree 3. Neutral 4.Disagree 5. Strongly Disagree |
| 35. | Boreholes provision promoting regular face washing among children and adults in households. | 1. Strongly Agree 2. Agree 3. Neutral 4.Disagree 5. Strongly Disagree |
| 36. | Absence of boreholes affected farming activities of households. | 1. Strongly Agree 2. Agree 3. Neutral 4.Disagree 5. Strongly Disagree |
| 37. | Lack of water for drinking on farms | 1. Strongly Agree 2. Agree 3. Neutral 4.Disagree 5. Strongly Disagree |
| 38. | Very low farm output before boreholes provision | 1. Strongly Agree 2. Agree 3. Neutral 4.Disagree 5. Strongly Disagree |
| 39. | Boreholes provision contributing to increased farm acreages in communities and earnings in households | 1. Strongly Agree 2. Agree 3. Neutral 4.Disagree 5. Strongly Disagree |
| 40. | High level of poverty before boreholes were provided | 1. Strongly Agree 2. Agree 3. Neutral 4.Disagree 5. Strongly Disagree |
| 41. | Low level of poverty after boreholes were provided | 1. Strongly Agree 2. Agree 3. Neutral 4.Disagree 5. Strongly Disagree |
| 42. | Low households incomes before boreholes provision | 1. Strongly Agree 2. Agree 3. Neutral 4.Disagree 5. Strongly Disagree |
| 43. | Boreholes provision resulting in increased incomes and progressive wealth creation in households | 1. Strongly Agree 2. Agree 3. Neutral 4.Disagree 5. Strongly Disagree |
| 44. | Boreholes provision facilitating improved school attendance in communities | 1. Strongly Agree 2. Agree 3. Neutral 4.Disagree 5. Strongly Disagree |

| # | Opinion Statement | Response Options |
|---|---|---|
| 45. | Borehole provision enabling children to be regular and punctual at school in communities | 1. Strongly Agree 2. Agree 3. Neutral 4.Disagree 5. Strongly Disagree |
| 46. | Availability of teachers in community with the provision of boreholes | 1. Strongly Agree 2. Agree 3. Neutral 4.Disagree 5. Strongly Disagree |
| 47. | Boreholes provision enabling people practice improved personal hygiene in households | 1. Strongly Agree 2. Agree 3. Neutral 4.Disagree 5. Strongly Disagree |
| 48. | Poor personal hygiene in community before the provision of boreholes | 1. Strongly Agree 2. Agree 3. Neutral 4.Disagree 5. Strongly Disagree |
| 49. | Boreholes provision facilitating improvement in the quality of life in households. | 1. Strongly Agree 2. Agree 3. Neutral 4.Disagree 5. Strongly Disagree |
| 50. | Boreholes provision improving school attendance | 1. Strongly Agree 2. Agree 3. Neutral 4.Disagree 5. Strongly Disagree |
| 51. | Boreholes provision helping to improve punctuality at school | 1. Strongly Agree 2. Agree 3. Neutral 4.Disagree 5. Strongly Disagree |
| 52. | Boreholes provision helping to check frequent absenteeism at school | 1. Strongly Agree 2. Agree 3. Neutral 4.Disagree 5. Strongly Disagree |
| 53. | Community members having low incomes before the provision of boreholes in community | 1. Strongly Agree 2. Agree 3. Neutral 4.Disagree 5. Strongly Disagree |
| 54. | Availability of water from boreholes contributing a significant proportion of household income | 1. Strongly Agree 2. Agree 3. Neutral 4.Disagree 5. Strongly Disagree |
| 55. | Boreholes provision contributing to reduce poverty through increased farm acreages and earnings | 1. Strongly Agree 2. Agree 3. Neutral 4.Disagree 5. Strongly Disagree |
| 56. | Boreholes provision assisting to improve health in households | 1. Strongly Agree 2. Agree 3. Neutral 4.Disagree 5. Strongly Disagree |
| 57. | Boreholes provided facilitating freedoms from the effects of the physical environment | 1. Strongly Agree 2. Agree 3. Neutral 4.Disagree 5. Strongly Disagree |
| 58. | Boreholes provision creating enabling environment for economic enterprises development in households | 1. Strongly Agree 2. Agree 3. Neutral 4.Disagree 5. Strongly Disagree |
| 59. | Boreholes provision helping to increase earnings on incomes from livelihoods. | 1. Strongly Agree 2. Agree 3. Neutral 4.Disagree 5. Strongly Disagree |
| 60. | Boreholes provided enabling water to be fetched before and after school hours | 1. Strongly Agree 2. Agree 3. Neutral 4.Disagree 5. Strongly Disagree |
| 61. | School attendance adversely affected by time spent searching for water | 1. Strongly Agree 2. Agree 3. Neutral 4.Disagree 5. Strongly Disagree |

## APPENDIX B: HOUSEHOLD QUESTIONNAIRE - CONTROL COMMUNITIES

### RESPONDENT IDENTIFICATION SECTION

INTERVIEWER: Begin by introducing yourself-for example: `I am here to interact with you on the impact of the lack of boreholes have on your households. The questions will take a short time and we would like to speak with the head of the household.

| | | | | | |
|---|---|---|---|---|---|
| | EA CODE: Region/District/locality/EA Type | | 007 | Respondent's First Name: | |
| 001 | Region: | | 008 | Respondent's Last Name: | |
| 002 | District Name: | | 009 | Respondent's HH QN. Number: | |
| 003 | Community Name: | | 010 | Respondent's HH Roster Line Number: | |
| 004 | House Number: | | 011 | Name of HH Head | |
| 005 | Household Number: | | 012 | Line Number of HH Head | |
| 006 | Questionnaire Number: | | | | |

| | INTERVIEWER'S VISITS | | | | |
|---|---|---|---|---|---|
| 021 | Interviewer Name | 1st | 2nd | 3rd | Final Visit |
| 022 | Date(dd-mm-yy) | | | | |
| 023 | Time (Start/End) | | | | |
| 024 | Result** | | | | |
| 025 | Next Visit | | | | |

**Results Codes: 1. Complete 2. Not Found 3. Postponed 4. Refused 5. Partially complete 6. Incapacitated 7. Other (Specify) …

| | | |
|---|---|---|
| 031 | Language of Interview** | |
| 032 | Native Language of Respondent** | |
| 033 | Translator Used? (Yes = 1, No = 2) | |

** Language Codes: 1. English 2. Twi/Fante/Other Akan 3. Ga 4. Ewe 5. Hausa 6.Dagbani 7. Other (Specify) ………

EDITING/DATA ENTRY

| | | | | | |
|---|---|---|---|---|---|
| 041 | Field Supervisor | | 047 | Survey Manager | |
| 042 | Date(dd-mm-yy) | | 048 | Date(dd-mm-yy) | |
| 043 | Status** | | 049 | Status** | |
| 044 | Office Editor | | 050 | Data Entry Clerk | |
| 045 | Date(dd-mm-yy) | | 051 | Date(dd-mm-yy) | |
| 046 | Status** | | 052 | Status** | |

Status Codes: 1. Complete 2. Additional Visits Required 3. Other (Specify) ……………………………………………….

SECTION A: BACKGROUND

Region: ____________________ District:_____________________

House No: _______________ Household No.____________________________________Name of Respondent:-

Household Member Listing Form - Name of Respondent:-

| Household member No. | First name of household member | Relation to household head (A) | Sex M-1 F-2 | Date of Birth (DMY) | Age (yr) | Marital Status (B) | Work Status (C) | Highest level of Education (D) | Read/Write (E) |
|---|---|---|---|---|---|---|---|---|---|
| 01 | | | | | | | | | |
| 02 | | | | | | | | | |
| 03 | | | | | | | | | |
| 04 | | | | | | | | | |
| 05 | | | | | | | | | |
| 06 | | | | | | | | | |
| 07 | | | | | | | | | |

| A | B | C | D | E |
|---|---|---|---|---|
| 1. Head | 1. Single | 1. Farrmer | 1. Non-formal | 1. Read |
| 2. Spouse | 2. Married mono | 2. Pastoralist | 2. Primary 1-6 | 2. Write |
| 3. Child | 3. Married poly | 3. Regular wage earner | 3. Middle/JSS | 3. Both |
| 4. Other relative | 4. Divorced/separated | 4. Casual employee | 4. SSS/Technical | 4. Neither |
| 5. No relation | 5. Widowed | 5. Business/trade | 5. University/College | |
| 6. Grand-child | 88 Not Applicable-Chi | 6. Fisherman | 7. Other (Specify) | |
| | | 7. Domestic/house work | 8. None | |
| | | 8. Student/pupil | | |

| # | QUESTIONS | RESPONSE OPTIONS |
|---|---|---|
| 1. | To which ethnic group/tribe do you belong? | 1.Ashanti 2. Other Akan 3. Ga/Adangbe<br>4.Ewe 5. Guan 6. Mole-Dagbani 7.Other (Specify) ……… |
| 2. | What is your religion? | 1.Christian – Catholic, Protestant, Pentecostal)<br>2.Muslim 3. Traditional 4. No Religion 5.Other (Specify) … |
| 3. | How long have you lived continuously in this Community? | Years ……….<br>1. Always (Since birth)<br>2. Visitor |
| 4. | How old were you at your last birthday? | Age in completed years ………… |
| 5. | What is your marital status now? | 1.Married 2. Divorced 3. Widowed 4. Separated |
| 6. | Type of house: | a. Mud house with thatch roof<br>b. Mud house with metal roof<br>c. Cement block house with thatch roof<br>d. Cement block house with metal roof<br>e. Other (specify) …………… |
| 7. | Who owns this house? | 1. Self-owned 2. Family 3. Rented |
| 8. | Do you have the following items:<br>Radio ………….. Television ……………. Tape Recorder ……<br>Bicycle…………. Tractor ……… Electricity ……… Vehicle …<br>Bed with mattress ……….. Kerosine lantern ………. Rechargeable<br>Lamps (Solar/Electric) ...………. Chair …………….. Table …… | 1.Yes 2.No |
| 9. | Have you ever attended school? | 1. Yes 2. No |
| 10. | What is the highest level of school you attended? | 1.Koranic 2.Primary 3.Middle/JSS 4. Secondary/Technical/<br>5.Commercial/SSS 6. 6.Higher (specify) … |
| 11. | How many children/ dependants of school going-age do you currently have in: | 1.Koranic 2. Primary 3. Middle/JSS 4. Secondary/Technical/<br>5.Commercial/SSS 6. Higher (specify) ………… |

| # | QUESTIONS | RESPONSE OPTIONS |
|---|---|---|
| 12. | What is your main occupation?<br>(Probe: What kind of work do you mainly do?) | 1.Farmer 2.Fisherman/Fishmonger 3. Merchant/Trader<br>4.Mechanic 5.Carpenter 6.Tailor/Seamstress<br>7.Hairdresser<br>8.Other skilled Trade, 9.Daily Labourer<br>10.Student/Pupil<br>11.Teacher 12.Civil Servant 13.Apprentice<br>14.Unpaid Family Worker 15.Housewife |
| 13. | Do you hire farm hands to work on your farm? | 1.Yes 2.No |
| 14. | On the average how much income do you earn annually from your major livelihood activities? | |
| 15. | Apart from your main work, what other work do you do?<br>(Probe for secondary occupation?) | 1.Farmer 2.Fisherman/Fishmonger<br>3.Merchant/Trader<br>4.Mechanic 5.Carpenter, 6.Tailor/Seamstress<br>7.Hairdresser, 8.Other skilled Trade<br>9.Daily Labourer 10.Student/Pupil 11.Teacher<br>12.Civil Servant, 13.Apprentice<br>14.Unpaid Family Worker<br>15.Housewife, 16.Unemployed<br>17.Other (Specify)…… |
| 16. | Do you do any work relating to agriculture? | 1.Yes 2.No |
| 17. | Do you usually do this work throughout the year, or do you work seasonally, or only once in a while? | 1.Throughout the year<br>2.Seasonally/Part of the year<br>3.Once in a while |
| 18. | Do you earn cash for your work? | 1.Yes 2.No |
| 19. | Is there water available in your household which can be used always for hand-washing after visiting the latrine and before eating? | 1.Yes 2.No |
| 20. | Do you have any schools in this Community where children attend? | 1.Yes 2.No |

| # | QUESTIONS | RESPONSE OPTIONS |
|---|---|---|
| 21. | What are your sources of obtaining water during the raining season?<br>** (Multiple Response) | 1.River/stream 2.Rain water<br>3.Well/spring 4.Pond<br>5.Unprotected hand dug-out well<br>6.Dug out well fitted with pump<br>7.Tube well/borehole |
| 22. | What are your sources of obtaining water during the dry season?<br>** (Multiple Response) | 1.River/stream 2.Rain water<br>3.Well/spring 4.Pond<br>5.Unprotected hand dug-out well<br>6.Dug out well fitted with pump<br>7.Tube well/borehole |
| 23. | How long does it take to fetch water and come back in the wet season? | 1.0 – 30minutes 2.30 mins – 1hour<br>3.1 to 2 hours 4.2 – 3 hours<br>5.More than 3hours<br>6.Don't know<br>7.Other (Specify) …………….. |
| 24. | How long does it take to fetch water and come back in the dry season? | 1.0 – 30minutes 2.30 mins – 1hour<br>3.1 to 2 hours 4.2 – 3 hours<br>5.More than 3hours 6.Don't know<br>7.Other (Specify) …………….. |
| 25. | Who usually fetches water? | 1.Women 2. Men<br>3.Children in the household (girls/boys)<br>4.Other (Specify) …………….. |
| 26. | How do you convey water fetched home? | 1.Human (head poterage)<br>2.Bicycle 3.Tractor services<br>4.Cart/wheel barrow 5.Animals<br>6.Other (Specify) ………….. |

| # | Opinion Statement | Response Options |
|---|---|---|
| 1. | Poverty prevalent in this community | 1. Strongly Agree 2. Agree<br>3. Neutral 4.Disagree 5. Strongly Disagree |
| 2. | Poor occupational livelihoods in this community | 1. Strongly Agree 2. Agree<br>3. Neutral 4.Disagree 5. Strongly Disagree |
| 3. | Daily survival issues prevalent in this community | 1. Strongly Agree 2. Agree<br>3. Neutral 4.Disagree 5. Strongly Disagree |
| 4. | Life's aspirations hindered for lack of potable water sources | 1. Strongly Agree 2. Agree<br>3. Neutral 4.Disagree 5. Strongly Disagree |
| 5. | Living in fear and insecure environment | 1. Strongly Agree 2. Agree<br>3. Neutral 4.Disagree 5. Strongly Disagree |
| 6. | High prevalence of waterborne/ related diseases in this community | 1. Strongly Agree 2. Agree<br>3. Neutral 4.Disagree 5. Strongly Disagree |
| 7. | Living in poor shelter and unsafe safe dwellings | 1. Strongly Agree 2. Agree<br>3. Neutral 4.Disagree 5. Strongly Disagree |
| 8. | Very poor personal hygiene prevalent in households | 1. Strongly Agree 2. Agree<br>3. Neutral 4.Disagree 5. Strongly Disagree |
| 9. | Inhabitants live at the mercy of the physical environment | 1. Strongly Agree 2. Agree<br>3. Neutral 4.Disagree 5. Strongly Disagree |
| 10. | Living a life of limited options | 1. Strongly Agree 2. Agree<br>3. Neutral 4.Disagree 5. Strongly Disagree |
| 11. | Limited freedoms in relation to limited time available | 1. Strongly Agree 2. Agree<br>3. Neutral 4.Disagree 5. Strongly Disagree |
| 12. | Poor incomes prevalent | 1. Strongly Agree 2. Agree<br>3. Neutral 4.Disagree 5. Strongly Disagree |
| 13. | Poor school attendance and high drop-out level | 1. Strongly Agree 2. Agree<br>3. Neutral 4.Disagree 5. Strongly Disagree |
| 14. | Low level of economic activities in households | 1. Strongly Agree 2. Agree<br>3. Neutral 4.Disagree 5. Strongly Disagree |
| 15. | No trained teachers in schools in this community | 1. Strongly Agree 2. Agree<br>3. Neutral 4.Disagree 5. Strongly Disagree |

# APPENDIX C

## COMMUNITY MEETINGS GUIDE - CONTROL COMMUNITIES

**(Interview respondents by gender, age, ethnicity and occupation)**

1. What are the most common diseases in this community?

- Malaria
- Diarrhea
- Guinea worm infestation
- Skin diseases
- Schistosomiasis
- Trachoma
- Others (Specify) ..........................)

2. What are the main sources of water in this community?

- Rivers/streams
- Ponds
- Home dug-out wells
- Others (Specify….)

**3.** Which of these water sources are most reliable?

4. What is the distance to the nearest source of water? (Km or time spent walking)

**5.** Do you spend long hours searching for water to fetch?

**6.** If Yes, what has been the effect of spending long hours to fetch water on you and life in this community?

**7.** Has the lack of potable water affected your:

- Domestic life?
- Economic activities?
- Social relations in this Community?

# APPENDIX D

## In-Depth Interview Guide - Control Communities

**(Check if these conditions are prevalent in this Community)**

1. Poverty prevalent.
2. Poor livelihoods prevalent.
3. Poor incomes prevalent.
4. Low level of economic activities.
5. Daily survival issues prevalent.
6. Live under constraints of physical environment.
7. Live under influence of superstition and ignorance of causes of guinea worm infections.
8. Live in fear and insecure environment.
9. High prevalence of waterborne/ related diseases.
10. Poor shelter and unsafe safe dwellings.
11. Poor marriages.
12. Live in a state of helplessness and constrained poverty.
13. No teachers in community schools.
14. Poor school attendance and high dropout rates.
15. Low enrolment for girl-children in schools.
16. Poor health (guinea worm cases high, prevalent and endemic in households).
17. High infant and child mortality.
18. Very poor personal hygiene: skin diseases prevalent.
19. No water for bathing and laundry.
20. Living a life of very limited options.

21. Incapacitation with guinea worm disease.

22. Limited opportunities –disease ridden for months.

23. Limited freedom in relation to time available for other uplifting endeavours.

24. In what way has the lack of boreholes promoted poverty in this community?
    a. Small acreage of farms cultivated annually.
    b. Low crop output.
    c. Low level sales due to low farm produce.
    d. Very difficult to cater for your families better.

25. In what ways have the lack of boreholes affected school attendance in this Community?
    - Promoted frequent absenteeism at school.
    - Caused low punctuality at school.
    - Caused high level of children drop-outs.
    - New and good schools cannot be constructed.
    - Limited girl-child enrolment and retention in school.
    - Caused poor performance in examinations.
    - Children cannot progress to higher levels of education.

## APPENDIX E

## IN-DEPTH INTERVIEWS GUIDE – PROGRAMME COMMUNITIES

(Respondents: Community Chief/Queen mothers, Headteachers, Assemblymen, retired Civil and Public Servants)

1. Has limiting socio-cultural factors inhibiting women's freedom to access surface water been eliminated with the provision of boreholes?

2. Was there poor health and inability to access or afford good healthcare before the borehole was provided?

3. Was infant and child mortality prevalent?

4. Has poverty been minimised with the provision of boreholes and its patronage through:
   - Elimination of guinea worm?
   - Increased farm acreages and earnings?
   - Ability to access health and education for their children?
   - Ability to provide for basic critical domestic needs?

5. The provision of boreholes in your community reduced poverty in your household as follows: (Strongly Agree; Agree; Neutral; Disagree; Strongly Disagree)
   - Increased acreage of farms cultivated annually?
   - Increased crop output?
   - Increased income after sales due to increased farm produce?
   - Promoted other economic activities in the community?
   - Ability to cater for our families better?

6. Are these evident as a result of the availability of boreholes in this community:
   - Time savings in community because of availability and easy access to borehole water.
   - Women now able to discharge their domestic obligations and responsibilities without much constraints.
   - School attendance: improved punctuality and regularity in school attendance.
   - Improved health: elimination of guinea worm and diarrhoeal diseases.

7. Has the provision of boreholes improved the quality of life in your community as follows: (Strongly Agree; Agree; Neutral; Disagree; Strongly Disagree)
   - Facilitated higher earnings on income from livelihood occupations.
   - Provided more avenues of employment.
   - Facilitated improved education.

8. Has the provision of boreholes promoted:

- Improved marriages**.**
- Increased births?

9. Some of the major dangers encountered which led to insecurity in this community when the boreholes had not been provided were: (Strongly Agree; Agree; Neutral; Disagree; Strongly Disagree)

- Snake bites while walking on footpaths at night going in search for water.
- Pregnant women deliver while on the road to search for water.
- No water to drink on our farms.
- Total incapacitation for several months due to guinea worm infestation.
- Very low retention of children in school.
- Very poor personal hygiene.
- Very poor environmental sanitation causing a lot of diseases.
- Low level of authority of community leadership.
- Very low farm output.

10. Have the present generation of children and youth in this community (born between five to ten years ago) seen or experienced guinea worm infestation?

11. What are some of the significant achievements boreholes drilling has brought to this community?

- Quality of life improved.
- Intangibles valued: freedoms, autonomy, dignity, hope and options now available.
- An enabling environment created for economic enterprise growth.
- Local institutions development for water security assurance.
- Promoted the formation of social enterprises.

12. Some of the best practices for borehole sustainability are: (Strongly Agree; Agree; Neutral; Disagree; Strongly Disagree)

- Training of local artisans.
- Training of Pump Maintenance Volunteers from within in communities.
- Introduction and high patronage of functional adult literacy classes.
- Literacy has led to social cohesiveness and ability to mobilize communities for repairing of boreholes.
- Involvement of women in Pump maintenance training and maintenance.
- Generational training of PMTs.
- Availability and access to Pump parts.
- Local fundraising and savings for borehole repairs.
- Standardized handpump model – Modified Indian Mark II.

- Institutions established:
    - WATSAN Committees.
    - Women's groups trained.
    - Zonal Co-ordinating Committees

13. What strategies were employed for the borehole project implementation and sustainability?

- Local capacity building
- Training of Pump maintenance volunteers
- WATSAN Committees
- Establishing of literacy classes.

14. Is there evidence of poverty being reduced and wealth creation on the way in your household?

15. Has your community and your personal life improved since the provision of the boreholes as follows: (Strongly Agree; Agree; Neutral; Disagree; Strongly Disagree)

- Improved houses.
- Time savings for doing other beneficial activities to improve livelihood.
- Roofing of house with iron sheets instead of thatch.
- Improved accessibility – road network.
- Eradication of diarhoeal diseases.
- Improved personal hygiene – bathing and laundry.
- Increased farm produce: due to ability to provide hired farm-hands with water from the boreholes.
- Increased farm income.
- Domestic living made easier with availability of water.
- Women and children liberated from the drudgery and pain of daily searching for water and carrying water over long distances?
- Improved school attendance.
- Improved domestic social life – marriage relationships improved.
- Improved health: Intestinal and skin diseases minimized due to water available from borehole.
- Guinea worm disease completely eradicated from this community because of the good borehole water available.
- Have time now to come together with others to worship God.

# APPENDIX F

## FOCUS GROUP DISCUSSION GUIDE – PROGRAMME COMMUNITIES

1. Is functional adult literacy is promoting borehole sustainability in this community?

2. Has borehole sustainability been achieved through your community's leadership?
 If yes, how? ………………

3. Do you see sustained boreholes as important to sustaining livelihoods towards poverty reduction?

4. How many Pump Maintenance Technicians (PMTs) were trained in this community during the Water Project? ……

5. Are all PMTs trained for this Community still around and undertaking routine maintenance and repairs of the boreholes? If no, have they been replaced through training of others?

6. Competence of PMTs: What level of training were the PMTs in this community given by World Vision? (Level 1; Level 2; Level 3)

7. Who owns the boreholes in your community? (The Community; The District Assembly; World Vision?)

8. Who maintains and repairs the boreholes? (The Community; The District Assembly; World Vision)

9. Do you contribute funds to borehole maintenance? If "Yes" why?

10. Is there generational capacity building of Pump Maintenance Technician and WATSAN Committee members practised in this community?

11. How willing are community people to sustain the boreholes and why? (Very willing; Partially willing; Not willing) .

12. How is money generated in this community to maintain the boreholes? (Household levy; Sale of water at fetching point; Community fundraising).

13. Does community have confidence in the WATSAN Committee to carry-out its job?

**APPENDIX G**

**COMMUNITY MEETINGS GUIDE – PROGRAMME COMMUNITIES**

(Interview respondents by gender, age, ethnicity, occupation)

a) Community Knowledge, Attitude and Perception towards boreholes provision and water borne/related diseases.

**1.** Are any of these diseases in this community?

- Malaria, diarrhoea, guinea worm infestation, yaws, scabies, schistosomiasis, trachoma

2. What are the main causes of these diseases?

- Malaria, diarrhoea, guinea worm infestation, yaws, scabies, schistosomiasis, trachoma

3. How can these diseases be prevented?

- Malaria, diarrhoea, guinea worm infestation, yaws, scabies, schistosomiasis, trachoma .

b) The effect of working hours lost/gained in fetching water.

5. What are the main sources of water in this community?
6. Which of these sources are most reliable?
7. What is the distance to the nearest source of water?
8. How much time do you spend in fetching water?
   a) Before World Vision provided the borehole(s)?
   b) After World Vision provided the borehole(s)?
9. Do you spend long hours searching for water to fetch?
10. If yes, what has been the effect of spending long hours to fetch water on your livelihoods earnings for your households?
11. If you are presently spending less time in fetching water, what are you doing with the time now available?

c) The impact of the boreholes provided on the economic and well being of households:

12. Have there been any changes in the sources of water patronized by your households over the last 5 years in this community?
13. Is there a Committee in charge of maintenance and sustaining the water sources in this community?
14. Do you think availability of potable water from the boreholes provided eradicated/reduced guinea worm and other related diseases?
15. Do people ever become sick from drinking the water from the boreholes provided in this community?
16. In what ways have the provision of boreholes in your community reduced poverty?

- Increased acreage of farms cultivated annually?
- Increased crop output?
- Increased income after sales due to increased farm produce?
- Promoted other economic activities in the community?
- Ability to cater for our families better?

17. Boreholes provided in this community benefited school children as follows:

- Checked frequent absenteeism at school?
- Improved punctuality at school
- Checked high level of drop-outs
- Provided water to drink and use at school
- Facilitated the construction of new schools
- Encouraged and facilitated girl-child enrolment and retention
- Borehole in community or near the community so water fetching can be carried-out before and after school hours.