IMPROVING THE MANAGEMENT AND USE OF WATER RESOURCES FOR SMALL-SCALE IRRIGATION FARMING AND ITS CONTRIBUTION TO POVERTY REDUCTION IN GARU-TEMPANE DISTRICT. A STUDY OF IRRIGATION SCHEMES IN BUGRI AND GAGBIRI

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Declaration

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

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Abstract

Small scale irrigation farming has been recognized as an important avenue for improving the well being of poor people living in arid and marginal areas of the world. It has the potential of generating income for the growing number of unemployed people especially in Africa thereby enabling the poor to escape from poverty. The contribution of small scale irrigation can be seen in its ability to ensure food security as well as contribute to the income of farmers. In the Garu-Tempane District as depicted from the findings of the two communities indicates that small scale irrigation farming is a major source of livelihood for people in the district. Despite the importance of the irrigation schemes to dry season farming the scheme faces challenges such as inadequate water and inadequate canals, choked and broken canals due to frequent breakdown and inadequate repairs.

This study therefore seeks to assess the management practices put in place to ensure the sustainability of the dams as well as the contribution of the irrigation schemes to poverty reduction in the Garu-Tempane District with reference to Bugri and Gagbiri communities. In conducting this research various participatory tools of data collection were employed. The data collection methods employed were interviews, observation, questionnaire administration and focus group discussions. The uses of the dams are mainly for irrigation farming, fishing, watering of animals and for domestic and household chores. Predominantly it is used for irrigation farming.

The management of these irrigation schemes is the responsibility of the community represented by the water user associations. They are in charge of the day to day management of the schemes. They are in charge of operation and maintenance of the irrigation schemes. The main source of revenue for the operation and maintenance activities of the WUAs is through the levies paid by the farmers. Among the tasks they carry out are revenue mobilization, repair of broken canals, distribution and regulation of water, embankment of the dam, catchment area protection and conflict resolution.

The maintenance of the schemes are not satisfactory due to the high financial burden for maintenance as well as the reluctance of some farmers to pay levies, poor coordination among WUAs and poor participation by farmers who are the direct beneficiaries of the schemes in maintenance activities. Despite these bottlenecks the irrigation schemes are the major avenue of poverty reduction in the communities hence the district. The contribution of

small scale irrigation farming to poverty reduction in the district is in the form of food security, improved household incomes and ability of farmers to access social services such as education and health services. Managers of the schemes should therefore be provided with the necessary managerial skills and support services to enhance their skills. This will go a long way to improve upon the management of the irrigation schemes to ensure their sustainability.

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Dedication

I dedicate this work to the memory of my late father Justice Andrews Amosah Abanga who was called to the bosom of the lord on 4th April 2008 and my niece Amosah Felicity Mendor.

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List of Abbreviation

ADRA	Adventist Development and Relief Agency
DADU	District Agricultural Development Authority
DFID	Department for International Development
FAO	Food and Agricultural Organization
GAD	Gender and Development
GDP	Gross Domestic Product
GIDA	Ghana Irrigation Development Authority
GLSS	Ghana Living Standard Survey
GPRS I	Ghana Poverty Reduction Strategy
GPRS II	Growth and Poverty Reduction Strategy
HDI	Human Development Index
ICOUR	Irrigation Company of Upper Region
IDA	Irrigation Development Authority
IFAD	International Fund for Agricultural Development
ILO	International Labour Organization
IMT	Irrigation Management Transfer
ISSER	Institute of Social, Statistical and Economic Research
IUCN	World Conservation Union
IWMI	International Water Management Institute
LACOSREP	Land Conservation and Smallholder Rehabilitation Project
MDG	Millennium Development Goals
MOFA	Ministry of Food and Agriculture
NDPC	National Development Planning Commission
NGO	Non-Governmental Organization
SIS	Smallholder Irrigation Schemes
UN	United Nations
UNCED	United Nations Conference on Environment and Development
UNCSD	United Nations Commission on Sustainable Development
UNDP	United Nations Development Programme
UNEP	United Nations Environment Programme
WCED	World Commission on Environment and Development
WDR	World Development Report

WFP	World Food Programme
WHO	World Health Organization
WID	Women in Development
WSSD	World Summit on Sustainable Development
WUA	Water User Association
WWF	World Wide Fund for Nature

CHAPTER ONE
INTRODUCTION

1.1 Background

Ghana has witnessed dwindling economic fortunes since independence in 1957. The economic terrain has been very unstable with mixed fortunes over the years. This was clear in the early 1980s when Ghana and most developing countries were forced to restructure their economies by adopting the Structural Adjustment Programme as prescribed by the World Bank and International Monetary Fund. The outcome of this programme had an adverse effect on some segments of the population as subsidies on agriculture were removed and government forced to redeploy workers from the civil service. Under this programme Ghana was supported with substantial amount of credit, but this did little for the economy as the composition of internal production and external trade remained largely unchanged (GPRS II, 2006-2009: iii). According to GPRS II, agriculture is the largest contributor to GDP, contributing about 6% per annum and provides employment for over 60% of the population. It is therefore prudent that for the country to achieve its goal of attaining a middle income status (with a per capita income of at least US$ 1000) by the year 2015, then agricultural modernization should be given topmost priority.

Even though the mainstay of the people is agriculture, it is still largely rainfed and as such opened to the vagaries of the weather. Rainfall in Ghana is highly unreliable with regard to its onset, duration, intensity and amount, this has disrupted food crop production over the decades thereby leading to spirals of poverty among the farming populace. In view of this Ghana developed the GPRS I document, (2003-2009) and GPRS II document, (2006-2009) as broad national policy documents to stem the tide of poverty in the country and thereby achieve a rapid and stable development. The vision of these policy documents are to reduce poverty and ensure that Ghana achieves middle income status by 2015 thereby moving towards achieving the Millennium Development Goal of reducing extreme poverty and hunger, but Ghana still shows marked disparities between the north and south, although there has been a substantial overall decline in the incidence of poverty in Ghana. This is depicted by the fact that over the past two decades the national poverty rates have been almost halved, from approximately 51.7 percent in 1991-92 to 28.5 percent in 2005-06.

Poverty decreased by about 17 points in urban areas and by 24 points in rural areas. The World Bank indicates that Ghana's growth and poverty reduction rates are probably the best that have been achieved in all of sub-Saharan Africa over the past 15 years.

In spite of this decline, poverty is still endemic in rural areas, especially in the north. There is a wide disparity of income between people in the south, where there are two growing seasons and greater economic opportunities, and people living in the drought-prone northern plains (IFAD, 2007:1). According to the Ghana Living Standard Survey (GLSS) fourth round in GPRS I (2003-2005:14), the incidence of poverty for the Upper East Region where the study District (Garu-Tempane) is located is 88% with 79.6% classified as extremely poor which makes her the worst compared to the other regions in Ghana. The GLSS sets 900,000 cedis per year as the upper limit (poor) in the poverty line and 700,000 cedis per year as the lower limit (extremely poor) in the poverty line on per capita annual income. Therefore by this measure 9 out of 10 people in the Upper East Region of Ghana are poor (GPRS I 2003-2005:14-15). It is interesting to note that the regional poverty profile of the Upper East Region increased by incidence from 67% in 1991-1992 to 88% by 1998-1999 (GPRS I, 2003-2005:15).

Poverty is basically a rural problem; about 70 percent of the poor people in Ghana live in rural areas. Poor rural people have limited access to basic social services, safe water, all-year roads, electricity and telephone services. Poverty is deepest among food crop farmers, who are mainly traditional small-scale producers. About six out of ten small-scale farmers are poor (IFAD, 2007:1). Poverty among these farmers remains nearly 19% above the national average of 40% in 1998/99 and they together with those in non-farm self-employment experienced the least reduction (9%) (GPRS I, 2003-2005: 16). Seminally, DFID (2005:11), indicated that vulnerability in Ghana is more acute in the Upper East Region and this is based on the fact that the region has the lowest return on food crop production, the lowest household income from non-farm activities and the most food insecure region. This therefore means that pragmatic measures must be put in place to help the people in the District to create wealth and thereby ensure a sustainable reduction in poverty. Agriculture being the main source

of employment for the people in the Garu-Tempane district should therefore be given a boost.

The Upper East and Upper West regions are covered by the Sahel savannah in the north-east and grassland savannah in the north-west. There is one short rainy season between May to October, followed by a long period of dry weather influenced by the dry harmattan wind from the Sahara Desert. Farmers generally live at the subsistence level, and farming is confined mainly to the short rainy season. In the dry season farmers can only cultivate land under irrigation (IFAD, 2007:2). Irrigation therefore continues to be seen as a promising avenue of public investment for solving problems of hunger, malnutrition and poverty. International donors and lending agencies and national governments alike conceive the development and improvement of an area under irrigation as one important strategy to increase levels of food production, cash income and achieve food security.

The average rate of irrigation development for the countries of sub-Saharan Africa from 1988 to 2000 was 43,600 ha/year (FAO, 2001). If this rate continues, then an additional 1 million hectares will be brought into irrigated production by the year 2025. This regional figure does not reflect how fast small-scale irrigation schemes are developed in Ghana, this is because according to FAO (2008) the irrigation potential of Ghana is 1.9 million hectares nearly four times the potential in Mali and Zambia, but according to the Public Agenda (Accra), 26th September 2008 edition, Ghana still lags behind in irrigation facilities, in that only 10,000 hectares or 0.05% of the country's agricultural land was under irrigation and it is expected that by 2015 100,000 hectares of land will be put under irrigation. Despite this trend there are over 160 of these small reservoirs in the Upper East Region of Ghana alone. It was due to the above prospects of small-scale irrigation farming that small-scale irrigation facilities were constructed for the Bugri and Gagbiri Communities in the Garu-Tempane District. This research therefore questions how irrigation farming can contribute to poverty reduction in the selected communities. The study also seeks to analyze and assess the management practices that the communities thus Bugri and Gagbiri have employed to ensure there is efficient utilization of water and facilities for irrigation purposes to achieve sustainable poverty reduction in the communities.

1.2 Problem Statement

Poverty as a social phenomenon is opened to a myriad of explanations and interpretations depending on the school of thought of the person. Although the nature of poverty varies depending on gender, age, culture, and location of people there are obvious similarities across countries. Material deprivation, troubled gender relations, discriminating social relations, lack of security, ineffective institutions, and lack of information, education and health remain the main characteristics of poverty (Klein and Hadjimichael, 2003:14). Poverty is the inability to command sufficient resources to satisfy basic needs (Todaro, 2003). This means the inability of people to meet basic needs such as food, healthcare, education, shelter and to participate in decisions that affect them. According to IFAD (2007:2), Poverty is basically a rural problem, this is manifest in the Upper East Region and for that matter the Garu-Tempane District where many poor rural people face chronic food insecurity. Livelihoods are more vulnerable in this region, and all the members of the community suffer as a result of food insecurity during some parts of the year. Among the causes of rural poverty, according to the government's poverty reduction strategy paper, (GPRS I), are low productivity and poorly functioning markets for agricultural outputs. Small-scale farmers rely on rudimentary methods and technology and they lack the skills and inputs, such as fertilizer and improved seeds that would increase yields. Because of erosion and shorter fallow periods, soil loses its fertility, posing a long-term threat to farmers' livelihoods and incomes. Increasing population pressure leads to continuous cultivation in the densely inhabited Upper East region. In the case of the Garu-Tempane it is 99 persons per sq. km (Garu-Tempane District Medium Term development plan 2006-2009:14). Seminally, the underdevelopment and the pervasive poverty in the north, hence the Garu-Tempane district has been put squarely at the door steps of the colonial administration's policies and that of successive governments after independence.

According to Buah (1998:133), education was deliberately delayed in the northern territories until 1906 when the British gave the White Father Missionaries who were of French origin the chance to open a school in Navrongo, the highest level in the north was standard seven. Buah's observation was evident when Lord Selborne in 1899 remarked; "*If the Northern Territories are simply tacked onto the Gold Coast,*

goodbye to all chances of development, no government will ever go near them, (and) no at six pence will be devoted to their development except by the direct orders of the Secretary of State". (Bening 1990:177). The northern territories were therefore seen as a labour camp to recruit able bodied men to work in the mines and plantations in the south as well as serve in the army. The assertion is that these policies made it very difficult for an elite northern class to emerge to champion and demand for development from government whereas this was not the case in the south.

To escape from poverty, the poor need jobs. Investment is key to alleviating poverty because it is the mechanism that provides jobs. The main issue is not just employment, but increasingly productive employment that allows living standard to rise (Klein and Hadjimichael, 2003:17). In view of this government and various development bodies such as the World Bank and IFAD have seen the need to undertake interventions that is aimed at targeting the poor to earn a decent income. The GPRS II, therefore recognized agricultural modernization as key to alleviating poverty especially in the driest savannah. The document recognizes the fact that rain-fed agriculture cannot amply meet the demands of providing food and sustainable income to people. The government has therefore sought to develop a systematic policy to conserve and utilize rainfall in all parts of the country by taking a cue from Burkina Faso, by using simpler and cheaper technologies for the harvesting and the use of rain water. The construction of these irrigation facilities in the Garu-Tempane District is in line with the goals of GPRS II. The farmers and people in the communities therefore depend on these facilities for their livelihoods. The sustenance of this resource is hampered by the pressure being put on it during the dry season since a large majority of people rely on it for dry season irrigation farming as well as other domestic uses. The population density of the district also means that the dam cannot adequately support all farmers in its catchment area, as such the issue of competition for the use of this resource is gradually putting enormous pressure on it. A fundamental problem is the fact that farmers who use these facilities are reluctant to pay for their use and in some cases others pay and share their plot with others, thereby denying the managers of these resources the needed revenue to carry out routine maintenance to ensure efficient and optimum functioning of the facility. In the light of the prevailing circumstances the dam cannot serve all the potential access holders,

this therefore leads to conflicts and rivalry among the users of the water. The problem therefore is how to manage these resources with regards to allocation and distribution of water to ensure that its utilization provides optimum benefits to the community in terms of food security and thereby ensuring that individuals and household get additional income.

1.3 Research Question

The study seeks to assess how the communities manage and utilizes water for irrigation farming and its contribution to poverty reduction. In line with this the study seeks to answer the following questions:

1. What are the operation and maintenance activities carried out by the communities to ensure sustainable use of the irrigation schemes?
2. What are the challenges faced by the communities in the operation and maintenance of the irrigation schemes?
3. What is the income of small scale irrigation farmers from dry season irrigation farming and its benefits to their households?
4. What are the challenges faced by small scale irrigation farmers in the use of the irrigation schemes for dry season irrigation farming?

1.4 Objectives of the Study

The overall objective of the study is to examine the management practices adopted by the communities to ensure the sustainability of the small-scale irrigation schemes and how they have contributed to poverty reduction through dry season farming in Bugri and Gagbiri in the Garu-Tempane District.

The specific objectives of the study include the following:

1. To identify the operation and maintenance activities carried out by the communities to ensure sustainable use of the irrigation schemes.
2. To find out the challenges faced by the communities in the operation and maintenance of the irrigation schemes.
3. To determine the income of small scale irrigation farmers from dry season irrigation farming and its benefits to their households.
4. To identify the challenges faced by small scale irrigation farmers in the use of the irrigation schemes for dry season irrigation farming.

5. To make recommendations that can be adopted to improve upon the operation and maintenance of the irrigation schemes as well as farming activities.

1.5 Scope of the Study

The study covers the Bugri and Gagbiri communities in the Garu-Tempane district. The district is located in the Northern Savannah Belt of Ghana. The district shares a boundary with Togo. The two communities have been purposively chosen because they have small scale irrigation schemes which are managed by the communities themselves, also the areas are in the semi-arid zone of Ghana where poverty is endemic and dry season irrigation farming is a major avenue for people to reduce the incidence of poverty. The study therefore seeks to assess how the communities are able to effectively and efficiently use the community dams for small-scale irrigation farming and how this has impacted on poverty reduction in the communities.

1.6 Justification / Relevance of the Study

The pre-occupation of governments and donors as well as NGOs is to identify and solve the bottlenecks that impede development. The construction of the dam for the Bugri and Gagbiri communities is one of such development interventions. The significance of this study is to conduct a thorough investigation into the contribution that sound management and utilization of water for small scale irrigation farming has on poverty reduction. The study will therefore provide useful information which will serve as a guide to other communities.

Secondly, the study would also serve as a major input to government, policy-makers and other stakeholders concerned with development of semi-arid areas of the savannah on how to handle strategies aimed at improving livelihoods since the study will focus on management and utilization of water resources for small-scale irrigation farming and it contribution to sustainable income.

Finally, the study provides information which serves as basis for further research by students and researchers in the academia into issues of managing and using water for small scale irrigation and how this can lead to poverty reduction.

1.7 Methodology

This section throws light on the specific research techniques which were used for the study. It also looks at the relevant data collection procedures and the appropriate data analysis.

1.7.1 Study Design

The case study design was adopted for this study. This method is important because it provides a systematic way of looking at events, collecting data, analyzing information and reporting the results. According to Kumekpor (2002:102), the case study method involves procedures and techniques of investigation usually but not exclusively or always based on interviews. It is method of careful inquiry or investigation and examination seeking the facts of a case, a problem or an issue. It is used to narrow down a very broad field of research into one easily researchable topic. It enables the researcher to probe deeper into the problem being studied since it brings the investigator and the case being studied into direct contact.

Similar to this study is the study conducted by Munawar Hussain, Zakir Hussain and Muhammad Asfaq on the Impact of Small Scale Irrigation Schemes on Poverty Alleviation in Marginal Areas of Punjab, Pakistan in 2006. The study was conducted to assess the impact of small scale irrigation on agricultural production and poverty in marginal areas of Punjab. They established that irrigation farming reduces poverty. They asserted that the percentage of people living below the poverty line was 27% for irrigated areas and in rain fed area the incidence of poverty was 37%. This study also seeks to assess the management of small scale irrigation schemes and how it contributes to poverty reduction through dry season irrigation farming in Bugri and Gagbiri in the Garu-Tempane District.

1.7.2 Unit of Analysis

The unit of analysis is the major entity that is analyzed in a study. Kumekpor (2002:54) defined unit of analysis as the actual empirical units, objects, occurrences etc, which must be observed or measured in order to study a particular phenomenon. The most typical unit of analysis are individual people, other unit of analysis can be groups, organizations and social artifacts. In this study, the unit of analysis is the small scale irrigation farmers who are in charge of managing the irrigation scheme

through their representativeness, thus the water user associations and also carry out farming activities using the irrigation schemes. Therefore their activities pertaining to farming and management of the irrigation schemes are the issues that have been analyzed.

1.7.3 Sampling Design

Considering that not all small scale irrigation farmers can be used for the study, there is the need to select a sample which will be representative as possible such that it can be used to generalize for the larger population of irrigation farmers. The study used both probability and non-probability sampling techniques. With probability sampling, the study made use of stratified and simple random sampling. Whiles purposive sampling was employed from the non-probability sampling.

1.7.4 Sample Size

The selection of a sample size is necessary since total enumeration of the study population is hampered by factors such as limited time and financial constraints. It is therefore important to take part of the population from which information was drawn from. The core principle is that the sample size should have features which reflect the entire population, such that conclusions can be generalized for the entire population. Based on this formula the sample size was determined;

$n = N/1+N\alpha^2$

Where; n=Sample Size, N=Sample Frame (Small-scale Irrigation Farmers)

α = Confidence Level (which will be 10% or 0.1).

The total population of farmers according to the WUAs for Bugri was 653 and that of Gagbiri was estimated at 351.

Using the formula above, the sample to be interviewed in Bugri and Gagbiri were 81 and 88 respectively, but due to time constraint a total of 120 were interviewed. 65 were interviewed in Bugri and 55 in Gagbiri, this was intuitively distributed because the farmers in Bugri in terms of numbers are more than the farmers in Gagbiri.

1.7.5 Stratified Sampling

The choice of this method was due to the fact that in both schemes there are farmers near the water points and those who farm further away from the water pump. In Bugri, those further away are in the valleys. Based on this the unit of analysis was

grouped into two strata according to the nearness to the point of water delivery. A simple random technique was then used to pick the required samples. The selected samples (farmers) were then administered with farmer questionnaires. According to Kumar (1999:158) the advantage of the stratified sampling is that it enables you to reduce the variability and heterogeneity of the study population with respect to characteristics that have a strong correlation with what you are trying to ascertain and this enables the researcher to achieve accuracy. It also helps to improve upon the representativeness of the sample and this can reduce sampling error and allows for different sampling techniques for different subpopulations.

1.7.6 Simple Random Sampling

In statistics, a simple random sample is a subset of individuals (a sample) chosen from a larger set (a population). Each individual is chosen randomly and entirely by chance, such that each individual has the same probability of being chosen at any stage during the sampling process. Yates et al (2008). In this study the farmers were categorized into two, these were those who farm near the water points and those further away from the water points. Simple random was then employed in each subgroup to choose the respondents. In Bugri out of the 65 respondents 40 was allotted to the subpopulation of farmers near the water points and 25 for those in the valleys or further away from the water points and in Gagbiri the allocation was 30 and 25 for subpopulations near the water points and further away from the water points respectively. To get the respondents, numbers of the plots were written on pieces of paper and placed in a tray and based on the number allotted to each stratum the numbers were picked randomly till the desired number was gotten. It should be noted that in some instances farmers were not found on their plots and they had to be replaced by picking again from the tray. Some were also easily located in their homes due to the social cohesion in the communities which made it possible for people to easily direct us to their homes.

1.7.7 Purposive Sampling

In a population universe certain characteristics are not distributed uniformly or randomly. This is used primarily when there are a limited number of people who have expertise in the area being researched. In the study the information from the purposive sampling was used to argument what was gotten using the simple random technique.

Purposive sampling was therefore used to get information from people who have specialized or in-depth knowledge on maintenance activities at the irrigation schemes and to clarify the challenges raised by farmers as well as the operations carried out at the schemes. Respondents in this category included the chiefs, tindanas, opinion leaders, executive members of the water user associations, the Directors of Garu-Tempane District Agricultural Development Unit and Irrigation Development Authority. Interview guides were used to get information from these categories of respondents.

1.7.8 Data Collection

The main sources of primary data for this study was obtained from small scale irrigation farmers around which the utilization and management of water revolves, the WUAs and the various stakeholders in irrigation management in the district. The irrigation farmers were administered with questionnaires, the water user associations and the various stakeholders were administered with interview guides. Secondary data relevant for the research was gotten from existing literature, journals, magazines, the internet and institution such as Ministry of Food and Agriculture (MOFA), irrigation development authority (IDA) and the district assembly.

1.7.9 Data Collection Techniques

Every research is carried out using a number of techniques. According to Twumasi (2001:29), by employing various techniques in data collection, it helps the researcher to evaluate his data sources and to correct inconsistent answers. The following techniques were employed.

Household Questionnaire

This was used to collect both qualitative and quantitative data from farmers. It was employed to get in-depth information on the social and the economic activities of the farmers as well as operation and maintenance issues carried out in the irrigation schemes. In all 120 farmers were interviewed by administering questionnaires to them.

Interview

This technique included interview guides and checklist to question respondents on specific issues concerning irrigation farming and management of the irrigation

scheme with reference to poverty reduction. The interview guides were used to conduct key informant interviews with Agricultural Extension Officers, Directors of the District Agricultural and Development Unit and the Irrigation Development Authority. Others interviewed included the chiefs, tindanas and opinion leaders in the community. With this method the respondents were probed further to get in depth information from them concerning the objective of the study.

Focus Group Discussion (FGD)

This is an extension of the individual interview. In this technique, the interviewer uses many of the same one-on-one interview techniques but in a group setting with semi-structured questionnaires. This technique is very stimulating; often the interaction among participants and the interviewer raises information that otherwise might not be revealed in individual interviews (Crandy, 1998). This method was used to collect data from small groups of people ranging from six to twelve. In all six focus group discussions (three in each community) were organized in the two communities. This was done with the use of the checklist whereby the questions posed were answered by anybody from the group and where there was a problem the group was given the chance to debate on the question to ensure that there is a consensus with regards to the answer. By the use of this method the researcher can get in-depth information on the issue at stake as well as cross check information collected using other techniques.

Observation

This method was employed to observe how water is used by farmers for irrigation farming and the type of crops grown by the farmer. Issues of interest included the layout of farm plots around the catchment area of the dam, the type of irrigation method employed by farmers as well as activities being carried out to ensure the sustenance of the dam. This method is critical because it enables the researcher to obtain first hand information on the activities carried out around the dam.

1.7.10 Data Analysis

The analysis of data gathered from the study went through editing, coding, tabulation, and presentation. The data was analyzed using simple statistical tables and graphs. The presentation involved the disaggregation of data into relevant themes.

Prominence was given to both qualitative and quantitative data analysis. This involved the use of figures, tables, diagrams such as bar charts, and pie charts

1.8 Organization of Work

The study has been divided into six chapters. Chapter one deals with the background to the study, problem statement, and rationale for the study, objectives, methodology and survey design as well as the limitation of the study. It sets out what the research is about and gives an insight as to what to expect. Chapter two throws light on the conceptual and analytical frame work as well as the theoretical underpinnings of the study. The third chapter gives a brief profile of the study area, chapter four and five deals with the analysis of the data gathered and finally chapter six presents the major findings, recommendations to improve on the situation in the communities and conclusion based on the findings of the study.

1.9 Limitations of the study

The problems the researcher faced included the following:

Financial constraints, this due to the fact that the researcher's purse might not adequately support the whole research process as such adjustment and novel ideas were generated to overcome the problem. Another is time constraint, this is because the researcher does not have the luxury to decide on his own time since the research is time bound and as such you must work to meet the deadline. Finally, the distance from the study community to the place of residence of the researcher also posed some problems due to the fact that the researcher had to travel more than 500km to collect data.

1.10 Concluding Comments

From the discussions made in this chapter, the following issues are the major concerns. First and foremost it was revealed that the agricultural sector in Ghana is the largest contributor to GDP and employs over 60% of the population but it is largely rain-fed therefore making it difficult for farmers to get reliable yield due to the fact that rainfall in the country is highly unreliable. It is therefore important that agricultural modernization should be given priority if Ghana is to achieve its goal of attaining middle income status by the year 2015. It also emerged that poverty is basically a rural problem and about 70% of poor people in Ghana live in rural areas. It

was also revealed that poverty is deepest among food crop farmers who are mainly traditional small scale producers. Another issue of concern that was revealed was that, in terms of income there is wide disparity between people in the south where there are two growing seasons and greater economic opportunities and people living in the drought prone areas of the north where Garu-Tempane is located. In the Upper East Region where the study communities are located has the lowest household income from non-farm activities, the lowest return on food crop production and the most food insecure region and 9 out of 10 people in the region are considered poor. It also emerged that in the Upper East Region and for that matter Garu-Tempane District, farming is confined to a short rainy season, that is from May to October and this makes irrigation a major avenue to enable farmers to cultivate during the dry season to solve the problem of hunger, malnutrition and poverty. This notwithstanding only 0.05% of the country's 1.9 hectare irrigation potential was under irrigation but fortunately the Upper East Region has about 160 of small scale irrigation schemes which are managed by the beneficiary communities just as it pertains in the study areas. It is therefore the maintenance of these small scale irrigation schemes and their contribution to poverty reduction which is at the centre of this study. Finally, problems that emerged which can hamper the sustenance of the small scale irrigation schemes in Bugri and Gagbiri are competition for the use of the facilities at the schemes due to population increase and the reluctance of farmers to pay for water use to enable managers of the resources to get the needed revenue to carry out maintenance activities.

The next chapter therefore in the scheme of things will be looking at studies and works which have already been undertaken by other scholars on the topic. Issues which will be looked at include the concept of management and sustainability, small scale irrigation farming, management and sustainability of small scale irrigation schemes and water resources, the concept of poverty and poverty reduction strategies in Ghana and the contribution of small scale irrigation schemes to poverty reduction. The above issues are a means of addressing the issues of irrigation development and the incidence of poverty highlighted in this chapter.

CHAPTER TWO
LITERATURE REVIEW

2.1 Introduction

This chapter takes a critical look at the work of others in the subject area. These are issues that are related to the research problem. These issues are management of water resources, sustainability of water resources, poverty reduction, small-scale irrigation farming, sustainability and management of small-scale irrigation schemes and the channels through which irrigation farming contribute to poverty reduction.

2.2 The Concept of Management

As the world moves rapidly into the technologically-advanced 21st century, management plays an ever-present key role in the lives of all people. Management is defined as the process of designing and maintaining an environment in which individuals, working together in groups efficiently accomplish selected aims. The nature of management is quintessentially the process, deriving from Henri Fayol's theories, of planning, organizing, leading and controlling the organization through the use of available resources to achieve organizational goals (Daft 2005).

According to Higgins, (1994:7), Management is creative problem solving. This creative problem solving is accomplished through four functions of management: planning organizing, leading and controlling. The intended result is the use of an organization's resources in a way that accomplishes its mission and objectives. To buttress the Higgins views on management Wright and Noe (1996: 1-28) added a human dimension to the concept of management when they said management is both an art and a science in that past and current research in science guides us by providing specific information on human and organizational dynamics, by drawing on this knowledge, we can make sense out of what we encounter and avoid mistake. Management is also an art because it deals with human beings and their relationship. According to them management is directing the use of an organization's resources in a way that efficiently accomplishes the organizations goals. Management is therefore getting work done through people effectively and efficiently through the use of the resources of the organization or entity so as to improve performance. According to them for management to be humanistic, managers of resources through the ethic of

golden rule should identify various causes of action and choosing the one that treats others the way they would want to be treated. Wright and Noe also reiterated the fact that for an entity to perform well, management will have to perform certain functions. They identified four functions based on Fayol's theories, these functions are planning, organizing, leading and controlling the organization through the use of available resources to achieve organizational goals. In essence, management is a social function. Techniques for planning, organizing, leading and controlling succeed only to the extent that they enable managers to work with others to make their knowledge productive to the organization.

2.3 Management of Water Resources

Water resources management has currently gained widespread publicity in the 21st century and it is a major development issues in international seminars and forums.

According to Medalye (2008:1) Water resources are used in various ways by society and scientists predict that water scarcity will be one of the most important issues of the 21st century. To her throughout the history of civilization governments have grappled with the issue of water system management. Historically, governance structures range from fully privatized systems to public-private arrangements to public systems. In the last decade the global water sector has experienced rising involvement of private entities in the production, distribution, or management of water and water service. According to her, currently, 2.4 billion people lack access to basic sanitation and 1.2 billion people lack access to safe water sources. Nearly 2 billion people live with water scarcity, and this number is expected to rise to 4 billion by 2025 unless radical reforms emerge. Therefore, water is not an option if sustainable development is to be achieved.

Similarly, the Inter-American Development Bank (2007: 2) also said that Water is a vital resource for human survival and economic development. As populations and economies grow, water demand increases while the availability of the resources remains constant. Shortages engender water use conflicts, both in terms of quantity and quality. The Bank therefore calls for guidelines that are flexible enough to be tailored to different situations involving institutions, legal instruments, and the technical means to achieve an integrated approach to planning that considers all

sources and uses of water in a given basin. The bank suggested that efforts should be directed towards supporting water resources planning, policy making and management through development of a strategy that considers several issues associated with the core problem of developing multiple sources and managing multiple uses (municipal, industrial, irrigation) of water so that, over time, more efficient water resource supply systems and use patterns will emerge, while maintaining or improving ambient water quality. According to the bank better use and quality of water resources might also be obtained through reduction of water system losses, optimal water pricing or marketing policies, privatization, decentralization, effluent discharge regulation, water quality monitoring and enforcement, soil and water conservation programs, non-point source pollution control, and water and soil conservation measures.

According to Yilma and Donkor (1998), the objective of water management should be the development of water resources in an efficient, environmentally sound, equitable and reasonable manner in order to satisfy society's demand for water, water-related goods and services, as well as to safeguard the ecological functions of water resources. In view of this sound management of water resources must embody the concept of equity and give priority to the satisfaction of basic needs. It is therefore imperative that existing facilities be utilized and maintained to the optimum, so that water losses are minimized and available supply capacities are fully used. This therefore calls for coordination of water management activities involving communities, government and the private sector. Similar to this assertion the construction of the irrigation schemes in Bugri and Gagbiri is to ensure that there is equity in the use of the resources so as to meet the basic needs of the people since they are in charge of managing the facilities.

2.4 The Concept of Sustainability

Sustainability over the past three decades has taken centre stage in development discourse. According to the Concise Oxford English Dictionary, Sustainability comes from the word sustain which means to keep something going over time or continuously. Sustain also has its origins from the old French word soustenir and Latin word sustinere with 'sus' which means 'from below' and 'tenere' which means 'hold'. Therefore loosely put sustain also means to 'hold from below'. Sustainability

is a complex term that can be applied to almost every facet of live on earth, particularly the many different levels of biological organization, such as; wetlands, prairies and forests and is expressed in human organization.

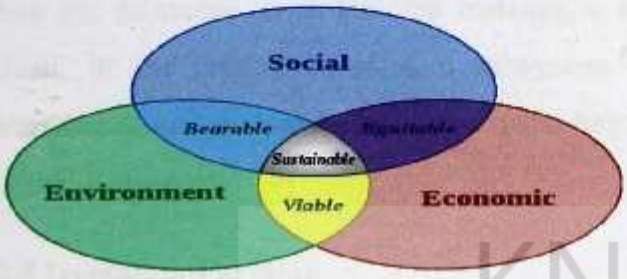
According to IUCN (2006: 2), at the start of the twenty-first century, the problem of global sustainability is widely recognized by world leaders, and a common topic of discussion by journalist, scientists, teachers, students and citizens in many parts of the world. The World Summit on Sustainable Development (WSSD, 2002 in IUCN 2006) confirmed that the first decade of the new century, at least, would be one of reflection about the demands placed by humankind on the biosphere. According to IUCN the idea of sustainability dates back more than 30 years, to the new mandate adopted by IUCN in 1969. It was a key theme of the United Nations Conference on the Human Environment in Stockholm in 1972. The concept was coined explicitly to suggest that it was possible to achieve economic growth and industrialization without environmental damage. In the ensuing decades, mainstream sustainable development thinking was progressively developed through the World Conservation Strategy (1980), the Brundtland Report (1987), and the United Nations Conference on Environment and Development in Rio (1992), as well as in national government planning and wider engagement from business leaders and non-governmental organizations of all kinds (Rodda 2004: 161). The Brundtland Commission, formally the World Commission on Environment and Development (WCED), known by the name of its chair Gro Harlen Brundtland which was convened by the United Nations in 1983 is the panacea to modern term of sustainability which is widely used now. The Brundtland Commission's work provided the basis for the UN Conference on Environment and Development (UNCED) in Rio de Janeiro in June 1992, also known as the Earth Summit, an unprecedented international meeting of delegations from 178 countries and representatives of more than 1,000 NGOs. Its purpose was to develop a global consensus on measures needed to balance development pressures against an increasingly imperiled global environment. Agenda 21, which is considered the most important agreement related to UNCED, was adopted by more than 178 states. It covers topics on virtually everything regarded important for a sustainable future, ranging from agriculture to biodiversity to hazardous waste to eco-tourism. The term sustainability is defined in many ways according to the context in which it is applied.

As all human activity entails sustainability the word may be used to refer to any aspect of human behaviour. Definitions of sustainability may be expressed as statements of fact, intent, or value with sustainability treated as either a journey or destination. This difficult mix has been described as a dialogue of values that defies consensual definition (Ratner 2004:50). As an appeal for action it is also open to many interpretations as to how it can be achieved. Sustainability has been regarded as both an important but unfocused concept like liberty or justice (Pearce et al 2000) and as a feel-good buzzword with little meaning or substance (Dunning 2008). According to a quote by Joy Wilson (2007: 3, 16) "Sustainable practices are necessary today to preserve the potential for an even better quality life for future generations". He further defined sustainability as an approach that integrates environmental stewardship, social responsibility and economic prosperity to ensure the long-term supply of aggregate materials to society.

In 1987, the United Nations Brundtland Commission articulated what has now become a widely accepted definition of sustainability. The Brundtland Report (1987:43) defined sustainability as development that meets the needs of the present without compromising the ability of future generations to meet their own needs. According to Lele (1991:607-621), this definition was vague, but it cleverly captured two fundamental issues, the problem of the environmental degradation that so commonly accompanies economic growth, and yet the need for such growth to alleviate poverty. The report of the IUCN (2006: 3) also reiterated that the Brundtland definition was neat but inexact. The concept is holistic, attractive, elastic but imprecise. The idea of sustainable development may bring people together but it does not necessarily help them to agree goals. In implying everything sustainable development arguably ends up meaning nothing. A simpler definition is given by the IUCN, UNEP and WWF (1991), according to them sustainability is improving the quality of human life while living within the carrying capacity of supporting eco-systems. To buttress the view of the IUCN, UNP and WFF, Flint (2004:44) defined sustainability as progressive socio-economic betterment without growing beyond ecological carrying capacity: achieving human well-being without exceeding the Earth's twin capacities for natural resource regeneration and waste absorption. As all human activity entails sustainability the word may be used to refer to any aspect of human behaviour. The fundamental integrated dimensions of sustainability are often

taken to be: ecological, social and economic known as the "three pillars" (WHO 2005). These are depicted as three overlapping circles, to show that these are not mutually exclusive and can be mutually reinforcing. Below are the three Pillars of sustainable development.

Figure 2.1: Three pillars of sustainable development



Source: Culled from IUCN Report, 2006

The IUCN Programme 2005-8, adopted the interlocking circles model in figure 2.1 above to demonstrate that the three objectives need to be better integrated, with action to redress the balance between dimensions of sustainability. These elements interact with each other so continuously that we cannot make decisions, make policy, manufacture, consume, essentially do anything without considering the effects and costs upon all three simultaneously. Each circle (sustainability principle) is defined as follows (Flint 2004:44): *Economic Vitality* (Compatible with Nature) is development that protects and/or enhances natural resource quantities through improvements in management practices/policies, technology, efficiency, and changes in life-style. *Ecologic Integrity* (Natural Ecosystem Capacity) that is understanding natural system processes of landscapes and watersheds to guide design of sound economic development strategies that preserve these natural systems. *Social Equity* (Balancing the Playing Field) is guaranteeing equal access to jobs (income), education, natural resources, and services for all people (total societal welfare). Carrying out activities that are sustainable requires simultaneous, multi-dimensional thinking about the consequences of present actions in a cause and effect pattern on future public and environmental health through examination of the connections among environmental, economic and social concerns when we make choices for action. The three 'pillars' cannot be treated as if they are equivalent. First, the economy is an institution that

emerges from society: these are in many ways the same, the one mechanism or set of rules created by society to mediate the exchange of economic goods or value.

Porritt (2006:46) said while this model was intended to increase the standing of ecological concerns, it has since been criticized for not adequately showing that societies and economies are fundamentally reliant on the natural world. According to him the economy is, in the first instance, a subsystem of human society, which is itself, in the second instance, a subsystem of the totality of life on Earth (the biosphere), and no subsystem can expand beyond the capacity of the total system of which it is a part.

2.5 Irrigation Farming

The Encyclopedia Britannica stipulates that archaeological investigation has identified evidence of irrigation in Mesopotamia and Egypt as far back as the 6th millennium BCE, where barley was grown in areas where the natural rainfall was insufficient to support such a crop. Irrigation is an artificial application of water to the soil usually for assisting in growing crops. In crop production it is mainly used in dry areas and in periods of rainfall shortfalls, but also to protect plants against frost (Snyder and Melo-Abreu 2005). Additionally irrigation helps to suppress weed growing in rice fields (Williams et al 2006). In contrast, agriculture that relies only on direct rainfall is referred to as rain-fed farming.

At the global level, 2,788,000 km^2 (689 million acres) of agricultural land was equipped with irrigation infrastructure around the year 2000. About 68% of the area equipped for irrigation is located in Asia, 17% in America, 9% in Europe, 5% in Africa and 1% in Oceania. The largest contiguous areas of high irrigation density are found in North India and Pakistan along the rivers Ganges and Indus, in the Hai He, Huang He and Yangtze basins in China, along the Nile River in Egypt and Sudan, in the Mississippi-Missouri river basin and in parts of California. Smaller irrigation areas are spread across almost all populated parts of the world (Siebert et al 2006). Sources of irrigation water can be groundwater extracted from springs or by using wells, surface water withdrawn from rivers, lakes or reservoirs or non-conventional sources like treated wastewater, desalinated water or drainage water. In the Gagbiri and Bugri irrigation schemes water is extracted from dams for small scale irrigation farming.

2.5.1 Sizes of Irrigation Schemes

There are different criteria for the classification of irrigation schemes around the world. The main criteria frequently used for the classification of irrigation schemes are the irrigated areas, scale of operation and management types. The most commonly used classification is small, medium and large scale irrigation schemes, though the interpretation of these categories may vary from country to country. For example, in Ghana an irrigation scheme of 300 ha is classified as small-scale, whereas in India 10,000 ha is categorized as small-scale (Smith, 1998 cited in Assefa 2008:21). In Ethiopia during the Dergue regime, irrigation schemes were categorized into three types based on size into small-scale (200 ha), medium scale (<200-3000 ha) and large scale (>3000 ha) (Rahmato, 1999 cited in Assefa 2008:21).

2.5.2 Methods of Irrigation

Various types of irrigation techniques differ in how the water obtained from the source is distributed within the field. In general, the goal is to supply the entire field uniformly with water, so that each plant has the amount of water it needs, neither too much nor too little. Freken (2005) identified three main types of irrigation. These are surface irrigation, drip/trickle irrigation and sprinkler irrigation. These are discussed below:

- **Surface Irrigation** - Surface irrigation is defined as the group of application techniques where water is applied and distributed over the soil surface by gravity. It is by far the most common form of irrigation throughout the world and has been practiced in many areas virtually unchanged for thousands of years. Surface irrigation is often referred to as flood irrigation, implying that the water distribution is uncontrolled and therefore, inherently inefficient. Surface irrigation comes in three major types; level basin, furrow and border strip.
- **Drip Irrigation** - Drip irrigation, also known as trickle irrigation or micro irrigation is an irrigation method which minimizes the use of water and fertilizer by allowing water to drip slowly to the roots of plants, either onto the soil surface or directly onto the root zone, through a network of valves, pipes, tubing, and emitters. Modern drip irrigation has arguably become the world's most valued innovation in agriculture since the invention of the impact

sprinkler in the 1930s, which replaced flood irrigation. Drip irrigation may also use devices called micro-spray heads, which spray water in a small area, instead of dripping emitters.

- **Sprinkler Irrigation** - In sprinkler or overhead irrigation, water is piped to one or more central locations within the field and distributed by overhead high-pressure sprinklers or guns. A system utilizing sprinklers, sprays, or guns mounted overhead on permanently installed risers is often referred to as a solid-set irrigation system. Higher pressure sprinklers that rotate are called rotors and are driven by a ball drive, gear drive, or impact mechanism. Sprinklers may also be mounted on moving platforms connected to the water source by a hose.

2.5.3 Small Scale Irrigation Farming

Irrigation is the most common means of ensuring sustainable agriculture and coping with periods of inadequate rainfall and drought. Irrigation can play a significant role in improving food security and household income in Africa. Africa's river systems have been the target of development planners since the 1960s, and many of the major rivers of the continent have been dammed for irrigation, for power generation and flood control, Rahmato (1999:2). Rahmato argued that water policy in Africa should enable the development of different categories of irrigation systems, namely, large, medium and small-scale. However, he argues that given our past experience and the fact that large systems have failed in many African countries, a concerted effort should be made to encourage small and user-based water development schemes. Such schemes are less costly, more sustainable, environment friendly and do not involve human displacement, as is the case with large schemes. Moreover, small schemes provide beneficiaries the opportunity to manage them directly. The purpose of agricultural water development should be to increase social benefits, and to promote food security and poverty alleviation. Small scale irrigation schemes which are at the crust of this research have been defined differently by different authors;

Rahmato (1999:6) defined small-scale irrigation schemes as schemes that are controlled and managed by the users themselves. He stressed that the success of small-scale systems is due to the fact that they are self-managed and dedicated to the felt needs of local communities. According to him small-scale irrigation is widespread

and has a vital role to play because modern large irrigation schemes have had a very poor record, and because small schemes are less costly in the fullest sense of the term. To buttress this view, Vaishnav (1994 in Aberra 2004, in the Journal of Geography Volume 170) indicated that the major reasons given for the failures of the major irrigation schemes in sub-Saharan Africa are related to cost, institutional problems, policy environment, design issues, cultural factors and environmental problems. In fact, the cost of large-scale irrigation schemes have been much higher in Africa than elsewhere in the world due to the reliance on imported materials, equipment and expertise. Seleshi (2003:4) added an area dimension when he defined small scale irrigation as schemes with irrigation area less than about 200 hectares managed and owned by the community and that is reproducible and affordable.

According to Hussain et al (2006:7) access to irrigation through these small-scale irrigation schemes should be encouraged to increase crop productivity and hence reduce poverty. Kamara, Van Koppen and Magingxa (2001:119) reiterated that at the scheme level, viability will largely depend on the capacity to organize into water user associations who manage the organization, make and enforce resource use rules and regulations, and resolve emerging conflicts. Farmers' participation in decision-making for the irrigation schemes is also crucial and important. This calls for services that make irrigation farming profitable. The democratic process of selecting farmers' representatives guarantees such participation. In a world where the people's desire for participation in public affairs is expanding quickly, securing such participation is most relevant to the viability of small scale irrigation schemes. According to them, the level and distribution of net income and net profits may result in investments in new technology, and improvements in resource conditions, as well as the provision of institutional and support services (markets, credits, and training) that further enhance viability and sustainability of irrigation schemes but this is a challenge to most small holder schemes. The challenge is due to the lack of finance, weak extension services, inadequate marketing and managerial lapses. Water user associations can become effective if they have access to simple, cheap and environmentally friendly water technologies, responsive management, reliable credit scheme, access to support services in the form of training and opportunities for producing high value crops.

2.5.4 Irrigation Development in Ghana

Agriculture is Ghana's most important economic sector, employing more than half the population on a formal and informal basis and accounting for almost half of GDP and export earnings (GPRS II 2006-2009:23). Agricultural crops, including yams, grains, cocoa, oil palms, kola nuts, and timber, form the base of Ghana's economy. The cultivable area is estimated to be 10 million hectares (ha), which is 42% of the total area of the country and this (the sum of arable land and permanent crops) was about 6.33 million ha in 2002 (FAO, 2008:4). Rainfed agriculture is predominant and average farm size is small (<1.2 ha), thus smallholder farms dominate the sector, accounting for about 80% of total agricultural production. According to FAO, the main consumptive water uses in Ghana are for domestic, industrial, and irrigation purposes. In 2000, about 652 million cubic meters (m^3) were withdrawn for irrigation (66%), 235 million m^3 for domestic purposes (24%), and 95 million m^3 for the industry (10%), giving a total water withdrawal of 982 million m^3. Total irrigation potential of Ghana has been estimated at 1.9 million ha. The FAO stipulated that the development of formal irrigation is comparatively recent in Ghana. The first schemes was initiated in the early 1960s and 22 public irrigation schemes existed in the country by 2003 The construction of most of the schemes was supply-driven and often emphasis was on developing exclusively smallholder plots regardless of whether interested smallholder farmers and with irrigation experience were available and willing to cultivate them. In other instances, the sources where supplies were purchased were fixed by the donor country without the choice of buying from the cheapest source.

The FAO (2008:11) postulated that in 2000, the total water-managed area in Ghana was estimated to be 30,900 ha. It is believed that overall about 27,900 ha of the total of 30,900 ha equipped, or 90%, were actually irrigated in 2000, while in the 22 public irrigation schemes, only 5,600 ha of the 8,587 ha equipped, or 65%, were actually irrigated. This is due to deterioration of the infrastructure because of insufficient funds for maintenance. The bad state of the infrastructure leads to a decline in productivity which is worse in pumped schemed than in gravity-feed schemes. The cost of electricity is one reason for this.

It is estimated that 24,600 ha area are equipped for surface irrigation, of which 8,007 ha public schemes, 4,693 ha private schemes and 11,900 ha informal peri-urban irrigation, and 6,300 ha for sprinkler irrigation, of which 580 ha are public schemes and 5,729 ha are private schemes. Surface water is primarily used to irrigate the developed areas through gravity, pumping, or a combination of the two. For most of the irrigation projects in the country, dams have been constructed to store water to be used for irrigating the lands. The data situation on irrigation costs is poor and only a few figures are available.

The Kpong Scheme in the Greater Accra Region had a development cost of US$2,200/ha (year 2000 cost). In contrast, the Tono Scheme in the Upper East region had a development cost of US$40,000-50,000/ha. Since irrigated agriculture is relatively new in Ghana, the management of the schemes had hitherto been entrusted to the staff of GIDA, and the relatively larger projects to reputable consultancy firms during the first few years after completion. A few irrigation projects in the country are operated by private companies. Because of the precarious financial state of GIDA most of the public irrigation schemes have deteriorated and need some form of rehabilitation, they are operating at low levels of overall efficiency. Water use efficiency at conveyance and field levels is low since no concerted efforts have been made to address the problem of water losses. This calls for more action to be taken to introduce a lot of small holder schemes that can be managed by communities, as this guarantees greater sustainability of irrigation schemes. In view of this the Ghana Poverty Reduction Strategy (GPRS) (2003-2005), mentions irrigation development and rehabilitation of existing viable facilities to attract private sector management as part of its package of infrastructure enhancement. Financial support within the GPRS (total budget for modernizing agriculture: US$84.1 million) will be directed to the vigorous promotion of mainly small-scale irrigation, which communities and districts can easily construct and maintain as in the case of the irrigation schemes in the Garu-Tempane District.

2.6 Management and Sustainability of Water Resources and Small Scale Irrigation Scheme

According to Gleick (1998:5), a wide range of ecological and human crises result from inadequate access to, and the inappropriate management of freshwater resources.

These include destruction of aquatic ecosystems and extinction of species, millions of deaths from water-related illnesses, and a growing risk of regional and international conflicts over scarce, shared water supplies. As human populations continue to grow just as in the Garu-Tempane District, these problems are likely to become more frequent and serious. New approaches to long-term water planning and management that incorporate principles of sustainability and equity are therefore required and are now being explored by national and international water experts and organizations. In an era of global water shortage, probably no goals are more important than achieving the sustainability of water resources. The exponential growth of the human population in the twentieth century was not the only force driving demand for water, for per capita consumption has grown even faster than human populations in most parts of the world (Dellapenna1997; La Riviere 1989; UNSD 1997 in Dellapenna 2004:87). The prospect of global climate change could worsen this situation dramatically (Abu-Taleb 2000 in Dellapenna 2004:87). While water is found nearly everywhere, water for our essential needs is often in the wrong place, inadequate in amount, or too impure. For example, annual precipitation in Egypt amounts to a mere 50 cubic meters per person, while in Zaire (DR. Congo) annual precipitation produces 76,000 cubic meters per person (Kukk and Deese 1996 in Dellapenna 2004:87). According to Dellapenna (2004:87), Fresh water is one of the most essential resources for human survival, let alone for human thriving. Water has one other quality that, when combined with its unusual importance, gives rise to considerable risk of conflict among neighbouring nations or communities. He further said water is an ambient resource that largely ignores human boundaries. He reiterated that some 264 river basins in the world home to nearly 50 percent of the world's population are shared by more than one nation. The most cordial and cooperative of neighbouring States have found it difficult to achieve mutually acceptable arrangements to govern their trans-boundary surface waters, even in relatively humid regions where fresh water is usually found in sufficient abundance to satisfy most or all needs. When the region is arid, conflict becomes endemic and intense. No wonder the English derived the word "rival" from the Latin word "rivalis," meaning persons who live on opposite banks of a river (Schwebel 1982 in Dellapenna 2004:87). The foregoing has led many observers to conclude that the major wars of the twenty-first century will be over water rather than oil or other resources (Gleick 1998 in Dellapenna 2004:88).

Similarly, the Garu-Tempane District falls in the arid zone of Ghana and demand for water for dry season irrigation farming sometimes leads to conflicts among farmers due to water inadequacy.

Therefore if conflict is to be avoided, States must undertake to create and implement legal mechanisms for resolving disputes and for cooperatively managing the resource. Therefore balancing economic and social desired uses of water implies not only weighing human and environmental needs but also balancing the water needs for economic and other purposes among different social groups. In other words, sustainability must involve equitable and just distribution of water resources as well as the costs of securing those resources. Simply put, when groups in society are denied access to needed water supplies, the situation is not sustainable (Roseland 1996 in Gesteyer 2004:34). At the same time, a right to water implies a right to participate in decision making about how water is to be allocated and treated. The development of water resources from the late 1800s through the 1970s was often carried out by centralized government authorities charged with managing these resources. From mismanagement of water resources in regulated water ways of the western United States to failing irrigation systems in Pakistan, there is sufficient evidence that top-down management approaches have failed to ensure water sustainability (Postel 1992 in Gesteyer 2004:34). Through the 1980s and 1990s, an increasing body of literature has demonstrated the need for public participation and multi-stakeholder approaches to water management (Ostrom 1996 in Gesteyer 2004:34). Scholars of community sustainability use indicators of human, social, built/financial, and natural capital to understand the dynamics of sustainable water resources management at the community level (Flora 2000 in Gesteyer 2004:34). According to Gesteyer (2004:34), social infrastructure in water resources management involves a combination of human capital and social capital. Human capital refers to skill levels and abilities such as the average level of education in a given community. Social capital refers to the networks and trust that exist both within and outside the community, such as the number of organizations, the level of participation in community events or the range and number of community members involved in decision making. It also refers to linkages of community groups to other groups outside the community. An implicit assumption is that a key component of community-level water resources sustainability is the ability of the community to

engage in constant innovation as the ecosystem changes around them (Kemp-Rye 2003 in Gesteyer 2004:34). In other words, indicators of water sustainability in the community context must measure community skills, conditions, and networks as well as physical infrastructure and environmental conditions. Embedded in the issues of sustainability of water resources and for that matter irrigation schemes is the issue of proper or improved management.

In the views of Kamara, Van Koppen and Magingxa (2001:16), the reduction of state presence in irrigation and the transfer of management from government agencies to farmers or farming communities has become a widespread phenomenon in response to the dual problem of low irrigation performance and constraints to public funding. The underlying principle is to encourage farmers and local communities to take responsibility for the management of local resources, and thereby limit external interventions to the provision of information and institutional support services. According to Perret (2002:3-4), over the past three decades, the world's irrigation sector has been increasingly exposed to a global trend towards decentralization and privatization, due to this many countries including Ghana have embarked on a process to transfer the management of smallholding irrigation systems from government agencies to local management entities. This process of Irrigation Management Transfer (IMT) includes state withdrawal, promotion of water users' participation, development of local management institutions, transfer of ownership and management. Using the case of South Africa, Bembridge, (2000) in Perret (2002:3), said at present, South Africa has an estimated 1.3 million hactares of land under irrigation. Owing to history and past policies, different types of irrigation schemes have been developed and that most smallholding irrigation schemes (SIS) were developed during the early apartheid era. They cover approximately 47000 ha and account for about 4% of irrigated areas in South Africa. It is estimated that 20,0000 to 23,0000 rural black people are dependant at least partially for a livelihood on such schemes. In spite of such a relatively small contribution, it is believed that those schemes could play an important role in rural development, hence the rehabilitation and transfer policies. According to him in South Africa the new National Water Act of 1998 promotes the creation of Water User's Associations (WUAs) which refers to an organization of users who aim at appropriate use of water for irrigation among

farmers of the community (FAO 2008). It is envisaged that such local institutions take over most irrigation management functions which include, water allocation and distribution, maintenance of facilities, water charging system, financial management, and so on. The situation is however not the best as most SIS are currently moribund and have been inactive for many years. Several causes have been mentioned. According to IWMI (2001) in Perret (2002:3), some of the causes are: infrastructure deficiencies emanating from inappropriate design, management and maintenance deficiencies, both beneficiaries and government-assigned extension officers lacking technical know-how and ability, absence of people involvement and participation in maintenance activities, inadequate institutional structures, inappropriate land tenure arrangements, local political power games, a history of dependency and subsistence orientation, low land productivity and high cash costs. To achieve sustainable management of small scale irrigation schemes, Perret (2002:3) in his work on testing the viability of smallholding irrigation schemes in South Africa said the IMT approach acknowledges that there are costs incurred by supplying water and water-related services to farmers, and that an objective of financial viability should be pursued at scheme level (involving partial or total cost recovery), this therefore means that: (1) the management entity (WUA) provides irrigation water and related services to farmers, (2) such services generate costs (capital, maintenance and operation costs, and personnel-related costs), (3) the management entity should therefore charges the farmers according to a system to be established, and (4) the farmers should tap into their monetary resources (generated by irrigated or rain-fed cropping systems, by off-farm income-earning systems) to pay these water service fees.

Secondly, smallholders' agricultural and resource-management systems face a quickly changing economic, legal and social environment. For the necessary adaptations to occur renewed approaches require facilitation of collective learning and negotiated agreement (Jiggins and Roling, 1997:151), as such a common ethical framework needs to be negotiated and accepted by all stakeholders. Also, according to IWMI (2003), most transferred schemes in Africa are not performing as expected due to the financial burden on the WUA and farmers but with the necessary support services and readily available markets these schemes can become viable. In South Africa small scale irrigation farmers have been able to assume management of irrigation schemes

and are successful because they enjoy broad based credit and input supply and markets. Similarly, the Small Grower Development Trust in Kwazulu Natal and Ka Ngwane Regions of South Africa has developed a series of financial, training and support services which has yielded enough benefit for them in their sugar cane production. In a nutshell for small scale irrigation farming to be made sustainable and to meet the expectation of all groups and stakeholders the issue of community participation is critical to avoid conflicts since water is a common property resource and is critical for sustainable livelihood especially in food security and household income. Participation by all groups in the management of small scale irrigation schemes is critical for their long term survival.

2.7 Operation and Maintenance of Small Scale Irrigation Schemes

In many cases, WUAs are also responsible for maintenance and for collecting irrigation fees from its users. WUAs could also play an important role in negotiating with the scheme operators on the service agreement, in the case of schemes operated by another entity (FAO 2005:11). Many irrigation schemes around the world do not provide adequate service to farmers, because gates can no longer move due to rust or because parts are missing or broken, canal sections have collapsed or are full of silt, water level gauges have disappeared among other problems. All the above are the result of poor maintenance. A newly-built irrigation scheme is expected to function for thirty years or more. Yet, in many places irrigation schemes can be seen which have deteriorated after only a few years of service, (FAO 2005:33). In such instances farmers become frustrated because they cannot realize the full potential of the irrigation schemes. Irrigation schemes in South Africa, Italy, Pakistan and Egypt gives evidence that properly maintained schemes can be of permanent benefit to many generations and can last longer than their original designers and contractors had envisaged (FAO 1998).

FAO (2005:35-36) categorized maintenance activities for an irrigation scheme into three categories, these are discussed below.

Routine maintenance

Routine maintenance activities have to be repeated throughout the lifetime of an irrigation scheme to keep it functioning. Some of these activities are daily routines

which do not require special skills. These are greasing of gates, removing vegetation from embankments, canals and drains, removing silt from canals, drains and structures. Whenever possible, these daily routines should be done by the water users themselves or operational field staff.

Other routine maintenance activities require skilled artisans, such as a mechanic, a mason, a carpenter and a painter. They may be needed to do routine maintenance work such as: repairs to gates and measuring structures, repainting of steel structures, installation of water level gauges, maintenance and small repairs of pumps and engines. Larger routine maintenance jobs are usually done between irrigation seasons, when the canals are drained. These include: Major repair or replacement of gates, pumps, and engines, large-scale silt clearance from canals and drains, large-scale maintenance of roads and embankments. In the off-season, both farmers and operators are not busy with irrigation and can therefore more easily be engaged in maintenance work. Sometimes, for very large or difficult jobs, it may be necessary to hire a contractor.

Emergency Works

Emergency works require immediate and joint action by irrigation staff and farmers to prevent or reduce the effects of unexpected events such as: Breach or overtopping of canal embankment or river dike causing flooding; Critical failure of pumps or head works, causing interruption of irrigation water supply and Natural disasters such as floods, earthquakes or typhoons.

Scheme Improvement

The routine maintenance and emergency repairs described above are all aimed at keeping or restoring the technical infrastructure in the condition it was in when it was newly built. There are a number of reasons, however, not just to maintain the scheme in its original condition, but to gradually improve it. The main reasons are: A newly constructed scheme is hardly ever perfect. Some alterations are usually necessary to make it fully operational and secondly, it is sometimes better to construct a scheme at minimum capacity, with low cost structures. Then, if the scheme proves to be a success, it can be expanded gradually and the structures replaced with more permanent ones.

2.8 Charging for Water use

In order to ensure efficient management and operation and maintenance of small scale irrigation schemes, Water User Associations need to have the necessary finances. To do this they have to charge for water use in the irrigation sites. This is referred to as operational cost for the running of the entity. Operational costs are the expenditures for operating, maintaining and managing the scheme. These expenditures come back year after year, for as long as the scheme is kept in operation. Therefore, they are also called recurrent costs. An important principle is that operational costs of an irrigation scheme should be paid by the users. If users are not capable or willing to pay the operational costs, this is an indication that something is wrong (FAO 2005:43). According to FAO (2005: 44), there are various methods for charging users, these are; by the irrigation volume, by the size of the irrigated area and by a share of the harvested crop.

The major problems for many irrigation systems are that most farmers do not pay these levies due to free riding, rent seeking, and corruption (Ostrom, 1992 in Penov, 2004 in Assefa 2008:28). Free riding evokes lack of trust between the actors. Potential rents stimulate efforts to influence public decision-making and evoke corruption. Free riding can be overcome when farmers are convinced that the benefits exceed cost and by improving the communication among them. Therefore to reduce corruption there is the need to establish institutions that do not allow a single official to have full control over the resources. Improvement in communication between farmers, irrigation schemes, and state institutions could make the parties more aware of the problems and reduce both rent seeking and corruption.

2.9 The Concept of Poverty

Poverty is understood as multidimensional, encompassing both income and non-income factors. Raising welfare in all these dimensions requires developing a wide portfolio of assets that is human, physical, natural, intellectual, financial, and social capital. Sustainable economic growth and poverty reduction are phenomena deeply affected by institutions (the formal and informal norms, values and rules determining relations in society), which determine how asset are shared and used (World Bank 2003:2). Some of the common terms used to describe poverty are income or consumption poverty, human (under)development, social exclusion, ill-being, (Lack

of) capability and functioning, vulnerability, livelihood unsustainability, lack of basic needs and relative deprivation.

Simon (1999:1-4), said the concept of poverty has developed rapidly over the last three decades. According to him poverty is blessed with a rich vocabulary, in all cultures and throughout history. From an analytical perspective, thinking about poverty can be traced back at least to the codification of poor laws in medieval England, through the pioneering empirical studies, at the turn of the century, by Booth in London and by Rowntree in York. Rowntree's study, published in 1901, was the first to develop a poverty standard for individual families, based on estimates of nutritional and other requirements. In the 1960s, the main focus was on the level of income, reflected in macro-economic indicators like Gross National Product per head. This was associated with an emphasis on growth. In the 1970s, poverty became prominent, notably as a result of Robert MacNamara's celebrated speech to the World Bank Board of Governors in Nairobi in 1973, and the subsequent publication of Redistribution with Growth. Two other factors played a part. First was emphasis on relative deprivation, inspired by work in the UK by Runciman and Townsend. Townsend, in particular, helped redefine poverty not just as a failure to meet minimum nutrition or subsistence levels, but rather as a failure to keep up with the standards prevalent in a given society. The second shift was to broaden the concept of income poverty, to a wider set of 'basic needs', including those provided socially. Thus, following ILO's pioneering work in the mid-1970s; poverty came to be defined not just as lack of income, but also as lack of access to health, education and other services. The concept of basic needs inspired policies like integrated rural development. New layers of complexity were added in the 1980s. The principal innovations were: (a) the incorporation of nonmonetary aspects, particularly as a result of Robert Chambers' work on powerlessness and isolation. This helped to inspire greater attention to participation. (b) A new interest in vulnerability, and its counterpart, security, associated with better understanding of seasonality and of the impact of shocks notably drought. This pointed to the importance of assets as buffers, and also to social relations (the moral economy and social capital). It led to new work on coping strategies. (c) A broadening of the concept of poverty to a wider construct, sustainable livelihood. (d) Theoretical work by Amartya Sen, who had earlier

contributed the notion of food entitlement, or access, emphasized that income was only valuable in so far as it increased the 'capabilities' of individuals and thereby permitted 'functioning's in society. (e) Finally, the 1980s was characterized by a rapid increase in the study of gender. The debate moved from a focus on women alone (women in development (WID)), to wider gender relations (gender and development (GAD). Policies followed to empower women and find ways to underpin autonomy, or agency.

The 1990s saw further development of the poverty concept. The idea of well-being came to act as a metaphor for absence of poverty, with concomitant emphasis on how poor people themselves view their situation. At the same time, inspired by Sen, UNDP developed the idea of human development: the denial of opportunities and choice to lead a long, healthy, creative life and to enjoy a decent standard of living, freedom, dignity, self-esteem and the respect of others.

Poverty encompasses not only material deprivation (measured by income or consumption) but also many other forms of deprivations in different aspects of life such as unemployment, ill health, lack of education, vulnerability, powerlessness, social exclusion and so on. The income approach views poverty as deprivation of income (or consumption). Poverty is defined by a poverty line, which is the minimum income needed to be able to satisfy minimum basic needs or the income (or level of spending) required to purchase a bundle of essential goods (typically food, clothing, shelter, water, electricity, schooling, and reliable healthcare). Identifying the poor as those with income (or expenditures) below a given line brings clarity and focus to policy making and analysis. Having a poverty line allows experts to count the poor, target resources, and monitor progress against a clear benchmark. Communicating the extent of poverty becomes easier, and explaining the notion of deprivation simpler. But income is not the only kind of deprivation people may suffer. Although income deprivation may give rise to several other kinds of deprivations, people may suffer acute deprivation in many aspects of life even if they possess adequate command over commodities. It is the low level of wellbeing which is important rather than low level of income. Thus, poverty should be viewed as the deprivation of basic capabilities rather than merely as low level of income. Under the capability deprivation approach, an individual may be defined as poor if he or she lacks basic capabilities. There is no

clear-cut formula for determining basic capabilities. Poverty is present when basic capability failure arises because a person has inadequate command over resources, whether through market or non-market sources. The choice of a poverty line should reflect the cost of achieving basic human needs. Therefore, in 1990, the World Bank proposed a common international poverty threshold of one dollar per day, in 1985 purchasing power parity prices (Ravallion 2004 in UNDP 2004:2,).

Kakwani (2006 in UNDP 2006:21), said if the reduction of poverty, as properly understood, is to be achieved, then new measures of its extent and distribution in the world will be required. Fukuda-Parr (2006 in UNDP 2006:7), said there was a shift in the treatment of poverty by the World Bank in their World Development Reports from 1980 up to the WDR 2000/01, which analyzed poverty in terms of opportunities, empowerment and vulnerability. This consensus builds on a lively debate that challenged the income focus and argued for a human focus. This debate included various perspectives on poverty, such as basic needs, participatory assessment, human rights, social exclusion, and capabilities.

2.9.1 Concept of Poverty Reduction

By the World Bank's latest estimates, 1.1 billion people lived on less than a frugal $1 a day in 2001, representing about one-fifth of the world's population. This therefore calls for a global effort to fight poverty, so as to reduce its incidence.

According to Laderchi et al (2003 in UNDP 2006: 10) there is now world-wide agreement on poverty reduction as an overriding goal of development policy, but not on the definition of poverty. In view of this Narayan (2000) in Klein and Hedjimichael (2003:2) said for the poor to escape from poverty they have to deal with and depend on a number of government institutions, but they find those institutions rather ineffective. They therefore appear to rely heavily on family and community based organizations for support. Stieglitz (1998) in Klein and Hedjimichael (2003: 5-6) coming from a purely economic perspective said openness and competition are key reasons we can have for poverty reduction. He further said the effective and rapid adoption of best practice requires openness to new ideas and technology. Competition provides incentives to adopt improved practices. Open and competitive markets have proved to be the best mechanism both to stimulate innovation and to spread best

practice within and across borders. Using the case of East Asian economies, he said openness and product market competition, particularly in demanding export markets underpinned much of their growth. Growth driven by such markets is a powerful prerequisite for poverty reduction. Measures such as connecting the poor to markets by giving them choice, by providing entrepreneurial opportunity and by building roads and communication systems support the most powerful mechanism for escaping poverty, namely the ability to adopt and adapt practices, hence competitive markets are one of the reasons we can consider in halving poverty by 2015. In a rebuttal to Africa, he said by the same token, we can be upset about the lack of progress in poverty reduction in many countries particularly in Africa, precisely because growth and rapid poverty reduction are now possible, although not automatic, because when there is growth it does not always trickle down across countries or within them.

In much the same vain to help in the global debate of poverty reduction, IFAD (2002:5-12) said poor people who are preoccupied with surviving today do not have the liberty of providing for the future, gaining food now is their major concern not tomorrows depletion of resources. IFAD further reiterated that, there are 1.2 billion people living in extreme poverty and of these 900 million live in rural areas where they depend directly or indirectly on agriculture to survive. Poverty according to IFAD, is a condition of low income and lack of assets, it is also a condition of vulnerability, exclusion and powerlessness. Poverty reduction to IFAD is about enabling rural poor women and men to transform their lives and livelihoods and about supporting government and civil society in creating the conditions that allow them to do so. As such poverty reduction requires empowering poor people to gain greater access to assets. Assets here include: human and social, natural, technology, infrastructure and financial. In view of this IFAD proposed three strategic objectives if adhered to will enable rural people to overcome poverty. These are enumerated below:

Strengthening the Capacity of the Rural Poor and their Organizations

This implies developing and strengthening organizations of the poor to confront issues they define as critical, increasing access to knowledge so that poor people can grasp opportunities and overcome obstacles, expanding the influence the poor exert over public policy and institutions and enhancing their bargaining power in the

marketplace. To achieve this, capacity building is critical to ensure sustainability in investment in social and economic infrastructure. It also involves developing and promoting processes that increase the accountability and transparency of rural service delivery within decentralized decision-making frameworks.

Improving Equitable Access to productive Natural Resources and Technology

This involves making natural resources such as land, water and forest accessible to the poor. This is because one of the most important factors leading to entrenched poverty is lack of access to these resources. Their inequitable distribution is often derived from long standing historical and cultural practices. The poor play a critical role in managing and conserving the world's natural resources including its biodiversity, hence where pressure on land and water is great natural resource degradation has reached alarming levels and this affects the poor. This objective therefore calls for appropriate technologies and research to improve productivity by boosting returns to land, water and labour.

Increasing Access to Financial Services and Markets

This involves diversifying income sources either by exploiting off-farm opportunities more fully or producing and marketing non-traditional crops. Efforts to increase agricultural productivity should be linked to market potential and the appropriate investment and working capital. Therefore, assistance for rural financial services needs to focus on developing responsive rural financial institutions with emphasis not just on providing credit but also on encouraging savings. Rural finance is essential in access to assets and technology adoption.

2.9.2 Poverty Reduction Strategies in Ghana

In Ghana various policies and documents have evolved over the years to deal with the issue of poverty reduction, mention can be made of the 1992 constitution, Vision 2020, the First Term Medium Development Plan 1997-2000, the Ghana Poverty Reduction Strategy (GPRS I 2003 – 2005) and the Growth and Poverty Reduction Strategy (GPRS II 2006 – 2009). The 1992 constitution in which the sovereignty of Ghana resides stipulated in Chapter six ("Directive Principles of State Policy") that, the state should ensure the realization of basic human rights, a healthy economy, the right to work, the right to good health care and the right to education. Much in the same spirit Article 36(1) enshrines that "The state shall take all necessary action to

ensure that the national economy is managed in such a manner as to maximize the rate of economic development and to secure the maximum welfare, freedom and happiness of every person in Ghana and to provide adequate means of livelihood and suitable employment and public assistance to the needy". In view of this various policy papers have been formulated to deal with the issue of poverty reduction in Ghana. Globally, there is a debate on the basis for supporting vulnerable groups with social protection measures that guarantee that disadvantaged groups enjoy acceptable and humane quality of life and are able to engage in activities that will lead to overall national development (ISSER 2008:22).

GPRS I (2003-2005:3) defined poverty as unacceptable physiological and social deprivation which may be caused or exacerbated by lack of macro-economic stability that erodes the resources of the poor through inflation and other variables, low capacities through lack of education, vocational skills, entrepreneurial abilities, poor health and poor quality of life, low levels of consumption through lack of access to capital, social assets, land and market opportunities, exposure to shocks due to limited use of technology to stem effects of droughts, floods, crop diseases and environmental degradation, lack of capacity of the poor to influence social processes, public choices and resource allocations and finally other factors leading to vulnerability and exclusion. In other to tackle poverty the GPRS I identified some key areas which include among others the provision of agricultural infrastructure especially in the area of irrigation development with much focus on the northern and coastal savannah due to both erratic rainfall and insufficient rainfall, provision of storage facilities and improving farmers access to markets through feeder roads and other vital road networks and finally to provide farmers with adequate funding and other resources as well as access to marketing outlets to break the existing well-organized monopolistic marketing channels. Following in the heels of the GPRS I, the GPRS II seeks to change the structure of the economy by developing the private sector, diversifying the export base and increase agricultural productivity and rural incomes. The overarching goal is to develop an agenda to attain middle income status by the year 2015 within a decentralized democratic environment as well as adopting an overall social policy, aimed at empowering the vulnerable and excluded, especially women to contribute and to share the benefits of the growth of the economy, thus ensuring sustainable poverty reduction, GPRS II (2003-2006: xxi). To do this GPRS II (2003-2006:23-24),

has identified agricultural modernization as a driving force to attain accelerated growth and poverty reduction. Agriculture will therefore be linked to industry, ensure food security and to diversify into other crops apart from cocoa, especially cereals and other cash crops for export markets. Also efforts will be made to use cheap and appropriate technologies to harvest and use the rain water endowments through irrigation as this will be of immense benefit to agricultural productivity and poverty reduction. In line with the notion that for the poor to escape from poverty employment is key, the GPRS II has proposed to follow the path of employment generation and expansion of safety nets through employment-centered and cross-sectoral development strategy for accelerated growth and poverty reduction. To fulfill this, various policies to provide employment and to cater for the needs of the vulnerable are currently running, these according to ISSER (2008:221) are education Capitation Grant Scheme for public basic schools, School Feeding Programme for public primary schools and supplementary feeding for rehabilitation of malnourished children, National Health Insurance Scheme for indigents, children, pregnant women, lactating mothers and the elderly over 70 years, Free safe water provision for guinea worm endemic communities, Livelihood Empowerment against Poverty (LEAP) programme, National Youth Employment Programme (NYEP), and Expanded Programme on Immunization. Admittedly, these have unfolded in piecemeal fashion over the past five years, some in fulfillment of GPRS targets. Another challenge in implementing some of these programmes are the issues of targeting as there are limited or absent national identification database systems, sustainability issues and the lack of a clear mandate for ministries and departments responsible for the management and coordination of social protection programmes and policies. In a nutshell, ISSER (2008:23) said Ghana is making progress toward the MDGs goal of reducing the proportion of poor and hungry people by half by 2015. According to ISSER the most recent household survey, the Fifth Ghana Living Standards Survey (GLSS 5) the proportion of people defined as poor declined from 51.7 percent in 1991/92 to 39.35 percent in 1998/99 and to 28.5 percent in 2005/06. Extreme poverty also fell from 36.4 percent in 1991/92 to 26.8 percent in 1998/99 and to 18.2 percent in 2005/06. But moving beyond the half way mark towards the year 2015 a major challenge to achieve the first goal of the MDGs is for Ghana to ensure that rising growth rates translates into poverty reduction and less inequality.

2.10 Contribution of Small Scale Irrigation Farming to Poverty Reduction

Interest in small scale irrigation owes much to the 'small is beautiful' school and the search for alternative form of development. These are in turn related to ideas of sustainable development or economic development (IUCN, 1980, Redclift, 1984 in Adams and Carter, 1987:27). Relevant also are ideas of 'development for below' (Taylor, 1981 in Adams and Carter, 1987:27), and basic needs and poverty-oriented strategies. Therefore the overall government policy in most African countries is to promote social and economic development through irrigated agriculture which is sustainable over time, economically justified, financially viable, socially acceptable and technically sound, without causing unacceptable impacts on the environment. Irrigation development programmes must also benefit as many household as possible and in particular those that belong to the most vulnerable groups of the rural community. Irrigation development, particularly small-scale irrigation, will be an important component of a diversification and expansion strategy to strengthen food security for the future. There is therefore a need to identify crops and irrigation techniques which will give higher returns to irrigation water and overall investment.

According to Hussain and Hanjira, (2004 in Assefa 2008:27) there are strong direct and indirect linkages between irrigation and poverty. Direct linkages operate through localized and household level effects, whereas indirect linkages operate through aggregate or sub-national and national level impacts. Irrigation benefits the poor through higher production, higher yields, lower risk of crop failure, and all year-round farm and non-farm employment. Irrigation enables smallholders to adopt more diversified cropping patterns, and to switch from low-value staple production to high-value market-oriented production. Increased production makes food available and affordable for the poor. Since irrigation investments leads to production and supply shifts, indirect linkages operate through regional and national levels and have a strong positive effect on the national economy. Past interventions in irrigated agriculture have yielded immense benefits, for example, cereal production in Asia has more than doubled between 1970 and 1995, from 300 million tons to 650 million tons (Hussain and Hanjra, 2004 in Assefa 2008:27). Many sub-Saharan African countries have recognized the contribution of irrigation to food production despite all the constraints identified (FAO, 2000 in Assefa 2008:27). Also in Africa there are examples of

success. For example, in Zimbabwe farmers could secure food production thanks to irrigation and the use of high-yielding varieties and fertilizers (FAO, 2000 in Assefa 2008:27).

In India poverty head count ranges from 18% to 53% in irrigated areas and 21%-66% in rain fed areas and poverty incidence is 20%-30% lower in most irrigated areas compared to rain fed areas (Hussain and Hanjra, 2004 in Assefa 2008:27). Studies using a dynamic concept of poverty show that the incidence of chronic poverty is 10% and 5% lower for irrigated areas in Sri Lanka and Pakistan respectively than adjoining rain fed areas (Hussain and Hanjra, 2004 in Assefa 2008:27). These authors also identified five key interrelated linkages of how access to good irrigation water contributes to socioeconomic upliftment of rural communities and poverty alleviation. These are production, income and consumption, employment, food security, and other social impacts contributing to overall improvement in welfare. The access to good irrigation facilities helps smallholders to increase their production and income, creates employment opportunities for the local people, increases the opportunity of smallholder farmers to diversify their income base, and to decrease their vulnerability to drought due to short and erratic rain fall conditions. In Gambia, irrigation provided smallholder farmers the chance for increasing income that was reflected on increased expenditure, investment in productive and household assets, savings and trade (Webb, 1991 in Assefa 2008:27). Finally, in Ghana, studies around Kumasi confirmed that farmers income from irrigation can be several times the income of farmers engaged in rain-fed agriculture (Drechsel et al 2004). The above contribution of irrigation farming makes it very important for the Government of Ghana to increase the size of agricultural land currently under irrigation especially small scale irrigation schemes which can directly be managed by communities themselves.

2.11 Conceptual Frame Work

A conceptual framework is used in research to outline possible courses of action or to present a preferred approach to an idea or thought. Conceptual frameworks are a type of intermediate theory that has the potential to connect to all aspects of inquiry (e.g. problem definition, purpose, literature review, methodology, data collection and analysis). Conceptual frameworks act like maps that give coherence to empirical inquiry (Shields and Tajalli 2006:313).

The conceptual framework for analyzing the management of small scale irrigation schemes and its contribution to poverty reduction in Garu-Tempane District is depicted in figure 2.2 below. From the diagram the main institutions for small scale irrigation schemes development in the district are the District Assembly, District Agricultural Development Unit, Irrigation Development Authority and the Communities represented by the Water User Associations (WUAs) who are at the crust of this study. The management of the schemes is the responsibility of the WUAs. The activities carried out by the WUAs include charging for water use, distribution of water, allocating land, repair of canals, dam embankment and fixing of pumps. From the diagram below, it is envisaged that effective operation and maintenance activities will lead to financial and managerial sustainability. Financial sustainability will be achieved because with proper operational activities farmers will be willing to pay for water use. This will also enable managers of the schemes to get the needed revenue to effectively carry out maintenance activities which will enable farmers to engage in dry season irrigation farming without major challenges. If farmers are able to farm without any setbacks it will lead to an improvement in their income which will be a major impetus to reduce poverty. The assumption is that if the incomes of farmers improve they will be able to pay for water use which will enhance the financial sustainability of the small scale irrigation schemes. This will invariably enable the WUAs to maintain the schemes. Also, with improved incomes, farmers can cater for the food requirements of their households, access social services for themselves and their households as well as enable them to acquire assets which will serve as buffers to guard against shock, this can therefore enable them to continue to pay for water use which will also enable the long term sustainability of the irrigation schemes.

Figure 2.2: Conceptual framework for analyzing management of small scale irrigation schemes and its contribution to poverty reduction

Source: Author's construct, April 2009.

2.12 Concluding Comments on Literature Review

The review of literature showed that management is a creative solving activity which involves directing the use of the resources of an organization in a way that efficiently accomplishes the organizations goals. Management should be responsive to the needs of the organization. This is important because the management of small scale irrigation schemes in terms of water distribution, charging for water use, repair of canals and pumps should be responsive to ensure the smooth running of irrigation schemes. It was revealed that management of irrigation schemes in Africa has yielded disastrous results hence the transfer of the management of small scale irrigation schemes from governments to the communities (Rahmato 1992:6). In Ghana the Tono and Vea irrigation schemes in the Upper East are at the verge of collapse due to management lapses which have led to them operating at low capacities. Also most small scale schemes have been transferred to the communities. In Upper East over 160 small scale irrigation schemes have been transferred to the communities to manage (FAO 2001). The transfer is because of the inefficiencies experienced by government's management of the irrigation schemes. Issues that also emerged were that water scarcity has become an important issue in the 21st century and this is more pronounced in the arid and semi-arid regions of the world. Bugri and Gagbiri fall in this category and in most parts of the dry season they experience low levels of water to adequately support farming activities. Also as populations grow water demand for irrigation increases and sometimes leads to conflicts. The Nile River which passes

through ten countries including Egypt, the Sudan and Ethiopia is a perfect example where the countries are competing for a greater share of the water for irrigation as well as hydroelectric purposes (Ashok 2002). This situation also pertains in the study communities whereby the farmers also compete for water for dry season irrigation farming. It also emerged from the review of literature that at the global level about 689 million acres of agricultural land was equipped with irrigation as at 2000 and out of this only 5% of the area equipped is in Africa. The assertion is not different in Ghana where only 0.05% of agricultural land is under irrigation and this situation is not the best since the country has the potential to equip more agricultural land with irrigation.

It also emerged that the management of small scale irrigation schemes in Africa is plagued with challenges such as frequent breakdown of facilities due to lack of finances to carry out maintenance activities, weak extension services, inadequate marketing and managerial lapses. This notwithstanding, farmers in the Kwazulu Natal and Ka Ngwane Regions of South Africa are successful in managing their schemes because they enjoy support services such as broad based credits, input supply and market for their produce.

Finally, small scale irrigation is a major contributor to the reduction of poverty in countries such as Pakistan, Sri Lanka, India, Egypt, Zimbabwe and Gambia through increased income and securing their food requirements (Hussain and Hanjira in Assefa 2008:27). Similar to the study area, small scale irrigation is the major source of livelihood for the people in Bugri and Gagbiri in terms of providing for their food needs as well as providing additional income. In terms of poverty measure the World Bank proposed a threshold of somebody living on less than a dollar a day as been poor. In the case of Ghana the GPRS I indicated that an adult whose annual income is below GH¢90.00 and GH¢70.00 as being poor and extremely poor respectively. This is problematic for a country like Ghana where the economy is not stable and prices tend to fluctuate due to inflation.

The next chapter focuses on the profile of the study area. Issues which will be looked at include the location of the district, the relief and drainage of the district, the vegetation and soil types, and the social, economic and demographic issues. The governance structure of the district will also be looked at. The above issues will be looked at in relation to the development of irrigation schemes in the district.

CHAPTER THREE

PROFILE OF THE STUDY AREA

3.1 Physical Characteristics

3.1.1 Location and size

The District is located in the South-eastern corner of the Upper East Region. It shares boundaries with Bawku Municipality to the North, Bunkpurugu-Yunyoo District to the South, Bawku West District to the West, and the Republic of Togo to the East. It covers an area of 1,230 Km^2. It lies on approximately latitude 10^0 38^1N and 11^0N and longitude 0^0 06^1 E and 0^0 23^1 E.

3.1.2 Relief and Drainage

The District forms an extension of the Gambaga scarp and is underlain mainly by Birimian and granite rock formations separated in parts by thinly to moderately bedded sandstones. The relief of the District easily marks the highest point of the Upper East Region. In areas bordering the White Volta and its tributaries the relief is generally low and slightly undulating with heights of 120-150 meters above sea level. The rest of the District consists of a series of plateau surfaces. The average height of the plateau is 400 meters above sea level, but isolated peaks rise beyond 430 meters. Being relatively flat, the area supports Agricultural Development. Mechanized Agriculture using Tractors and Bullock Ploughs is therefore common. The White Volta and its tributaries, the most significant of which is the Tamne, drain the District. The other is Pawnaba-Kiyinchongo streams. The presence of the White Volta and its tributaries is an asset because it can be dammed for irrigation purposes in some communities within the district. This is intimated by Rahmeto (1992) when he said most of the major rivers in the continent have been dammed for irrigation purposes.

3.1.3 Climate

Garu-Tempane is part of the interior continental climatic zone of the country characterized by pronounced dry and wet seasons. The two seasons are influenced by two alternate air masses. One of them is the cold, dusty and dry harmattan air or the North east trade winds which blows mostly from Late November to early March in the north-easterly direction. During that period rainfall is entirely absent and humidity is very low, sometimes less than 10mm and relative humidity rarely exceeds 20% during the day. This therefore makes irrigation farming very paramount in the district

hence the two communities. Temperature is usually modest at this time of the year by tropical standards (26^0-28^0C). Between March and May Temperatures could be as high as 38^0C. The highest mean monthly temperature is 40^0C, which occurs in April while the lowest temperature of 18^0C occurs in December/January.. There are also potentials for wind mills which can be used for irrigation purposes.

The second air mass occurs between May and October. During this period the area comes under the influence of the deep tropical maritime air mass. The air mass, together with rising convection currents, provides the District with its rains. Total rainfall amounts average 800mm per annum. During this period the rainfall is torrential, unpredictable and unreliable. The large quantity of rainwater is normally lost through evapo-transpiration from open surfaces. To minimize the lost of water irrigation schemes have been development to store water for dry season irrigation in some communities in the District. It is these schemes which support the off-season cultivation of the major food and cash crops in the District.

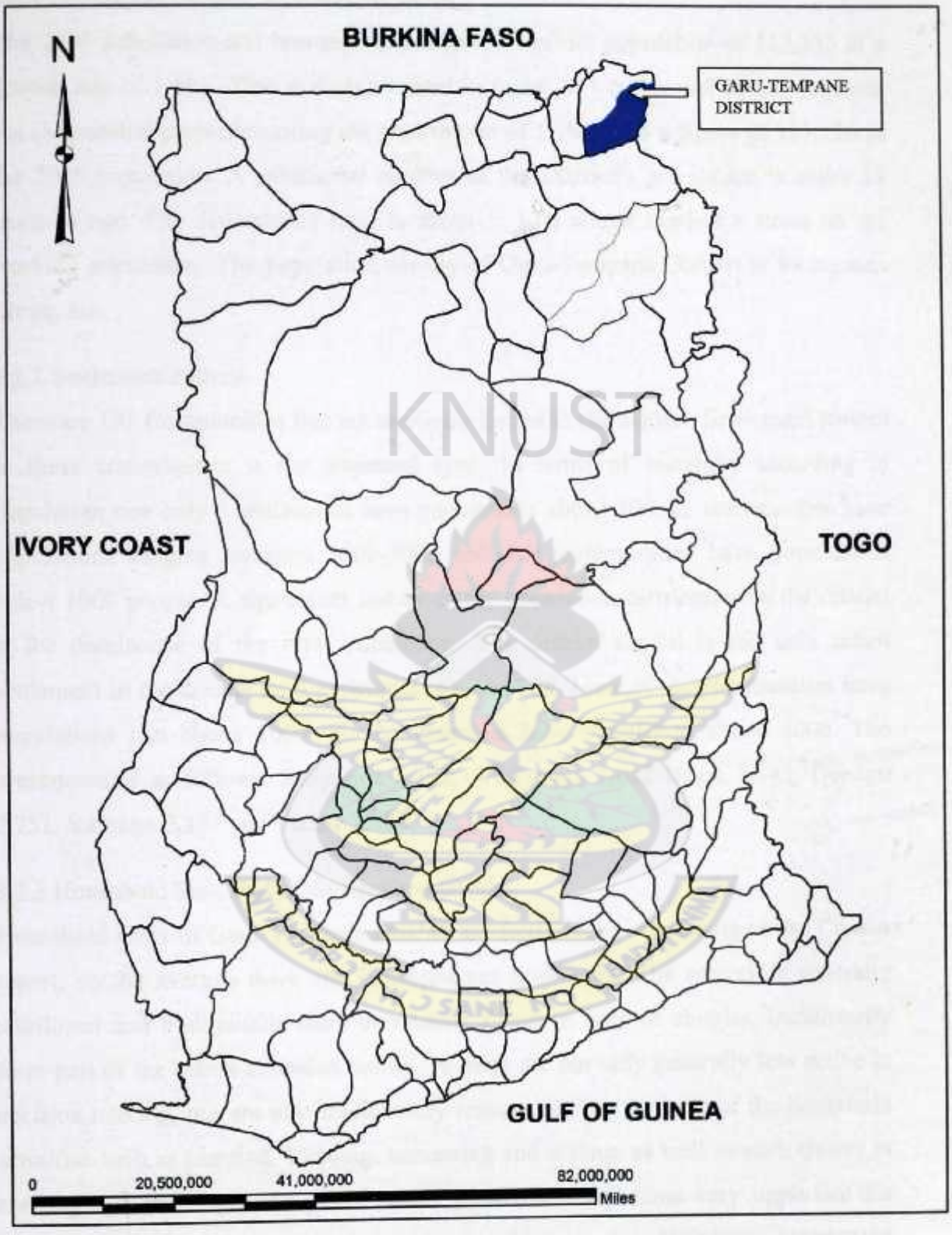
3.1.4 Vegetation

The vegetation is mainly of the Sahel savannah type, consisting of open savannah with fire swept grassland separating deciduous trees among which can be seen a few broad-leaved species. The Sahel savannah is a major reason for the low rainfall pattern which makes the development of irrigation paramount in the district.

3.1.5 Soils

The District is covered with three main soil types; these are red and brown Sandy loam and clays associated with hornblende granular, moderately deep, pale brown coarse sandy loams associated with biotitic granites and gray sandy loams and clays in river valleys. These soils can support a variety of crops in the District, mainly cereals, Legumes, vegetables and onions which can strive well during the dry season. Irrigation is therefore a major avenue to enhance the production of these crops.

Figure 3.1 Location of Garu-Tempane District in the National Context



Source: Civil Engineering Department-Kumasi Polytechnic, 2009.

3.2 Demographic Characteristics

3.2.1 Population Growth, Size and Structure

The 2000 population and housing census gave a district population of 113,333 at a growth rate of 1.1%. This is disaggregated in to 54, 091 males and 59,239 females. An exponential projection using the growth rate of 1.1% gives a figure of 125,126 as the 2009 population. A substantial number of the District's population is under 15 years of age. The dependency ratio is about 1: 1.08 which implies a stress on the working population. The population density of Garu-Tempane District is 99 persons per sq. km.

3.2.2 Settlement Pattern

There are 195 Communities that are unevenly spread in the district. Settlement pattern in these communities is the dispersed type. In terms of hierarchy according to population size only 3 settlements have populations above 300, 31 communities have populations ranging between 1000-3000 and 101 communities have populations below 1000 people. A significant feature of the population distribution in the district is the dominance of the rural population. The district capital is the only urban settlement in the district with population above 5000. Most of the communities have populations just above 1000. Six communities have population above 2000. The breakdown is as follows: Basyonde 2,304, Woriyanga 3,012 Bugri 2,145, Denugu 3,751, Yabrago 2,277 and Tamne 3,029.

3.2.3 Household Size, Family System and Gender

Household sizes in Garu-Tempane District are fairly large. According to the Census report, on the average there are 7 persons per household. The society is generally patrilineal and traditionally male dominated. Children born to couples, traditionally form part of the man's extended family. Women are not only generally less active in decision-making, but are also traditionally responsible for the bulk of the household activities such as planting, weeding, harvesting and selling, as well as such chores as cooking and fetching water. This makes gender considerations very important for planning in general. The traditional marriage entails the distinctive practice of payment of a bride-price; the system where the family of the bridegroom meets some marriage expenses including the payment of 2 to 4 cows to the family of the bride.

The predominant tribes in the district are Kusasis, Busangas, Mosis, Bimobas and Mamprusis.

3.3 Socio-Economic Characteristics

3.3.1 Education

The importance of education in the social and economic development of the people cannot be overemphasized. There are 39 pre-schools, 65 primary schools, 19 junior secondary schools and a private vocational school. The total number of teachers in the district for both primary and JSS was 304 out of this number 103 are untrained. The enrolment figures for the different school categories are low compared to children who are supposed to be attending those schools.

3.3.2 Health Sector

There is no Hospital in the district. The nearest hospital is about 25 kilometers away in Bawku. In the absence of a hospital there is only one Health Center in the district capital playing the role of a hospital, which is ill equipped to function as such. This health centre, which is located in Garu, needs to be up-graded to a district Hospital. Four (4) clinics at Basyonde, Songo, Worikambo and Denugu need to be up-graded to Health Centres. There are also five CHPS compounds and a private clinic in the district. There is the need to provide certain logistics such as motorbikes, fridges, electricity or solar panels for the Health Centers and more personnel to help improve the health situation in the district. The nurse patient ratio is 1: 4,604 and the doctor patient ratio is precarious since there is only one doctor in the district. Common diseases in the district are malaria, intestinal worm infection, diarrhea, pneumonia and skin diseases.

3.3.3 Water and Sanitation

Water coverage in the district stands at 13.86%. This represents coverage of boreholes and hand-dug wells that provide all year round water. Sanitation facilities consist of 23 KVIP and institutional latrines, 210 Household Latrines and 35 water closets and 8 septic tank latrines giving coverage of 11.78%. There is a small town water system in Garu.

3.4 Economic Activities

The main economic activity in the district is farming followed by small scale industrialization, fishing and mining. A small proportion of the people are also engaged in the service industries. In terms of spatial distribution of socio economic infrastructure and analysis of both the aggregate and optimum accessibility for existing socio economic facilities and services shows that most of the facilities have low surface accessibility figures, an indication of uneven spatial distribution. These relate to water and sanitation, health, agricultural extension, marketing, post and telecommunication, banking, justice and security and secondary education.

Agriculture consists mainly of the production of subsistence crops and a few cash crops. About 70% of the people in the district are engaged in this sector. Small scale industrialization also contributes significantly to the space economy both in output and employment generation. In terms of trade there are two main destinations; first to big towns mostly outside the Region like Kumasi, Techiman and Tamale and also to neighbouring countries like Togo and Burkina Faso. Goods like plantain, yam, salt, cola and fruits and a variety of industrial products are received from the towns in Ghana. Onions, cattle, sheanut, cashew, are set to the Ghanaian towns while potatoes, soya beans, millet and maize are sent to the neighbouring countries. Though the dominant activity is agriculture it is mostly rainfed and this calls for the development of small scale irrigation schemes to support dry season farming. The result of all the above spatial Analysis reveals the following poverty pockets in the district. All the communities in the Kpikpira Area council and Kugri and Denugu Area councils communities. In all these areas surface accessibility to socio-economic facilities are particularly poor. These areas also have poor soils and are oncho-free zones.

3.5 Governance

3.5.1 Political / Administrative set up

The assembly is composed of 34 members out of which 22 are elected. The district has a single constituency. The sub-structures of the assembly consist of 9 Area Councils, 63 unit areas and 520 unit committee members. Many of the decentralized departments and other agencies now operate in the district. The problem facing the departments are inadequate logistics, staffing and infrastructure both office and residential for them to work efficiently. The District Assembly and District

Agricultural Development Unit have been instrumental in the development of small scale irrigation schemes in the district and this includes Bugri and Gagbiri communities.

A number of NGOS and Civil Society Organizations are also working in the district. These include; Presbyterian Agriculture Station which supports farmers in the district, Community based rehabilitation, IBIS-GHANA, Community Based Rural Development, ADRA-Ghana, Bessfa Rural Bank. The presence of these departments and organizations fosters collaboration.

Traditional authorities also play an important role in governance. There are five divisional chiefs and one sub-divisional chief in the district. The chiefs help the district assembly in revenue mobilization, mobilization of communal labour for the execution of projects, this was revealed during the construction and rehabilitation of small scale irrigation schemes in the district during the Land Conservation and Small Holder Rehabilitation Project during the 1990s when the chiefs collaborated with the district assembly to mobilize communal labour for the exercise.

3.6 Concluding Comments

The above chapter focused primarily on the profile of the study district. From the profile the relief is fairly flat and hence can support agricultural development especially mechanized farming, the district is also drained by the White Volta which can easily be dammed for irrigation purposes, the climate of the district is characterized by a long dry season and rainfall is low and much water is also lost through evapo-transpiration. This therefore makes the development of small scale irrigation schemes in the district very necessary so as to support off-season farming. Finally, with governance the chiefs in the district collaborate well with the district assembly especially in the area of development by mobilizing communal labour to support in development activities. This was explicit during the rehabilitation of small scale irrigation schemes in the district during the 1990s.

The next chapter deals with the analysis and presentation of data collected from the field. Issues of management of small scale irrigation schemes and the contribution of small scale irrigation farming to poverty reduction in Bugri and Gagbiri and for that matter Garu-Tempane district will also be analyzed in the next two chapters.

CHAPTER FOUR

ANALYSIS AND PRESENTATION OF DATA

This chapter focuses on the analysis, presentation and discussion of data gathered from the field. It captures the various issues of management of irrigation schemes, dry season irrigation farming and it contribution to poverty reduction in the Garu-Tempane district. The analysis is in line with the stated objectives of the study.

4.1 Characteristics of Respondents

4.1.1 Sex Distribution of Respondents

In collecting data for the study 120 small scale irrigation farmers were interviewed based on the stated method of data collection. The people were randomly selected and out of the 120 interviewed 53% were males and 47% were females. This indicates that both sexes have the opportunity to use the irrigation schemes for dry season irrigation farming without any hindrance.

4.1.2 Educational Level of Small Scale Irrigation Farmers

For the successful development of any community the capabilities of her human resource is very important. The educational level of people determines to a large extent the nature of responses and their understanding of the issues at stake. The ability of farmers at the irrigation schemes to imbibe the new farming methods and techniques largely depend on their level of education. The ability to also effectively manage the irrigation schemes and to bargain for better prices also depends on the skills of the WUAs and farmers. A very highly educated community is likely to manage their schemes effectively. They can even lobby for support to carry out operation and maintenance of their schemes. From data gathered from the field it revealed that the educational level of respondents leave much to be desired, majority of the farmers have never had any formal education. The study showed that 42.5% have never been to school or attended any non-formal classes. This indicates that the illiteracy rate is quite high, as the 20.8% who have had some primary education truncated their schooling before primary four. This situation can have negative consequences for the development of the irrigation schemes as well as the farming activities of the farmers. This is because according to Gesteyer (2004), water resource management involves the combination of human and social capital. Human capital

refers to the skills and abilities such as the average level of education in a given community. This is shown in Table 4.0 below.

Table 4.0: Educational Level of Small Scale Irrigation Farmers in Bugri and Gagbiri

Educational Level of Small Scale Irrigation Farmers	Frequency	Percent
Primary	25	20.8
Middle school/JHS	23	19.2
SHS/ Technical	10	8.3
Post secondary	8	6.7
Tertiary	3	2.5
No Education	51	42.5
Total	120	100.0

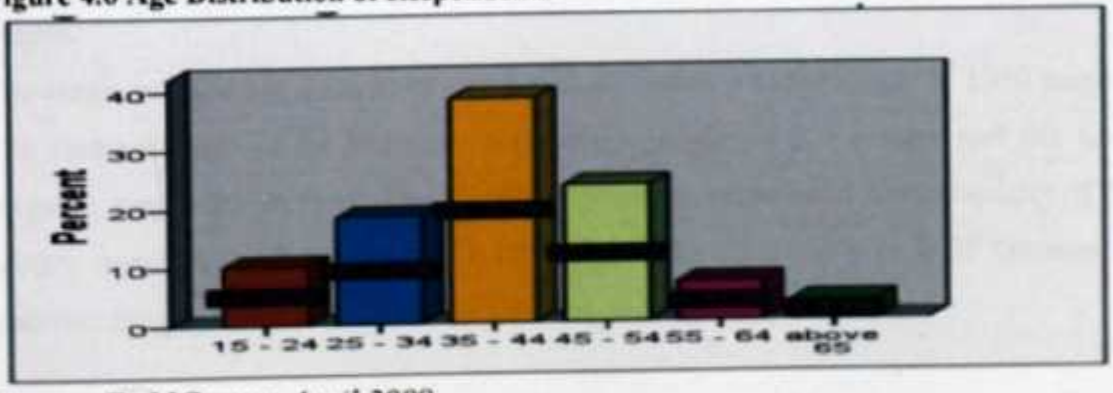
Source: Field Survey, April 2009

The implication of the above educational level of the communities are that it can have an adverse effect on the management of the irrigation schemes a well as their farming activities since the level of education determines to a large extent the ability of an individual or a group of people to embrace new ideas and innovations which can help to improve upon the operation and maintenance of the irrigation schemes as well as new farming practices which can help them to improve upon their yields and to bargain for better prices for their produce. A high educational level will also enable communities to form linkages with institutions outside the communities which will enable them improve upon the existing situation and this is lacking in Bugri and Gagbiri.

4.1.3 Age of Respondents

The age distribution of respondents ranged from 15 years to above 65 years. From the data collected most of the respondents fell within the ages of 35-44. This bracket constituted 38.3% of dry season irrigation farmers interviewed. Figure 4.0 below shows the age distribution of respondents.

Figure 4.0 Age Distribution of Respondents



Source: Field Survey, April 2009

From the Figure above very few respondents in the communities were in the range of 55-64 years and above sixty years. Their combined percentage is 10%. This signifies that majority of respondents fell in the working class with a few dependents still engaged in dry season irrigation farming. This is laudable because the working class can adequately provide labour to carry out maintenance activities at the irrigation sites. They also provide for the social needs of dependents as 92% respondents revealed that they use the income accruing to them to provide for the health needs of their household and all those with children of school going age also use the income to cater for the educational needs of their children.

4.2 Brief History of the Bugri and Gagbiri Irrigation Schemes

The Bugri and Gagbiri dams were constructed in 1952 and the early 1960s respectively. The former was constructed by the then colonial government of the Gold Coast while the later was constructed by the Nkrumah regime. The contractors and supervisors to the construction of the dams were Mr. Bush or Buse as the indigenes gave varied names to the supervisor of the project and Mr. Thomas respectively for the two communities. Mr. Buse was an Indian contracted by the colonial government and Mr. Thomas was a British contracted by the new independent government of Ghana. The dams initially were not constructed as small scale irrigation schemes but for domestic and animal use. Due to the intention of the originators of the projects at that time they were fitted with valves and later development into irrigation schemes. The major uses to which the dams were put to after their completion were for the cultivation of tomatoes, onions and leafy vegetables during the dry season. This was only for domestic and household consumption. Today the schemes serve as a major source of livelihood for the people of the communities especially during the dry season as produce from rainfed agriculture is not enough to meet the needs of the people.

The Bugri scheme has a capacity of 51 hectare meter, a canal length of 1350 meters. The reservoir size is 24 hectares, a reservoir height of 7.5 meters and the total irrigable area is 30 hectares. The Gagbiri scheme on other hand has a capacity of 95 hectare meter, a canal length of 2.9 kilometers. The reservoir size is 36 hectares, a reservoir height of 10 meters and the total irrigable area is 35 hectares.

4.3 Rehabilitation of the dams

After the construction of the dams they have not seen any major rehabilitation until the 1990s. The Gagbiri dam was rehabilitated in the 1980s but deteriorated over time. The rehabilitation of the Bugri dam started in 1992 and was completed in 1996. The Gagbiri dam's rehabilitation started in 1992 as well and was completed in 1994. The rehabilitation of the dams was part of the Land Conservation and Smallholder Rehabilitation Project (LACOSREP I), in the Upper East Region. The International Fund for Agricultural Development (IFAD) provided funds for the project with further assistance from the World Food Programme (WFP). The main aim of the project was to support in the alleviation of poverty by providing communities with dams while rehabilitating existing ones. The communities provided labour as their contribution to the project. This was due to the fact that LACOSREP I was labour intensive. To motivate communities to provide labour they were offered food every month in appreciation of their labour. This was termed Food-for-work programme. This component of the project was funded by the WFP. People who participated were given rice, beans, canned fish and oil.

The Irrigation Development Authority (IDA) was in charge of supervising the projects, providing technical advice and expertise to the communities and in turn communities provided their own local knowledge to the design of the infrastructure. The main reason for the involvement of the local people in the rehabilitation of the dams was to give them a sense of ownership and therefore ensure sustainability of the schemes.

4.4 Uses of the dams

According to the executive committee of the Water User Association (WUA) and District Agricultural Development Unit (DADU), the categories of water users include gardeners (small scale irrigation farmers), livestock farmers and fishermen. All these users have their own interest and aspirations. According to the executives of the water user association, the main reason for the construction of the dams are for small scale irrigation farming and livestock watering, but due to pressure on the dams they have agreed to use the water more for small scale irrigation farming, whiles dialoguing with livestock farmers and fishermen to give the dam a respite in times of inadequate water. In Gagbiri the WUA intimated that the chief has been strict on

fishermen who still want to fish during the lean season when the water in the dam is not enough for the small scale irrigation farmers. This is because fishing has the tendency of reducing water in the dams since their activities can impede the smooth flow of the water.

As noted above even though there are several users of the dam almost all of them engage in irrigation farming as the main source of their livelihood and sustenance especially in the dry season. This is because rainfed agriculture does not yield the desired result to ensure the food security of the people. In view of this conflict among water users is almost non-existent. Even though all respondents in the study are irrigation farmers who draw their food and income from the irrigation scheme through dry season gardening, there are other uses to which these farmers use the water for, Table 5 depicts the uses to which water is put to aside dry season irrigation farming and fishing.

Table 4.1: Other Uses of the Dams

Other uses	Frequency	Percent
Irrigation farming only	6	5.0
domestic and home consumption	34	28.3
livestock drinking	39	32.5
domestic consumption and livestock drinking	41	34.2
Total	120	100.0

Source: Field Survey, April 2009

From Table 5 above, 5% of farmers at the schemes use the water from the dams for only irrigation farming. From Focus Group Discussions (FGD) organized with sections of farmers in the communities, it was realized that the 5% of those who use the water for irrigation farming only do not live near the catchment area of the dam as such after their day's activities they retire to their homes. Also, from the table it could be seen that 34.2% use the water for domestic consumption and livestock drinking. This means that majority of people in the community rely on the dam to water their animals and for domestic purposes. From the interviews the domestic uses are for building and repair of houses, washing of clothing and for household chores such as washing of bowls and cooking utensils, but they do not drink or encourage the use of the water for human consumption since the communities have a number of bore holes and hand dug wells which can serve the potable water needs of the communities. From a combined percentage 95% of farmers use the water for other purposes apart

from farming, this therefore underscores the importance of the dam to the communities.

4.5 Method of Irrigation

The method used for irrigation in the two schemes is the surface or furrow method. As the name suggest it involves moving water through channels. This method involves flooding of the surface of the land for some hours for the water to seep down into the root of the crops. In the two schemes the water flows through main canals and laterals canals into the farms. This method is widely used because it is cheap but a major disadvantage is that it is inherently water inefficient. In the two schemes, due to the absence of lateral canals, farmers dig small trenches in-between beds to serve as laterals. Also in the two schemes due to the limited length of the main canals farmers dig ditches to store water which they later use with improvised watering cans and buckets to water the crops. According to DADU efforts were made to introduce drip irrigation in the Gagbiri irrigation scheme but due to in fighting among sections of the community the donors declined to introduce the drip method which is an improvement upon the surface irrigation. This method of irrigation is one of the causes of low crop output since it leads to a lot of water lose. This method has also led to the inability of farmers to cultivate on a much larger scale since the method of watering crops is tedious and demands a lot of time to undertake, this also invariably leads to low crop output and a major drag on household income.

4.6 Management of the Irrigation Schemes

The management of community resources and for that matter small scale irrigation schemes has shifted from government management to community management. The ownership and management of the irrigation schemes in Bugri and Gagbiri is in the hands of the communities. The Water User Association of the two communities is in charge of the day-to-day management of the irrigation schemes. This was buttressed by the Regional Director of IDA who said apart from the Tono and Vea irrigation schemes which are under the control of government and managed by the Irrigation Company of Upper Region (ICOUR), all the other irrigation schemes are managed and owned by the communities. In view of this communities were encouraged and supported to set up Water User Associations (WUAs) with elected executives to carry out the day-to-day management of the schemes during the rehabilitation period. The

WUAs is made up of all water users with varying interest but the dominant users in the two irrigation schemes are farmers. Presently, even though the ownership and management resides in the communities there are a number of organizations and institutions who have a stake in the management of the dams.

4.6.1 Water User Association (WUA)

The Water User Associations were formed primarily to take over the day- to- day management of the irrigation schemes. The WUAs in the two communities have moved the two communities from their hitherto passive participation in the management of the schemes to the main stakeholders and active participants in the management of the schemes. The idea of the water user association is to actively involve the communities in the management of the scheme and to ensure a sense of ownership within the communities. Among the benefits derived from the water user association are that: people can participate in decisions that affect them directly pertaining to the use of the resources as well as ensuring that land and water is made accessible to all users irrespective of gender and ethnicity since all interest groups are represented in the association as well as ensuring the financial sustainability of the irrigation schemes. In the early days of the inception of the WUAs government provided the platform for them to flourish by providing the WUAs with training in book keeping, meeting and election procedures and how to mobilize people for the maintenance of the schemes. The other stakeholders in the management of the irrigation schemes are enumerated below.

4.6.2 District Agricultural Development Unit (DADU)

The District Agricultural Development Unit in the Garu-Tempane District is a fairly new office and as such has not been involved in the management of the schemes in the past. In the 1950s and 60s when the dams were constructed the Bawku Municipal Agricultural Development Unit managed the dams on behalf of the government. The District Agricultural Unit currently does not directly manage the irrigation schemes since that is the work of the water user associations. The role of the unit in the management of the schemes has been supervisory and technical. The DADU has been instrumental in the formation and training of the WUAs. According to the Unit they have been instrumental in providing training for the WUAs in the district. The training organized by the unit for the WUAs include catchment area protection,

planting of trees upstream, maintaining the dam walls, building of laterals and cementing of broken canals. Part of the train include economic use of water by teaching them plan periods to distribute water to ensure judicious use of water to prevent crops from drying up due to inadequate water. The unit has also been instrumental in trying to organize farmers into groups so that they can access credit facilities but this has not been successful. The District Agricultural Development Unit still remains the focal point where problems regarding the schemes are reported to by the WUAs. They reiterated that they are under no obligation to support maintenance of the dam since they have no funds for that purpose.

4.6.3 Irrigation Development Authority (IDA)

The Irrigation Development Authority (IDA) is not directly involved in the day-to-day management of the irrigation schemes. The role of the IDA is primarily to supervise, construct, provide expert advice and rehabilitate existing dams. They aid communities who contact them to design dams and rehabilitate broken ones as well as help them with technical proposals which they can use to solicit for funds to construct new dams or rehabilitate existing ones.

4.6.4 The District Assembly

The District Assembly which is the highest political body in the district has been instrumental in the sustenance of the schemes. The Bawku Municipal Assembly was the main organ that negotiated for the rehabilitations of the two irrigation schemes in the 1990s. It was after the negotiations and discussions that led to the rehabilitations of these dams and the formation of the WUAs. The Garu-Tempane District Assembly still shows interest in the management of the irrigation schemes since they remain the major source of funds for the rehabilitations of major facilities in the irrigation schemes.

4.6.5 The Traditional Authority

The traditional authority which comprises the chiefs, tidanas and elders of the communities are the custodians of the schemes since they are the link between the people and the gods. The traditional authority has relegated the management of the schemes to the WUAs, but in times of taking major decisions and resolving conflicts that are beyond the powers of the WUAs, the chiefs and their elders are consulted for

their opinion and advice. In Bugri and Gagbiri the chiefs are the life patrons of the WUAs.

4.6.6 Composition of the Bugri and Gagbiri Water User Associations (WUAs)

The WUAs in the Bugri and Gagbiri irrigation schemes have been in existence for almost two decades. To qualify as an executive member you should have be a registered member of the scheme and be in good standing. The tenure of office for the executives in both irrigation schemes is four years and a person can serve a maximum of two terms. In both schemes there is a constitution and set of bye-laws to guide their operations and conduct of members.

The Bugri scheme has two set of farmers who are represented at the scheme. These are those who farm in the gardens and those who farm in the valleys. Those in the gardens tend to outnumber those in the valleys but the elections are opened to all and there is no discrimination as to where one farms or comes from, the major criteria is that the farmer should be resident in the community. The executive committee of the Bugri WUA is composed of nine (9) members. These are the chairperson, vice chairperson, the secretary, vice secretary, treasurer, vice treasurer and three positions reserved for women. When asked why the three reserved position for women the chairman responded that at the scheme the ratio of men to women is almost 1:1, but when it comes to elections they shy away hence the decision to reserve three positions for them since their views are also necessary for the smooth management of the irrigation scheme. They also intimated that with this arrangement, problems confronting women will be brought to the fore. This therefore makes the management of the Bugri irrigation scheme gender sensitive.

With regards to the Gagbiri scheme elections are opened to all members as well. The only difference is that in the Gagbiri irrigation scheme the executive committee is composed of eighteen members. These are composed of the chairperson, vice chairperson, secretary, vice secretary, treasurer, organizing secretary, six (6) representatives from the six farmer groups at the irrigation scheme. To ensure gender sensitivity and to ensure that issues and decisions with regards to the management of the scheme is not loop sided in favour of men six (6) positions are reserved specifically for women.

4.7 Management Practices at the Irrigation Schemes

The effective management of small irrigation schemes is very critical for the sustenance of the dams and the facilities for irrigation farming. The management of the irrigation schemes has not been an easy task for the WUAs but they have been able to stand the challenges. In this regard the effective participation and contribution of all community members who directly or indirectly derive benefits from the dams is very crucial to ensure successful management of the dam. The contribution of community members ranges from making financial contribution to communal labour if the need arises. In terms of participation in maintenance activities which is an important aspect of dam management 99.2% of respondents participated in maintenance activities whiles 0.8% representing one (1) respondent does not take part in maintenance activities. Table 4.2 below indicates the contribution or activities undertaken by farmers at the schemes to ensure its sustenance.

Table 4.2: Contribution of Small Scale Irrigation Farmers in maintenance activities

Contribution	Frequency	Percent
Financial contribution	13	10.8
Labour (cementing of canals, planting of trees, grassing and weeding around the catchment area and canals.)	73	60.8
Financial contribution and labour	34	28.3
Total	120	100.0

Source: Field Survey, April 2009

The above contribution of farmers is purely based on extra contribution they make in the maintenance of the schemes if the need arises but not the compulsory fees they are suppose to pay for water use. From Table 4.2, above, the contribution and participation of irrigation farmers in the maintenance and management of the irrigation schemes is very encouraging. For example, the 73% of respondents who contributed labour in the maintenance of the irrigation schemes gave the assurance that they are always willing to contribute their strength anything the need arises and the additional financial commitment that the respondents contribute is also worth commending since money is very necessary for the smooth management of the irrigation schemes. Among the management activities carried out by the WUAs are collection of water fees, distribution and regulation of water, allocation of extra plots, maintenance of irrigation facilities, catchment area protection, and resolution of conflicts.

4.7.1 Land ownership and allocation

The ownership of land around the irrigation site is very complex. This is because part of the plot is owned by individual households whiles others are owned by the government but leased out permanently to farmers, who even have the power to hand them over to their families or prospective farmers. According to DADU the actual owners of the land at the irrigation schemes are the communities and the district assembly. According to them a memorandum of understanding was signed between the chiefs, tindanas and the district assembly leasing the land to the assembly. The district assembly in turn transferred the ownership of the land to the water user associations for distribution among farmers. The demarcations of plots were made by DADU. The agreement was that during the rainy season the landowners farm on their lands and revert it to the WUAs during the dry season for distribution among registered farmers. This arrangement has been problematic because some individual land owners at the sites have not been willing to release their lands to the WUAs. In the Bugri site some lands are owned permanently by members who acquired them legally after the construction. According to executives of the WUA and buttressed by the chief of the community, after the construction of the dam people were not interested in dry season irrigation farming and the few who showed interest were registered by the district agricultural officers and were allocated plots permanently. They reiterated that this arrangement so far has not faced any problems as members are satisfied with it.

Land Allocation: The allocation of plots for irrigation purpose is in the hands of the WUAs. The rule governing irrigation farming in the two schemes is that land should not lie fallow in the scheme but accessibility to land also depends on the distribution network, so where water cannot get to due to the limited length of the canals those lands are allowed to lie fallow. Fallow lands within the scheme are then allocated to prospective farmers upon the payment of a fee of GH¢ 2.00. In the Bugri scheme those who acquired land legally during the distribution can also lease it out to others but must notify the WUAs for them to take their charges. In the case of Gagbiri the plots are shared among all registered members, if there is extra land it is then allocated to new members also at a fee of GH¢ 2.00. The WUAs and respondents admitted that there has not been any dispute with regards to distribution of land, the

only challenge is that some land owners lease their lands at a fee without the knowledge of the WUAs.

4.7.2 Charging for irrigation water use

Charging for the use of water at the irrigation schemes is the major source of revenue for the management of the schemes. The revenue from the farmers is the main source of resources for the operation and maintenance of the irrigation schemes. According to executives of the WUAs levies are imposed on farmers annually and payment is made at the onset of the farming season in November. This was supported by all respondents who affirmed that they pay fees to the water user association annually even though varying figures were given. A good signal was that all respondents affirmed that they paid all the fees they were suppose to pay and if this is the trend in the communities then it is a good sign to ensure proper management of the irrigation schemes. Table 4.3 indicates the amounts paid by the respondents.

Table 4.3: Amount of fees for irrigation water use annually

Amount in Ghana Cedis (GH¢)	Frequency	Percent
.20 per bed	30	25.0
1.00	4	3.3
2 .00	77	64.2
above 2 .00	9	7.5
Total	120	100.0

Source: Field Survey, April 2009

From the table above it can be seen that respondents gave different amounts they pay for the use of the water in the irrigation schemes. The 64.2% for GH¢ 2 .00 tops the list because in the Gagbiri irrigation scheme this amount is flat for all farmers. The variations in fees stems from the Bugri irrigation scheme. In the Bugri scheme there are two groups of farmers. These are those who farm at the location the respondents refer as the 'garden' and those in the valleys or upstream. In the 'gardens' there are well demarcated beds of equal lengths and farmers at this site pay GH¢ 0.20 per bed. This indicates that at this site payment is based on the amount of land one farms on, this is in consonance with FAO (2005) assertion that one of the methods for charging users is by the size of the irrigated area. The second group of farmers at the scheme are levied between GH¢ 1.00 and GH¢ 2.00 and above. The variations here is due to the fact that the WUA levies a flat rate for the farmers in the valleys who have organized themselves into groups, therefore depending on the size of the farms of the entire group they are levied a flat rate. This ranges between GH¢ 20.00 and

GH¢ 60.00. The farmers then divide the amounts among themselves to meet the flat rate levied on them. This therefore accounts for the variations. The levies here is also based on the farm size but not on the amount of water utilized.

4.7.3 Fixing of fees

In finding out the mode of fixing fees for water use two major issues came up. The first is that fixing and determination of fees is the preserve of the executive committee of the water user association whiles the second is that the fees is based on consensus between the water user association executives and the farmers. 76 farmers representing 63% of farmers said the executive committees of the WUAs determine the fees to be paid and 37% of respondents representing 44 farmers said the fixing of the fees is a consensus between the farmers and the executives of the WUAs. In contrast to this, during a Focus Group Discussions organized with farmers in both communities it was clear that the farmers and the executives at a common platform determine the fees to be paid but in some instances if such meetings cannot come off the executives determine the fees and communicate it to the farmers for their reactions. This was also confirmed by the executives of the WUAs during interviews in both communities. They reiterated that farmers are involved and made aware of the fees before the farming season begins. This democratic way of fixing fees will make it acceptable to all farmers and ensure that fees are paid without any reservations to ensure that the WUAs get the needed revenue to carry out maintenance activities.

4.7.4 Water Distribution and Regulation

Water Distribution: The distribution of water at the schemes depends largely on the amount of water available in the reservoirs. If the water in the reservoirs is enough then farmers are given constant supply of water, but if the water tends to wane the executives result to scheduling water among the various sections and group of farmers. The distribution of water in the two schemes is mainly through the lined open main canals. The schemes are fitted with pumps and connected to the main canals. In both schemes the lined length of the lined canals are not enough to supply water to the entire farms in the catchment area of the dams. Those downstream and in the valleys receive water through buried pipelines. They dig big holes to collect the water. They then use improvised water cans made out of gourds to water their plants. The case of Gagbiri is precarious because the length of the main lined canals cannot

even serve the farmers who are about 2000metres from the dam as such they rely on opened pipelines. In both schemes laterals canals are lacking so farmers dig opened earthed and unlined canals in between beds to receive water to irrigate crops. This practice leads to a lot of water loss as water tends to seep into the ground. The lack of lateral canals was a major concern to the WUAs as they complained about the wastage associated with the earthed and unlined lateral canals. About 62% of respondents complained that the absence of lateral canals and the short length of the main distribution canals leads to them wasting a lot of productive hours going to and fro to obtain water to irrigate their crops and this has been a major contribution to low crop output in the two communities, hence limited income from the sale of produce.

Regulation of water use:

Table 4.4: Decision on regulation of water use

Decision on water scheduling	Frequency	Percent
WUA executive committee	48	40.0
Based on agreement between the water users	72	60.0
Total	120	100.0

Source Field Survey, April 2009

In other to ensure efficiency and equity in the distribution of water, there are laid down and agreed times when the water should be supplied to farmers in the irrigation schemes. This measure of regulating water use is to reduce water loss and to minimize conflicts among farmers. The frequency of supply largely depends on the amount of water in the reservoirs, if the water is enough then water can be supplied on an everyday basis but when the water in the reservoir reduces, a rationing method is used to supply the water to the farmers. From the above table the supply regime at the irrigation schemes is largely based on the agreement between farmers. It is based on this agreement that the WUAs officers act upon to open the water for the farmers. According to the executives of the WUAs in the mornings from 6:00am to 6:00pm they supply water for farmers who are near the dam or water points and from 6:00pm till the next morning they supply those downstream and in the valleys. They further added that when the water in the reservoir is not enough they reduce the time they supply the water instead of the 24hours and in extreme cases they ration the water on daily basis among the farmers.

4.7.5 Maintenance of Irrigation Schemes

For small scale irrigation schemes to serve their intended purpose of providing a source of livelihood for beneficiary communities, then their sustainability is very

paramount. To achieve this, the facilities at the schemes must be maintained regularly to avoid their breakdown and collapse. The routine maintenance of these schemes is the main responsibility of the WUAs. It is only when it is above their capacity that they report the problem to the District Agricultural Development Unit and District Assembly. The maintenance activities carried out at the scheme are enumerated and discussed below:

Fixing of broken pumps: Repair of pumps is one of the maintenance activity that the WUAs pay prompt attention to. The reason is that the pumps serve as the main artery for the supply of water to the farmers, therefore in its absence it brings farming activities to a halt. The repair work is done by local artisans. For instance in Bugri the one in charge of opening the water said he learnt the act of repairing the pumps from his acquaintance with external artisans. It is only when the damage is beyond the might of the local artisans that experts are brought in to fix the pumps.

Embankment of the dam walls: This aspect of maintenance is carried out by the members of the communities through communal labour. The activities undertaken include filling of pot holes on the dam walls and lining the walls with heavy boulders to prevent the walls from breaking its banks and also to prevent erosion occurring on the dam walls. Maintenance of the bank is carried out during the rainy season. This is to enable the dam to store plenty water during the rainy season.

Spill way protection: Maintenance of the spill way is carried out during the rainy season to prevent it from collapsing. The spill way regulates the amount of water in the dams. When the dam is full the spill way ensures that the excess water is released to prevent the dams from breaking their walls. The spill way in Bugri is in good condition but that of Gagbiri is in a poor state. During the rainy season the community members line the walls of the spill way with big boulders to prevent it from falling and also avoid erosion. In the dry season they poor concrete at the foot of the walls to reinforce it.

Renovation and cleaning of canals: The renovation and cleaning of canals is a maintenance activity carried out routinely by the community members. Whenever the concrete slaps or walls of the canals are broken, officers of the WUAs organize community members and with their own expertise cement and patch cracks or build the slaps entirely. The repair works on the canals are carried out with funds generated internally. The WUAs buy cement and stones needed for the repair works. Prior to

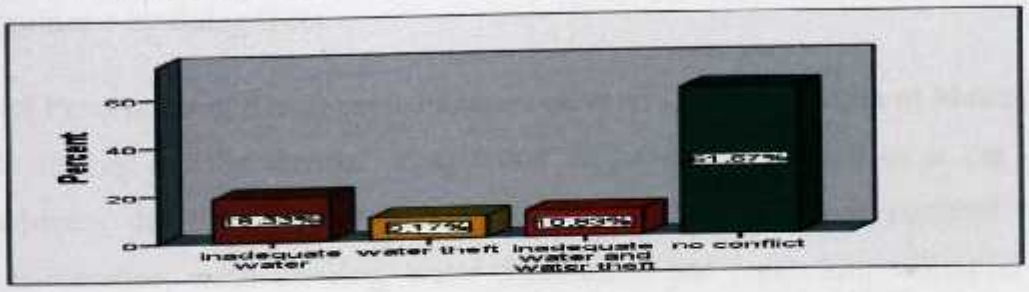
farming at the schemes the WUAs organizes its members to clean the canal and other distribution networks. This is to allow for the smooth flow of water to the farms. The cleaning of canals is necessary because during the rainy season the canals are not used and weeds tend to grow inside them. Some are also choked with sand and mud hence the need for them to be cleaned before the dry season farming begins.

Protection of the catchment area: During interviews with the WUAs and chiefs in the two communities it is evident that the stock of water in the dam has been reducing with time. A major case of the problem is siltation of the dams. Farming around the catchment area of the dam has been blamed for the siltation of the dams. In an attempt to arrest the situation the communities were encouraged by the District Agricultural Development Unit to plant trees and grasses to protect the catchment area of the dams. The species introduced to the WUAs was the vertira grass. The advantage of the grass is that it can guard against siltation of the dams. Farmers also under took the planting of trees around the dams catchment area all in an effort to protect the dam.

4.7.6 Conflict Resolution

Conflicts have been part of all human organizations and this not different in the irrigation schemes. Conflicts have been inherent among farmers in the two schemes even though not on a large scale. The groups interviewed during the focus group discussions made it clear that from time to time conflicts do arise but in most instances the farmers resolve it among themselves. In a few cases they report to the executives of the WUAs. In analyzing the data 61.7% of farmers said they have not been engaged in any conflict whiles 38.3% affirmed that they have had confrontation with other small scale irrigation farmers. The causes of conflicts among farmers are depicted in Figure 4.1 below.

Figure 4.1: Reasons for conflicts among farmers



Source: Field Survey, April 2009

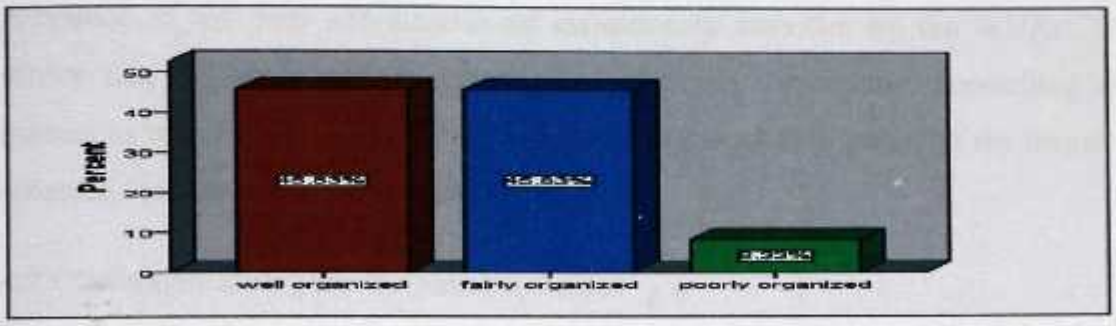
The causes of conflicts are inadequate water to serve all farmers at the same time and water theft. With regards to inadequate water, the cause of conflict has to do with the equity problem. Farmers upstream feel that those near the water points are monopolizing the use of water to their detriment. They therefore sometimes confront farmers near the water points accusing them of been selfish. With regards to water theft the distant farmers accuse those near the water points of stealing water meant for their use especially if it is their turn to be supplied with water. This phenomenon is very common in the Gagbiri irrigation scheme whereby the canals are used to supply water to distant farmers instead of pipelines so at any point in time the farmers near the water points have water passing through canals in their farms, they are therefore tempted to use the water even though it might not be their turn to use the water.

The main institution for the resolution of conflicts is the executives of the water user associations. They are the first point of call for any aggrieved person or party. It is only when they find it difficult to resolve the problem that they report it to the traditional authorities and in extreme cases to the District Agricultural development Unit. In dealing with cases the executives of the WUAs make use of the association's constitution and bye-laws. According to the executives of WUAs in both communities, they have not sent any case regarding conflicts to the District Agricultural Development Unit. They contend that so far the conflict resolution mechanisms they have adopted have yielded positive results. They further added that a few cases regarding non-compliance by losers have been reported to the chiefs and those have also been resolved. Among the conflict resolution mechanisms are vigorously enforcing the rationing arrangements agreed by farmers and engaging the aggrieved parties in dialogue for them to amicably come to an agreement. In some few instances the traditional authorities sanction people who persistently cause problems by fining them.

4.8 Perception of Small Scale Farmers on internal organization of Management

In finding out the internal organization of management practices at the irrigation schemes the following responses were given. The questions centered on canal maintenance, canal clearing, water distribution and regulation, collection of fees, conflict resolution among others. The options and responses are depicted in figure 4.2 below.

Figure 4.2 Perception of farmers on internal organization of irrigation schemes



Source: Authors field survey, April 2009.

From Figure 4.2 above 45.83% of respondents were of the view that the internal organizations of management practices at the irrigation schemes are well organized. The same percentage went for fairly organized and 8.33% of respondents are of the view that the schemes are poorly organized. The above responses indicate that over 50% of respondents are not satisfied with the management of the small scale irrigation schemes. Among the reasons given for this are indicated in table 4.5 below.

Table 4.5: Reasons for fair or poor internal organizations of management practices

Nature of Problem	Frequency	Percent
Poor coordination of maintenance activities By WUA	3	2.5
Poor imposition of sanctions on defaulting users	6	5.0
Low participation of members in maintenance activities	3	2.5
High cost of maintenance	7	5.8
Poor coordination of maintenance activities and high cost of maintenance	9	7.5
Poor coordination, poor imposition of sanctions and low participation	8	6.7
Poor coordination and imposition of sanctions on defaulters	6	5.0
Poor imposition of sanctions, low participation and high cost of maintenance	12	10.0
poor imposition of sanctions on defaulters and high cost of maintenance	16	13.3
no response	50	41.7
Total	120	100.0

Source: Field Survey, April 2009

From the above table it can be seen that the major reasons given by the farmers for their perception on the poor management of the dams centered mainly on poor coordination of management and maintenance activities by the WUAs, reluctance by the WUAs to impose sanctions on farmers who default with regards to their financial obligations to the associations, high cost of maintenance activities with regards to buying of spare parts and other logistics as well as hiring external experts to undertake repair works. The farmers revealed that the WUAs are really financially constraint and this limits their ability to meet both cost of maintenance. Finally farmers cited

low participation of members in maintenance activities as a cause of the poor or fair management of the irrigation schemes. The reason for the low participation is imbedded in the poor coordination of maintenance activities by the WUAs. This shows that the management principles of planning, organizing, controlling and leading as noted by Higgins (1994) is not been adhered to ensure that the irrigation schemes function effectively and efficiently.

4.9 Challenges facing the irrigation schemes

The irrigation schemes in Gagbiri and Bugri are plagued with a number of challenges which hamper the smooth flow of management activities as well as irrigation farming. The challenges are discussed below:

Insufficient Water to meet Demands: This is by far the major challenge facing the irrigation schemes. The water level in the two schemes has been dwindling, and this is as a result of siltation and the low and erratic rainfall pattern of the district which hampers the ability of the reservoirs to store plenty water, as well as the high demand for water for small scale irrigation farming. This high demand stems from the increasing populations in the two communities coupled with the fact that small scale irrigation farming still remains the major source of income for people in these communities. The high demand for water and its insufficiency is the major source of conflict among farmers as well as low crop output. The limited amount of water in the reservoirs has led to some farms been abandoned, due to the inability of management to distribute water to such areas. This situation creates a number of problems to management since there is always enormous pressure from people to be allocated farm lands in areas where they can have access to water.

Limited Funds to support Management Activities: This challenge stems from the inability of the WUAs to effectively mobilize funds. Currently the mechanism put in place to mobilize revenue is not yielding the desired results. This leads to some farmers still not paying the approved levies. The measures stipulated in the bye-laws to prevent defaulting farmers from engaging in farming activities the following season until they settle outstanding arrears are not being enforced. This creates room for some farmers to continue to default in the payment of levies. Also some landowners allocate lands to prospective farmers at a fee which should have been paid to the WUAs. This practice has contributed significantly to eroding the revenue base of the

WUAs. The interviews with the WUAs in Bugri and Gagbiri revealed that their balance currently at the BESSFA Rural Bank in Garu stood at GH¢101.00 and GH¢235.00 respectively. This precarious financial situation makes it very difficult for management to undertake major maintenance activities at the irrigation schemes thereby hampering farming activities since some facilities tend to breakdown and are not repaired in time.

Lack of a Fence: The catchment areas of the irrigation schemes do not have fence walls around them. The challenges the absence of the fence creates include the following: destruction of crops by animals especially cattle, goats and sheep, encroachment of the catchment area by some individuals and stealing of water which is already not sufficient by farmers outside the catchment area of the scheme.

Low Technical Knowledge and Inadequate Infrastructure: The WUAs are constraint when it comes to technical knowledge pertaining to maintenance of infrastructure at the schemes and without enough funds to hire expertise all the time, major repairs such as repair of valves, building of canals and pump maintenance are always delayed. Inadequate infrastructure is another challenge faced by the irrigation schemes. Among the problems are the short length of the canals, lack of lateral canals and lack of modern equipments to measure the level of the water in the reservoirs, the rate of discharge as well as sedimentation.

Problems with Equity in Water Distribution: The issue of equal access to water still remains a major challenge to the WUAs. The rationing adopted by management to some extent has been successful but there are still problems with regards to access to water. Distant farmers still feel that their counterparts near the water points are stealing water meant for them and this sometimes creates quarrels among farmers, even though these are mostly resolved by the executives of the WUAs. The challenges enumerated supports Perret (2002) assertions that the causes for the poor functioning of irrigation schemes in Africa are infrastructure deficiencies emanating from inappropriate design, management and maintenance, both beneficiaries and government-assigned extension officers lacking technical know-how and ability, absence of peoples involvement and participation in maintenance activities, inadequate institutional structures, inappropriate land tenure arrangements, local political power games, a history of dependency and subsistence orientation, low land productivity and high cash costs.

4.10 Opportunities for improving the management of the irrigation schemes

Despite the above challenges facing the irrigation schemes, opportunities still abound in the communities which can improve upon the management practices at the dam. These were revealed during the interviews and FGDs. The opportunities include the following;

- A willing and readily available labour force. The survey revealed that 60.8% of respondent's contribution towards the maintenance of the irrigation schemes was in the form of labour and over 80% of respondents are willing to offer labour anytime the need arises. This communal spirit by the farmers is one major potential which can improve management practices.
- The users of the dams are also willing to contribute financially towards the maintenance, dredging, desilting and even expansion of the dams. The chief of Bugri had this to say: *"If government or any donor request that we provide counterpart funding and labour for the expansion of our dam we can meet their demands since the farmers and traditional council are prepared to commit in that regard."*
- In both communities the WUAs and the traditional authorities have been collaborating well. The harmonious relationship between the two institutions is a very good potential to improve upon the operation and maintenance of the irrigation schemes to ensure the sustainability of the irrigation schemes.
- Peaceful co-existence among the users of the schemes as indicated by 70% of respondents who revealed that they have never had any conflict with neighbouring farmers as a result of water distribution and their acceptance and adherence to a rationing system by the WUAs executives is an important catalyst to promote the sustainability of the dams.

4.11 Suggested recommendations by farmers to improve the management of the irrigation schemes

In finding out the views of small scale irrigation farmers on measures to improve upon the management of the scheme various suggestions were given. This is indicated on Table 4.6 below.

Table 4.6 Suggested Recommendation by Farmers to improve upon the Management of the Irrigation Schemes.

Suggested Recommendations to improve Management of Schemes	Frequency	Percent
Provide WUA with training to upgrade their skills and knowledge	38	31.7
More monetary contribution from users	42	35.0
Expansion of the dam	7	5.8
Provide WUA with training and monetary contribution	14	11.7
Provide WUA with training and expansion of dam	8	6.7
Monetary contribution and expansion of dam	11	9.2
Total	120	100.0

Source: Field Survey, April 2009

From the above responses, farmers are of the views that if WUAs are provided with training to upgrade their knowledge and skills it will help improve the management of the irrigation schemes. This is true and necessary because knowledge is not static and if WUAs are given the needed training it will go a long way to improve the management of the dams and facilities at the irrigation schemes. Also farmers have also shown their awareness that money is the backbone of successful operation and maintenance of the scheme therefore they are of the view that if more monetary contributions are made it can lead to improving the operation and maintenance activities in the irrigation schemes. Finally, they are of the view that if the dams are expanded to enable them store more water it will reduce the challenges faced by the irrigation schemes and management with regards to inadequate water.

4.12 Concluding Comments

This chapter dealt with issues on the operation and maintenance of the irrigation schemes and the challenges and prospects to improve upon the management of the schemes. From the analysis it was revealed that the educational level of farmers was very low. This situation has implications for the management of the irrigation schemes since education is necessary for people to be able to imbibe knowledge and new skills successfully. It also emerged from the analysis that the composition of the executive committees of the WUAs in both Bugri and Gagbiri are gender sensitive. This is because 3 and 6 positions are reserved for women respectively. This provides a good basis for broad based decision making with regards to the management of the irrigation schemes. Also in terms of fixing fees, it is consensus between the farmers and the executives of the WUAs. This ensures acceptability by all farmers, hence the farmers pay the fees without any reservation. From the analysis the maintenance activities carried out at the irrigation schemes included repair of canals and pumps,

embankment of dam walls, spill way protection and catchment area protection. From the analysis in this chapter the schemes faces challenges such as inadequate infrastructure, inadequate funds to carry out maintenance activities and inadequate water to meet demands. The effects of these challenges are that it hampers farming activities and invariably hampers the ability of small scale irrigation farmers to maximize output so as to get enough output to sell. This situation therefore minimizes the ability of farmers to also maximize income and also has an effect on food security in the district. This notwithstanding the small scale irrigation schemes are still the major source of livelihood for people in the two communities.

The next chapter will therefore look at the analysis of small scale irrigation farming with regards to the type of crops crown and their output as well as farmers perception on poverty and wealth. The contribution of small scale irrigation farming to poverty reduction will also be analyzed with special references to the contribution of irrigation farming to household income, food security and access to social services in the communities and for that matter Garu-Tempane District.

CHAPTER FIVE

ANALYSIS OF SMALL SCALE IRRIGATION FARMING AND POVERTY REDUCTION IN GARU-TEMPANE DISTRICT

This Part of the study looks at the issues of small scale irrigation farming in the Garu-Tempane District and its contribution to poverty reduction. The chapter will deal with the farm holdings of farmers, the major crops grown, the output and income from the sale of farm produce, the contribution of the farming activities to the families of the farmers and the challenges the farmers face at the irrigation schemes.

5.1 Farm Holdings of Small Scale Irrigation Farmers

From the data collected it was observed that the farm holdings of small scale irrigation farmers range below a hectare to six hectares. From Table 5.1 below, it is observed that 40.9% of farmers have farm sizes between 1-2 hectares, 25.8% and 23.3% have farm sizes between 3-4 hectares and below 1 hectare respectively while 10% have landholdings between 5-6 hectares. This clearly indicates that farmers at the schemes do not.farm on a large scale. The reason given by farmers is that due to the growing population in the communities the landowners have to release part of their land to others so that they can also enjoy the benefits of dry season irrigation farming. This underscores the importance of the small scale irrigation schemes to the people of Bugri and Gagbiri and for that matter the Garu-Tempane district.

Table 5.1 Farm Holdings of small scale Irrigation Farmers

Farm Holdings in Hectares	Frequency	Percent
< 1	28	23.3
1 - 2	49	40.9
3 - 4	31	25.8
5 - 6	12	10.0
Total	120	100.0

Source: Field Survey, April 2009

5.2 Number of Years Spent Farming in the Irrigation Schemes

From the study, it is observed that majority of farmers have spent their entire life working in the irrigation scheme taking into consideration the average ages of farmers. From Table 5.2 below, 39.2% of farmers said they have been engaged in small scale irrigation farming for the past 11-15 years, 15% have been farming for the past 16-20 years. The least number of years spent by some farmers using the scheme is 6.7% representing less than five years. This phenomenon further buttresses the point that the irrigation schemes serve as the major source of employment for the

communities in Garu-Tempane District. Similarly, 78.3% of farmers confirmed that the irrigation schemes have extended their farming activities by 3-4 months, thereby ensuring that they have some form of occupation during the dry season. They added that with enough water in the reservoirs the period could have been extended beyond 4 months and this would have led to their ability to increase crop output which would invariably increase their ability to sell more produce and to meet the food requirements of their families.

Table 5.2 Number of years spent farming in the irrigation schemes

Number of years spent farming	Frequency	Percent
Below 5	8	6.7
6 – 10	16	13.3
11 – 15	47	39.2
16 – 20	18	15.0
21 – 25	17	14.2
Above 26	14	11.7
Total	120	100.0

Source: Field Survey April 2009

5.3 Major Crops Cultivated in the Irrigation Schemes

The major crops grown using irrigation water in Bugri and Gagbiri include onions, pepper, and leafy vegetables. By far onion is the major crop cultivated by the farmers. The interview with farmers revealed that 96.7% of them cultivate onions. Table 5.3 below shows the major crops cultivated. From the Table, it is observed that farmers do not engage in the cultivation of only one crop. The cultivation of leafy vegetables from the survey is dominated by women. This is always undertaken after the harvest of onions.

Table 5.3 Crops Cultivated by Small Scale Irrigation Farmers

Crops Cultivated	Frequency	Percent
Onions	57	47.5
Pepper	3	2.5
Leafy vegetables	1	.8
Onions and pepper	14	11.7
Onions and leafy vegetables	16	13.3
Pepper and leafy vegetables	4	3.3
Onions, pepper and leafy vegetables	25	20.8
Total	120	100.0

Source: Field Survey, April 2009

The reason for the cultivation of onions is that it can easily be stored by the indigenous farmers in times of inadequate market or clout. The crop does not also require a lot of water and thrives well in arid and semi-arid areas. The study also

revealed that all farmers cultivate crops mainly for market purposes but also use part of the produce to feed their households.

5.3.1 Output of Onions Cultivated

To give a comprehensive income derived from the sale of farm produce it is necessary to determine the output of crops cultivated. Farmers during the survey found it difficult to quantify the output of leafy vegetables and pepper. They contended that with these crops they sell them as and when they are matured for harvesting. They were however able to quantify the output of onions for the season. They were able to tell how much they make or made from the sale of pepper and leafy vegetables. The output of onions is depicted in Table 5.4 below

Table 5.4 Output of Onions to Small Scale Irrigation Farmers

Output of Onions (100kg Bag)	Frequency	Percent
below 1	8	6.7
1- 4	41	34.2
5- 8	44	36.7
9- 12	12	10.0
13- 16	8	6.7
above 16	7	5.8
Total	120	100.0

Source: Field Survey, April 2009

Table 5.4 above shows that majority of farmers obtain between 1-12 100kg bags per annum from their onion farming. The farmers confirmed that, output has been reducing annually and this season in particular has not been very good for them. A farmer had this to say. *"when I started farming in the early 1980s I use to make about 16 maxi bags per hectare but currently I struggle to make half of that, this I blame on the pest and diseases I find difficult to control, so report this to the 'big men' so that they can remedy the situation for as or else we would lose our source of livelihood".*

5.4 Income of Small Scale Farmers from Sale of Produce

The sale of farm produce is one of the ways through which farmers in the communities obtain their income. From the interviews with farmers it was revealed that the prices of their produce especially onions is not stable. It continues to fluctuate. The prices peak during the rainy season when they cannot grow the crop any more, but due to improper storage facilities they are forced to sell their produce before they go bad. In the case of leafy vegetables, the women sell it to buyers from the nearby towns of Bawku and Garu at the farm gate. In most instances they carry the produce to the local market where they sell to the local indigenes. The income

from the sale of vegetables according to the women is mostly used to buy household consumables such as salt, fish, sugar and in some cases clothing for their children.

Table 5.5 Income of Farmers from Sale of Farm Produce

Income of Farmers in Ghana Cedis (GH¢)	Frequency	Percent
< 30.00	4	3.3
30.00 – 50.00	7	5.8
51.00 – 70.00	6	5.0
71.00 – 90.00	8	6.7
91.00 – 110.00	11	9.2
111.00 – 150.00	9	7.5
151.00 – 250.00	12	10.0
251.00 – 350.00	28	23.3
above 350.00	35	29.2
Total	120	100.0

Source: Field Survey, April 2009

The average price for a bag of onions stood at GH¢35.00. The sale of pepper is mostly done at the farm gate when they are matured for harvesting. A pan of pepper is sold at GH¢30.00. The income from the sale of farm produce is shown in Table 5.5 above. From Table 5.5 above majority of farmers earn above GH¢350.00 from dry season irrigation farming. In some instances a few farmers earn between GH¢700.00 and GH¢1,100.00. The Table above indicates that 79.5% of farmers earn above GH¢ 90.00 which according to the Ghana Living Standard Survey is the upper poverty line per adult per year. This indicates that about 80% of small scale irrigation farmers, representing 8 out of 10 of farmers by income measure are not poor as indicated by the Ghana Living Standard Survey. This is also in contrast with the Ghana Poverty Reduction Strategy which said that by income measure 9 out of 10 people in the Upper East Region are poor.

From data gathered, it was revealed that the income of farmers was not dependent on the size of plots but on the ability of farmers to be able to acquire the necessary farm inputs to carry out farming activities. From table 5.5 above majority of the farmers representing 67% of those who earn between GH¢250.00 and GH¢350.00 are able to buy and use fertilizer and other farm inputs such as pesticides and weedicides on their farms but not necessarily on the size of their plots. This is because the study also revealed that 58% of farmers who earn between GH¢30.00 and GH¢90.00 do not use inputs such as fertilizer and pesticides. This therefore means that farmers who are economically endowed are able to use farm inputs which enable them to acquire much yield and invariably more income from the sale of their produce in contrast to farmers who do not use these farm inputs.

The diversification of a farmer's sources of income is very critical to cushion him against shocks. In other to ensure that they make the most of their income the farmers in the community diversify their investments. The commonest form of investment took the form of buying livestock such as cattle, goat, sheep and donkeys. Farmers also invested in the buying of ploughs which they use for animal traction during the dry season as well as the buying of donkey carts to transport farm produce and goods. The livestock are sold in times of need to solve problems and even to buy farm inputs such as fertilizer, seeds and chemicals (Insecticides and Pesticides) to support their farming activities, about 60% of farmers attested to this form of diversifying their income. The income of farmers has been of immense benefits to their households. The contributions include the ability of farmers to provide the daily food requirements of their households, cater for the educational needs of their wards, repair their houses which include roofing their homes with aluminum roofing sheets, buying of clothing for their families and providing the health needs of their children. The benefits accruing to the household of farmers is depicted in Table 5.6 below.

Table 5.6 Contribution of Farmers Income to Household of Farmers

Contribution of Income of Farmers	Frequency	Percent
Food security, health care and education for children	52	43.3
Food, health care, education and clothing for family members	24	20.0
Food, health care, education and house repairs	13	10.8
Food security and health care	9	7.5
Food security and education for children	10	8.3
All the five benefits	12	10.0
Total	120	100.0

Source: Field Survey, April 2009

To show the benefits derived from small scale irrigation farming as depicted in table 5.6 above, one farmer remarked "it *is through the proceeds of dry season onion farming that I have been able to send my children to school and also to subscribe to the national health insurance scheme, in fact I do not know the type of work I would have done without this scheme since I have never been to school*". The table above shows that food security is the major benefit to families of farmers from the sale of their farm produce. Apart from the above contribution 6.7% and 2.5% of respondents intimated that they use the income to cater for funeral expenses and to pay off pride prices respectively. This indicates that the income of farmers also helps them to attend to other social issues. This is important because the ability of one to participate in the social processes of his community is an important dimension of poverty reduction.

5.5 Contribution of Small Scale of Irrigation Farming in Poverty Reduction in Garu-Tempane District

In order to analyze the contribution of small scale irrigation farming in poverty reduction in Garu- Tempane, the perception of farmers about poverty and wealth is very paramount. This was obtained through interviews and focus group discussions with farmers.

5.5.1 Definition and Indicators of Poverty

This deals with the definition and indicators of poverty as provided by the farmers. This is indicated in table 5.7 below. From the table 5.7 below, it is observed that all respondents saw poverty as inadequate food. This means that the definition of poverty in the district is food poverty, where farmers indicated that the inability to feed oneself and his/her family means the person is poor. This definition largely has to do with the fact that the communities in the district are agrarian and the respondents are also small scale irrigation farmers, therefore their interest might be in food.

Table 5.7 Farmers Definition of Poverty

Definition and Indicators of Poverty	Frequency	Percent
Inadequate food to feed family	44	36.7
Inadequate food and low income	29	24.2
Ill-health and inadequate food	26	21.7
Inadequate food and inability to access medical and educational services	14	11.7
Inadequate food, ill-health, low income and lack of clothing	7	5.8
Total	120	100.0

Source: Field Survey, April 2009

Indicators of Poverty: Indicators used by the small scale irrigation farmers to identify poverty include inability to feed oneself and family, malnourishment, eating once a day, possessing no livestock and unhappiness. Others include lack of decent clothing, indecent accommodation, ill-health, inability to access medical services and to educate ones children. From the table above and indicators, poverty in the communities and for that matter the district is food poverty even though other forms of poverty such as inability to enjoy social services was also given prominence. Indicators of wealth by the farmers are also shown below;

Table 5.8 Perception of wealth by Small Scale Irrigation Farmers

Indicators of Wealth	Frequency	Percent
Enough money	11	9.2
Lot of food	30	25.0
If you are healthy	11	9.2
Plenty Livestock	21	17.5
Have many children	4	3.3
Enough food and plenty livestock	18	15.0
Enough of money and food	12	10.0
Enough money, food and plenty livestock	13	10.8
Total	120	100.0

Source: Field Survey, April 2009

The table above shows that food and livestock play a major role in determining who is wealthy in the district. This is also a major factor in determining the social status of a person, whereby a person with more cattle is deemed rich or wealthy and is given a higher social status in the community.

5.5.2 Small Scale Irrigation Farming and Poverty Reduction in Garu-Tempane District.

Haven looked at the perception of farmers about poverty and wealth. It is important to analyze the contribution of small scale irrigation farming to poverty reduction in the district. The issues to be looked at include income, food security, ability to access social services and employment. These are discussed below. According to Rahmato (1999) Irrigation can play a significant role in improving food security and household income in Africa. He further said the purpose of agricultural water development should be to increase social benefits, and to promote food security and poverty alleviation. Also looking at the contribution of small scale irrigation farming Hussain and Hanjira (2004 in Assefa 2008) said there are strong direct and indirect linkages between irrigation and poverty. The direct linkages they said operate through localized and household effects whereas the indirect linkages operate through aggregate or sub-national and national level impacts. Irrigation they contended benefits the poor through all year-round farm and non-farm employment. This assertion is true for the Garu-Tempane district, this will be demonstrated in the ensuing analysis.

Income: The income of a given population is one of the commonest indicator of measuring well being or poverty. The indicator refers to the minimum income needed to be able to satisfy minimum basic needs or the income (or level of spending) required to purchase a bundle of essential goods (typically food, clothing, shelter,

water, electricity, schooling, and reliable healthcare). In the two communities the income accruing to farmers from the sale of their crops indicates that majority of farmers earn above the minimum income considered by the GLSS 4 classification of who is poor in Ghana. From the survey about 80% of small scale irrigation farmers earn above GH¢90.00 for the 3-4 months spent farming in the schemes. Out of this percentage 52% of them earn incomes ranging between GH¢150.00 and above GH¢ 350.00. The income is used to argument what they obtained during the rainy/wet season. Therefore, by income measure using the GLSS 4 standard of considering the poor to be adults earning between GH¢70.00 and GH¢90.00, it will be right to conclude that 8 out of 10 farmers in the small scale irrigation schemes are not poor.

Food Security: From the study, it was revealed that farmers saw food insecurity as the major indicator of poverty. According to the farmers dry season irrigation farming has extended their farming or occupation by 3-4 months. This has therefore reduced the hunger gap from 6 months to only 2-3 months. The income earned by farmers is mostly used to secure additional food to feed oneself and family. All the small scale farmers interviewed said dry season irrigation farming has helped them to secure their household food requirement. A farmer during a focus group discussion expressed the relevance of food security to poverty reduction when he remarked that "*if you take away the food problem you have taken away poverty and this is what dry season irrigation farming has taken away from us*". This indicates that food poverty among small scale irrigation farmers is reducing at an appreciable level.

Employment: According to Klein and Hadjimichael (2003), for the poor to escape from poverty they need jobs and investment is key to alleviating poverty because it is the mechanism that provide jobs. To them the main issue is not just employment, but increasingly productive employment that allows living standard to rise. Considering this assertion by Klein and Hadjimichael then it can be concluded the irrigation schemes in the district is contributing significantly to poverty reduction. This is because dry season irrigation farming is the single highest employment avenue for people in the communities. This is even more significant since majority of those who farm in the scheme are in the active labour bracket of 15-60 years. The employment avenue created by the irrigation schemes has immensely reduced the migration of the youth to the southern part of the country. The irrigation schemes have been able to support all-year agriculture thereby ensuring job security. Therefore, in terms of

employment creation and retention as an indicator of escaping from poverty then the irrigation schemes in the district are guaranteeing just that. The benefit is that they serve as safety nets for the care of the aged and vulnerable such as children and as buffers against shocks such as drought.

Access to Social Services: Deprivation such as inability to access social services such as education and health care due to inadequate command over resources is one indicator of poverty. Small scale farming in the Garu-Tempane district is contributing significantly to people having access to such social services by providing farmers with the resources that will enable them to enjoy such services. From the interviews, all farmers who had children of school going age said they use the income they earn to take care of the educational needs of their children, others have also been able to send their children to vocational institution so that they can have entrepreneurial training. About 92% of farmers also revealed that through irrigation farming, they able to comfortably seek health care for themselves and their households when the need arises. About 52% also revealed that they have been able to subscribe to the national health insurance scheme due to dry season irrigation farming. This shows that by measuring well being in terms of access to social services then irrigation farming has contributed immensely to the well being of the communities in the district.

The above contribution of the Bugri and Gagbiri irrigation schemes to poverty reduction gives credence to the conclusions drawn by Hussain and Hajira (2004 in Assefa 2008) that access to irrigation water contributes to the socioeconomic uplift of rural communities and poverty alleviation by providing rural people with production, income and consumption, food security and other social impacts thereby contributing to overall improved welfare and also decrease their vulnerability to drought due to short and erratic rain fall conditions.

5.6 Challenges faced by Small Scale Irrigation Farmers

According to IFAD (2002), poor people can overcome poverty through strengthening the capacity of the rural poor and their organizations, improving equitable access to productive natural resources and technology, and increasing their access to financial services and markets. The views of IFAD still remain some of the challenges confronting small scale irrigation farmers in Bugri and Gagbiri. The challenges facing farmers are enumerated below.

Inadequate Water: The water levels in the reservoirs continue to dwindle thereby making it difficult for the required amount of water to be distributed constantly. This was confirmed by 56% of respondents. The effects of this problem are conflict among farmers, drying up or withering of crops, low yields and loss of productive hours digging the ground to find water at the expense of other serious and rewarding activities, as such a major drag to the general productivity of farmers.

Diseases and Pest Infestation: Infestation of crops by diseases and pest according to the farmers has affected them drastically this farming season. This situation they contended has led to failure of crops leading to the low yields they have been experiencing, thereby also leading to a reduction in their income.

Destruction of Crops by Animals: The lack of a fence around the catchment area of the irrigation schemes has created a situation whereby the crops of farmers are destroyed by animals such as cattle, goats and sheep. In some instances farmers are forced to sleep in their farms to turn away animals. This sometimes creates rifts between families, especially if the farmer is married.

Inadequate and High Cost of Farm Inputs: The problem of farm inputs is due to the high prices of inputs such as fertilizer, improved seeds, pesticides and insecticides. The problem is exacerbated by the few dealers of farm inputs who turn to inflate the prices of the inputs. In some cases they do not even get the inputs to purchase within the communities except in Bawku and Garu. According to DADU the subsidies put on fertilizer the previous year by the government and the introduction of the coupon system did not achieve the intended purpose due to political interference.

Lack of Credit Facilities: All farmers interviewed said they have never had any facility extended to them by any organization. The lack of credit they said affects their ability to buy the needed inputs to enhance their farming activities.

Inadequate Extension Services: Extension services to farmers are woefully inadequate. About 96% of farmers interviewed revealed that they have not had access to extension services for the whole year. Farmers are aware of the benefits of extension services. They acknowledged that extension services will provide them with new farming methods and also help them to control diseases and pest attacking their crops. The situation according to DADU is due to inadequate staff, only one person is in charge of managing eight communities including the study communities, hence their inability to reach all farmers.

Marketing Challenges: With marketing, the farmers are not always offered real value for their produce. Due to the inability of most farmers to personally transport their produce to major market centers in Bawku and the southern part of the country, the middlemen turn to offer them low prices at the farm gate. This is particularly bad for pepper and leafy vegetables since they are perishable crops. They are therefore forced to sell at the prices offered to avoid total lose.

Inadequate and Broken-down Infrastructure at the Irrigation Schemes: The technical infrastructures in the irrigation schemes are not adequate to ensure that farmers use the schemes without any difficulty. The lengths of the main canals are not enough to serve all farmers. The irrigation schemes lack lateral canals leading to farmers having to adopt other methods to water crops. This mostly involves the use of much physical labour. Broken down and blocked canals are also impeding the farming activities of farmers.

5.7 Concluding Comments

The chapter analyzed the contribution of small scale irrigation farming to poverty reduction in the two communities and for that matter the Garu-Tempane District with reference to household food security and income, employment generation and ability to access social services. From the analysis it was revealed that 79.5% of farmers earn incomes above GH¢90.00 which is the national poverty line per adult per year. It also emerged that the farm holdings of small scale irrigation farmers range between 1-3 hectares. From the analysis in this chapter the challenges faced by small scale irrigation farmers include inadequate water, pest and disease infestation, high cost of farm inputs, destruction of crops by animals, market challenges, broken down infrastructure, inadequate extension services and lack of credit facilities. Crops grown at the schemes include onions, pepper and leafy vegetables. It was also revealed that the income accruing to farmers benefits their household in so many ways. The benefits include the ability of farmers to meet the food requirements of their families, cater for the educational and health needs of their children and households, buy clothing and repair their homes. Also the irrigation schemes from the study are the major source of employment in the communities as such the major source of livelihood for the communities. From the analysis it was revealed that the challenges identified have contributed significantly to the low yields obtained by farmers who

use the irrigation schemes. This notwithstanding it still contributes immensely to the wellbeing of people in the two communities.

The next chapter deals with the summary of findings, recommendations to improve upon the existing situation and conclusion based on the findings of the study.

CHAPTER SIX

SUMMARY OF FINDINGS, RECOMMENDATIONS AND CONCLUSION

6.1 Introduction

This section discusses the summary of findings, recommendations and conclusions drawn from the findings. It is a highlight of issues that were revealed during the research. It also involves recommendations that can help management to overcome the challenges faced by the irrigation schemes so as to improve upon the operation and maintenance of the schemes to ensure their sustainability. Recommendations to overcome challenges faced by small scale irrigation farmers are also highlighted in this chapter.

6.2 Summary of Findings

6.2.1 Access to land for irrigation farming

The access to land for irrigation farming in the communities though a critical issue is not a problem to the communities and small scale irrigation farmers so long as there is enough water in the reservoirs for farming. Land ownership within the catchment areas of the irrigation is in the hands of the original land owners. Most of these lands are family lands. During the construction of the two dams in the 1950s and 1960s, farmers who showed the desire to use the schemes were allocated land permanently and duly registered in their names as family or individual lands. This situation though has not generated any conflict among community members since they are conversant with the arrangement. This is in contrast with Perret (2002) when he observed that the major causes facing small scale irrigation schemes is the inability of WUAs to have control and power to ensure that they take charge of the distribution of land.

6.2.2 Access and regulation of water for small scale irrigation

Access to water for irrigation farming is largely dependent on the amount of water in the reservoirs. The level of water in the reservoir is also influenced by the rainfall pattern. The location and distance of a farmer also affects access to water for irrigation farming. Water for irrigation farming is woefully inadequate leading to rationing of water at sometimes. The method of irrigation which is furrow/surface irrigation used at the schemes is not water efficient. The only advantage is that it is cheap to construct since it does not require much capital as compared to other methods. This method of irrigation turns to exacerbate the problem of inadequate

water since it involves the use of large amounts of water to flood farm lands. The inability of farmers to get adequate water is the main cause of conflict among farmers because those further away the water points accuse those near the water points of monopolizing the use of water thereby denying them access to water due them. This supports Dellapena's (2004) observation that due to the universal importance of water it has the risk of giving rise to conflicts among individuals, communities and states, especially in arid regions of the world as in the case of Garu-Tempane District. He further reiterated that the major wars of the twenty first century will be over water that support livelihood rather than oil or other resources. He therefore proposed that for water resources such as small scale irrigation schemes to achieve their intended purpose there is the need to balance the water needs for economic and other purposes among different social groups.

6.2.3 Charging for water use

The charging for water use in the two irrigation schemes is very democratic since the fixing of fees is a consensus between the farmers and the executive committee of the WUAs. This is important because it ensures acceptance by farmers. The charging for water use in Gagbiri is a fixed price which is not based on the volume of water used, the size of the irrigated area or the share of volume of harvested crops as proposed by FAO (2005). It is only in Bugri that farmers on the demarcated beds are charged based on the size of the irrigated area. Collection of levies from farmers according to executives of WUAs has not been effective due to the reluctance of some farmers to pay agreed levies. The reluctance by the executives to enforce bye-laws with regards to defaulting users has created apathy among farmers who hitherto have been paying their levies regularly. This has led to the WUAs not having enough revenue to carry out proper maintenance of facilities at the irrigation schemes.

6.2.4 Management system

To ensure active community participation in the management of small scale irrigation schemes, most African states have reduced state involvement in the management of such schemes and transferred it to farmers or farming communities as stipulated by Kamara e'tal (2001). In Ghana this is epitomized by the water User Association. The management practices adopted by the water user associations are not always yielding the desired results due to high financial burden placed on the farmers and the

executives, lack of technical know-how and inability of WUAs to actively mobiles farmers to undertake maintenance activities.

The election of executive members of the WUAs in the two communities is through the democratic process. One is elected for a fixed term of four years. This gives the executives legitimacy to manage the schemes. An important feature of the WUAs in Gagbiri and Bugri are that they are gender sensitive and this is an impetus to ensure participation by all farmers. In the schemes six (6) positions and three (3) positions are reserved for women in Gagbiri and Bugri respectively.

6.2.5 Maintenance activities

The sustenance of the irrigation schemes and their ability to support sustainable dry season irrigation farming largely depends on the routine maintenance of the schemes. The survey revealed that the schemes are fairly managed. This is as a result of the challenges faced by managers of the schemes. These notwithstanding the WUAs have been able to mobilize and organize farmers to maintain facilities in the irrigation schemes. The contribution of the farmers is mostly in the form of communal labour and in some instances the payment of special levies. The maintenance of some facilities is done routinely such as the embankment of the dam walls and cleaning of canals whiles others are responsive that is as and when they breakdown such as repairing broken canals, repair of pumps and broken down valves.

6.2.6 Poverty

Poverty according to the farmers is basically inadequate food, low income and lack of decent clothing, inability to access social services, ill-health and malnourishment. All the farmers agreed that poverty is basically the inability of someone to feed oneself and family. This is supported by the UNDP (2006) which analyses poverty in terms of opportunities and empowerment in terms of having access to healthcare, education and recreational facilities. In terms of wealth respondents were of the view that wealth connotes having enough food and money, plenty livestock, many children and ability to educate children and access health services. This shows that the community still places value on livestock and children. The reason is that livestock serve as a source of cushioning against shock and the children serve as a source of labour on the farms.

6.2.7 Household income and access to social services

The survey revealed that by income measure using the GLSS 4 report, 20.5% of farmers can be considered extremely poor or poor, whiles 79.5% earn above GH¢90.00 limit postulated by the report as the upper poverty limit. This indicates that the irrigation scheme contributes significantly in augmenting the household income of farmers. The revenue from the sale of produce is used to secure the educational needs of children and health needs of the household of farmers as well as buying extra food to feed their families. Farmers contended that the revenue they made from the sale of produce enabled them to subscribe to the National Health Insurance scheme (NHIS). It is also worth noting that the income from the sale of produce is used by farmers to buy livestock which they sell in times of need to support their farming activities and provide for the needs of their family.

6.2.8 Food security

All farmers during the survey said the major contribution of the irrigation schemes to their household is that it has been able to secure their household food consumption. The interviews revealed that the farming season in the communities have been extended by 3-4 months thereby closing the food gap by 2-3 months as produce from the farms are used to feed the family.

6.3 Recommendations

According to IWMI (2003), most transferred schemes in Africa are not performing as expected due to the financial burden on the WUAs and farmers, but with the necessary support services and readily available markets these schemes can become viable. The recommendation will therefore center on the need for support services for both farmers as well as the WUAs. The recommendations are summarized below.

1. From the analysis the major problem facing the irrigation schemes is water inadequacy. To combat this problem, the District Assembly which is the highest decision making body should provide funds or financial assistance so that the Irrigation Development Authority to assess the dams and come out with measures to rehabilitate the facilities in the irrigation schemes to ensure that they are in good shape. Top among the rehabilitation of the dams should be the expansion of the reservoirs to enable them store more water to overcome the problem of inadequate water. In fact the communities expressed their willingness to provide counterpart

funding for the purpose of rehabilitating and dredging the dams. The District Assembly can therefore exploit this avenue.

2. The length of canals at the irrigation sites are not enough to serve the catchment area of the irrigation schemes as such farmers have to store water in drenches to water their crops. In view of this District Assembly should provide funds to enable the canals to be expanded as this can reduce water loss and lead to efficient use of the water. Also the farms should be provided with concrete lateral canals to reduce the loss of water through seepage into the ground.

3. The WUAs should institute task forces to ensure that levies are paid by farmers before they are supplied with water for irrigation farming. The task force should be made up of farmers who are respected by their colleague farmers. The bye-laws of preventing defaulting farmers from engaging in farming activities using the facilities in the irrigation scheme should be enforced to the later.

4. The District Agricultural and Development Unit should intensify their education and training programmes to farmers and WUAs. The training should be factored into the annual activities of DADU and should center on extension services and capacity building so as to upgrade WUAs on management practices such as effective revenue mobilization, operation and maintenance activities, proper book keeping and conflict resolution mechanism. This will go a long way to improve upon the management of the dams and irrigation facilities as well as improve farming practices. Extension services will also help upgrade the farmers knowledge on irrigation practices as well as new farming methods and disease control. This will enable them maximize yields from their farms. The government should therefore lift the ban on employment especially in the agricultural sector to enable the unit employ more extension officers to help in the training of farmers.

5. As an urgent measure the District Assembly should provide financial assistance to enable the catchment area of the irrigation schemes to be fenced. The communities should provide labour in this regard to complement the funding from the district assembly. The fence is important because it will reduce the destruction of crops by animals, in the interim farmers should be allowed and encouraged by the executives to build fences around their farms.

6. Lack of credit is a major challenge facing farmers. DADU should intensify their effort to organize farmers into groups or cooperatives so that they can access credit

services from financial institutions. Also farmers should be encouraged to save with financial institutions as this can serve as an impetus to enable them access credits from the institutions. The District Assembly should also encourage micro-finance institutions to provide credit to farmers without formal collateral.

7. For successful farming, farmers need farm inputs. The government can help in this direction by subsidizing farm inputs such as fertilizer, improved varieties of seeds, insecticides and pesticides to farmers. Also financial institutions should be encouraged by DADU and the District Assembly to provide farm inputs to farmers as credit instead of physical cash. This will enable them obtain inputs which may not be readily available to farmers in the community.

8. With regards to marketing of farm produce, the district agricultural development unit should train farmers on how to store their produce especially onions which is the dominant crop grown by farmers in the district. This will enable them to get better prices for their produce. Also farmers should form cooperatives to enable them team up and take advantage of the urban-based markets in Bawku and Garu where they can get better prices for their produce. Linked to the marketing problem is the poor road network linking the communities to the major urban centers. Due to the poor road network trucks which can easily serve as a link between the communities and the urban-based markets do not often ply these roads thereby enabling middlemen who have the resources and means to exploit farmers. In this vain the department of feeder roads should come to the aid of the communities by paving and graveling the roads to put them in good conditions, so that trunks can find it convenient to ply those roads.

6.4 Conclusion

The small scale irrigation schemes in the two communities remain the major source of dry season farming. The irrigation schemes are the major source of employment and income for people in the communities. The role of the irrigation schemes in the communities can be observed in the ability of farmers to secure the food requirements of their families. The study revealed that the farming period of farmers in the communities have been extended by 3-4 months. This situation has impacted positively on the communities by helping to close the hunger gap by three months. The presence and use of the irrigation schemes for irrigation farming has also reduced the vulnerability of small scale irrigation farmers since in times of drought the

irrigation schemes serve as the major life wire to cushion the communities against the shocks. Similarly, about 79.5% of farmers earn incomes above GH¢90.00. Some even earn between GH¢500.00 and GH¢1,200.00. The irrigation schemes are therefore important in increasing income and reducing food poverty in the district.

This notwithstanding the irrigation schemes are faced with challenges such as inadequate water in the reservoirs due to unreliable rainfall and human activities around the catchment area of the dams. Broken down infrastructure due to inadequate capital to repair them is another challenge facing the irrigation schemes. These challenges have the tendency to threaten dry season irrigation farming. With regards to management of the schemes WUAs have in their small way done well in the management of the schemes, but due to limited technical know-how and financial constraints they have not been able to adequately maintain and manage the operations of the irrigation schemes. Therefore for small scale management transfer to succeed in the communities there is the need to link farmers to markets and institutions such as technical and financial institutions. Similarly farmers should be provided with support services to ensure that the communities improve upon the management of the small scale irrigation schemes to enable them to be sustainable as well as ensure sustainable dry season irrigation farming, thereby improving the well being of farmers.

REFERENCES

Adams, W. M., Carter, R. C. (1987), *Small-scale irrigation in sub-Saharan Africa.* Progress in Physical Geography.

Awulachew et al. (2005), *Experiences and Opportunities for Promoting Small-scale/Micro Irrigation and Rainwater Harvesting for Food Security in Ethiopia.* Addis Abba. IWMI.

Bembridge, T. J. (2000), *Guidelines for rehabilitation of small-scale farmer irrigation schemes in South Africa,* WRC report Number 891/1/00, Pretoria, SA.

Bening R. B. (1990), *A History of Education in Northern Ghana (1907-1976).* Accra, Ghana University Press.

Buah F. K. (1998), *History of Ghana. Revised Edition.* Macmillan Publishers Limited.

Brundtland, H. (1987), *Our Common Future*, Oxford University Press, for the World Commission on Environment and Development.

Concise Oxford English Dictionary. Oxford University Press

Crandy M. P. (1998), *Qualitative and Action Research (A practitioners hand book).* Phi Delta Kappa Educational Foundation Bloomington, Indiana, U.S.A.

Daft R. L. (2005), *Organisation Theory and Design, International Student Edition.* Thomson/ South Western.

Dellapenna J. W. (2004), *Is Sustainable Development a Serviceable Legal Standard in the Management of Water?* Villanova University School of Law.

Dessalegn Rahmato (1999), *Water Resource Development in Ethiopia: Issues of Sustainability and Participation*. Forum for Social Studies. Addis Ababa.

DFID (2005), *Economic Growth in Northern Ghana.* Draft Report prepared by Overseas Development Institute, London and Centre for Policy Analysis, Accra.

Dillehay et al. (2005), *Preceramic irrigation canals in the Peruvian Ands. Proceedings of the National Academy of Sciences* 102 (47): 17241-4.

Drechsel et al. (2004), *Water for Food in the Cities: The Growing Paradigm of Irrigated (Peri)-Urban Agriculture and its Struggle in Sub-Saharan Africa.* African Water Journal Vol. 1 (2).

Encyclopaedia Britannica, 1911 and 1989 edtitions.

FAO (1998), *Organisation, Operation and Maintenance of Small scale irrigation schemes.* FAO Corporate Document Repository.

FAO (2001), *Smallholder Irrigation Technology: Prospects for Sub-Saharan Africa. International Programme for Technology and Research in Irrigation and Drainag.* Knowledge Synthesis Report #3. Rome.

FAO (2005), *Irrigation Scheme Operation and Maintenance.* FAO, Rome Italy.

FAO (2008), *Water Profile of Ghana.* Food and Agricultural organization.

Frenken, K. (2005), *Irrigation in Africa in figures.* AQUASTAT Survey – 2005, Food and Agriculture Organization of the United Nations,

Garu – Tempane District Assembly Medium-Term Development Plan 2006-2009

Gasteyer Stephen P. (2004), *Building Bridges: Community-Based Social Networks for Sustainable and Secure Water Management.* Rural Community Assistance Program, Inc. Universities council on water resources. Water resources update, issue 127.

Ghana Republic (1992), Constitution of the Republic of Ghana, 1992.

Ghana Statistical Service, (2000), *Ghana Living Standard Survey: Report of the Fourth Round.* Ghana Statistical Service, Accra.

Gleick, P. H. (1998), *Water in crisis: paths to sustainable water use.* Ecological Applications Vol. 8, no. 3.

Hussain M. Hussain Z. Ashfaq M. (2006), *Impact of Small scale Irrigation Schemes on Poverty Alleeviation in Marginal Areas of Punjab, Pakistan.* International Research Journal of Finance and Economics ISSN 1450-2887 Issue 6 (2006) © EuroJournals Publishing, Inc.

IFAD (2000), *The Rural Poor: Survival or a Better Life? The choice between destruction of resources and sustainable development.* IFAD.

IFAD (2007), *Enabling Poor Rural People to Overcome Poverty in Ghana.* International Fund for Agricultural Development.

Inter-America Development Bank (2007), *Integrated Water Resource Management.* IADB.

IUCN (2006), *The Future of Sustainability: Re-thinking Environment and Development in the Twenty-first Century.* Report of the IUCN Renowned Thinkers Meeting. 29-31 January, 2006.

ISSER (2008), *The State of the Ghanaian Economy in 2007.* University of Ghana, Legon,

IUCN/UNEP/WWF (1991). *Caring for the Earth: A Strategy for Sustainable Living.* Gland, Switzerland.

IWMI (2001), *Can poor farmers in South Africa shoulder the burden of irrigation management?* IWMI website document: Retrieved from www.cgiar.org/iwmi/home/IMTSAf.htm on 15/01/09.

Jiggins, J. and Roling, N. (1997) *Action Research in Natural Resource Management. Marginal in the first paradigm, core in the second.* Etudes et Recherches sur Systemes Agraires et le Development.

Joy Wilson (2007), *Guiding Principles for Sustainability: Moving towards Sustainability.* NGSSA.

Klein M.U. and Hadjimichael B. (2003), *The Private Sector in Development: Enterpreneurship, Regulation, and Competitive Disciples.* World Bank, Washington D.C.

Kumar Ranjit (1999), *Research Methodology: A Step by Step Guide for Beginners.* SAGE Publications. London. Thousand Oaks. New Delhi.

Kumekpor T.K.B. (2002), *Research Methods and Techniques of Social Research.* Sonlife Press and Services, Accra.

Lélé S. M. (1991), *"Sustainable development: a critical review,"* World Development 19.

Liu, M. (1994), *Action-research and development dynamics in Systems-Oriented Research in Agriculture and Rural Development.* International Symposium, Montpellier, France.

Medalye Jacqueline (2008), *Water Governance.* Global Water Partnership, Stockholm Sweden.

Mengistu Assefa (2008), *Socio-economic assessment of two small-scale irrigation farming in Adami Tullu Jido Kombolcha Woreda, Central Rifi Valley of Ethiopia.* MSc Thesis in Environmental and Natural Resources. Environmental Economics and Natural Resources Group, Department of Environment Sciences, Ethiopia.

NDPC, (2003), *Ghana Poverty Reduction Strategy, (2003-2005). An Agenda for Growth and Prosperity.*

NDPC, (2005), *Growth and Poverty Reduction Strategy (GPRS II), (2006-2009).*

Perret Sylvain R. (2002), *Water policies and Smallholding Irrigation Schemes in South Africa: A History and New Institutional Challenges.* Journal Water Policy (June 9th 2002).

Perret, S. and Touchain, E. (2002), *A simulation-based approach to assess the economic viability of smallholding irrigation schemes in South Africa.* University of Pretoria, CIRAD-Tera, research report num. 02/02, Pretoria, SA. IWMI.

Perret, S.R. (2002), *Testing scenarios on the viability of smallholding irrigation schemes in South Africa: a participatory and information-based approach.* Working paper: 2002-16 University of Pretoria, CIRAD-Tera, research report num 02/02, Pretoria, SA.

Porritt, J. (2006) *Capitalism as if the world mattered.* Earthscan, London. P.46.
Public Agenda (Accra), 26th, September 2008 Edition

Shields Patricia and Hassan Tajalli (2006), *"Intermediate Theory: The Missing Link in Successful Student Scholarship,"* Journal of Public Affairs Education 12(3): Retrieved from http://ecommons.txstate.edu/polsfacp/39/ on 09/06/09

Siebert et al. (2006), *The Digital Global Map of Irrigation Areas – Development and Validation of MapVersion 4. Tropentag 2006* – Conference on International Agricultural Research for Development.

Simon Maxwell (1999), *The Meaning and Measurement of Poverty.* ODI Poverty Briefing.

Snyder, R. L.; Melo-Abreu, J P. (2005), *Frost protection: fundamentals, practice, and economics – Volume 1,* Food and Agriculture Organization of the United Nations, ISSN: 1684-8241. Retrieved from ftp://ftp.fao.org/docrep/fao/008/y7223e/y7223e00.pdf on 07/02/09.

Swain Ashok (2002), *The Nile River Basin Initiative: Too Many Cooks, Too Little Broth.* SAIS Review. Volume 22, Number 2, Summer Fall 2002.

The History of Technology – Irrigation. Encyclopaedia Britannica, 1994 edition.

Todaro P. M. and Smith S. (2003), *Economic Development in the Third World.* Eighth Edition. Pearson Education Limited, England.

Twumasi P. A. (2001), *Social Research in Rural Communities.* Second Edition. Ghana University Press, Accra.

UNDP (2004), *Dollar a day: how much does it say?* International Poverty Center. In Focus.

UNDP (2006), *What is Poverty? Concepts and Measures.* International Poverty Center. In Focus.

WHO (2005), World Summit Outcome Document. World Health Organization.

Williams et al. (2006), *"Managing Water for Weed Control in Rice".* UC Davis, Department of Plant Science. Retrieved from http//www.plantsciences.ucdavis.edu/uccric/water/water.htm on 15/01/09.

World Bank (2003), *Second Urban Research Symposium of the World Bank on Urban Development for Economic Growth and Poverty Reduction.* Washington, D.C.

Wright Patrick M. and Noe Raymond A. (1996), *Management of Organizations.* McGraw-Hill.

Yates et al. (2008), *The Practice of Statistics, 3rd Ed.* Freeman. ISBN 978-0-7167-7309-2.

Yilma Seleshi (2003), *Community based small scale irrigation types and importance in poverty alleviation.* Hydrologist Department of Civil Engineering Faculty of Technology Addis Ababa University May 2003, ILRI, Addis Ababa.

Yilma E.W. and Donkor S.M.K. (1998), *Integrated Water Resources Management in Africa. Issues and Options.* UNECA. Addis Ababa.

Yohannes Aberra (2004), *Problems of the Solution: Intervention into Small-Scale Irrigation for Drought Proofing in the Mekele Plateau of Northern Ethiopia.* Journal article by; The Geographical Journal, Vol. 170.

APPENDICES

APPENDIX 1: PICTURES DEPICTING CHALLENGES IN THE IRRIGATION SCHEMES

Picture 1: A dug-out for storing water at the Bugri Irrigation Scheme

Picture 2: Water being drawn from a dug-out to irrigate crops at the Bugri Irrigation Scheme

Picture 3: Collapsed spillway in the Gagbiri Irrigation Scheme

Picture 4: Canal with broken slabs in Gagbiri Irrigation Scheme

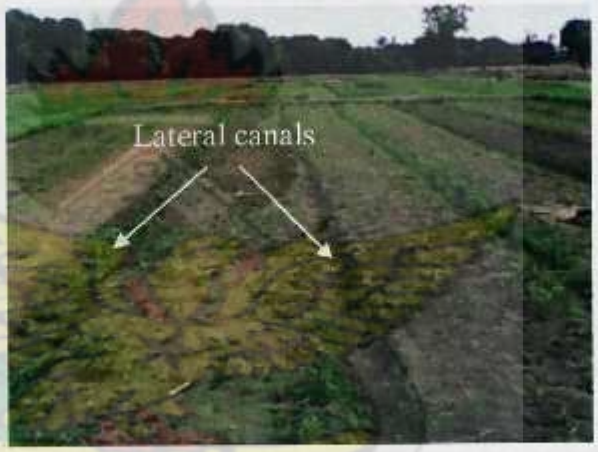
Picture 5: Choked canal in Bugri Irrigation Scheme

APPENDIX 2: FARMING ACTIVITIES IN THE IRRIGATION SCHEMES

Picture 6: A woman weeding in Bugri Irrigation fields

Picture 7: Vegetable ready for harvest in Bugri Irrigation fields

Picture 8: A woman using perforated gourd as watering can to irrigate crops in Bugri irrigation fields



Picture 9: Harvested field showing trenches which serve as lateral canals in Gagbiri Irrigation fields

Appendix 3

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QUESTIONNAIRE FOR FARMERS

Name of Community.....

SOCIO-DEMOGRAPHIC CHARACTERISTICS OF RESPONDENTS

1. Name of Respondent	2. Household Members (Name and Relationship)	4. Sex a. male b. female	4. Age (Yrs)	5. Religion a. Christian b. Islam c. Traditional d. Others (Specify)	6. Marital status a. Married b. Single d. Divorced e. Widowed	7. Educational Attainment	8. place of origin

FARMING AND POVERTY RELATED ISSUES

1. When was the dam constructed?.....

2. Who constructed the dam?.....
3. Why was it constructed?.....
4. When did you start irrigation farming?.....
5. How many hectares of land do you cultivate?.....
6. By how many months has the irrigation scheme extended your farming season?.....
7. What are the crops you grow?.....
8. What is your yield for this season?.....
9. For what purpose do you use the crop you produce under irrigation? a. Home consumption only [ ] b. Market purpose only [ ] c. Both [ ]
10. How much did you make from the sale of your produce?.....
11. How has the income from your produce been of benefit to your family?

.....

.....

.....

.....

.....

12. What other things do you use the income for?

.....

.....

.....

13. In your opinion how do you judge the contribution of the irrigation scheme to your household food security? .....
14. For what other purposes do you use the dam's water? a. For domestic use [ ] b. For livestock watering [ ] c. Only for irrigation [ ] d. Others, specify.....
15. Do you engage in any other occupation? a. Yes [ ] b. No [ ]
16. If yes, what occupation?.....
17. How does the occupation help in your farming activities and vice versa?

.....

.....

.....

18. Do you obtain the right amount of water for your farming activities all the time? a. Yes [ ] b.No [ ]

19. If no, how does it affect your farming?

.....

.....

.....

.....

20. Do you make any payment for using the water for irrigation? a. Yes [ ] b. No [ ]

21. If yes how much do you pay?.....

22. How often do you pay? a. Monthly [ ] b. Quarterly [ ] c. Yearly [ ]

23. Do you have any outstanding fees? a. Yes [ ] b. No [ ]

24. If yes what is the reason?.....

25. Who determines the fees you pay?.....

26. Do you get extension service from DADU? a. Yes [ ] b. No [ ]

27. Do you get credit services? a. Yes [ ] b. No [ ]

28. If yes from which organization and how much?.....

29. Is the credit sufficient? a. Yes [ ] b. [ ]

30. Do you need additional training on irrigation practices? a. Yes [ ] b. No [ ]

31. If yes what type of training?.....

32. What are the problems you face with regards to using the irrigation scheme?

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.....

.....

.....

33. Suggest ways to overcome problems enumerated in 32 above?

.....

.....

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34. In your opinion what is poverty?

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.....

35. What are the symptoms of poverty in your opinion?

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.....

.....

36. In your opinion what are the indicators or who will you classify as wealthy?

.....

.....

.....

MANAGEMENT ISSUES

1. Who are those in charge of managing the irrigation scheme?.....
2. How are they elected or chosen? a. Nominated by the chief and opinion leaders [ ] b. Elected by the water users [ ] c. Others, specify.....
3. Who makes decision on the distribution or sequence of water use in the scheme? a. Water user association executives [ ] b. Based on agreement between the water users c. Others, specify.....
4. How do you rank the internal organization of the irrigation scheme (in terms of canal cleaning and repairs, water distribution and revenue mobilization) a. Well organized [ ] b. Fairly organized [ ] c. Poorly organized [ ]
5. If the internal organization is poor or fair in your irrigation scheme, what do you think are the causes? (Tick multiple responses if any). a. poor coordination of maintenance activities by WUA committee [ ] b. poor imposition of sanctions on defaulters [ ] c. low level of members participation in maintenance activities [ ] d. cost of maintenance is high [ ] e. others, specify.....
6. In your opinion what are the major problems facing the scheme?

   .....

   .....

   .....

   .....
7. Do you take part in maintenance activities at scheme? a. Yes [ ] b. No [ ]
8. If yes what activities have you undertaken?

.....

.....

.....

9. Have you faced any conflicts with neighbouring farmers because of using irrigation water? a. yes [ ] b. No [ ]
10. If yes what were the cause of the conflict?

.....

.....

.....

11. What measures were taken to resolve the conflicts?

.....

....

12. What interventions in your opinion would help in improving the management of the irrigation scheme?

THANK YOU VERY MUCH FOR YOUR ATTENTION

Appendix 4

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INTERVIEW GUIDE FOR EXECUTIVES OF WATER USER ASSOCIATION

1. For how long has the association been in existence?
2. How does one qualify to be a member of the association?
3. What is the membership strength?
4. What are the functions of the association?
5. Who constructed the irrigation scheme?
6. Did the community contribute in the construction and rehabilitation of the dam?
7. What was the form of the contribution?
8. What mechanism does the association employ to distribute land?
9. Do you face any problem in land distribution?
10. If yes enumerate them and the mechanism adopted to solve the problem.
11. How is water distributed to the farmers?
12. Is the water enough to support your farming activities?
13. If not enough, how do you ensure that every farmer gets water?
14. How much do you charge for water use and who determines the fees?
15. Are the fees enough to support the management activities of the association?
16. What measures have been put in place to ensure regular payment.
17. How often do you carry maintenance activities in the scheme?
18. What maintenance works do you carry out?
19. Does the association get external assistance to help in the maintenance of the irrigation scheme?
20. If yes what is the nature of the assistance?
21. Do you have any conflicts among farmers?
22. What are the causes of the conflicts and how do resolve such disputes?
23. What are the problems you face in managing the scheme and what support do you need most?
24. What measures has the association put in place to overcome these problems?
25. What are the benefits of the scheme to the community?

THANK YOU VERY MUCH

Appendix 5

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INTERVIEW GUIDE FOR IRRIGATION DEVELOPMENT AUTHORITY (IDA)

1. Is the Bugri and Gagbiri irrigation schemes under the supervision of the IDA?
2. Who constructed the dams?
3. When were the schemes constructed?
4. Did the IDA take part in the construction of the irrigation schemes?
5. If yes what was the role of the IDA in construction?
6. Did the communities take part in the construction of the irrigation schemes?
7. What was their contribution?
8. What are the capacities of these two irrigation schemes?
9. What are the total irrigable areas of the irrigation schemes?
10. What are the methods of irrigation in these schemes? Is the method water efficient?
11. What is the collaboration between the IDA and the communities?
12. Do you take part in the management of the irrigation schemes?
13. If yes what management activities do you undertake?
14. What are the problems facing the irrigation schemes in the district?
15. What suggestions will you put forward to address these problems?

THANK YOU

Appendix 6

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INTERVIEW GUIDE DISTRICT AGRICULTURAL DEVELOPMENT UNIT (DADU)

1. How many small scale irrigation schemes are in the Garu-Tempane District.
2. When were the Bugri and Gagbiri irrigation schemes constructed and rehabilitated?
3. What was the role of DADU in the construction and rehabilitation of the irrigation schemes?
4. What was the role of the community in the construction and rehabilitation of the irrigation schemes?
5. Who financed the construction and rehabilitation of the irrigation schemes?
6. Who owns and manages the irrigation schemes
7. Does DADU take part or assist in the management of the irrigation schemes?
8. If yes what management functions do you play?
9. What support services do DADU provide for the farmers and the water user association?
10. Are the support services enough?
11. If no what measures have been put in place to ensure that the farmers get enough support services?
12. In the opinion of DADU what are the challenges facing the irrigation schemes as well as the farmers in the irrigation schemes?

THANK YOU FOR YOUR ATTENTION

Appendix 7

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CHECKLIST FOR FOCUS GROUP DISCUSSION

1. When was the irrigation scheme constructed?
2. Who owns the irrigation scheme?
3. Who are charge of managing the irrigation scheme?
4. What role do you play in the management of the scheme?
5. What are the problems with regards to the management schemein terms of operation and maintenance? Suggest solutions to overcome the challenges.
6. What is the prevailing land tenure system in the community?
7. Do you have any problem with the allocation of land and distribution of water?
8. Enumerate the problems.
9. What are the causes of conflicts in relation to the use of the irrigation scheme?
10. How were these conflicts resolved?
11. What are the major crops grown in the irrigation scheme?
12. What are the major problems you face in using the scheme for dry season irrigation farming?
13. What is the contribution of irrigated crop production in facilitating household access to food and different social services (Health care, input supply, school. Veterinary services among others).

THANK YOU FOR YOUR COOPERATION