UNIVERSITY FOR DEVELOPMENT STUDIES, TAMALE

# IMPACTS OF SMALL SCALE IRRIGATION ON FOOD SECURITY AND RURAL LIVELIHOODS EMPOWERMENT IN LAWRA MUNICIPALITY



BY

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# DECLARATION

## CANDIDATE'S DECLARATION

I hereby declare that this thesis is the results of my own original works and that no part of it has been presented for another degree in this university or elsewhere.

The works of other authors in this work have been duly acknowledged by complex references.

Candidate's

Signature……Date……

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## SUPERVISOR'S DECLARATION

I hereby declare that the preparation and presentation of the thesis were supervised in accordance with the guidelines on supervision of dissertation laid down by the University for Development Studies.

REV. DR. AFRED B. KPIETA ..... .....

DATE


## ABSTRACT

The study examines the impact of irrigation on farmer's livelihoods in the Lawra Municipality of the Upper West Region. A multi-stage sampling was used to obtain a sample of 84 irrigated farmers and 54 non irrigated farmers. The Z- Shape technique on yield plots and farm budget were used to analyze the food security situation and impact of schemes on farmer's livelihoods. The study identified four major types of irrigation (surface irrigation, drip irrigation, sprinkler irrigation and culvert diversion). It was established that farmers with irrigation facilities are food secured. Large household size or labour engagement, access to credit, access to ready market, access to extension services, tend to increase farmers involvement in irrigation schemes. Irrigation schemes create employment and serve as a source of income to households, as well as a source of revenue to the Lawra Municipal Assembly. It was further revealed that irrigation schemes contribute to increase yields, reduce youth out-migration and ensure diversification of assets hence, livelihood empowerment. Poorly developed irrigation facilities, limited access to credit, low extension services are some of the challenges facing irrigation farmers. The study recommends repair of breached dams, training of extension staff on irrigation management, supplies of irrigation logistics such as drip lines and pumping machines and improve markets infrastructure.

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## DEDICATION

This work is dedicated to my late parents, Alhaji Ibrahim Erasung and Hajia Hawawu Mugtar. May their souls rest in peace.



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## LIST OF ACRONYMS/ABBREVIATIONS

| | |
|---|---|
| ASSER | Adaptation at Scale in Semi- Arid Regions |
| ATA | Agricultural Transformation Agency |
| DFID | Department for International Development |
| IMF | International Monetary fund |
| GDP | Gross Domestic Product |
| FASDEP | Food and Agricultural Sector Development Plan |
| FAO | Food and Agricultural Organization |
| GIDA | Ghana Irrigation Development Authority |
| GPRSI | Growth and Poverty Reduction Strategy |
| GPS | Geographical Positioning System |
| GSS | Ghana Statistical Service |
| IFAD | International Fund for Agriculture |
| IWMI | International Water Management Initiative |
| MTADP | Medium Term Agricultural Development |

| | |
|---|---|
| | Programme |
| MOFA | Ministry of Food and Agriculture |
| NGO | Non-Governmental Organization |
| NRGP | Northern Rural Growth Programme |
| UWADEP | Upper West Agricultural Development Programme |
| WUA | Water Users Association |
| WFP | World Food Programme |
| RESULT | Resilience Sustainable Livelihoods Transformation |
| SARI | Savannah Agricultural Research Institute |
| SRID | Statistical Research and Information Department |
| SPSS | Statistical Package and Service Solutions |
| UNDP | United Nations Development Programme |

# CHAPTER ONE

# INTRODUCTION

## 1.1 Background of the Study

Globally, there is a steady increase in the world population that requires equivalent level of food production, making it paramount to increase agricultural production to meet the increasing demands for food (Dejen, 2014). The Agriculture sector is responsible for providing the food needs of the population (IFAD, 2014). According to Food and Agricultural Organization (2012), to meet the increasing demand for food by 2050, the world agricultural production would have to be increased by 60 percent in order to meet the over 7 billion and increasing population of the world.

Agriculture in third world countries depend greatly on rainfall. Rain -fed agriculture contributes 40 percent of global harvest of which 20 percent of it goes into croplands with no water conservation methods. This results in about 60 percent of fresh water to waste as run offs. Considering the challenges faced by developing countries in the agricultural sector, there is the need to transform the sector (Apam, 2012). Irrigation development is seen as a dynamic tool that can quickly transform the agricultural sector in these countries (Kpieta *et al*., 2013). Various strategies have been put in place by Governments, NGOs and Civil Society Organizations towards irrigation development in these countries.

In Ghana, the Government of Ghana has put in place several strategies to promote the development of irrigation towards eradication of poverty and empowering the livelihood of rural dwellers. Some of these policies include the National Irrigation Policy, Ghana Poverty Reduction Strategy (GPRSI) and the Growth and Poverty

Reduction Strategy (2002-2004), Modernization of Agriculture, The Medium Term Agricultural Development Programme, The Accelerated Agricultural Growth and Development Strategy and the Food and Agricultural Sector Development Policy (CSA, 2007). These aim at shifting from subsistence farming to mechanised, commercially viable large scale farming.

In the Upper West Region, researchers such as (Kpieta *et al*., 2013: Peprah *et al*., 2015) have given several accounts on the contribution of irrigation development to rural livelihood empowerment. For instance, Kpieta *et al*., (2013) pinpoint from their empirical study that the government has constructed numerous dams and dugouts in the North Western part of Ghana and this has significantly contributed to lessening poverty in these localities. Among communities that benefited from these dams and dugouts includes Sankana, Baleifelee, Siiru, Tanina and Dafiama. According to Monnah, (2001) irrigation development does not only benefit men but also women have access to own farm lands.



Irrigation technology is the surest way to improving rural livelihoods (Gebregziabher *et al*., 2009). The Lawra Municipality is endowed with several irrigation facilities including dams and dug-outs. Assessing the effects of these irrigational facilities on the livelihood of the people is paramount.

**1.2 Problem Statement**

The Agricultural sector remains the food source of the Ghanaian citizenry.it contribute greater percentage to the national GDP since independence but has recently been over taken by the service sector with (56.6%) as against (19.0%) in 2017(GSS, 2017). In the Upper West Region, 90% of the populations are employed in the Agricultural sector (Inkoom and Nanguo, 2011). However, output from the

agricultural sector continue to fall due to factors such as pests and diseases, smuggling of fertilizers, inadequate credit, low technology adaptation and erratic rainfall pattern (Todaro and Smith, (2010; Bashiru, 2013).

Governments and other stakeholders have put in place measures aimed at mitigating these challenges, with irrigation development identified as the surest way of addressing low farm output in the Upper West Region (Daniel, 2014). Empirical studies (e.g. Preprah et al., 2015, Kpieta et al., 2013) on the role of irrigation agriculture on livelihood argued that most small scale dams and dugouts in the Upper West Region were not developed to address the irrigational needs of the people. Small scale dams and dugouts that were developed are underutilized (Peprah et al., 2015).

The Lawra Municipality has benefited from the construction of several small scale dams and dugouts. This notwithstanding, the impact of these dams on agriculture development and livelihood empowerment remains unknown. It is against this background that the study was conducted in the Lawra Municipality to assess the impact of irrigation facilities on the livelihood of the people. The following research questions are therefore asked.



### 1.3 Main Research Question

What are the effects of irrigation on the livelihood of farmers in Lawra Municipality?

### Specific Research Questions

1. What are the types of irrigation schemes practice in the Lawra Municipality?
2. How is irrigation influencing food security in Lawra Municipality?
3. What are the challenges affecting the irrigation farming in Lawra Municipality?
4. How is irrigation impacting on households in Lawra Municipality?

### 1.3 Research Objectives

The main objective of this study is assess the impact of the irrigation on the livelihood of farmers in the Lawra Municipality.

1. To examine the type of irrigation system practiced in Lawra Municipality.
2. To examine the role of irrigation on food security in Lawra Municipality.
3. To assess the challenges facing irrigation farmers in Lawra Municipality.
4. To determine the impact of irrigation on farm households in Lawra Municipality.

### 1.4 Significance of the study

There is high demand for irrigation facilities in the Lawra Municipality to supplement the erratic rainfall pattern that leads to low output in the Municipality. Examining the impact of irrigation technology as a dynamic tool to modernizing agriculture is relevant. The result of the study sets a path for further discussions on the irrigation technology toward increasing agricultural production.



Secondly, the study is relevant in the sense that it provides valid data to institutions that are interested in water resource development toward poverty reduction, food security and general livelihoods empowerment. The study therefore seeks to assess the impact or contribution of irrigation technology on the livelihoods of farmers.

The study results may serve as empirical evidence on the synergy on irrigation technology, poverty reduction that will inform decisions to develop agriculture, and also as bases for further expansion and investments in to irrigation technology in the Lawra Municipality.

The study document may serve as reference report for Government and Non-governmental Organizations that are interested in developing Agriculture through water resource development and also as an input to policy makers concerned in water resource development in the Savannah on the ways to improving irrigation technology contribution to food security, employment and sustainable income generation. This is important due to the findings of Kpieta *et al.* (2013), Peprah *et al*. (2015). They suggest in their various studies that irrigation facilities in the Upper West Region are underutilized and this does not meet the needs of rural famers in fighting poverty and livelihood empowerment.



### 1.5 Scope of the Study

Lawra Municipality is the study area in the Upper West Region within which the study will be conducted focusing on selected communities that practice irrigation and those that do not practice irrigation. These communities include Mettor, Dikpe, Ko and Brewong, Tollibre, Koro respectively. Due to the limited funds and time of the study, it is to access the contribution of small scale irrigation as a tool to rural livelihood empowerment in the lawra Municipality. These communities are therefore selected for this comparative study due to the strategic location of the Municipality along the Black Volta catchment drain area (Apam, 2012).

Intensive review of relevant secondary data was carried out covering the entire Municipality especially yield records per crop for the Municipality by contacting the Department of Agriculture in the Municipality and the Ghana Irrigation development authority for the water resources availability in the Municipality. The areas of focus includes the type of irrigation practice, cropping intensity, productivity levels, food

security situations, household income levels, access to credit, and labour engagement among farmers with irrigations and farmers without irrigation.

The study has a timeframe of one year from 2017 to 2018 with data collection covering 2015 to 2017 crop season and concerns itself with the micro–level influences that are noticed at farm gates, households and local immediate environment.

### 1.6 Limitations of the Study

The study encountered a number of challenges such as inadequate finance to seek the services of research assistants to help pick farm data, Bad satellite signals in some areas of the study communities for GPS Data collection makes them visit the same venue more than once for the same data. Farmers experience with NGOs on payment of time spent has made getting information difficult from farmers and thereby increasing budget on data collection. Language barriers especially translation, Synonyms between Waali and Central Dagaree were also time consuming especially on names of crops. For instance Groundnut as" Jinee" in Waali is Sinkaa in Dagaare but is "Singbele" in 'lusalee' –a dialect of Dagaare spoken by the people of Lawra Municipality. Finally, Community entry processes are time consuming as chiefs or traditional authorities require answers to the motives in the selection of their locality and access to respondents and their fields for data collection.



### 1.7 Organization of the work

The study is organized into five chapters.

Chapter1; Background of the study, which includes the statement of the problem, the objectives, Purpose of the study, limitations of the study and scope of the work.

Chapter 2; Literature review and conceptual framework which includes accesses relevant existing works on related studies such as livelihoods, food security, Climate Change, poverty and their related causes and effects.

Chapter 3; Consist of the context of the study (Community Profile) and the research Methodology. Chapter 4; Data analyses and Presentation. Chapter 5; Summary, Conclusions and Recommendation.



# CHAPTER TWO

# LITERATURE REVIEW AND CONCEPTUAL FRAMEWORK

## 2.1 Introduction

This chapter reviews relevant existing literature on related studies on irrigation and its related impacts on livelihood in order to make a blend of studies and to identify the differences in the presentation of ideas on the subject matter that requires filling in. A number of studies have been considered regarding small irrigation and its impacts on rural livelihood empowerment, the concept of small scale irrigation, food security, poverty, climate change and livelihood empowerment in rural areas. Other sections of this chapter deal with analysis of theoretical review of previous studies so as to identify the appropriate methods of analyzing data.



## 2.2 Definition of Concepts

### 2.2.1 Concept of Livelihood

According to Apam (2012), livelihood is the availability of assets and resources that are jointly used to make ends meet. He stressed that livelihood includes capabilities (material and resources) and activities that support living. It is the acquisition of assets and activities influenced by once Gender, class, kin, and belief systems and institution (Allis, 2000). This means that livelihood encompasses the use of resources or assets and activities to attain ones basic needs. These views are strongly backed by Apam (2012), livelihood is exposure to contingencies, difficulties and stress in coping with them.

Majority of rural people depend on the environment as their only assets (Boyd and Turton, 2000). The assets in the focus of this study are irrigation facilities and how

they support rural livelihoods. Things that people do to support life or generate revenue are described as livelihood strategies. Livelihood strategies include activities that generate financial asserts, provides means of household survival and has the potential to affect the environment and culture (Asuming-Boamping *et al*., 2005). They pinpoint in their study that the level of assets possessed by an individual is equivalent to the levels of risk associated in terms of resistance and threats. The assets in this study are irrigation facilities, assess to irrigated land, labour and services rendered by institutions and agencies.



Sustainable livelihoods in a community requires the combined use of asserts and resources in a strategy to construct the means of living (Mumin, 2017). Livelihood strategies are the structures, process that people undertake upon certain impacts resulting in livelihood outcomes. These may include social, human, physical, financial and natural assets that people owe and use to make do with living within a group or a community as a livelihood. This forms a livelihood group that shares similar assets and resources to gain their living through different activities to assist themselves. This is better explained by the livelihood capitals such as Human capital which includes: Health, nutrition, Education, capacity to work, capacity to adopt. Natural capital includes: Land, water resources, trees and forest, Environmental services, Biodiversity wildlife, and wild food and fibre. Social capital includes: kinship, leadership, rules and sanctions, formal and informal groups. Financial capitals include: Credit and debts, savings, pension and Remittances. Physical capitals include: transport (Roads and Vehicles), secure shelter and building, Energy, water supply and sanitation, communication, tools and technology.

Poor people are able to adapt to different capital needs in order to make a living. These mixed livelihood assets are achieved through diversification of assets to create a balance. The use of strategies to create a balance results in sustainability in order to promote and protect natural resources as advocated through the sustainable millennium goals (DFID, 1998; .1).

### 2.2.2 Types of Risk in Agricultural Value Chain

Risk is how sudden, fast and regular a condition of loss will occur or the rate of probability of loss. Five types of risk are identified which include production risk, credit risk, income risk, trade market risk and labour risk (Home, 2014). A production risk occurs when the likelihood of production loss is due to floods, drought, pest insects' attacks and diseases. Credit risk is where there is the likelihood of not able to service credit facility by farmers, wrong timing of loans received, and high interest rates from the Banks, Income risk occurs during fluctuations in output and price among others in year to year resulting in dominance of rain fed agriculture and impacts of climate variability (Asuming-Boampong, 2012). Trade and Market risks occur due to conflicts in locations that stop movement of imports and exports. Poor storage structures, poor roads infrastructure. Finally Labour risk is where farm labour is abundant or scarce during the peak of the season (Farrington, Slater and Homes, 2004). Risk and uncertainty can results in loss of welfare (Cahn, 2003). An individual is bound to possess one of these risks. A person who does not like to take risk is called risks avert; the one that love taking risk is risk loving within the production levels. A risk loving person is therefore able to increase his or her assets by the mere taking of risk to enhance his or her livelihoods, Making him or her vulnerable and loss of livelihoods (Home, 2014).



Society therefore has the responsibility to provide for the vulnerable that are food insecure. This may be due to the unfavorable shifts in exchange entitlement mapping of resources coursing a reduction in food sufficiency. The failure of entitlement by vulnerable groups had to do with the amount, severity and the magnitude of risk experienced since their endowment is rooted in entitlements. The magnitude and range of food insecurity among vulnerable groups is mostly from chronic and transitory food insecurities (Paul *et al.*, 2013). The ability of households to save, diversify to other sectors such as from farming to petty trading turns to create a different employment to the family. It opens way for further investments and generation of incomes, hence investments is able to reduce the rate of household frequencies to famine. It simply indicates the ability of households to produce surplus over and above their basic food requirements, the excess resources are diverted to assets for the household. These assets enable household's members to draw services during crisis (Bashiru, 2013).



Apart from availability of food and access, time is also a factor to consider in the analyses of risk and food security. Time is able to explain the nature of food insecurity and risks that are associated to individuals in the society. Chronic food insecurity is the continuous inability of obtaining food sufficiency making them at high risk in nature while transitory defines the moment of famines that a family faces due to uncertainties that are not regular. Such as foods insufficiency and drought that are temporal and less risky but requires emergency supplies to overcome the situation. Transitory is further divided in to cyclical food insecurity that occurs regular, periodic pattern of food insecurity within the society while temporal food insecurity occurs for a limited period of time (Gadisa, 2013).

### 2.2.3 Sustainable livelihood Framework (SLF)

Sustainable livelihood approach is postulated by DFID (1999). It shows the important aspects of sustainable livelihoods in rural empowerment using the available resources in reducing poverty. Issues of resource entitlements especially natural resource ownership is a positive step towards reducing poverty (Leach *et al*.1999). Livelihood includes capabilities and assets used together to make ends meet (Amaltirc, 1998).

Sustainable livelihood was first conceived by the Brudtland commission on environment and Development expanded by the 1992 United Nations Conference on Environment and Development with emphasis on achievement of sustainable livelihood as a goal for poverty reduction (Carney, 1998). Researchers such as (Scoone, 1998: Bebbininggton, 1998) contributed to the definition of sustainable livelihood when it had to cope with stress and shocks and also provide opportunities for the next generations.



Chamber and Conway (1992) also contributed to the definition of sustainable livelihood as potentials of assets such as stores, resources, claims, access and activities that are used together to make ends meet.

From the various definitions of sustainable livelihood the following are given better understanding in figure 2.1

- Vulnerability context- Causes of people vulnerability
- Livelihood resources and Assets- What people have and have to access
- Livelihood strategies- What people do?
- Livelihood outcomes- Goals people pursue
- Policies, institutions and processes-Governance environment (DFID, 1999;1).

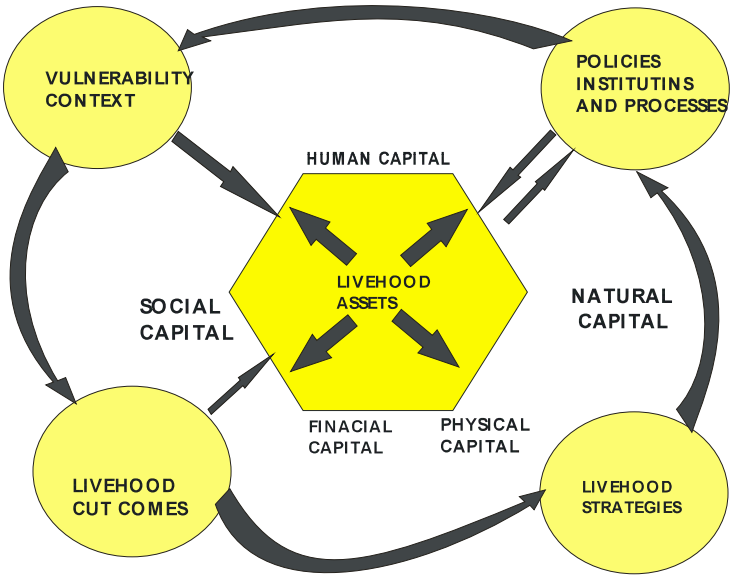



**Figure 2.1 linkages on five capital levels**

**Source: Adapted from MuminS, (2017)**

### 2.2.4 Climate Change, Vulnerability and Resilience

#### 2.2.5.1 Climate Change

Livelihoods of farmers in most rural areas are threatened by climate change effects. These effects are considered major barriers to agricultural production and general food security in the world. In Ghana agriculture provides livelihoods to over 90% of the working labour making climate change menace a crucial matter for discussion in terms of food security and poverty reduction in Africa especially Ghana (Kaur, 2017).

Increase in population, innovations, technological advancement and development infrastructure leads to invasion of natural capitals such as land and water tend to affect agricultural production (Kumar and Shama, 2013). These invasion of natural capitals tend to generate greenhouse gases at high concentration within the atmosphere leading to increase in precipitation and heat and floods. These have the tendency to

course havoc to man in his habitat and general destruction leading to poverty and increase food insecurity situations within the environment (Tripathi, 2014). Climate change presence tend to destroy biotic and abiotic factors to extinction leading to malnutrition and poverty. (Troy et al., 2015).

Agriculture is the sector with that is engaged in the food production but this sector contribution has been insignificant. This is due to climate effects such as drought, floods, earth quakes and other natural and human activities.it leads to growing pressure on limited lands for crop production, multiple uses of land, general land degradation activities such as sand winning and deforestation of woodland due to increasing population levels coupled with bad government policies (Kaur, 2017).

The indicators of vulnerability in rural communities includes the lack of care for women and children as they suffer much in such situations since they cannot cope with the situation for a very long time. Issues of malnutrition are the first to manifest in most rural areas as food is a basic necessity and indicates the level of poverty or vulnerability unlike in the urban areas (Reddy, 2016).



**2.2.5.2 Vulnerability and Resilience**

According to Devereux (2001), threat exposes vulnerability of communities. Threat has the ability to destroy livelihoods of rural farmers. This makes farmers vulnerable as they suffer to make ends meet due to the shocks they experienced. Shocks such as drought, floods, and adverse government policies tend to make individuals vulnerable. However the capacity of these individuals to cope with these challenges make them resilient therefore has to do with the capacity of people and communities to resist, cope and recover from disasters or conflicts (Asumining-Boamping *et al.*, 2005).

Some coping strategies are not damaging to livelihoods and are easily reversible while others are damaging and have to be reversed. For instances short term migration of people during dry season in the north to cocoa areas allow them to be engaged in meaning work, child labour in farms leads to permanent withdrawal from school among households, hence high illiteracy levels respectively (Mumin, 2017).These coping strategies are as a result of the shocks, risk people experienced leading to adaptation of these strategies. Shocks are simply the environmental disasters people face that they were not prepared for while risks are the exposers that live with people making them vulnerable and of which they cannot do anything without, hence the need for external support. Adaptation strategies is therefore the basic steps individuals or society takes to reduce vulnerabilities of people affected (Scoone, 1998).



### 2.2.6 Livelihood Support

These are supports given to people or communities confronted with difficulties and these include replace livelihood asserts, restoring livelihood activities, strengthen livelihoods and diversify livelihoods Projects. These are carried out under three stages namely early recovery, and development geared towards poverty reduction and to ensure general rural food security situations They are also called livelihood assistance with focus on what, why, when and how answers to the support livelihoods and food security (Cahn, 2003).The assets in this study are the irrigation facility and access to land, labour, services and agencies. These are used together to reduce or alleviate poverty and ensure rural livelihood empowerment through food security.

### 2.2.7 Concept of Food Security

According to Gadisa, (2016) food security occurs when people at all time in any particular period are able to obtain sufficient food for their consumption to improve their dietary need, production and their general health conditions. He further states that the provision of emergency food supplies, scavenging, stealing and other coping strategies in a particular environment are basic features of the insecurity features one should note. According Paul *et al*., (2013) food security include the minimum availability of nutritional food free from infections that can cause diseases and can assure the consumer of acquiring acceptable food in a society without the need for emergency assistances. The most influential definition of food security is that of Result, (2016) the ability of people to acquire sufficient food at all times to improving their active healthy life. This definition is to ensure production of food taking in to consideration its availability: people must be able to get food at any time within their environment for consumption. Food accessibility in these communities: people should be able to sustain themselves with the amount of food available in their environment for their basic survival. To reduce the effects of food security, warning signals or indicators such Food production, distribution and consumption must be monitored consciously.

Food production has to do with the presence of the right amount of food for consumption within the family, District and the Regional levels. Food distribution deals with the access to individual of all food produced within their social certain. Consumption has to deal with people food dietary needs or satisfaction by the available food within the environment that are free from restriction to make individuals active and healthy. This requirement must also be very sustainable in

nature. The basic implications of these definitions are the focus on households and how they ensure sustainable food security. It encompasses how households produce their food, storage of this food, process and preserve the food to overcome shortages aim at reducing the number of coping strategies. But the major components of food security sustainability in households includes three essentials components, namely (1) Food Availability in the household: the sufficiency nature of the food at all time, (2) Quality of the food available for the household or access to the food (3) Food Utilization in the households including the type of food and diversity of the diet (WFP, 2015).



Food security is a synergy of a number of factors that range from micro, macro and meso levels. It has to do also with policy and programs development in all sectors of the food system, hence the attainment of sufficient production, distribution and access to this food, plays an important role in the attainment of national food security situation of any nation (Monnah, 2013). He further indicates that the need to care for the vulnerable in society by households is so important since it determines the health of the household. A farming households can save, educate themselves, diversify their business if such households could reduce the rate at which they spend on health of members of the household (Bashiru, 2013).

Food insecurity situations occur when people do not have enough food at all the time in their living environment and turn to adopt coping strategies to overcome the stress and shocks. These situations could vary from within regions and among regions in countries. For instance Ghana experienced famine in the early 1980s making farmers not to have enough to eat and sell due to serious levels of droughts. For this reason, there is the need to tackle the issue of food insecurity with the urgency it deserves by

ensuring that households have enough for their immediate use using other alternative access to water(Gadisa, 2016).

According to Dittoh *et al.*, (2013) there are four aspects of "enough food "the analysis is focused on an individual not the household which is the total sum of the individuals. Secondly, the focus also is on food as in calories not as in protein, and other micronutrients, food quality and safety. This is because if the caloric satisfaction is rich, then all things are satisfactorily in place yet the measurement of caloric intake for different people is difficult within a population. Thirdly the definitions are not based on just needs for survival but for the active healthy life and finally access not just for shortfalls but its gravity.



Access to the food is also another very important factor to consider on "food entitlement" (Amartya, 1981). He stress that an individual ownership of food is rooted from the resources used in production and trade. Indicating the ability of the individual to acquire sufficient food through the production of a commodity for consumption or for trade. Being without a commodity makes an individual go without food. He has agreed that food access remains a key issue in food security. According Gadisa, (2013) investment creates wealth for ownership by individuals. Farmers owe their food crops and sales from these crops give incomes for other investments that they can own themselves. This investment becomes their support in times of disasters such as drought leading to famine. Other households through investments also purchase asserts for their future use such as training of medical doctor using proceeds from the farm. Such families have asserts more than farm households that do not invest, hence poses few assert at their disposal.

Food security is achieved from availability and access to as mentioned above, Security builds on vulnerability of entitlements failure, focusing on risk. Risk and its avoidances are very important to food security that holds the two pillars of food availability and food access. Time is the last most important concept of secure accesses to enough food at all the times. It differentiates between chronic and transitory food securities. Chronic food insecurity means households are continually unable to meet their food needs all the time while transitory is focused on the intra and inter-annual changes in households' food access. Transitory food insecurity is further classified in to cyclical and seasonal food insecurities: cyclical or seasonal means continues or regular pattern of occurrences of food insecurities while temporal food insecurity occurs due to unforeseen events or uncertainties such as drought (Gadisa, 2013).



Food security is therefore a general concept that encompasses a number of important factors, issues and magnitudes ranging from macro to micro levels through the attainment of policies and development programmes for its success. It is also a fact to identify the indicators of foods security among households to better get a grip of the idea. These indicators can be grouped in two to better monitor food situations and utilization of households' food security situations. These include generic indicators such as those that are collected from different places in society while location specific indicators are those that are particular to a specific sitting in a process. The process of indicators allows estimations of food supply and access situations. Food supply indicators ensures food availability at households levels to further ensure regional food availability as farmers will sell their surpluses and purchases of assets at the major central markets around them. The more supplies to the market, the more food availability at the district, regional and national levels, the lesser the cost of food,

hence food security. While food indicator by access is manly the most effective way of accessing food security at the household, regional and national levels, it reflects various strategies in the process of managing diversified sources of food. These indicators are used to measure the status of food security at any point in time as far as food consumptions are concerned. They are direct and indirect indicators. Indicators that are close to actual consumption rather than the use of market channels information and un availability of direct measure in terms of money leads to the application of indirect indicator. Households' consumption, budget surveys on their perception and frequency of assessment are termed the direct indicators (Result, 2017).



Food security is improved significantly in northing Ghana is successful using the presence of irrigation infrastructure. Irrigation is able to provide reliable and adequate water availability to enhance food production, and increase employment. Farmers are able to adapt to new technologies and crop intensively leading to increase in food production (Kpieta *et al.*, 2013). Other studies such as (Apam, 2012:Gadisa, 2016) confirms the benefits derived from access to all year round water for agricultural activities contribute to the food security situations in rural communities and have identified five main dimensions. These include production, income generation, consumption and employment towards enhancing food security and other social impacts that are aimed at improving welfare of rural people. These studies further reveal that Africa is slow in adapting to technologies such as irrigation, application of the use of fertilizers and improved seeds. By 2020 the number of food without food people will be on the rise. For instance children population will be much affected.

Africa has a lot of land mass but these lands are not able to produce enough to support the citizens. Irrigation is the only technology that is able to make use of the land resource such as land and water through farming and livestock production towards enhancing food security and increase in production levels. It makes people independent as they can produce their native crops and would not have to depend on imports during shocks such as drought and bush fires (Result, 2017).

**Process Indicators**



The process through which food at the households and community levels is being estimated is described as process indicators. A process indicator is in two forms; namely supply indicators and food access indicators. Food supply within an area is a number one factor in trying to reduce food insecurity in a locality. It is directly proportional to food shortages at the household levels, communities, municipalities and regional levels. This is because the supply indicator has the duty to explain the levels of shocks or disasters and their various impacts which might affect the household, communities and regional levels (WFP, 2015).

Some supply indicators that are very important and must be taken seriously includes the following -the supply of agricultural inputs like raw materials and production levels, information on food supply, usage and surpluses, presence and utilization of natural resources, creation and development of market infrastructure, traditional beliefs and norms that may result in conflicts (Gadisa, 2016). Food access indicators enable the monitoring of food security situations in households, communities and municipalities and regional levels. The food access monitoring indicators also ensures food diversity and their source management in most localities battling with food

insecurity situations through the disposal of food productive and less productive properties or capitals (Result, 2017).

**Food Security outcome Indicators**

Food security indicators are used to assess the food security of a particular place at any given time. These indicators are grouped into two types, namely indirect and direct indicators. These are indicators that are mainly related to food consumption. The direct indicator does not consider measurement in monetary terms while the indirect indicator actually has to do with measurement in monetary terms at most time. It also had to do with household budget and consumption surveys, household perception of food security and frequent food assessment (Gadisa, 2016).

According to Result, (2017) the family budget and consumption surveys are mostly successful using the gross margin analysis. It allows the comparison of income levels of farmers that are considered irrigators and non-irrigators. This is mathematically represented as



Gross Margin Analysis (GMA) = Total sale (Gross income)-Variable cost (VC)

Where Gross income = Total Volume of output × Price (P) and Variable cost. Variable cost are cost incurred in areas such as the procurement of fertilizer, seed, labour and fuel. These vary in operations. He further added that for a direct indicator, it is directly proportional to the food consumption per household member especially the adult household member or the adult equivalent per person. The adult equivalent per adult is the caloric content of food items that are taken by sample households are computed using the caloric conversion table of 14 days. This implies that the conversion of adult food consumption or the total amount of food or calories taken by

households is computed by dividing it by 14 days to obtain consumption per day. The method is also adopted and used on farmers that are irrigators and farmers that are not irrigators. There are a number of factors that might impede the successful computation of method that might also lead to inconsistencies in accessing the food situation at any time. The most important of such factors are funerals and marriage ceremonies or birth day celebrations that occur within the 14 days range. These celebrations result in the preparation of larger portions of food to feed large number of relatives and friends who travel from far and near to partake in the celebrations. This influences the computation of adult equivalent leading to the assessment of the food security situation in the households (Gadisa, 2016: WFP, 2016).



### 2.2.8 Concept of poverty and its Measurement

**Concept of Poverty**

Poverty as a concept is difficult to define. Rather different scholars have explained it. Few of such are as follows. According to Opoku (2011), poverty is the combination of inequalities, subsistence or peasantry. Morris (1973) explains in his study of irrigation as a tool to reducing poverty pinpoints that poverty is the outcome of inabilities of unfavorable cluster centers to compete successfully.

**Poverty Measurement**

Poverty measurement considers certain indicators by researchers. The most being the use of income leading to inequality and general deprivation. According to Tarp *et al.* (2002), using the rulings curve analyses, incomes that fall below the poverty line are termed as being poor. This means households that consume below 1US$ day thresholds are considered very poor (Walker *et al.*, 2004). They pinpoints that the

identification of better and bad times especially bad times is as best considered as poverty times. Bourguig and Chakravary (2003), indicate that household welfare depends on both monetary and non-monetary variables suggesting that poverty cannot be understood without the involvement of both monetary and non-monetary variables. In 1992, the World Bank noted that the basic causes of poverty are the lack of access to services, opportunities and inadequate endowment in Africa. Some specifics includes inadequate access to employment opportunities, physical access to market for goods and services that the poor can sell, and the inadequate participation of the poor in decision making process (Opoku, 2011).



The World Bank therefore recognizes inefficient use of resources leading to risk in society and tends to further increase inequality in many African countries. It also acknowledge the involvement of the Britain Wood Institutions to reduce the gap between the poor and the rich making national, governments and non-governmental organizations in recent years focus on their development objectives towards mitigating the problem of poverty. According to Rao, (2006) some coping strategies under conditions of poverty include:

- Home gardens and exploitation of the macro environment;
- Common property resources such as fishing, mining, quarry, charcoal burning and water;
- Seasonal works and food;
- Livestock rearing;
- Dry season farming;

### 2.3.1 Agricultural Modernization Projects in the Upper West Region

Institutional structures have great impact in assets use, control and access resulting from laws, policies, social norms and incentives to influence livelihood development. Structures and processes create the link between micro (individuals or households) and macro that includes regional, government and the private sector (Cahn, 2003). In Ghana, institutions such as Ministry of food and Agriculture and its various departments like Extension Services and Veterinary, Irrigation Development Authority (GIDA) and NGOs in research in food security such as World Food Programme are tasked with the duties of promoting technological development, adoption, increase and efficient use of irrigation technology (MOFA, 2010).



The Ministry of food and Agriculture (MOFA) in 1955 was mandated to undertake modern irrigation agriculture using its decentralized unit known as the land planning unit to plan the land for future development and productive agricultural use (Monnah, 2012). He explains further the duties of this department in1965 was land conservation and further indicated that in 1974, this planning unit was expanded to more divisional levels in the Ministry of Agriculture and named as irrigation, Reclamation and drainage division and finally as irrigation development authority in 1977 with the responsibility to promote irrigation, technical and infrastructure development and also to integrate agriculture and engineering towards irrigation development in the country (Ghana Irrigation Development Authority, 2010). According to Apam (2012), irrigation development authority facilitated the construction and conservation of water and water resources through the creation of dams and dug-outs of which some includes Kpong irrigation scheme in Accra and the Tano irrigation in the Upper East Regions.

The Upper West Region has also benefited from few projects from the irrigation development authority with the aim of providing all year round water for food crop production under the UWADEP project. Some of these dams in the Upper West Region includes Sankana and Dafiama irrigation facilities (Kpieta et al., 2013).In order to attain maximum use of these facilities, the government implemented several projects to fully maximize the use of the water resources to increase food production. Some of these supporting projects include the Savannah Accelerated development Authority, Medium Term Agricultural Development, Northern Rural Growth Programme, Block Farm Programme, West Africa Agricultural Productivity Programme (MOFA, 2010).

Increase population of farmer in the Upper West Region resulted in the presence of a number of NGOs to promote food production. These includes World Food Programme, Plan Ghana facilitated the construction and rehabilitation of dams and dug—outs in the Upper West Region especially in the Lawra and Sissala Municipality and Districts respectively (MOFA, 2010).



### 2.3.2 Empirical Studies of Irrigation Benefits

Erratic rain fall, climate change effects including drought reduces massive agricultural production making large parcels of land go unused. This increases food insecurity, poverty, vulnerability and weakens rural livelihoods. This makes the government of Ghana and other stakeholders to formulate policies to mitigate the situation in the country to ensure food security reduce poverty levels and enhance livelihoods in Ghana.

### 2.3.3 Irrigation as a Dynamic Tool for Agricultural Modernization

Agriculture is the backbone of every nation especially developing countries like Ghana (Fischer *et al.*, 2007). Irrigation technology is therefore the way forward since it allows all year round cropping with less dependent on rainfall or natural precipitation (Ye *et al.*, 2014).Ghana has 53.2kms of renewable water resources with only 0.25kms used for crop production (FAO, 2006), showing very low rate of irrigation (World Bank Report, 2005). Ghana has the potential of developing 384,000 ha of irrigation that would require 360 million cubic metre of water.



Small Scale Irrigation involves the technique of providing water to plants where there is no rain or not enough rain using artificial means to supplement the soil-water requirements. It is the centre of this study and has been defined differently by different authors. Peprah *et al*., (2013) indicate that small Scale Irrigation as a process of supplying water to crop, grasses, orchard, and any other plants. He indicates in his study that irrigation is the excavation of the earth to store water called a reservoir or network of pipes used by early civilization to supply water to farms. He further stress that small scale is now wide spread in Africa to enhance productivity and household income.

Aziabah, (2008) indicates that Small Scale irrigation system is to conveye water from a source to an area that needs water for crop production. Such a system involves one or more sources of water, the size of flow patterns and management system determines the scale of the irrigation system. He further stressed that the success of Small Scale irrigation facility is the factor that is managed by locals themselves and less costly since more large irrigation systems have had poor records due to high cost and institutional failures.

According Aerbeke *et al*. (2011) irrigation is an artificial application of water to land for purposes of enhancing plant production. This view is buttressed in his study relevance of supplementary water and its influence on crop production.

According Bhattarai *et al*. (2012) irrigation increasing the productivity of under agricultural production especially in peri-urban environments. He explains further that to increase Vegetable production, dry season gardening should be taken as a business in order to access credit from financial institutions.



Ye *et al*. (2013) define irrigation as saving water for agricultural practices and adaptation. He stressed in his study on food security enhancement the influence of Small scale Irrigation that water needed to be saved like money in order to ensure its availability for food production by stakeholders.

Kpieta *et al*. (2013) indicate that to improve income levels, general living conditions and finally reduction in youth migration, there is the need for the construction of irrigation infrastructure to ensure all year round farming.

### 2.4.1 Classification of Irrigation Schemes

According to (FAO, 2010), there are several ways or forms of classifying Irrigation schemes. Some includes:

***i. Scale of Operation***

An irrigation facility is considered small, medium or large scale irrigation scheme depending on the number of population it is serving. For instance 300 hectare scheme in Ghana is a small scale scheme while a 10,000 ha in India is also considered as small scale scheme (Asefa, 2008). About 200ha for small size while 200-3000 ha as

medium and above3000ha as large scales (ATA, 2003). This is because the population of Ghana when compared with India makes the 10,000 ha a large scale irrigation

***ii. Management Type***

Small scale irrigation scheme is managed by majority of the farmers themselves while large scales are managed by Government (Tefesse, 2003).

***iii. Mode of Water Transmission***



According to Dittol *et al*., (2010), small scale irrigations are grouped into four categories namely

- Bucket/calabash/watering can system
- Manual (pedal/hand) pump systems
- Motorized pump system.
- Gravity/canal systems

v. Namara *et al*., (2010) classified the above four into two systems with respect to the Ghanaian concept namely conventional systems and emerging systems. Conventional systems are those that exist as government and NGOs initiatives and emerging systems are those initiated by farmers with little or no support from central administration. These mostly include groundwater irrigation system based on motorized pump, river/streams lifting pump machines and partnerships (Owusu *et al.*, 2011).

vi. Based on mode of water application – There are three major types of Irrigation according to Freken, (2005). These include surface irrigation, drip irrigation and sprinkler irrigation.

### 2.4.2 Irrigation Types Base on Mode of Water Application

According to Freken, (2005) there are three types of irrigation. These are

***Surface Irrigation***

This method allows the general flooding of the irrigable land as a water application technique where gravity plays a major role in water transportation and percolation. The water is uncontrollable and is on the surface of the soil. It is not an effective method to practice in areas of water scarcity. In constructed dams, water is managed on to the field through the use of canals or furrows that are connected to the water resource or the dam. Within the dam reservoir is located key valves in both the reservoir and out of the reservoir to control the amount of water leaving the reservoir and canals or furrows then connected to these key valves and have the capability to transport water throughout the irrigable area. In this system, weirs are also inserted to control the level of water in the canals. Weir enable blockage of water from one canal to the other or from a bigger canal to a narrow canal for protection of the canal walls. The height of the dam wall or the embankments is the capacity of the reservoir and is also protected by the construction of spillway that allows excess water from the reservoir (Freken, 2005).



***Drip Irrigation***

This method drip irrigation direct water or fertilizer application to the main targets that is the roots of the plants through the use of a drip line,valves,pipes, tubes and emitters to the roots. It reduces the wasting of water and is good in areas of water scarcity or long periods of droughts and increases crop water utilization. There is total control of water under this scheme and can be practiced using the dam or flowing

river along which irrigable fields exist. The transportation of water to the fields is mainly through the main canal that is connected to a machine at one side and another on the opposite site with a suction head. The suction head pipe is dropped in to the water source either a dam or river with the suction heard serving as a restrainer that avoids debris in to the pumping machine. Drip lines are then connected to the main pipe or secondary pipes to allow oozing of water through the drip holes in to the fields directly proportional to the number of plants within rows and plants between plants. This system can also be practiced in households using domestic pipe borne water with available land for cultivation. Crops such as vegetables and other perishable foods are mostly successful under this system of irrigation (Freken, 2005).



***Sprinkler Irrigation***

Under this method, sprinklers are strategically located in the farm and water is distributed through pipes using pressure. It mostly consists of a sprinkler head, pipes, suction pipe or restrainer and a pumping pressure source. The ‘Gun’ popularly known as the sprinkler head is mounted on a pivot that moves round with the little pressure passing through as water. In front of the ‘Gun’ is metallic blockage from front of the ‘Gun’ connected to the rotating pivot few cm away from the channel of passage. The ‘Gun’ is then mounted on a retort stand in the field and pipe is connected to the ‘Gun’ and dropped on to a water source with the suction head as similar to the drip irrigation. The system can also be practiced in domestic homes as the domestic pipe can be used to practice the system.

The sprinkler head has a radius it can spray water and depending on the irrigable land: a number of sprinkler head are located at strategic positions in the field to cover the whole of the field for crop cultivation (Freken, 2005).

### 2.4.3 Small Scale Farmers, Small Scale Irrigation and Small Scale Farming

Small scale farmers are farmers with less land, capitals and are mostly resource pool farmers with divided lands in a peasant farming methods. They mostly use less inputs and simple tools. Land and labour are their major asserts with less finances internally (MOFA, 2006). These farmers make use of the rivers, streams and lakes in and around them to support plant growth during inadequate rainfall. This process ensures sustainable agricultural production and coping with periods of drought. It is also very effective since farmers adapt to technologies they can operate (FAO, 2008). According to IFAD, (2005), yield levels from these farmers turn to be very low translating in to lower incomes and food insecurity among farming households, hence level of production is very low and can best be described as production for household consumption. This is briefly known as production in small-scale.



### 2.4.4 Irrigation System Management

Irrigation system management includes three main components namely water use activities, Control structure activities and organization activities. Water use activities are management type that allows provision of water to crops in time and in the right amounts including conservation, allocation, and distribution of water (GIDA Technical Guideline, 2014).

Allocation is giving rights to people that use water (water users) or the right to use water. There are two forms of these rights and these are common pool and common property regime. Common pool is the continuous misappropriation of water resources beyond its carrying capacity while common property regime ensures the rules and regulations that are outlined by water users or stakeholders to sustain and prolong the

lifespan of the water resource respectively (Byrnes, 1992). Distribution has to do with the physical collection of water from the source and dividing among numerous users at various times and places (Byrnes, 1992: IWMI, 2005).Water usage, allocation and distribution is an issue of decision making that involves planning the resource for sustainability during its design phase, construction, maintenance and drains construction. Common pool water users' cause's negative environmental impacts such as extinction, loss of biodiversity in and around the catchment, and habitat loss while common property regime which is a management type that allow stakeholders of the water resources to make laws, regulations and proper planning process for the sustainable use of the resource (Wagnew,2004).



### 2.4.5 Supporting Irrigation Policy in Ghana

Irrigation policy is a statement of intent concerning irrigation with the major goal being to enhance performance of irrigation for sustainable growth and to open up investments in the agricultural sector under the Growth and Poverty Reduction Strategy (GPRS I and GPRS II).This is to benefit the Ghanaian economy and to improve the livelihoods. The targets of the policy include National Food Security, intensification and diversification of agricultural commodities: increasing livelihood options: judicious use of natural resources, reduce environmental externalities and expansion of investments. This according to the policy is put into four problem areas: the low agricultural productivity and slow growth, water and land resource challenges, environmental degradation associated with irrigation and the lack of support for irrigation, hence the creation of objectives to accelerate and sustain irrigation development in Ghana. These objectives are grouped in to A, B, C and D.

Objective 'A' considers the performance, capacity and growth of existing irrigation systems and their responses to current demands through public-private partnership. Objective 'B' aimed at removing bottle necks in land and water issues, hence socio-economic issues, Objective 'C' deals with environmental functions of various irrigation systems and their practices are taken care of. Objective 'D' consists of cost effectiveness; demand driven of irrigation services to both public and private irrigators (GIDA Technical Guideline, 2014).The Ghana Poverty Reduction Strategy (GPR, 2006-2009) had its genesis from the Britain Wood Institutions namely the International Monetary Fund and the World Bank. It is the main target through which development assistance is given to developing countries such as Ghana towards effective poverty reduction and better aid for development. This was taken in consensus in the Rome Declaration (Driscooll, 2004).The implementation duration of this policy has passed its phase in 2009 leading to the second phase of the policy known as Growth and Poverty reduction strategy II (GPRS II).This seeks to implement activities to reduce poverty while the first was on government emphasis on programmes and projects (Boateng, 2001).

A number of studies and evaluation in to these twin policies were conducted and focuses primarily on identifying good practices and removing or managing bottlenecks in both project implementation and activity planning (IMF 2009: World Bank, 2007:Wolter, 2008). Dixel *et al.*, (2004)explains that though the implementation and activities reports that over two-thirds of the poor in rural areas are small holder farmers meaning the major objectives of the policies have not been met that results in the challenge of meeting the millennium development goals as asserts, incomes livelihood patterns are heterogeneous in rural areas even though the national poverty rate has been cut to almost half, from 51.7 percent in 1991-1992 to 8.5

percent in 2005-2006, and poverty decreased by17 percent in urban areas and 24 percent in rural area(IFAID, 2010).

### 2.4.6 Water Resource Development (Irrigation) in Ghana, Relevance and Challenges to Agriculture

According to United Nations (2006) and Kpieta *et al.*, (2013) water resource development is the construction of dams, wells, dug-outs, boreholes to promote socio-economic life of small scale farmers. In their studies, water resource is linked inextricably to the state of human health and development such as water related conditions like inadequate irrigation or food production. It is therefore very important to fight poverty through water availability for the entire population to enhance both domestic and agricultural production (Boelee and Madsen, 2006).



Water resource management are in two forms, these are common pool resources and common property resources. Common pool resource occurs when individuals just used the resource and do not consider its survival for their future use., Hence extinction while common property regime occurs where stakeholders using the resource (irrigation) creates rules and regulations governing the resource usage to prolong the lifespan of the resource in a sustainable manner (Blaike, 2007: Shackleton *et al.*, 2010).

Irrigation development in Ghana is an ancient act that dates back to centuries ago (1960 and 1980) and has consisted of the conventional and emerging systems. . However very little is known about the emerging system though it is rapidly increasing in rural areas under farming group dynamic technologies transfer by the

Ministry of Food and Agriculture, Emerging system allows the provision of affordable pumping technologies (Namara *et al*., 2011).

This impacts more in the rural areas by reducing the relevance of the conventional irrigation in terms of area irrigated, yields obtained, production levels and value of production using tubes, well irrigation, small motor based irrigation, out-grower systems. Among the 10 Regions of Ghana, surface water pump systems are visible in most regions such as Ashanti, Eastern, Western, Brong Ahafo and Volta Regions especially Keta strip as public irrigation schemes dotted all over Ghana making the Upper West Region a beneficiary of these projects (Namara *et al.*, 2011). Lawra Municipality being one among 11 Districts and Municipalities in the Upper West Region haves its share of these projects.



### 2.4.5 Relevance and Challenges of Irrigation

Agriculture is the main source of livelihoods of most African countries and it is dependent on the amount of precipitation or water available. It is therefore very important to ensure the supply of water to enhance agricultural activities especially in the desert or savannah zone. The northern parts of Ghana being savannah zones requires constant supply of water in their long dry season in order to produce food crops and this is possible using irrigation technology. Irrigation in Africa over the last 60 years has aimed at reducing food shortages in most African countries. For instance the Nile river irrigation project ensures all year round food production in Egypt. Ghana in the early 1980s experienced severe famine due to drought as a result of the lack of water retaining structures to store water for the off season farming. Recently, countries such as Somalis is not an exception (Hussein and Hajra, 2014).

According to Rukuni *et al*., (2006) irrigation impacts on poverty and livelihood development yet it faces certain challenges. For instance migration in most rural areas increases astronomically during the dry season in the northern regions due to the lack of farming activities. In these areas, food security in households are much affected as the amount of food, assess to food and the general utilization of these foods in households reduces during the dry season (kpieta *at al*., 2013).

Due to small land sizes, indigenous methods of farming are still practiced and the massive invasion of farm land by illegal mining activities turns to reduce water quality for irrigation. The presence of chemicals in water bodies does impose health implications. In areas of irrigation facilities in remote areas, marketing centres for the purchases of farm produce do not exist coupled with bad road network course glut in a few satellite markets. Also is the issue of market access with produce of irrigation are readily unavailable causing glut at the few market centres indebting farmers coupled with institutional weakness makes farm performances inefficient (Lipton, 2003).



Gyasi *et al*. (2006) further added in otheir study on the public management of irrigation facilities, indicates that the cost of irrigation installation is paid off quickly if there is access to market for the sale of farm produce to offset the cost of installation.Yet irrigation systems do not have already market available for farmers due to the weak agricultural value chain systems. Other constraints include high capital investments, poor rural infrastructure facilities, and inputs of procurement of marketing of produce, interest rate and lack of land (Ziba, 2015).

According to Bashiru, (2013) credit is most important in agricultural production but the construction of water retaining structures is further increasing the cost of farming

to supplement rain-fed agriculture. This is far below the capacity of peasant farmers in Ghana. Some dams are constructed in rural communities that do not come with all the accessories. For instance the construction of dug-outs without the irrigable area, or the dam without conveying channels such as canals, pipes or pumping machines to lift water to the irrigable areas coupled with the lack of trained irrigation technologist in most water resources sites for proper management of the facilities (Monnah, 2011).

An irrigation facility also poses health challenges as water related diseases thrive well in areas of irrigation farming or its catchment areas (Kpieta et al., 2013). He further stressed that irrigation or water resource development comes with environmental and health consequences to its catchment areas in terms of diseases such as malaria and other water related diseases. Primary health risk with irrigation infrastructure presence in a community is the issue of water borne vector diseases. Water related diseases are generally classified in to four bases on their mode of transmission (Boelee, 2002).



These include;

- Water borne or fecal orally transmitted diseases such as cholera, typhoid and diarrhea;
- Water-washed disease, such as louse-borne infection and infection eye and skin
- Water-base disease with an intermediate host living in water, such as guinea worm and schistosomiasis that causes bilharzias;
- Water-related insect-bone parasitic diseases such as river blindness, fillariasis and malaria.

Water-washed diseases are mostly found in arid and semi -arid regions where irrigation systems are practiced and farmers use indigenous knowledge in preventing these diseases. Medicinal plants and herbs are the most used in these areas in treating water related disease and the use of control measures were adopted before the advent of Science and medicine (konradsen *et al*., 2002).It is possible to incorporate irrigation system in to drinking water planning at both the national and local levels to ensure the elimination of disease causing bacterial within water systems (Boelee, 2003).



Water resource development has the ability to increasing food availability and food security in the rural areas, hence the need for more support or intervention in developing the sector. Some of these include subsized fertilizers, high yielding varieties of seed, capacity building and resource allocation to extension division of the Ministry of food and Agriculture, presence of donor collaborations and the increasing availability of rural micro finance schemes in funding agricultural activities especially in supporting women empowerment (Monnah, 2012). Financial institutional issues, access to inputs and service, market outputs, technical back stopping, labour presence and high migration rates are the most constraints (Kpieta *et al*., 2013).

**2.5 Influence of Irrigation on Livelihood Parameters**

According to Smith, (2004) the aim of irrigation is to increase agricultural output levels. Monnah, (2012) and Lipton (2003) in their various studies reveal that irrigation boost total farm production due to a number of factors. Some of these areas through which irrigation has contributed significantly to livelihood includes expansion of farm size, multiple cropping, employment, income generation, extension delivery, deforestation, reduction of food prices, and guarantee for access to credit.

### 2.5.1 Small Scale Irrigation and Expansion of Farm Frontier

Irrigation allows rural folks to expand the frontiers of their farms increasing area cultivation in the savannah ecological zone especially the three Northern Regions and some parts of the Volta Region as more land can intensively be put under cultivation amidst constant supply of water. As compared to the rain-fed agriculture that does not allow cultivation of less than an acre due to the insufficient water at their disposal. Enough capital, labour and access to extension and inputs, good seed and high yielding varieties, access to extension services and proximate to agro inputs turns to further boost Agricultural production with the presence of irrigation since farmers with the availability of water vengers in to virgin lands increasing the number of acres per unit area(Apam, 2012).



Irrigation farmers also collaborate with research institution on the production of viable seed known as foundation seed. For instance, Foundation seed producers collaborate with research institutions such as SARI and Statistical Research Information Department of the Ministry of food and Agriculture using lands that farmers do not use for cultivation to feed their families, hence the need for other non-available lands for these research purposes(SRID,2016).

### 2.5.2 Small Scale Irrigation and Yield Levels

During the green revolution, yields were highly increased to the maximum levels due to irrigation. Irrigation is able to reduce crop loss due to erratic rain fall pattern, unreliable or insufficient rain water supply. It makes one acre of irrigated land more than multiple rain -fed cropland. Irrigation has the capacity to increase yield levels from 100% to 400%. It is less risky and ensures continuous level of labour

engagement of farm households (FAO, 2003). Researchers such as Hussein and Hanjra, (2004) in their study on the influence of irrigation on farmers output indicates that Irrigation enables subsistence rural farmers to achieve higher yields. They further stress that the production under irrigation conditions is higher than that of rain-fed conditions since they farm more than once. The world receives 40 percent of food through irrigated fields making 17 percent of cultivated land as farmers apply water at the most beneficial periods for the crop (Liston *et al*., 2003).



### 2.5.3 Small Scale Irrigation and Multiple Cropping

In rain-fed cropping, there exist a single rainy season that allows for food cropping in erratic manner with unreliable water or insufficient water supply. This makes it very risky in nature as farmers do not have the knowledge on weather data or weather forecast to inform them on the amount of rain for the season thereby promoting poor farm planning processes. Farmers that cultivates mainly for home consumption with very small land area that can be cultivated to much the little rains (Apam, 2012).

Land tenure and other traditional customs and norms in most parts of the country are also factors that promote single cropping because farming season and conflicts arising from boundary lands that are lying fallow close to farming communities or water bodies are not also utilized during off season or the major raining season (Kpieta *et al*., 2013). Gender issues are also affected due to the single season cropping in most Ghanaians communities where women are not eligible to owe lands making them to farm seriously in nearby community lands during the major rainy season (Monnah, 2011). But under irrigation, reservoirs collect water for all year round cropping even in dry and arid conditions making women contribute their quarter effectively in the Agricultural value chain.

Other highly knowledgeable farmers transport water from long distances to their farms for irrigation through the use of pipes, boreholes, erect tanks to supply enough water to their fields (Peprah *et al*., 2015).This artificial supply of water to crop farms ensures all year round farming hence promoting multiple cropping for farmers and moving from annual crop to two or three cropping within the season (Schoengold *et al*., 2007).Triple cropping turns to increase production of crops keeping farmers in business and promoting constant market supply of food stuffs that turns to reduce prices to the very minimum and improving households nutrition needs (Liston,2003).



### 2.5.4 Small Scale Irrigation and Job Creation or Employment

The construction of irrigation facilities increase labour at sites to engage in all year round cropping, maintenance of canals, pumps and wells, hence creating jobs for abandoned labour that might instead migrate to urban centers for non-existing jobs. According to Kpieta *et al*., (2013) irrigation farming has the tendency to employ over 70% of the youth in rural Ghana especially the three Northern Regions. He also added that the migration of the youth is as a result of pull factors in the urban centres.

Women constitute over 45% of youth that leave the rural areas after the major rains due to non-employable activities that can alleviate poverty in their families and turns to bring social vices such as unwanted pregnancies, rape and other social problems from the urban Centre (Monnah, 2011). Irrigation farming ensures all year round farming that requires enough labour for sowing, ploughing with machines or manual, Fertilizer application and insects management,thrashing,packing, bagging and even transportation(Wagnew,2004). Labour is required since more lands need to be cultivated under irrigation production (Lipton, 2003).

### 2.5.5 Small Scale Irrigation and Household Income Generation

Irrigation infrastructure presence in communities tends to ensure multiple cropping since there is availability of water for crop and livestock used especially in the Northern Regions. It is a sign of increasing the level of production through doubled cropping. This increases production levels of farmers in an irrigated farm making supplies to the markets to double. This translates into revenue for farmers increasing their household incomes. Household's income is the sum of farm income a farmer is able to generate if farming is the only livelihood strategy of the household (Bashiru, 2013). Such farmers due to double cropping engaged other labour and pay wages or salaries increasing the money levels for the labour supplied that can be skilled or unskilled and the rearing of livestock as a result of available water. Fodder presence allow for integrating livestock with irrigation for income generation (Shoengold *et* al., 2007).



Farmers under irrigated farms feed the rural markets and pay taxes or market tolls that increase MMDAs revenue mobilization to support their internal generation fund (Lipton and Litchfield, 2003). Increase in income levels to households tends to support women in households to undertake other petty trading to complements supplies of household needs for their families. For instance, a study by Monnah, (2011) on the impact of irrigation on gender challenges indicates that a household may sell animals to pay school fees or send a sick child to the hospital with proceeds obtained from the water resources that enable livestock production. Savings are possible when there is steady and stable income generation that is banked and this serve as collateral for loans and is possible under an irrigation farm where famers continue to produce and supply markets for purchases of consumers (Bashiru, 2013).

### 2.5.6 Small Scale Irrigation and Extension Service Delivery

An increase in agricultural production is directly proportional to the access to extension service delivery. The extension service is mandated to impact new technologies such as No tillage, line planting, calculation of plant population, the introduction of improved seeds, fertilizer application methods, efficient use of water in both a pool resource and a common property regime, hence making extension an important pivot in a farmer's motivation (Madussuda *et al.*,2002).

Water user associations require new extension techniques to produce with small plots for maximum returns making production not necessarily cultivating large area of land. The veterinary service takes care of the livestock production sector that provides extension service delivery in the form of vaccinations and general surveillance of diseases in collaboration with the Quarantine service unit. The presence of irrigation comes with other veterinary issues like the flies that courses both human and animal disease (SRID, 2016).



### 2.5.7 Small Scale Irrigation and Deforestation

Due to the single cropping season in the Northern Regions, households are left with no employable skills leading to over exploitation of natural resources. The forest and other woodlots turn to generate incomes to households through logging, lumbering and charcoal coarsing deforestation within the environment. The presence of irrigation infrastructure is therefore intended to reduce the menace of deforestation but this is not always the case (Shoengold *et al.*, 2007).Irrigation provides water all year round for food crop production and rearing of livestock that will in turn require expansion of frontiers of farm lands leading to forest and biodiversity degradation or deforestation and as more farmers embrace the irrigation farm methods, more of the

forest will be cut to expand the farm sizes leading to environmental and forest degradation since more lands are developed, the rate of deforestation will reduce as farmers get enough to live on in their lean seasons(Apam, 2012).

### 2.5.8 Small Scale Irrigation and Food Prices

Irrigation is able to increase supplies of staples and non-staple food output to the markets in constant supply resulting in glut in some markets especially perishable goods like tomato. This glut situations courses abundance of commodities in the market leading to reduction in prices in goods in the market (Bashiru, 2013). These prices are a disadvantage to the farmer but the consumers turn to benefit. But in a stagger production method where farmers plant on different dates of the same commodity tend to help both farmers and consumers to break even at affordable prices in a market equilibrium situation. Irrigation is therefore able to reduce poverty in the long run (Lipton, 2003).

### 2.5.9 Small Scale Irrigation and Access to Credit

According to Bashiru, (2013) analysing farmer access to credit determines the level of farmer's production. He defines credit as the monetary support a financial institution lent to farmers with an interest to aid their farming activities. The study further indicates that credits are given after a farmer is able to provide the necessary collateral to the bank that is worthy the credit facility and this replaces the credit in terms of default and its recovery can be in kind or in cash by the financial institutions. Irrigation farmers are able to use the irrigation infrastructure as collateral for such credits for the purchases of fertilizer, seed, Pumping machines and fueling of machines for the transportation of water. Other credit institutions are able to install solar mechanisms on farmers as credit to the farmers.

According to Swanikannu and Berger, (2009) access to credit changes farmers from peasant or subsistence to commercial farming, ran-fed to irrigation with marginal increase in household income and food energy consumption. Other sources of credit at the disposal of farmers a part from known financial institutions include Susu, relatives and friends, Traders, Government or Non-Governmental organization (Bashiru, 2013).

According to (Quaye: Seidu, 2008) credit from relatives and friends, Susu and NGOs are mostly given without collateral and are in cash and can be given to groups or individual farmers. Relatives and friends are the most patronised source of credit to most rural farmers since it reduces the risk of disturbances or force of payment terms to farmers, this makes repayment terms very weak. Repayment terms of these other sources of credit is most effective when recovery is done in kind by taking equivalent produce of farmers in place of cash. Thus is mostly practiced by traders (Abdulai and Haffman, 2008).



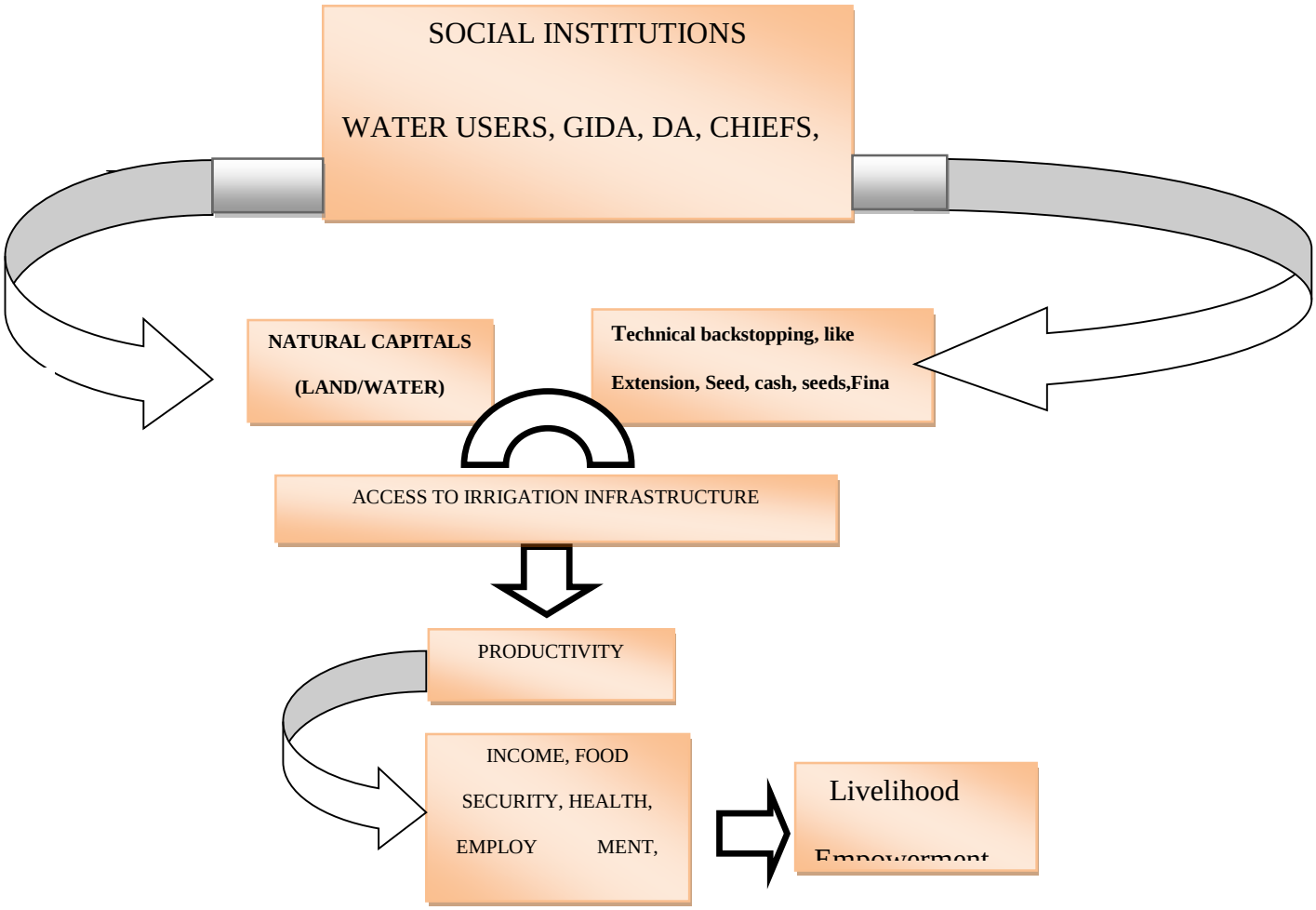





**Figure 2.2 Conceptual Framework for Analyzing Irrigation farming and its contribution to livelihoods**

Source: Adapted from Ziba, (2015)

### 2.2.6. Conceptual Framework

Figure 2.2 shows the conceptual framework for analyzing the effects of small scale irrigation on the livelihoods of farmers. Irrigation farming as a livelihood activity can be possible if there are livelihood resources available. These include natural capital such as land and water, economic or financial capital like credit, inputs, and technical support, social capital such networks, social relations, affiliation, associations and

human capital such as labour, skills and knowledge. The presence of environmental resources such as land and water makes the environment an agricultural base.

There are institutions (Water Users Associations, Irrigation Development Authority, MMDAs, Traditional Authorities and Non-governmental Organizations) that manage and ensure livelihood resources are put to good use for the benefit of large groups or society through productivity. This is mainly through the provision of services such as research that exposes the strengths, weakness, opportunities and threats of rural areas to able resource allocation. The institutions then ensure equal allocation of irrigation facilities and the outcomes of such decisions will result in enhancing the livelihood of farmers through food security, poverty reduction, capacity building and improvement of livelihood. This is achieved by training qualified human resources, purchases and building of irrigation infrastructure and financial support either by government, financial institutions or donor partners to boost agricultural production. The increasing levels of agricultural outputs tends to improve the food security situation of the farm household, increase income levels of farm households for the purchases of other service they could not produce such as education, health, and other social services.it also creates job for the youth and reduce out migration, hence irrigation empowers the rural farmers.

In conclusion rural livelihood empowerment is a factor that can address issues of poverty, malnutrion and food security.it is therefore paramount for stakeholders in the agricultural value chain to embarrass irrigation technology in making these dreams a reality.



# CHAPTER THREE

# PROFILE OF THE STUDY AREA AND RESEARCH METHODOLOGY

## 3.1 Introduction

This chapter presents the profile of the study area and the methodological paradigms that were applied in the study. Different research methodologies are used depending on the type and nature of the research (Neuman, 2014). The research methodology includes the research design, types and techniques of data collection, sampling and sample size determination and the methods of data analysis.

## 3.2 Profile of the Lawra Municipality

### 3.2.1 Geographical Background

***Location and Size***

Lawra is among the eleven MMDAs in the Upper West Region. It lies in the north western part of the Upper West Region in Ghana between longitude 2°25 W and at latitudes 2°45 W and latitudes 10°20”N and 11°00”N.It shares boundaries to the East by lambussie, to the south by Jirapa Municipality and to the north and West by Burkina Faso. The total land area of the Municipality is kept at 1051.2 square km which constitute 5.7% of the Region’s total land area. (LMA, 2006).

Figure 3.1 Waypoints of study communities, fields from which yield plots were cut from and water resource sites and potential sites for future considerations.

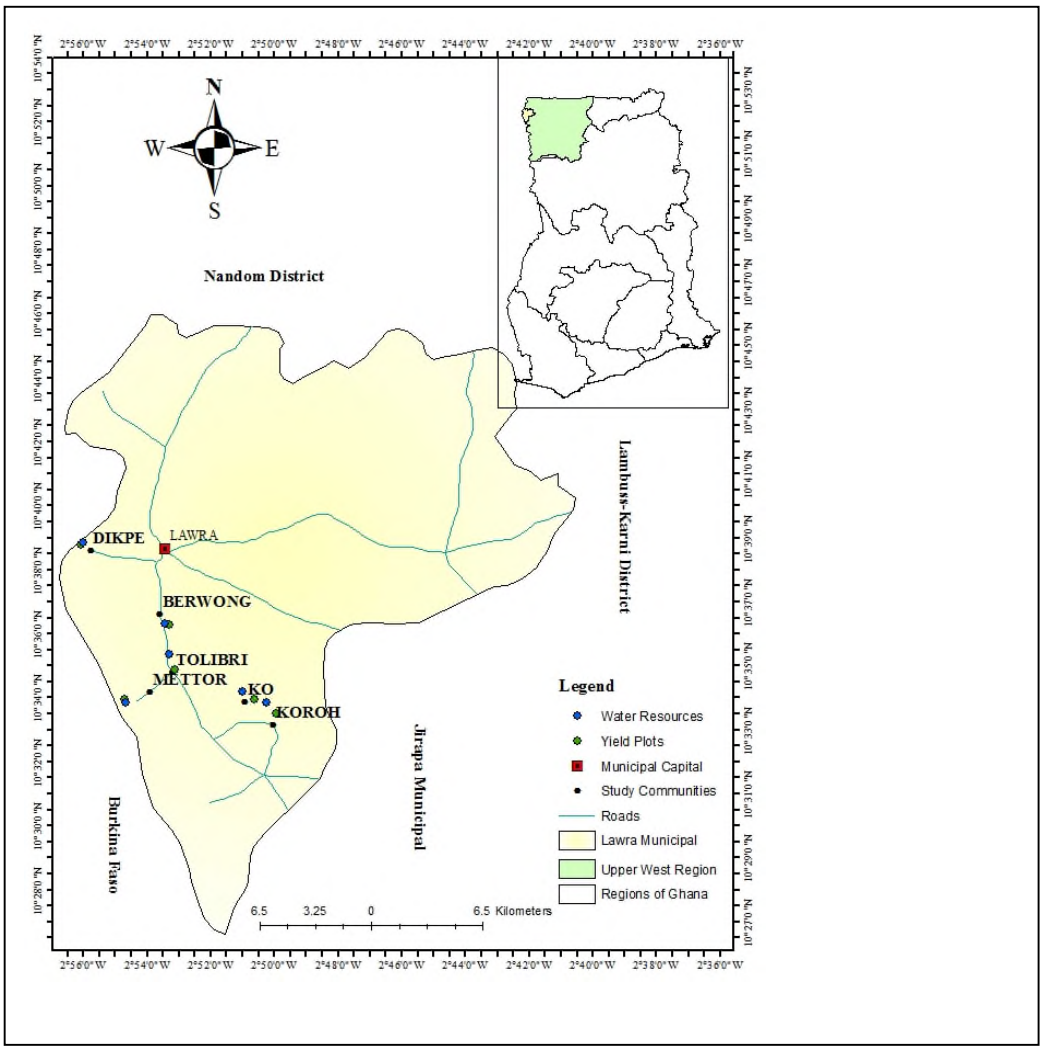



**Figure 3.1 Map of Lawra Municipality**

Source: Authors' Construct, June, 2017

### 3.2.3 Demographic Characteristics

According to the 2010 Population and Housing Census, Lawra Municipality is reported to have a population of 54,889. Out of this 48.0% (26,347) are male and 52.0% (2, 8542) been females population. The Municipality has high dependency ratio of 96.6% and a total houeholds population of 9,200 with average household size being 8.0.Projected population for 2015, 2016 and 2017 are illustrated in Table 3.1.

Table 3.1: Projected population figures for 2015, 2016 and 2017

| Year | Male | Female | Total population |
|---|---|---|---|
| 2015 | 29,5536 | 30,667 | 61,640 |
| 2016 | 30,257 | 31,383 | 63,075 |
| 2017 | 30,983 | 32,092 | 64,543 |

Source: Ghana Statistical Service, 2010

### 3.2.4 Age Distribution

Age grouping of the Lawra Municipality within a 5 year range is illustrated in table 3.2

**Table 3.2 Age Group of Population in a-5- year in Lawra Municipality**

| AGE-GROUP | YEAR RANGE(5 YEARS) |
|---|---|
| 1-14 | 2,234 |
| 15-39 | 2,768 |
| 40-59 | 962 |
| 60+ | 330 |

Source: Ghana Statistical Service, 2010



### 3.2.5 Topography and Drainage

The Lawra Municipality is very gentle in slope with hills ranging between 180 and 3000M above Sea level which drains towards the Black Volta to the western part of the Municipality sharing boundaries with the Republic of Burkina Faso. The Black Volta is visible through its tributaries in the Municpality.These tributaries includes Kamba/Dangbang, Dudaa and Kokoligu-baa and have the capacity to provide agro-base jobs for rural folks who might have left the area for non-exiting jobs in the south during the dry season (UNDP/GOG, 2010).

### 3.2.6. Climate, Soil and Vegetation

The Lawra Municipality lies within the Guinea Savannah Zone and is characterised by short grasses, shrubs and few woody plants which include Dawa, baobab and Shea trees and acacia. The vegetation is very suitable for livestock production and it contribute to incomes of most families in the Municipality because it prolongs in to the dry season giving the vegetation an added advantage for animal production. Erosion is very visible due to the torrential early rains. Bush burning is also rampant that courses reduction in vegetative cover and general transpiration which further affects the average rainfall totals (LMA, 2016).



The climate of the Municipality is tropical with its mean average temperature ranging between 27°C to 36°C making the period between February and April the hottest which affects the weather pattern. Between April and October, the tropical Maritime air mass blows over the area resulting in wet conditions in the year. Issues of migration become very high as less rain falls are experienced. The rock formation in the Municipality is brimian with dotted outcrops of granites. There is also the presence of well-shaped rocks in the form of Mushroom called Mushroom rocks that in a way contribute significantly to tourism though not well developed by the tourism Ministry(LMA, 2016)

The municipality has mineral potentials that are unexplored. There is also the occurrences of manganese, traces of gold, iron ore, clay and diamond. As a result of a well- developed fracture pattern in the rocks, the potential for obtaining ground water in the Municipality is very high. Borehole drilling activities in the early 1980s confirmed the presence of the granite and birimian rocks in the Municipality (LMA, 2016).

### 3.2.7 Environment and Irrigation

The Municipality's soil type consists of laterites soils produced from birimian and granite rocks. There are also trips of alluvial soils along the flood plains of the Black Volta as well as sandy loam along the river tributaries. Due to traditional land use practices coupled with the nature of the soils and the rainfall pattern tend to have effects on crop production forcing the youth to seek sustenance to different locations at the expense of their lives or health. The environment is blessed with a forest cover of 3,15.2 hectares reserved but has continuously witnessed all the types of degradations over the years resulting in dwindled vegetation and poor soil structure and wide spread bush fires in almost all communities. These tend to become an annual ritual in the municipality. Among communities that engaged mostly on none burning includes Goziri, Tongo and their catchment areas now adapting to non-bush burning cultures. Indiscriminate felling of trees for fire wood is rampant, inappropriate farming practices, soil erosion, over grazing of livestock, sand, gravel and stone winning are other acts of environmental degradation in the municipality (Lawra Municipal Assembly, 2016).



The built environment has not improved in terms of aesthetic features due to non-compliance with the provision of physical plan and increase in population. Sanitation infrastructure such as KVIPs is inadequate. Household sewerage disposal has become a problem in most of the communities. Buildings are not properly spaced and there is overcrowding in the towns leading to poor sanitation problems. Most of the fast developing towns such as Babile, Eremon, Dowine, Boo, Ko, and others do not have laid out plans which results in the indiscriminate putting up of structures. The Municipal Assembly, Zoom Lion (an NGO) and Ministry of Local Government and Rural Development have supplied sanitation tools to help improve the sanitation situation. Also, physical development plans need to be drawn for all major towns.

The Municipality places a high priority on irrigation infrastructural development to promote dry season farming especially under Government initiated Programme in the Municipality that constructed the Kokoligu Dam to irrigate farms using canals as well as fishing activities and general animal watering. Other irrigation infrastructure within the Municipality include Erimon Naburnye Dam constructed in 2005/2006,Guo Dam,Tanchara 1 and Tanchara 2 dug-outs, Babile Dam, Erimon Soriguon dug-out, Brutu dug-out, and Susu dug-out. All these facilities lack the necessary management in places making them white elephants with the exception of Babile and Kokoligu dams that have water users in place yet are also facing challenges. The Babile dam has currently broken its embankment due to activities of crocodiles while the Kokoligu dam is experiencing leakages at its embankment. Erimon-Naburnye is currently undertaking fish farming and smocking project to support farm livelihoods



The Municipality over the years has collaborated with NGOs within the Municipality towards the development of Irrigation infrastructure and among these NGOs includes Pronet North with provision of pumping machines, Concern Universal and Result project with the provision of hand dug wells in Lawra for both drinking and irrigation, World Food Programme facilitated the construction of 7 dug-outs in communities such as Eremon Danku,Naajibom,Mojiri,Venne,Boo and Tansili and Care International installed a solar powered pump for irrigation of animals and vegetables at Venne in 2009 (LMA, 2016).

### 3.3 Labour Force

The Region has a considerable good youth population that can be an asset for economic growth. About 60% of the youth are below 45 years. But this has been reducing gradually over the years. For instance from 60 percent to 56.7% in 2000, hence the need to consider

the labour force in their short/medium and long-term policy planning and formulation (GSS, 2000).

### 3.3.1 Economic Activities

The major economic activities amongst the people of Lawra include Agriculture, which contributes over 90 percent employment to especially the male population. They produce mainly for consumption. Agriculture also contribute over 60 percent to household incomes of farmers and few farms produce are marketed most in the village market or through the old tradition of barter where a commodity is exchanged for a commodity based on the demands for the two commodities (GSS, 2000).

### 3.3.2 Farming Systems

Farming or Agriculture is predominantly practiced on small scale basis involving over 90 percent of the population. Farm holdings are less than 2 hectares in size mostly maize and rice using simple farm tools such has hoes and cutlasses with little farm mechanization practices including bullock farming. Mono cropping are usually done in the few large scale farms with production varying according to the distribution of the major rainy season and most crops are also mixed cropped(GSS,2000).



### 3.3.3 Commerce/Service and Industry

The commerce and Service sector of recent is the largest employer of the Municipality's labour force after Agriculture. It includes tertiary services such as petty trading, transport and other financial services provided by civil servants. The sector is also dominated by informal small scale business especially in agricultural produce and other modern consumer products.

Lawra Municipality has two major markets located in the Municipal capital Lawra and Babile.These provide internal generated funds for the Assembly. The transport sector

contribute to the smooth running of the markets as is the conveyance belt for bringing in and out good, control of human traffic. Nevertheless, the sector is poorly developed since major routes are in deplorable states. The Municipality is also blessed with financial institutions such as Ghana Commercial Bank, Nandon Rural Bank, Group Ndoum located in Lawra and Credit Union in Babile with the focus on giving loans to rural folks for agricultural financing, Small scale industries and commerce. However, these banks have failed to provide support and security to farmers to increase their agricultural activities.



The intervention of NGOs such as Care International and Result Project in the Municipality facilitates the operations of financial services to the populace in the form of Village Savings and loan schemes locally known as “Dallee” laterally means Small box is rather making the boost due to flexibility and eschewing of bureaucracies such as the need for collateral to access credit. These allow more people to finance their agricultural and industrial needs but limit their ability to expand. (Lawra Municipality Assembly, 2016).

Also, the industrial sector is technically and professionally based where labour can be used for growth of the local economy. These include Pito brewing, local Akpetasi, Shear butter extraction, pottery, with training facilities by Ministry of Agriculture and the NGOs in the Municipality. The sector contributes to the local economy but is bedeviled with inadequate finance. The sector can be grouped in to Agro-based, wood-based, metal-based, clay-based, and sand–based and a few leather industries depending on the raw materials. Challenges that are confronted by these industries include low capital base and ownership. Most of the businesses are one man’s businesses, hence Sole proprietorship with over 80 percent, family ownership 8 percent and Cooperation 12 percent. The ownership types also come with the sources of funding. The following funding sources

exist in the Municipality and these are owner savings, Relatives and friends, co-operates and financial institutions (Lawra Municipality Assembly, 2016).

### 3.4 Research Methodology and Design

Research design philosophical underpinning researched considered as appropriate during research to solve a particular research problem based on science or the actions taken to investigate a research problem that allow the use of rational applications, procedures and techniques to enhance critical evaluations of the study or research. A research methodology adopts a number of methods that are suitable in addressing the research problem or it allow the use of qualitative, quantitative and mixed methods and gives adequate reasons for the use of each method in conducting a research (Patton, 2012).

A research design is the total plan of a scientific study. It outlines how the study will be conducted with the minimum difficulties or it is the overall master plan that has the ability to link different component of a study in to uniform logical manner, hence making it the blue print for data collection and analyses (Robert, 2013).The study used mixed method. Thus, both quantitative and qualitative data were collected and analysed.

Mixing means the use of both quantitative and qualitative data in a linkage or simply meaning mixing the qualitative and quantitative research together in data collection and analysis (Creswell, 2014).Since data collection took less time, complete understanding of pertinent issues were achieved and cross-validation of findings were done. The mixed method minimized the weaknesses of both qualitative and quantitative methods through triangulation and this increased the study credibility due to the fact that flaws in one of the methods will be neutralized by the other (Hussein,

2015).The combination of these strategies was found suitable for drawing past farming practices and analysing changes overtime.

Being empirical studies, the research use a case study and field survey to investigate the role of Small Scale Irrigation facilities on the livelihoods of farmers in selected communities in the Lawra Municipality of the Upper West Region. With respect to the focus of the study; it adopt the qualitative and quantitative survey design (Creswell, 2014). Patton, (2012) indicates that qualitative method allow a wider examination of previous concepts of different meanings and structures that explains effects while quantitative method is used to collect data on incomes, yields and resources with numerical values. It is therefore very important to blend both methods to minimize the weaknesses of each.



### 3.4.1 Sources of data

Data collection is very important in research because it contribute greatly to the understanding of theories that are used in the study (Creswell, 2014). The study used both primary and secondary data sources. Primary data was sourced using questionnaire, interviews of key informants, focus group discussion and observations from farmers without irrigation and farmers with irrigation using home and farm visits in the selected communities in the Municipality.

Secondary data were gathered from the Ministry of Food and Agriculture, Municipal Assembly, Department of Agriculture, Irrigation Development Authorities, Traditional authorities including opinion leaders in the Lawra Municipal. Other relevant organizations with already existing information were contacted to help the success of the study. Textbooks, Journals, newspapers and other student research works also helped in literature review and validation of findings.

### 3.4.2 Selection of Study Communities

The Lawra Municipality is among the Eleven Districts and Municipalities of the Upper West Region with Lawra being the administrative Centre. Six communities were considered for the study as a result of the presence of irrigation facilities or absence of it, nearness to each other and their homogeneity based on the livelihood activities they undertake. Table 3.3 and 3.4 show procedure for community selection.

Table 3.3 Clusters and communities selected procedure for both with irrigation and without irrigation.



| Clusters/communities selection Procedure | Number of MMDA and Communities Clustered | Total |
|---|---|---|
| **Number of MMDA** | 1 | 1 |
| **Number of clusters** | 3 | 3 |
| **Number of Communities with Irrigation** | 3 | 3 |
| **Number of communities without irrigation** | 3 | 3 |
| **Total number of communities** | 6 | 6 |

**Source:** Author's construct, 2017

From Table 3.3, Lawra Municipality is considered as the Municipality the study was conducted in. The Municipality was further clustered into three areas for the study. Each of the study areas among the three clusters is to produce one community that has irrigation facility described as farmers with irrigation and a community that does not have irrigation facility as farmers without irrigation given a total communities

selected to be 6. This was made possible by listing all communities under the two categories with the support of the Municipal Assembly and MOFA representatives.

Table 3.4 shows the three divisions of the Lawra Municipality clusters. Namely Lawra, Tanchara and Tollibre clusters. Each of these produced a community with irrigation and a community without irrigation.

Table 3.4: Selected Communities for the Study

| NAME OF CLUSTER/ Operational Areas | Communities with Irrigation | Communities without Irrigation | Total |
|---|---|---|---|
| Lawra | Dikpe | Brewong | 2 |
| Tanchara | Ko | Koro | 2 |
| Tollibre | Mettor | Tollibre | 2 |
| **Total** | 3 | 3 | 6 |

Source: Field survey, June, 2017



### 3.4.3 Methods of Data Collection

According to Creswell, (2014) data collection is the process of collecting and measuring information on interested variables in a systematic order that allow a researcher to answer his research questions and to evaluate outcomes. The aim for data collection is to collect or gather relevant, quality and evidence that will help in data analyses. The study will employ the following in data collection.

### 3.4.4 Focus Group Discussions

Focus group discussions (FGD) were carried out in two of the study communities to get the basic understanding of the impact of irrigation in both communities with irrigation and their counterparts without irrigation (Apam, 2012). Focus group discussion is an open-ended in-depth group discussion that only last less than two-hours to throw more light on the topic under investigation and enables respondents to

freely express their opinion (Robert, 2013). It involves a lead facilitator and discussants of both genders-females (5-15) and males (5-15).This was done to enable the study access common opinions, difference with regards to the impact of irrigation infrastructure among males and females. Discussants were selected from a community with irrigation and a community without irrigation, namely Dikpe and Tollibre respectively. Interview guides were used to facilitate open discussions and responses were recorded and noted to reflect the objectives of the study while the responses were presented in the form of statements and interested ones were quoted.



### 3.4.5 Interviews

Interviews were conducted in all six communities among farmers with irrigation and farmers without irrigation to find out the understanding of individual farmers on the impact of irrigation. A total of 138 respondents were contacted from all communities through face to face interaction to unearth their understanding on the impact of irrigation on their livelihoods. Another form of interview that was incorporated is key informant interview. This allows for experts views on a subject matter. They are selected because they have information or ideas that the researcher needs and are applicable in qualitative study.

For the purpose of this study, a number of key informants were interviewed ranging from the Municipal Director of the Department of Agriculture, representatives of Irrigation Development Authority and Extension officers in lawra Municipality and Assembly members. Key informants are able to compare past and present issues regarding the subject matter because they have in-depth knowledge. Interviews were treated as statements on thematic areas of the research and supports data from the focus group discussions considering their similarities and differences.

### 3.4.6 Observation

Irrigational activities in communities with irrigation were observed and its absence in communities without irrigation were also taken note of with regards to livelihood supports and strategies in these communities. Recordings and photographs were taken to further augment the discussions on the study subject matter. Photographs such as irrigation sites, types of irrigations practiced and the challenges irrigation farmers face to support the study findings. Observations such as number of times of cropping, food security situations among communities without irrigation comparative to their counterparts with irrigation. And the type of labour was duly observed to reveal the physical nature of these activities with the aid of observation checklist. According to Robert (2013) observation provides the opportunity to document activities, behavior and physical aspects without having to depend upon people willingness and ability to respond to questions. If the researcher is going in to a new environment, it may require him or her to practise a complete observation which allows systematic recording of observable behaviors that give way for obtaining first-hand information core to data collection in research methods (Creswell, 2014).It also allows consideration of physical evidence that is useful to the study (Baker,2006).



### 3.5 Geographical Information System (GPS) Data on Water Resource Sites and Potential Sites in Study Communities in Lawra Municipality

The study employs the (GPS) in data collection especially on the waypoints of the study communities which is the unique paths that leads to these communities. It was also used in taking coordinates of water resource sites and potential sites the study considered viable for future construction with the support of Irrigation technicians from irrigation development authority and finally coordinates of yield plots sites in

some selected farms were also recorded. These coordinates or way points were used to create map representing study communities in Lawra Municipality.

The Geographical Positioning System (GPS) is the best tool for locating objects, area pictures and elimination of obstacles. It is also used as a field record sheet for storage of data using satellites (SRID, 2016).

### 3.6. Municipality Production level and Yield Plot Cutting

The study tries to establish the yield levels of farmers with irrigation and farmers without irrigation by contacting a representative of the department of agricultural in Lawra Municipality and the data in Table 3.5 were obtained. The projected production figures for 2015, 2016 and 2017 are illustrated in table 3.5.



Table 3.5 Projected production figures for 2015, 2016 and 2017.

| **Crop** | **2015** | **2016** | **2017** |
|---|---|---|---|
| **Maize** | 6,019 | 5,109 | 5,201 |
| **Millet** | 13,639 | 13,914 | 14,052 |
| **Groundnut** | 17,755 | 19,460 | 19,477 |
| **Soya Beans** | 210 | 224 | 238 |
| **Rice** | 127 | 129 | 131 |
| **Sorghum** | 44,413 | 46,301 | 46,527 |
| **Yam** | 0.0 | 0.0 | 0.0 |
| **Cowpea** | 5,159 | 5,567 | 5,494 |

Source: MOFA, June, 2017

The study therefore adopted the yield plot method using the Z –shape technique to evaluate the yield levels of farmers with irrigation and farmers without irrigation. The study randomly and purposively selected three farmers from among farmers without

irrigation and same for farmers with irrigation resulting in six yield plot cuts in farms of these respondents for data collection to enable the study show the yield levels. The Z-shape technique is a research technique used by researchers especially Ghana Statistical Service, NGOs and the Statistical Research and Information Department- a subsidiary of The Ministry of Food and Agriculture in accessing yield levels of fields (SRID, 2016; WFP, 2016; Result, 2017).

Yield plot are cut out plots from an acre to make estimates of general field output, food security analyses and also household income determination (SRID, 2016). Farm plots of size (10m × 10m) with compass bearings of 90◦, 180◦, 270◦, and 360◦ were measured in each community on a farm using the Geographical Positioning System (GPS) to collect data such as number of plants, weight of plot yields and determination of their market values. This data will allow or help assess farmer's total yields, agricultural output, food security, household incomes of farmers and market accessibility within the rural sittings. Procedure for yield plot cutting using Z-shape Technique is illustrated in Figure 3.3.



Maximum of 3 yield plots per acre are cut out in a Z- form within an acre at the z - turns. Each yield plot is achieved by connecting all bearings to form a square parcel on the farms. This is repeated for the third or fourth times depending on the number of successful parcels found on the acre of land. The number of plants found on each parcel is then counted and averages taken and is repeated for all parcels in the six communities. To ensure credibility, the Z-Shape Technique is employed and data is recorded on the spread sheet illustrated in table 3.4.

The format operates by first identifying the field waypoints and names it as A at 90◦, 10m to B at 180◦, C at 270◦ and D at 360◦ respectively or more until 3 successfully

plots falls within the acre. This is illustrated in figure 3.2. Data on 3 yield plots per community are recorded and data spread sheet for recording in all six communities is illustrated in table 3.5 and 3.6 respectively.

Figure 3.2 Z- Shape Techniques (SRID, 2016)

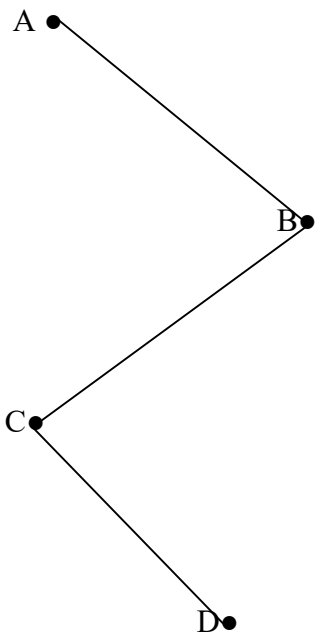
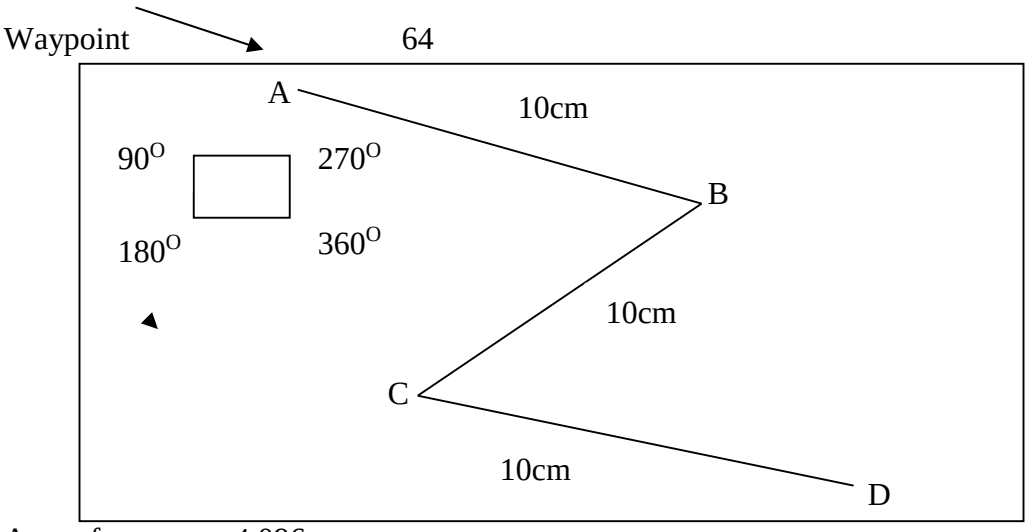





Figure 3.3 Yield plot cut and bearings within an acre




Area of an acre = 4,096sqm

Source: Author's Construct, June, 2017

Table 3.6 Data on 3 yield plots per Community/Farm

| Community/ Field no | Yield plot Coordinates | PLOT 1 Stands/plants | PLOT 2 Stands/plants | PLOT 3 Stands/Plants |
|---|---|---|---|---|
| Brewong | N10◦36.275 W002◦53.293' | 297/102 | 217/101 | 197/99 |
| Dikpe | N1038.801 W00256.069 | 224/98 | 207/105 | 199/89 |
| Tollibre | N10◦36.275 W002◦53.295' | 399/126 | 327/117 | 297/109 |
| Mettor | N1034.890 W00253.135 | 162/93 | 145/101 | 156/113 |
| Ko | N10◦33.959' W002◦50.606' | 98/64 | 78/48 | 104/70 |
| Koro | N1033.500' W002◦49.938' | 411/203 | 392/195 | 417/209 |

Source: Field Survey, June 2017

Table 3.7 Summarized data sheet for all 6 communities

| Community | Yield plots Coordinates | No of harvest in a year | Average No of stands | Average No of plants | Average Weighed Grain |
|---|---|---|---|---|---|
| Brewong | N10◦36.275' W002◦53.293' | 1 | 237 | 101 | 25kg |
| Dikpe | N1038.801 W00256.069 | 3 | 210 | 97 | 17kg |
| Tollibre | N10◦34.890' W002◦53.135' | 1 | 341 | 117 | 11.2kg |
| Mettor | N10.33949 W00254.692 | 3 | 154 | 102 | 12.2kg |
| Ko | N10◦33.959' W002◦50.606' | 3 | 93 | 61 | 9.3kg |
| Koro | N10◦33.896' W002◦50.572' | 1 | 407 | 202 | 31kg |

Source: Field Survey, 2017



### 3.8 Sampling

Sampling is the statistical process that allows the selection of characteristics of a small number of items from a larger number from which inferences will be made about the entire population. This is relevant due to the vast nature of the study area and limited time of the study (Creswell, 2014).

### 3.8.1 Sampling Techniques

The study employed the following sampling techniques.

### 3.8.2 Cluster Sampling

Cluster sampling is the successive division of a population into large numbers of groups called clusters (Creswell, 2014). This was used to cluster the Lawra Municipality as operational areas namely Lawra, Tolibre and Tanchara operational areas respectively. This allow for easy demarcation and location of communities and the comparing of communities under the two farmer categories that will be required for collecting data to be done effectively and representative in nature. Each cluster will produce one community with irrigation and without irrigation respectively. Purposive sampling was done using the procedure below.



- Defining the population or selecting the study area.
- Identify clusters and sample them within the study area to suit the population one is interested in from large groups to subgroups until the stage of individual subjects.
- Subjects then were randomly selected.

### 3.8.3 Purposive sampling

According to Patton (2002), purposive sampling allows the selection of respondents or objects that have direct focus on the study. Kumekpor (1989) defined purposive sample procedure as a sample technique internationally selected for a study. This would be applied in selecting respondents in communities with irrigation facilities in each cluster. Purposive sampling was done using the procedure below.

- First contacting a representation of the Municipal Assembly on communities within each cluster that practice irrigation.

- List all communities in each cluster that practice irrigation. Assembly men, women and other stakeholders such as Department of Agriculture representing each cluster are contacted to help identify groups and their leadership.
- Leadership of these groups was contacted for selection of respondents.
- Simple random sampling is employed to select respondents.

### 3.8.4 Simple Random Sampling

According to Creswell (2014) Simple Random Sampling technique allows participants to be selected to have equal chance or probability. This technique was employed in the selection of respondents in communities without irrigation and the analyses of general conditions of study areas. It also serves as a check to reduce deviations or errors in each cluster. Simple Random Sampling was done using the procedure below to select respondents in communities without irrigation facilities.



- Secure list of the entire households or population in which every subject is listed only once.
- Assigned numbers to the subjects in the list.
- Determine sample size required.
- Write numbers on ballot papers.
- Research team members with blindfolds pick the ballot papers until the require sample size is riched.
- This is repeated in all three communities without irrigation facilities.

### 3.8.5 Communities under Study in Lawra Municipality

This is the actual list of sampling units from which the sample size is taken from. It is simply the total number of households under study (Creswell,2014).The sample frame

for six communities (Brewong, Ko, Tollibre and Dikpe, Tollibre, Koro) under study is 706 households (Fields Survey, 2017).

### 3.8.6 Sample size Determination

Every researcher decides the sample size of his or her sample size to represent the entire population. The population is the total number of individuals or groups under study. A good representation of the entire population does not require fixed numbers or percentages or subjects in determining the sample size, hence the postulates of Best and Kahn, (1995) the nature of the population determines the sample size, the data required, funds available, method of analyses and time frame for the study. They further indicates that 20 or 40 percent sample size is enough representation on few thousands,10 percent for several thousands, 5 percent or less for higher size population and 15 subjects are required for reliability equation in regression analyses in Social Science Research.



From the above suggestions, the sample size for this study was determined using Krejcie and Morgan (1970). The sample size formula for infinite (unknown) population was used to arrive at a representative number of respondents when population estimate is known (Godden, 2004).

$$n = \frac{P(1-P)Z2}{M2} \quad \text{.....Equation 1}$$

Where n= Sample Size, Z= Z Value (1.96 for 95% confidence level), P =Population Proportion (p) for the study is o.1 (10%), M= Margin of error at 5 %( 0, 05).

$$n = \frac{0.1(1-0.1) \times (196)2}{(0.05)2} \quad \text{.....Equation 2}$$

$n = \frac{0.1(0.9) \times 3841}{0.0025}$ ……Equation 3

$n = 138$

Therefore, the sample size for this study involving farmers with irrigation and farmers without irrigation is 138 respondents.

### 3.8.2 Distribution of Sample Size among Study Communities in Lawra Municipality.

For each community, selected numbers of households were chosen for the selection of respondents giving equal chances to all communities. This is done by simply dividing the sample size evenly among the two farmer categories in all six communities. But lot of challenges on access to respondents especially in communities without irrigation leading to increase in number of respondents in communities with irrigation. This is shown in table 3.8



Table 3.8 Number of Respondents per Community

| **Community** | **Sample size** |
|---|---|
| Brewong | 13 |
| Dikpe | 26 |
| Tollibre | 22 |
| Mettor | 22 |
| Ko | 25 |
| Koro | 30 |
| TOTAL | 138 |

Source: Field Survey, 2017

### 3.8.3 Summary Stages of Data Collection

The study has been carried out in stages namely reconnaissance stage, Main survey, and in-depth survey. During these stages, data is collected on Small Scale Irrigation practices as a modern tool that augments crop production and its impacts on micro, meso and macro levels from farmers and links institutions that promotes irrigation development.

The study started with reconnaissance survey. This involves the selection of communities under consideration and familiarization trips were carried out to these communities to create linkages, rapport and build relationships with institutions and personalities that would support the study. Institutions such as MOFA, GIDA, Farmer groups, and Assemblymen in the Municipality were identified and contacted.

Irrigation sites and potential sites in these study communities were visited. Zoning was done putting the study communities into three Operational areas namely Lawra, Tollibre and Tanchara. To assess how crops are grown in the Municipality, visits were made to two major Markets in the Municipality namely Lawra and Babile Markets and identification of key informants by the research team and Agricultural Extension staff leading to the main survey.

The main survey stage focuses on data collection of how the irrigation presence or absence influences livelihoods development towards poverty reduction in terms of assess to inputs, assets acquisition, employment, yields, hunger. Households were selected using both random and purposive sampling techniques for both communities without small scale irrigation facilities and those with these facilities. Data collection were done using questionnaire. Also, relevant institutions members like MOFA, GIDA also took part in the questionnaire administration.



The in-depth survey saw selected groups and individuals being interviewed. These include Community leaders, experts, and farmer group leaders in both irrigated and non-irrigated communities during focus group discussions and market women for sales of produce. During this stage, there is collaboration of data from questionnaire administration yield plots data and other secondary data from MOFA, GIDA and other case studies. Table 3.9 summarizes data collected how they were done and source from which data was obtained.



Table 3.9 Categories of Data and Their Sources

| No | TYPE DATA | DATA SOURCE | Method of Data Collection |
|---|---|---|---|
| 1 | Community waypoints | Selected communities | GPS |
| 2 | Coordinate of waters/potential resource locations | Selected communities | GPS |
| 3 | Yield cutting | Selected Farms | Field layout/GPS |
| 4 | Households data | Key informants/Field survey | Questionnaire, interviews |
| 4 | Household asserts | Farm families | Observation,interview,focus group discussion, |
| 5 | Food Security | Farm families | Interview, Questionnaire, Observation |
| 6 | Agricultural production | Farm families, Agricultural unit, Extension agents | Observation, Interviews, Focus Group Discussion |
| 7 | Access to Agricultural Technologies | Farm Families, Extension agent, Agricultural units | Observation, Interview, Focus Group Discussions |
| 8 | Irrigation and its types | GIDA,Farm families | Observation, Focus Group Discussion, Questionnaire. |
| 9 | Farm employment | Farm families | Farm Families, Financial institution |
| 10 | Farm investments | Farm Families | Questionnaire, Interviews |
| 11 | Farm Savings | Farm Families | Farm Farmlies,Financial institution |
| 12 | Farm income | Farm Families,Community,Traders | |

Source: Authors Construct, June, 2017



### 3.9.9 Data Analysis

Upon the completion of field work, the data collected was organized for analyses. The data was transcribed and treated according to the status of the research participant and grouped based on the various responses to questions given during the interviews. This allows views of different interviewees and options to merge with focus group discussions and other relevant data collected for the study. After data collection, it is necessary to clean the information in order to allow for decision making. Quantitative responses were screened, coded inputted in to Statistical Package for Social Science(SPSS) software and Microsoft excel that makes use of descriptive statistics and multiple responds tools such as frequencies, percentages and the Arc Software for analyzing yield plot data taken with the Gamin GPS. Qualitative data in the study were represented in the form of tables and charts.



# CHAPTER FOUR

# DATA ANALYSIS, PRESENTATION AND DICUSSIONS

## 4.1Introduction

This chapter gives further understanding to the study area after having a feel of the place to better inform analysis and discussions on how irrigation infrastructure promotes agricultural activities and household's livelihood empowerment.



## 4.2 Demographic Characteristics of Respondents

### 4.2.1Gender of Respondents

Gender of respondents is an important variable in assessing the impact of irrigation on rural livelihoods. Figure 4.1 shows that a total of 138 farmers were contacted, Majority of respondents (60.8%) were males with 39.1% being females. This is evident that males constitute the majority of the respondents interviewed. This further confirms that farming is male dominated in the study area as a result of the labour intensive nature of its activities. The study further revealed that allocation of portions during the irrigation establishment was more to men than women. For instance activities such as ploughing, weeding, stomping of virgin lands are solely activities of men and they requires working for long hours in the sun making them not suitable for women, hence activities such as sun drying, winnowing and haulage of farm produce are the preserve of women.

According to Bonye and Kpieta. (2015), the majority of men domination in farming is due to cultural beliefs and norms that permit the male as the head of household and they are at liberty to inherit lands and keep them intrust for the future generations, thus through birth gives men or male sex domination over women or the female sex

through birth. They further added that the significant increase (39.1%) experienced in women access to land for irrigation is due to push factors and co-ownership as a family. Push factors makes household heads leave their families allowing the family portions of land to women intrust through the existence of vacancies for women to own lands in the Lawra municipality. These findings are however consistent researchers such as Gadisa, (2016) and Peprah *et al*., (2015) states that women low numbers in access to land is an indication of their few population in access to irrigation infrastructure, hence food insecurity among female households heads. Evidence of this observation has been confirmed in this study by the lower number of female respondents in irrigation sites.



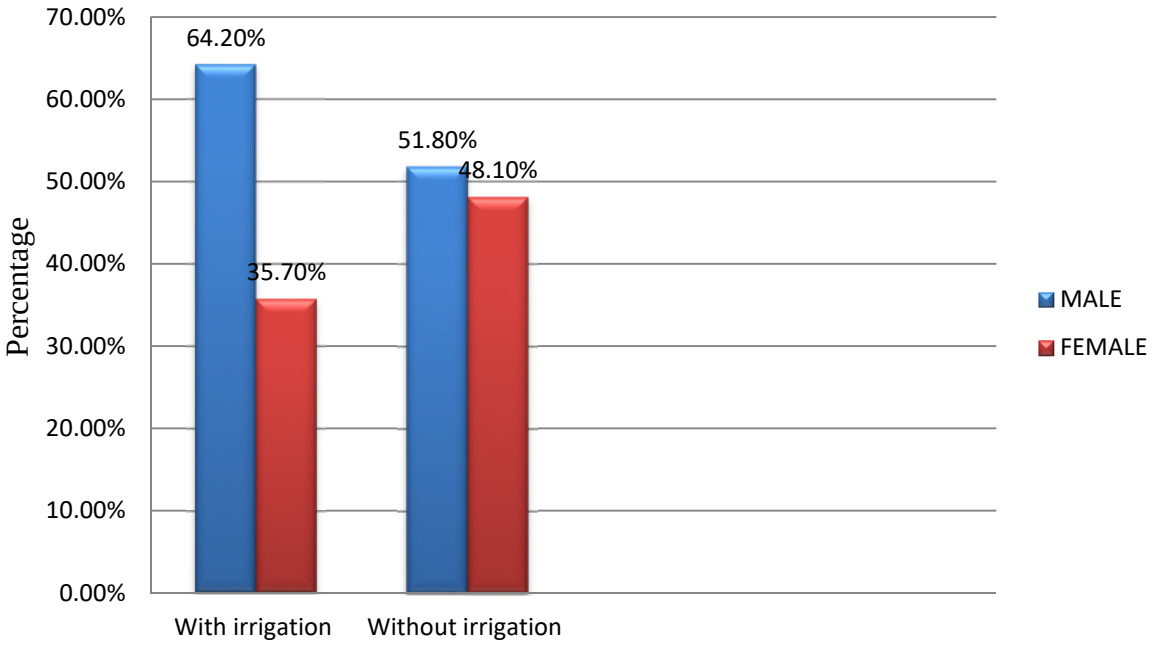



**Figure 4.1 Sex Segregation of Respondents**

**Source: Field Survey, June 2017.**

The study results further shows that about 64% representing 54 respondents were males and 35% representing 30 respondents were females from among farmers with

irrigation while farmers without irrigation have about 51% males and females being 48% from a total number of 54 respondents. In all, about 60% representing 84 respondents were males and 39% representing 54 respondents were female.

### 4.2.2 Age Distribution Respondents

To access participation of respondents in farming as either an irrigation farmer or a non-irrigation farmer, the study grouped farmers into a number of categories ranging from 15-20, 21-26, 27-32, 33-38, 39-44, 45-50 years. A total of 138 respondents were contacted in trying to solicite information on their participation in farming as either an irrigated farmer or non-irrigated farmers. This is crucial to ascertain the age categories of farmers in correlation to the impact of irrigation on their livelihoods. The study considered the age categories of farmers in the various study communities and the results shown in Figure 4.2.



The result shows that most of the respondents contacted were found in range 45-50 that represents about 46 respondents. The youngest age is 15 and the oldest being 50.This suggest that between 15 to 50 years of age is a good range for most active population that is capable of providing labour or gaining jobs in the agricultural sector to increase production. It also indicates that most farmers within the Lawra Municipality would not have gone on retirement if famers were to be enrolled in the National Security and insurance trust (SSNIT) as pensioners since the retirement age is 60.

Kpieta *et al.*, (2013) indicates that farm labour within the age ranges of 15-50 can maximize production. This is because farmers within the \Lawra Municipality at age 50 still undertake farming activities. The study results revealed that lower numbers of respondents were within the age group of 15-20 age categories. This is consistent with

studies of Apam, (2012) indicates the lower numbers is due to the school going age. This further implies that it would not be out of place if irrigation infrastructure is developed for schools to enable students to have some practical knowledge on the technology. This would further increase their interest in agriculture and to encourage them in its production after completion in the Lawra Municipality.

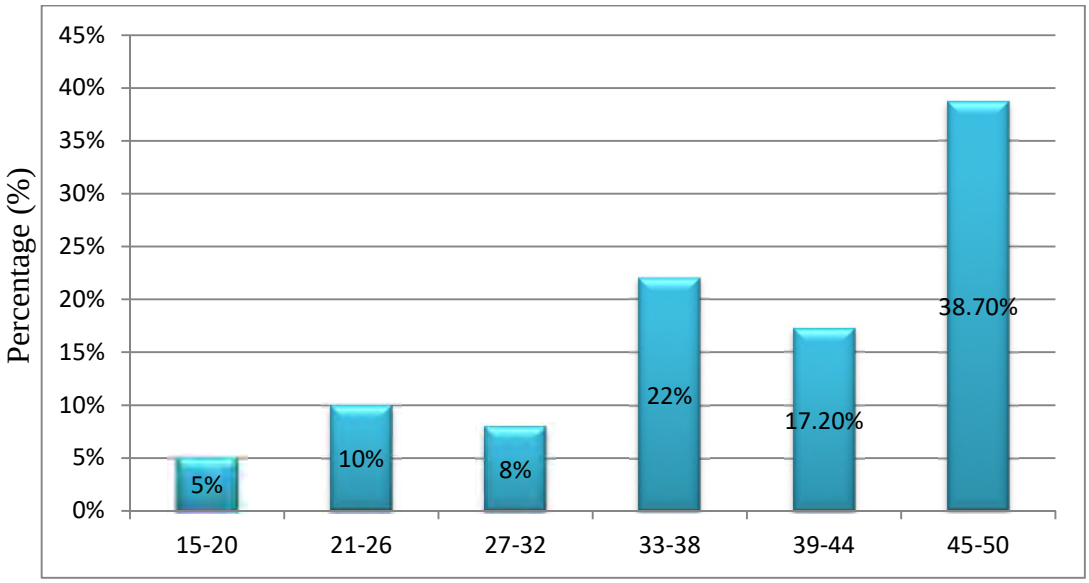



**Figure 4.2 Age Distribution of 138 Respondents**

**Source: Field Survey, June, 2017**

### 4.2.3 Educational Background

The Agricultural sector requires enough skilled professionals such as Agricultural Extension Agents to improve on its efficiency. In order to determine the knowledge of respondents in study communities, the study accessed the educational levels of 138 respondents from among communities with Irrigation and communities without Irrigation. The results shown in Figure 4.3 indicates that about 67% representing 93 farmers do not have any formal education, 13.9% of farmers representing 19 respondents have had Basic education, 8.2% representing 11 respondents have SHS

certificates, 7.4% of farmers representing 10 respondents have middle level education and 3% of respondents representing 4 farmers among 138 respondents have tertiary education.

The results also suggest that about 52% representing 72 respondents out of 84 farmers with irrigation have had no education, 7.1% representing 6 respondents have basic education, 11% of respondents representing 9 farmers have SHS, 25 respondents representing 30% have Middle level education and no respondents have tertiary level education. For farmers without irrigation, the number of respondents that have no education at all is 33 representing 61.6%, 10farmers have basic education representing 18.3%, 3farmers have SHS representing 5% , 4 farmers representing 6.6% have middle school certificates and 4 farmers representing 7.4% equally have tertiary level.

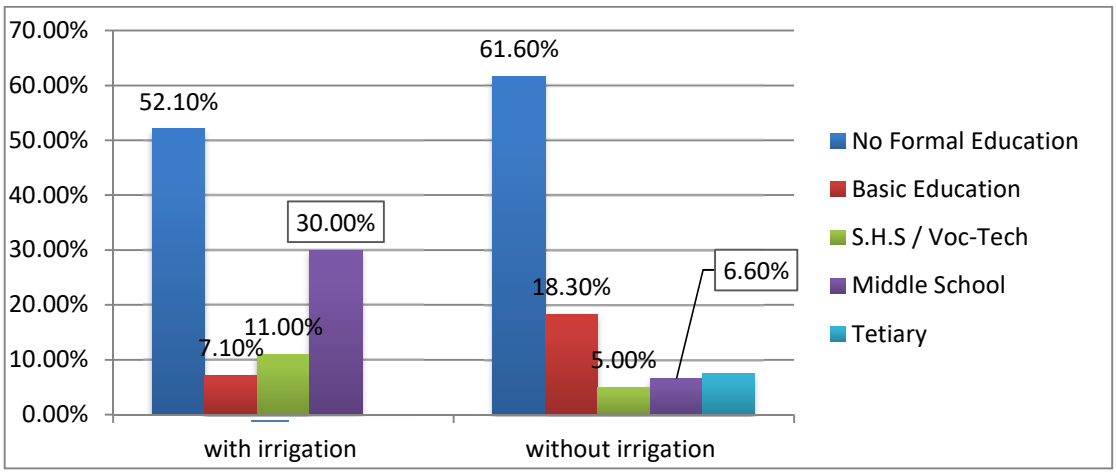


Majority (67 %) of farmers have no education making farmers vulnerable and not capable to indulge in any other work, hence no choice but to engage in farming as a livelihood (Monnah, 2015). Most farmers are illiterates resulting in the bad yields farmers especially women obtains in farming making farmers not qualified to engage in any meaningful occupation such as banking, teaching and Nursing(Monnah,2015). Farming is the preserve of illiterates that results in the low yield levels they experienced and manifest the severity of the food insecurity situations in their various households (Apam, 2012).This makes famers not able to adopt to new technologies that are able to increase their yield levels in order to break from the poverty circle.

Figure 4.3: Educational levels of respondent



rcentage (%)




Source**:** Field Survey, June, 2017

### 4.2.4 Households Size

The household size of a farmer determines the level of food production and food security of that particular household. The study therefore tries to examine the number of people that are the responsibility of the respondents contacted during the field data collection and the results shown in Table 4.1. Table 4.1 shows grouping of farmers or respondents in ranges. These ranges include 1-5, 5-10, 10-15 and 15-20. The result indicates that15-20 range had no farmer meaning no farmer had household members that members between 15 to 20 among all the respondents.

Also both farmer categories have the highest household members in a range of 10-15 and lowest household members being 8 for farmers with irrigation and 3 for farmers without irrigation indicating that at least, in every household within the study communities have 3 members that are the responsibility of the respondents.

From the study results, most household in Lawra Municipality have at least 10 members (WFP, 2015; Result, 2017). This implies that, the 2010 Ghana Statistical Service Population and Housing Census report has lower household members than

that from the study findings that suggest 8 members in every household in Ghana at any point in time.

Table 4.1 Household Size of Respondents under the Ranges

| | **With irrigation** | | **Without irrigation** | |
|---|---|---|---|---|
| **Household size range** | Frequency | Percentage | Frequency | Percentage |
| **1-5** | 13 | (84) 16.0% | 20 | (54) 36.7% |
| **5-10** | 35 | (84) 41.9% | 23 | (54) 41.7% |
| **10-15** | 28 | (84) 33.9% | 8 | (54) 15.0% |
| **15-20** | 0 | (84) 0.00% | 0 | 0.00 |
| **20+** | 8 | (84) 8.1% | 3 | (54) 6.6% |
| **Total** | 84 | 100% | 54 | 100% |

Source**:** Field Survey, 2017

### 4.3 Water Resource Presence in Lawra the Municipality for Agricultural Production

Objective one of the study is to examine the types of irrigation schemes practiced in the study area. This leads the study to examine the water resource availability in the Lawra Municipality. The results in Table 4.2 revealed that out of the total number of water resources in the table, some of those that were being used for irrigation farming are few, and therefore classified as functional.

Table 4.2 Types of Water Resources in Lawra Municipality.

| Water resource | Total number | Number functional |
|---|---|---|
| Black Volta | 1 | 1 |
| Dams | 3 | 2 |
| Dug-outs | 9 | 4 |
| Greenhouse | 3 | 1 |
| Culvert Diversion | 4 | 1 |

Source: Field Survey, 2017



Access to water resources is a prerequisite for irrigation development (Kpieta *et al.*, 2013). The results suggest that some communities with water resources are still not able to transform them into viable irrigation facilities. This means that the presence of a water resource alone does not guarantee irrigation development. Other factors come into play. For example, the provision of canals, pumps, pipes and technology must be made available for the success of a constructed Dam. Plate 4.1, is a Green house with all its accessceries, hence functional irrigation facilities in Lawra Municipality.

Plate 4.1 Greenhouse in Babile Agric Station

Source; Field Survey, June 2017.

The study probed further to ascertain how some communities are able to develop some of these useful water resource and others are not able. It was revealed that these facilities are provided by the central government and lack pipes to transport water resulting in farmers own purchase of these pipes to make them useful.. However, those facilities that are underutilized are due to the lack of communal sprites and conflicts which is not different from what Peprah *et al.* (2015) found in Sankana in the Nawdoli-Kaleo District. In an interview with a key informant. He had this to say: *Though the efforts of central Government that provides all these structures coupled with policies such as One- Village, One-Dam, turns to run to the south to learn the Twi language and with the mentality that "I have also been to south" and not because of greener pasture. I earned more than 10,000 Ghana cedis annually when i invest in farming in Manwe irrigation sites in the Upper West Region. However, my major challenge there was getting labour. (*Key informant interview IDA, Wa, June, 2018).



**4.4 Types of irrigation schemes respondents engaged in Lawra Municipality**

The types of irrigation schemes farmers in Lawra Municipality engaged in was sought in Table 4.3. The results revealed that 37% of farmers with irrigation engaged in drip irrigation, culvert diversion was the least irrigation type respondents' practice which represents 10% of the sample population.

4.3 Types of Irrigation practices in Lawra Municipality

| Type of Irrigation | Frequency | Percent |
|---|---|---|
| Surface irrigation | 29 | 35% |
| Drip Irrigation | 45 | 37% |
| Sprinkler Irrigation | 10 | 12% |
| Culvert Diversion | 8 | 10% |

Source; Field Survey, June 2017



From the results in Table 4.3, it brings to the fore that drip and surface irrigation are the major types being practiced by farmers in Lawra Municipality. These are the types that are easily accessible due to the presence of surface water resources such as dams and dugouts, as well as the Black Volta. Furthermore, the culvert type of irrigation fell short because few culverts exist for farmers to divert water into irrigation farm. However, it was found that the sprinkler method of irrigation is costly to practice. Though farmers in Lawra Municipality could have improvised other techniques such as manual tridal pump, few farmers practised it. This present convincing evidence to conclude that farmers cannot afford to purchase the sprinkler type of irrigation, hence the low patronage in Lawra Municipality. The finding of this study differs from Franken, (2005), Apam, (2012) and Gadisa, (2016) which indicates three types of irrigation but in consistent with the discovery of the irrigation development Authority. Most communities' in Lawra Municipality must be assisted to practice irrigation using culvert diversion. It could create job opportunities in the dry season. Respondents understanding and definitions of the types of irrigation was tested by recording a number of definitions, but the common definitions that run through for each of the irrigation types include;

***Surface irrigation***

Surface irrigation is the flooding of the soil surface or farms with water with the help of gravity. Water under this type of scheme is uncontrollable, hence wastage is huge since it is mostly practiced in areas of no water scarcity. It is also possible to use canals in transporting water from one field to another. Plate 4.2 is Babile dam, plate 4.3 is key valve in dam reservoir and plate 4.4 is canal with a v shape weir respectively, indicating water transportation in a surface irrigation using canals.



Plate 4.2 Site view of Babile Dam

Source; Field Survey, 2017

Plate: 4.3 Key valve from Babile Dam

Source; Field Survey, June 2017

Plate 4.4: Cross section of a canal with v- shape weir

Source; Field Survey, June 2017

***Sprinkler irrigation***

Sprinkler irrigation consists of a sprinkler head connected to a pipe placed in water under pressure. Unlike the gravity feed system a machine initiates the pressure forcing water out of the sprinkler head or the gun making it to pivot on a retort stand on the field. A number of such connections are made on a field with their radii tangent to each other depending on the nature of the land for the purpose of watering crops or fertilizer application. Plate 4.5 is a Tridal pump as a form of Sprinkler irrigation.

4.5 A typical Tridal pump used in koro

Source; Field survey, June 2017



***Drip irrigation***

Drip irrigation is the type of irrigation where water is directly placed into each individual plants or crops on the field. This help to augment the water for plant growth in the dry seasons. This occurs when drip lines are connected to a water source under pressure moves through the drip lines with perforated holes that are equal in distant to the plantings between rows and within plants. This method is most recommended in areas of water scarcity. The connections also have restrainer or suction head that prevents debris in to pressure system. The system can be practiced in domestic homes in the form of a greenhouse. A Greenhouse about 50cm by 20cm hen-cook structure with transparent zinc like material with drip lines hang up high or placed on the ground.

An external water source is connected to this drip lines for water passage under pressure to either fertilize or apply water to crops. Plates 4.6, 4.7, 4.8 and 4.9 are a tried and tested drip irrigation connection in Dikpe community in the Lawra Municipality.

Plate 4.6 Restrainer connected to Machine in Dikpe

Source; Field Survey, 2017

Plate 4.7 Layout of Main Drip lines

Source Field Survey, June, 2017

Plate 4.8 Drip lines connected to a Main line on field

Source; Field survey, June 2017

Plate 4.9 Greenhouse in Babile Station

Source; Field Survey, June, 2017

***Culvert Diversion***

Culvert diversion is a form of trapping run-offs under culverts by casting the culvert mat to a reasonable height. Dam water is now transported to the farms close by. This is mostly practiced in the early onset of the rains or its exit since water is readily needed during these periods. A typical culvert diversion that is being put to good use in Kunyukuo is shown in plate 4.10. A further discussion of the culvert diversion with a key informant proves its potency. He further added that;

*Culvert diversion is identified to be appropriate in the northern Regions. If we can locate irrigation fields or gardens along culverts for the production of vegetables for home consumption since water is collected under culverts during rains and escape as runoffs* (Key informant interview GIDA, Wa June, 2017).



Plate 4.10 A typical Culvert Diversion in Kunyukuo

Source; Field Survey, June, 2017

**4.5 Water Resource Management and Conflicts in Lawra Municipality**

From the results in Table 4.3, the study further assesses the management of these irrigation facilities in their various locations among communities. The findings shows that farmers in the study area practice three types of farm magement.These are common pool, common property regime and the mixed form. Respondent's ideas and

understanding of these management types were recorded and a general understanding was arrived at in each management type in terms of their definitions. These include;

***Common Pool Resource Management***

Respondents define common pool resource as the management type of resource where farmers either individual or group consult their own interest and misappropriate a particular resource within their catchment area. Farmers do not care in using the resource beyond its carrying capacity.

***Common Property Regime***

Respondents define common property regime as the creation of laws governing a water resource and also added that this type occurs where farmers and other stakeholders make rules and regulations governing the use of a resource with the intension of ensuring the resource is not used beyond its carrying capacity to prolong the life span of the resource for future use.

***Mixed Form***

A number of deliberations on the naming of the third form of management was arrived at during a focus group discussion as mixed form and was define as the type that occurs when some groups or farmers refuse to abide by rules governing the use of the resource.

Allowing every individual to do what he or she deemed fit to the use of the resource as long as it satisfies his need or her water need. This mostly results in conflicts between the regulators and these recalcitrant farmers.

During a male/female focus group discussion among farmers in Lawra Municipality on the challenges and management of irrigation farming. This is what a discussant had to say;

*We have a water users association among cluster communities close to a dam, Conflict arose when a non-member within one of the communities opened up water for his watermelon farms coursing all the water to drain out* **(**Chief of Tanchara, June 2017**).**

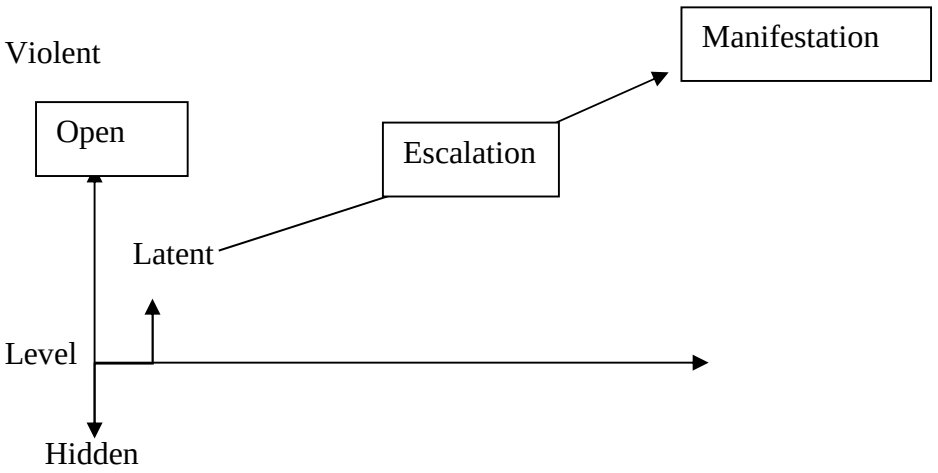
The study findings disagrees with studies of Apam, (2012) and Shackleton *et al*., (2010) identifies two management types in their various studies. From the study findings, it is obvious from the study results indicates that disagreements in the use of the resource results in the mixed type of water management.



### 4.4.1 Activities of Water Users Association and Conflicts Symptoms in Lawra Municipality

From the findings, it was revealed that the mixed form occurs due to conflicts, and to further understand how conflicts occur, the study further assessed activities of water users associations in the Lawra Municipality. It was revealed during deliberations with respondents that conflicts as shown in figure 4.4 arises in stages namely latent stage where people turn to disagree with each other yet they do not show physical signs of disagreement, The second is escalating stage where tensions rise among aggrieved parties. The third stage is the violent stage which occurs where individuals are prepared to fight each other and they throw verbal insults to their opponents and finally the manifestation stage where bad blood manifest or is visible among quarrelling parties.

Figure 4.4 Stages of conflicts




Source: Authors' Construct, June, 2017

According to the Municipal Director of Agriculture, to manage conflicts in water source communities requires the creation of water users association with the mandate to supervise the operations and maintenance of the facility. Water users Association allow for punishment of offenders and ensure sustainable usage of the resource. During a key informant interview on the relevance of water users associations, this is what a woman had to say;

*Unity among members of water users association makes us benefit from government fertilizes subsidy programme and farm machinery* (Key informant interview, FGD, Ko, June, 2017).

These findings agrees with Vic Res et al., (200) the role of water users association is not only to serve as collateral for accessing credit from financial institutions rather to serve as a protector of the water resources for its sustainability. The presence of water users association tends to reduce conflicts arising from the use of the resource. Chiefs are able to control and protect water resources better in places where there exist water users associations (Apam, 2012).

### 4.5 Agricultural Production and Food Security in Lawra Municipality

To determine the level of food crop production in Lawra Municipality, yield plots of the study communities was cut using the Z-shape technique. The results in Table 4.3 indicate that communities that have access to irrigation facilities had high yield. These communities' includes Dikpe (21bags), Mettor (13bags) and Koro (16bags). However communities without irrigation facilities recorded low yields.

From table 4.4 results revealed that communities with irrigation performs better than communities without irrigation, hence irrigation really increases production levels of farms. Agriculture has this tendency to employ about (90%) of most youth in the three Northern Regions with Lawra Municipality inclusive (Kpieta *et al.*, 2013), yet it is rain-fed



Table 4.4 Yields per communities under Study

| NO | COMMUNITY | YIELD( Bags/kgs) |
|---|---|---|
| 1 | Brewong | 10 bags,25kgs/ |
| 2 | Dikpe | 21 Bags |
| 3 | Tollibre | 11bags ,48kg |
| 4 | Mettor | 13 bags, 1kg |
| 5 | Ko | 10 bags 13 kg |
| 6 | Koro | 16 bags 7kgs |

Source: Fields Survey, June 2017

The Municipality experiences three months of rains resulting in low agricultural production that cannot meet the household requirements of farm households. The introduction of irrigation technology therefore comes as a necessity since it is able to provide water for agricultural activities after the major rain season. Making it possible

for farmers to increase their productivity. Increase in production levels turns to ensure food security among farm households as it is the most important obstacle in agriculture productivity. Food Security analyses considers availability of food, assess to this food by farm households and the utilization of these food to individuals within the operating community (Gadisa, 2016).

### 4.5.1 Food Availability

Food production is a factor of food availability as studied in table 4.3.A further assessment was studied on the months of food availability in table 4.4. The results show that averagely, farmers with irrigation have considerable food available throughout the year. However, their counter parts are hardest hit in the 5th t0 8th (May-August) months of the year at which time they rely mostly on stock meant for sowing. The indication of considerable food by farmers with irrigation is as a result of the number of cropping times within the year due to the presence of irrigation practices.

Table 4.4 Annual Food Availability in Households.



Table 4.5 Show annual food available in households

**Food Availability in 12 Months of the year**

| Category of farmer | 1-4 | 5-8 | 9-12 | Total |
|---|---|---|---|---|
| **Irrigators** | 21(17.6%) | 21(17.6%) | 32(26.9%) | 84(100%) |
| **Non irrigation** | 20(10.8%) | 10(5.4%) | 24(13%) | 54(100%) |
| **Total** | | | | 138(100%) |

Source; Field Survey, June 2017

From the results in table 4.5 respondents indicates the 8th month or August as their busy time for harvesting leading to abundance of food cook per day while in the 4th month or April less and less preferred foods are consumed especially in communities without irrigation. These revelations are in tandem with studies Gadisa, (2016),| and Result,(2017) farmers without irrigation have no alternative to water access accept the major rainy season making them to intensively farm within this period while farmers with irrigation have water all year round making farmers to produce fresh food stuffs throughout the year. This therefore suggests that farmers with irrigation conduct less coping strategies as compared to farmers without irrigation since they have considerable food throughout the year.



### 4.5.2 Food Accessibility

Food accessibility is a factor in food security and is directly linked to the periods of food availability within the 12 months of the year as shown in Table 4.6. This is to determine the category of farmers that are food secured by categorizing respondents' hunger gaps within the 12 months of the year.

Table 4.6 Lean Farmers hunger Gaps

| | **Months of the year** | | | |
|---|---|---|---|---|
| **Practice irrigation** | **1 to4 months** | **5 to 8 months** | **9 to 12 months** | **Total** |
| **With irrigation** | 84(9.7%) | 84(88.7%) | 84(1.6%) | 84(100%) |
| **Without Irrigation** | 54(5%) | 54(88.7%) | 54(6.6%) | 54(100%) |
| **Total** | | | | 138(100%) |

Source: Fields survey, 2017

The results show that 9.7% of farmers with irrigation experienced hunger from January to April, 88.7% experienced hunger from May to August and 1.6% experienced hunger in September to December. However 5% of farmers without irrigation experienced hunger in January to April, 88.7 % from May to August and 6.6% in September to December.

This indicates that farmers who have no access to irrigation experience food shortages than irrigation farmers. Access to food is the proximity to food and its preparation against the length or duration to which the food is meant to last. Larger food portions are cooked during bumper harvest and reduce and less preferred foods are cooked during lean seasons. Lean seasons are the times most coping strategies are conducted in order to manage the food shortages that may arise (Apam, 2012).



### 4.5.3 Food Utilization

The Mid Upper Arm Circumference (MUAC) Tape was used to determine food utilization in the study communities. This was done using children between the ages of one to five years and a total of three children was randomly selected in each community and their measurements averages taken. The results as shown in Table 4.7 indicate that communities with irrigation had 14.2cm which suggests that these children are not malnourished. On the contrary, communities with no irrigation recorded 11.0cm which indicate severely malnourished.

Table 4.7 Muac Results on Study Communities

| Community | Red | Yellow | Green |
|---|---|---|---|
| Community with irrigation | 0.00 | 0.00 | 14.2 |
| Community without irrigation | 11.00 | 12.00 | 11.5 |

Source: Field Survey, 2017

This finding suggests that farmers in communities with dry season gardens have their children eating regularly for the past seven days as shown to be 14.2cm making them normal in terms of their nutritional levels though not the best as against children in communities without dry season gardens being severely malnourished or risky as shown to be between 11.5cm and 12.0cm respectively. These figures make them food insecure.

From the food consumption score chart in table 4.8 indicates the weights' for each food groups found in the Lawra Municipality making it possible to calculate the weights for food eaten in the study communities. The study consciously eliminated respondents or households that have funerals, Marriage or Naming ceremonies as they influence the food availability in the households.



Table 4.8 Calculations of the food security situation in the Lawra Municipality

| Food Group | Weight | Frequency of eaten last 7 days | Summation |
|---|---|---|---|
| Main staple | 2 | 5 | 10 |
| Fruits | 1 | 2 | 2 |
| Vegetables | 1 | 4 | 4 |
| Meat/Fish | 4 | 1 | 4 |
| Total | | | 20 |

Source: Field Survey, June 2017

The food situation of a particular community is the summation of the weights' of the food groups combined in order to classify a community as being food secure considering the following ranges 0-20 is very poor or poor food security situation, 21-35 is within the border line or not seriously food insecure and greater than 35 is

acceptable(Gadisa, 2016).The food consumption score is an index that helps to aggregate household data on the food diversity frequency of food groups consumed over the previous seven days. To further assist in the classification is the level of coping strategies people will have to adopt in their households (Tiwari *et al.*, 2013).

The study finding disagrees with studies such as Gadisa, (2016|), Result, (2017) in their various studies, indicates consumption by adults was the determinant of how useful food was to the households in the past week. However, the findings agrees with studies of WFP, (2015) indicates in their various studies that a score of 20 makes a community food insecure, hence the need for coping strategies. Plate 4.11 is a Muac Tape and 4.12 is it's used in taking measurements of children in study communities.



Plate 4.11 Atypical Muac Tape

Source; Field Survey, June 2017.

Plate 4.12 Muac Measurement on a Child in Koro Community

Source; Field Survey, June 2017.

**4.5.4 Coping Strategies during Lean seasons or Food Shortages.**

To further assist in the food security situation of Lawra Municipality, a number of coping strategies were recorded. Table 4.9 shows Coping Strategies adopted by respondents. The results indicates that 18.9% is the highest score for both limits portions of food at meals time and borrow food or rely on relatives and friends and the lowest score is 13.9% for both reduce the number of meals eaten a day and restrict consumption by adults for children to eat respectively. This implies that most farmers adopt to copping strategies in the Lawra Municipality especially farmers without irrigation facilities than their counterparts with irrigation farms, hence the insufficiency in food security. Coping strategies are the number or the behaviors adopted by households during times of food shortages. They indicate the severity of food insufficiency in a particular locality(Gadisa,2016).The number of coping strategies adopted by a family is directly proportional to the nature of malnourished members in that community as a result of the lack of money to make purchases or insufficiency in food produced for consumption (Result,2017).

Table 4.9 Coping Strategies

| No | Coping Strategy | Persons that conduct behavior | Percentage that conduct Behavior |
|---|---|---|---|
| 1 | Limit portions of food at meals time | Women | 18.9% |
| 2 | Reduce number of meals eaten in a day | Men and Women | 13.9% |
| 3 | Restrict Consumption by Adults for children to eat | Women | 13.9% |
| 4 | Consume less preferred and less expensive | | 17.2% |
| 5 | Borrow food or rely friends and relatives | Men and Women | 18.9% |
| 6 | Consume stock held for next season | Women | 12.3% |
| 7 | Skip entire day without food | Men | 4.9% |
| 8 | Send children to beg | - | 0% |
| Total | | | 100% |

Source; Field Survey, June 2017



### 4.6 Challenges that confront Irrigation farmers in Lawra Municipality

The study further examined the challenges confronting farmers in communities with irrigation. The study observation shows that challenges are practical and visible.

A number of these challenges were identified namely digging of wells, Manual transport of water, runoff under culverts, encroached buffer zone of water bodies and breached dams. These informal practices the study revealed had the tendency to course environmental hazards especially soil erosion in furrow creation and pond or well construction. Plates 4.13, 4.14, 4.15 and 4.16 shows these local or disguise methods adopted by farmers to meet their irrigation water requirement in study communities.



Plate 4.13 Manual Water Transport in Dikpe Community

Source Field Survey, June, 20017

Plate 4.14 Wells in Dikpe Community

Source; Field Survey, 2017

4.15 Culvert Diversion in Kunyukou Community

Source; Field Survey, June, 2017

Plate4.16 Breached Dam in Tanchara Community

Source; Field Survey, June, 2017.

From the study observation, it was revealed that the study areas or communities have large parcels of land for irrigation, many network of the Black Volta for irrigation at communities' levels and high demand of irrigation in the Lawra Municipality.

### 4.6 Impacts of Irrigation on Livelihood Parameters

In order to access the impacts of irrigation on certain areas such as income generation, market access, Extension service delivery, number of cropping in a year, labour engagement and employment adopted the farm budget approach. This budget takes in to consideration the 2017 farming activities and its related variable cost components. It also considered maize as a crop since yield plot data were taking on maize fields. Respondents willingly contributed in drawing a budget on an acre of maize farm during the questionnaire administration on the Cost- benefit analyses ranging from cost on land clearing, sowing, weeding, harvesting till marketing .This is shown in Table 4.10. The table indicates that farmers with irrigation crops three times annually, increase in income generation, engage more labour and employ more people than farmers without irrigation. This means that livelihoods of farmers with irrigation are better improved than farmers without irrigation. Farm budget is briefly described as the process of estimating cost, returns and net profit of a farm, hence is a statement of estimated income and expenditure (Bashiru, 2013). The farm budget outlines the possible inputs and outputs of an acre to be used as bases for assessment of irrigation on the livelihoods of farmers with irrigation and farmers without irrigation in Lawra Municipality.



The study conducted a male, female focus group discussion in Dikpe and Tolllibre to assess the impact of irrigation along the following topics cropping times, income generation at household level, employment and access to market. Discussants each community total 15 comprising 9 male and 6 females for Dikpe and 12 males and 3 females for Tollibre. The low numbers of females was as a result of funerals within the catchment area and Babile markets for Dikpe and Tollibre respective

Table 4.10 Farm Budget for a typical Maize farm (an acre).

| ITEM | QUANTITY/PERSONS | UNIT COST | TOTAL COST | COMMUNITY / ACTUAL IRRIGABLE ACREAGE |
|---|---|---|---|---|
| Land (acre) | 1 | 100.00 | 100.00 | Brewong-14 |
| Seed | 9kg | 18.00 | 18.00 | Dikpe-24 |
| Ploughing | 1 | 100 | 100.00 | Tollibre-17 |
| Sowing | 7 | 25.00 | 175.00 | Mettor-39 |
| 1st Weeding(contract) | 5 | 25.00 | 125.00 | Ko-12 |
| Fertilizer: NPK | 3 | 160.00/82.00 | 122.00 | Koro 36 |
| 2nd Weeding | 5 | 25.00 | 125.00 | |
| Harvesting | 12 | 15.00 | 180.00 | |
| Transport | 10 | 6.00 | 60.00 | |
| Thrushing | 5 | 15.00 | 75.00 | |
| Sack | 10 | 5.00 | 50.00 | |
| Total Cost (ATC) | | | 795.00 | |
| Output in Bags(Q) | 10 | | | |
| Selling price | 10 | 120 | 1,200 | |
| Revenue(Rev) | 1,200 | | | |
| Profit=Rev-Tc | 1,200-<br>795.00=405.00 | | | |
| Without irrigation | 405.00 | | | |
| With irrigation | 1,215.00 | | | |

Source: Field Survey, June 2017

### 4.6.1 Small Scale Irrigation and Multiple Cropping

The presences of water determine the number of times a farmer can undertake within the year. Area with all year round water experienced more than one farming season. The results in Table 4.11 indicates that farmers with irrigation are able to crop more than twice in a year than their counterparts without irrigation. The study further reveals that farmers with irrigation use small sizes of land yet they have more yields while farmers without irrigation farm in larger farm size ranging between 2 to more than 10 acres and they still harvest low. In terms of increase in yield, Farmers attribute these increases in yield to the government flagship programme planting for food and jobs that has reduced the cost of inputs to 50%.



Table 4.11 land size of Respondents and number of cropping times annually

| **Farmers** | **Less than acre** | **1 to 2 acres** | **3 to 4 acres** | **Greater than 5** | **Number of cropping times** |
|---|---|---|---|---|---|
| With Irrigations | 21 | 44 | 14 | 5 | 3 |
| | Less than 1 | 1 to 3 | 4 to 7 | above 8 | 1 |
| Without Irrigation | 7 | 13 | 21 | 13 | |

Source: Field Survey, June 2017

These findings are in tandem with studies of Liston, (2013) and Monnah, (2011) indicates that irrigation farmers are able to crop all year round as a result of the presence of water in and all communities with access to irrigation facilities..

### 4.6.2 Small Scale Irrigation and Household Income Generation

Household income generation is the most important objective of every farmer through the sales of farm produce or rearing of livestock. The amount of income generated annually by a farmer in the Lawra Municipality is directly proportional to the level of food security in the household. The results revealed in Table 4.10 indicates that produce per farming season or during the major raining season earns the farm households an amount of Gh₵405.00 as profit from the farm. Farmers without irrigation do a single farming activity during the major rains in the Lawra Municipality earning such households an amount of Gh₵405.00 annually while farmers with irrigation facilities are of a great advantage since they have the opportunity to undertake further two farming activities making their annual farm activity in three folds due to the availability of water. From results in Table 4.10, such household tend to earn three times household income than farmers without irrigation. Making the amount earned annually to be Gh₵1,215.00.



This result in Table 4.10 further indicates that the ability to diversify into other businesses apart from farming is much easier for communities with irrigation facilities than communities without irrigation facilities because communities with irrigation have extra capital from farming to undertake such ventures. For instance Ko- a community without irrigation with 12 acres could yield income to the tune of Gh₵4,882.00 while koro –a community with irrigation could generate an annual income of Gh₵14, 580.00.

These finding conform with studies of Bashiru, (2013) who reveals that the activities in the farms during multiple cropping engages labour that will be paid wages or

salaries to increase their household income and could also allow farmers to open accounts, save and qualify for credits from the financial institutions .

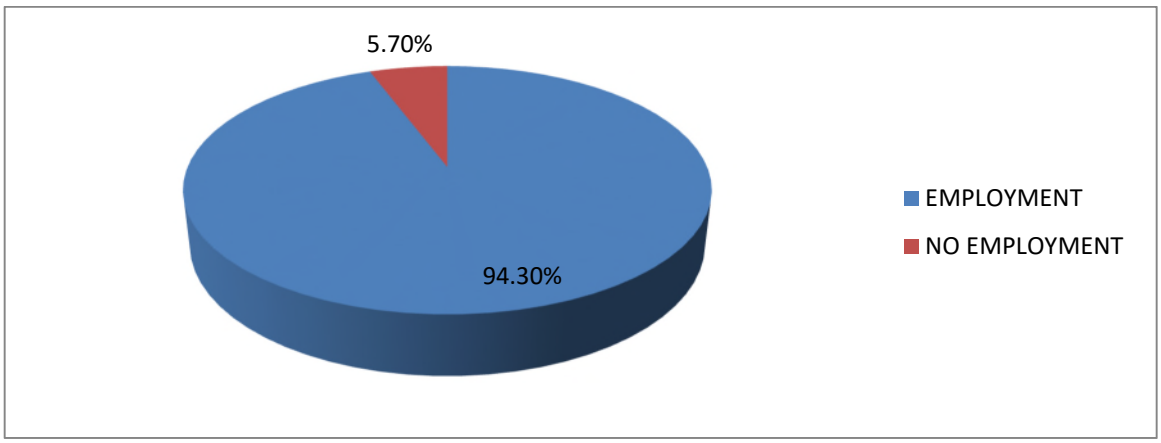
### 4.6.3 Small Scale Irrigation and Job Creation or Employment

The study seeks to find out from the respondents whether irrigation had the tendency to employ or create jobs than rain-fed agriculture. From the results in Table 4.10, it shows that sowing engage seven individuals while harvesting engage twelve individuals giving a total of 19 farmers. Each farmer hand is paid Gh₵25.00 and Gh₵15.00 for carrying out sowing and harvesting respectively in a farm. It is obvious that irrigation farmers are able to engage more people or provide job opportunities to the youth since they are able to crop three times within the year than non-irrigated farmers though they crop larger parcels in the major rainy season.



Agricultural activities such as ploughing, weeding, threshing and winnowing requires human labour to carry them out and from the farm budget in table 4.10, they have the ability to engage about 49 youth in the major rainy season with respect to farmers without irrigation and can also engage about147 youth under irrigated agriculture. Also, farmer's perception with regards to irrigation and employment was tested and over 94% of respondents confirm irrigation ability to create employment as against 5% that said otherwise as indicated in Figure 4.5. The study findings are in tandem with studies such as Kpieta *et al*. (2013) and Peprah *et al*. (2015) who indicate that irrigation has the ability to engage the youth, hence reducing the rate of youth out-migration to urban Centres.

Figure 4.5 Perception of irrigation on Job or Employment Creation




Source: Field Survey, June 2017.

### 4.6.2 Small Scale Irrigation and Access to Credit

To assess farmers' perception on the ability of irrigation farmers to access credit in the Lawra Municipality, respondent's perceptions are presented in Table 4.12. The results indicate that access to credit is low among farmers in the Lawra Municipality. About 15% and 2% respectively of farmers with irrigation and without irrigation are able to access credit while 85% and 98% of farmers with irrigation and farmers without irrigation are not able to access credit. In all, close to about 80% of all respondents or farmers contacted are not able to access credit in the Lawra Municipality. This is due to the fact that one requires collateral to secure a loan from the financial institutions which farmers do have. The makes them rely on friends and family members for agricultural financing.

The results further indicate that farmers earn low incomes from farms leading to the lack of savings culture in the banks and the few that are able to access credit are

farmers with irrigation using the farm or irrigation facility as collateral for the loan. This implies that farmers could have used their indentures if landed properties were duly registered, hence the need to use the farm.

Table 4.12 Percentage of Perception on Farmers' Access to Credit

| **Farmers** | **Yes: Access to credit** | **No: Access to Credit** | **Total** |
|---|---|---|---|
| With irrigation | (84) 15% | (84) 85% | (84)100% |
| Without Irrigation | (54) 2% | (54) 98% | (54) 100% |
| Total | | | (138) 100% |

Source: Field Survey, June 2017

The purpose of credit to farmers is to increase their production levels. It also enables farmers to earn suspense income as they supply the markets quarterly with food stuffs making them to be in a better position to open accounts with banks to qualify for credit facilities for farming (Bashiru, 2013). Farmers are therefore able to make surety with banks for loans even if without collateral.



In an interview, this is what a key informant had to say.

*We support farmers every year to boost their production but they must come with strong recommendation. Fin Gap a US based non-governmental Organization is able to secure tractor and machines to nucleus farmers in the Lawra Municipality at a cost of 1.3 billion Ghana cedis with a grand support of 300 million and 1,000 Ghana cedis respectively.(Key informant, Sunzele Rural Bank , lawra ,June,2017)*

Plate 4.17 and 4.18 are benefits farmers receive from financial institutions to boast agricultural production in Lawra Municipality.

Plate 4.17 Tractor on Credit to a Farmer in Kunyukuo Community

Source; Field Survey, June, 2017.

Plate 4.18 Pumping Machine on Credit to farmer Mettor Community

Source; Field Survey, June 2017.

In another interview with a key informant, this is what he says:

*Farmers think it is only collateral they need to get a loan or big money to open an account, rather they just need to open an account with GȻ 50.00 and save for 6 months to build surety with the banks to qualify for loans(*Key Informant, Lawra Rural Bank lawra, June, 2017*).*

About 17 % out of the 20% that are able to access loans, do that through their Village Savings and Loans schemes or Associations (VSLA) popularly known as 'Dalee'. Plate 4.17 shows a loan transaction in the form of a tractor given to a farmer in Kunyukuo community as a result of her involvement with farming as a dry season gardener from Sunzele Rural Bank in Jirapa under the Fin Gap Programme. Most farming communities without irrigation infrastructure financed their farming activities with support from the VSLA. Plate 4.19 is a meeting of VSLA members in Mettor Community.



Plate 4.19 VLSA meeting Mettor Community

Source; Field Survey, June, 2017.

Irrigation enables farmers to earn extra income as they farm and supply constantly to the markets. Farmers under irrigation are able to open Bank accounts, save and build sureties with Banks. This enables farmers to access credit (Bashiru, 2013).This implies that irrigation farms serve as collateral for farmers to access credit to finance or increase their production levels.

### 4.6.3 Small Scale Irrigation and Access to Market and Food Prices

The study again examined access to market by farmers with irrigation and farmers without irrigation. The results in Table 4.13. The results show that about 89% of farmers are not able to access secured market while 11% struggle and are able to access market for their produces. This is as a result of the bad roads and long distances away from the market centres. The study further tries to identify the markets in the Lawra Municipality and were found to be two namely Lawra and Babile Markets. The results further indicate that food prices in these markets tend to be very low in the major raining season and gradually increase during the dry season. From the farm budget in table 4.10. It indicates that irrigation farmers are able to harvest staples three times within the year and supply to the markets in the Lawra Municipality. This implies that there exists continuous reduction in price of food stuffs which sometimes leads to a glut as a result of the lack of stagger production by farmers.



Table 4.13 Farmers with market security and farmers without market security

| Practice | Access to market security | No market Security | Total |
|---|---|---|---|
| **With Irrigation** | (84) 44.3% | (84) 6.5% | (84)100% |
| **Without irrigation** | (54) 45.1% | (54) 4.1% | (84)100% |
| **Total** | (138) 89.4% | (138) 10.6% | (138)100 |

Source: Field Survey, 2017

From the results in Table 4.11, it is further evident that government, civil servants or consumers tend to also benefit from markets with irrigation supply for their domestic use.

From the results on the food consumption score, it was realized that children in irrigated communities are healthier than their colleagues in non- irrigated communities as a result of the consumption of fresh food stuffs. Also, the continues supply of irrigated products allow for the payment of tax or market tolls to the Municipal Assembly which further leads to increase in internal generated funds for the Municipality. The creation of employment is also strong as more of the wholesale and retail market structure tend to create secure jobs as supply is always constant compared to non-irrigated community markets leading to less revenue and farmers setting prices leading to increase in food stuffs as consumers bear the brand.

Construction of irrigation facilities tend to engage the youth as labour on farms throughout the year. Hence, creation of jobs or employment opportunities to the youth in rural areas where there exist secured markets for the purchases of agro products. Women are also engaged in agricultural activities such as weeding and sowing that earn them extra incomes to establish other non-agricultural jobs such as trading and Brewing of pito in these market structures and they are responsible for the transport

and sale of these vegetables (Kpieta *et al*., 2013 and Monnah, 2011). This means that irrigation has the ability to improve livelihoods of farmers in an open market economy.

### 4.6.4 Small Scale Irrigation and Labour Engagement

Access to labour in agriculture determines the levels of production. The study tries to identify the type of labour available in Lawra Municipality. The results presented in Table 4.14 indicate that skilled and unskilled labours are both present in the Lawra Municipality. It further shows that about 70% of labour in communities without irrigation are unskilled while about 60% in communities with irrigation are skilled. This is due to the capacity building trainings and the technical nature of irrigation system management given to farmers with irrigation on the use of the facilities.



Table 4.14 Farmer Category and Type of Labour Engaged

| Farmer/type of labour | With irrigation | Without irrigation | Total |
|---|---|---|---|
| Skill labour | (84)67.7% | (84)16.3% | (84)100% |
| Unskill Labour | (54) 28.3% | (54) 71.7% | (54)100% |
| Total | | | 138(100%) |

Source: Field Survey, June2017.

For instance land clearing, weeding, harvesting and threshing are labour intensive in nature and do not need specialization to carry out, hence the need for unskilled labour while the introduction of technologies such as the use of a new variety, establishing a demonstration field on comparative studies requires an expert to complete as skilled labours. These activities create job opportunities by payments of wages and salaries to unskilled and skilled labour respectively.

Farmers through the payment of wages or salaries has the ability to divert to other petty trading as they are able to save or apply for loans from their communities VSLAs. Works such as pito brewing, carpentry, poultry and other jobs that requires little amounts of money to start. In an interview with a key informant, he indicates that;

*Education of children in the Lawra Municipality is much financed by their individual engagement in farm labour either at home or at the southern part of Ghana especially in Techiman or Wenche where there exist more labour on farms that can earn them money to financed their education back home.* (Key informant Brewong, Lawra June, 2017).

Irrigated communities therefore have the ability to engage these children back home to work and earn wages to buy their school books, sandals and uniforms.

Irrigation has the ability to engage the youth as labour in farms as majority of the respondents are illiterates who cannot engage in other white colour job except depending on agriculture (Lipton, 2003; Wagnew, 2004). It is obvious from the results that most respondents believe that there is abundance of unskilled labour that could benefit rural households to enhance food security, poverty reduction and youth migration though it is not being used effectively.



### 4.6.6 Small Scale Irrigation and Extension Service Delivery

To increase agricultural production and food security using irrigation technology, access to extension service is very paramount to increase output of farms. Farmers were asked about their access to extension officers. Table 4.15 Respondents Access to Extension Delivery.

Table 4.15 Respondents Access to Extension Delivery

**Access to Extension Delivery**

| **Farmer Category** | **Yes** | **No** | **TOTAL** |
|---|---|---|---|
| Farmers with irrigation | (84)20% | (84)80% | (84)100% |
| Farmers without irrigation | (54)88% | (54)12% | (54)100% |
| TOTAL | | | (138)100% |

Source; Field Survey, June 2017.



The results in Table 4.14 show that 80% of farmers with irrigation indicate that farmers who do not have irrigation farms are those receiving much attention and 88% of farmers without irrigation further confirm they receive more extension service than farmers that practice irrigation. 20% of these farmers are basically dry season farmers who do build their individual relationship with their respective extension officers tend to receive training, field visits, demonstration and competitive crop production, income and value chain analyses of farm marketing. This is due to the low farmer to extension officer ratio and the population of farmers without irrigation is mostly subsistence farmers that produce for family consumption.

During an interaction with a key informant, this is what he had to say: *the low numbers has made us concentrate on the vulnerable farmer that lacks the capacity to afford information making the irrigation farmers who are mostly trained to see farming as a business as graduates farmers that we use for further education of other farmers* (Key informant, Department of Agriculture, Lawra, June 2017).

Agricultural extension service delivery is the movement of extension staff into rural communities with the mandate to educate farmers on new technologies, establishing demonstration fields on competitive crop production. They also serve as the linked between the farmers and the research institutions meaning taking farmer problems for analyses at the research stations and the vice versa Madussuda *et al.,* (2002) and SRID, (2016). This suggest that extension division of the Ministry of Agriculture needs to supports farmers with improved Seeds, Fertilizer and introduction of new technologies in both crops and animals through the provision of vaccines to livestock farmers in irrigated communities.



### 4.6.7 Impacts of Irrigation livelihoods on households, Communities and Municipality

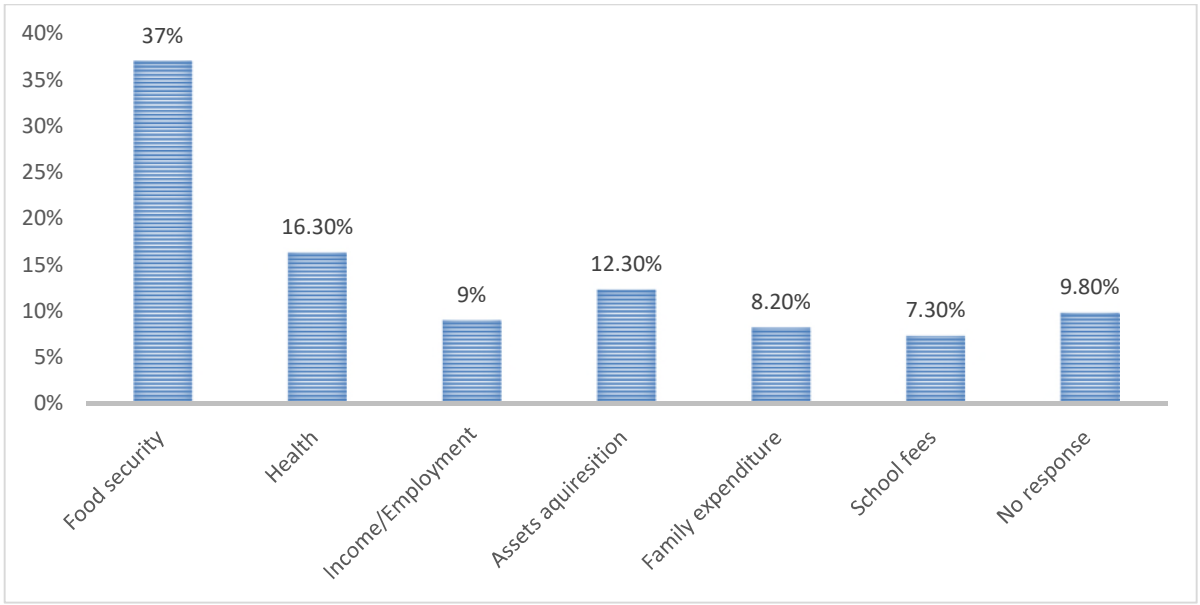
Small Scale Irrigation development as a tool has benefits to individual households, communities that practice it and the entire Municipality. The study therefore asked farmers based on the following parameters considered to ascertain the direct benefit to the households, Community and the Municipality as a whole. This includes Food security, asserts acquisition, increase income levels, family expenditure, health bills and school fees.

***Impacts of irrigation on Households***

To access the impact of irrigation on households, farmers were questioned about the benefits households derived from the practice of irrigation. The results in Figure 4.6 shows that a number of benefits were derived from irrigation and they includes health cost reduction, payment of school fees, asserts ownership, increase in income generation. It was evident that 37% indicates their food security situation is improved, about 16.3% scored next highest on improved health, and the lowest score was 8.2%

were respondents that refuse to respond on the scoring. This means that households food security is assured in communities with irrigation than households without irrigation. Their health conditions are also improved since members do not go hungry and malnourished leading to the spending of less household income on medical bills. They further indicate that households with irrigation can save money for assert acquisition as they spent less on health. Scoring on payment of school fees was also low and the reason farmers gave was the implementation of the free senior high school policy that has reduced the cost of education drastically.






Source: Field Survey, June 2017

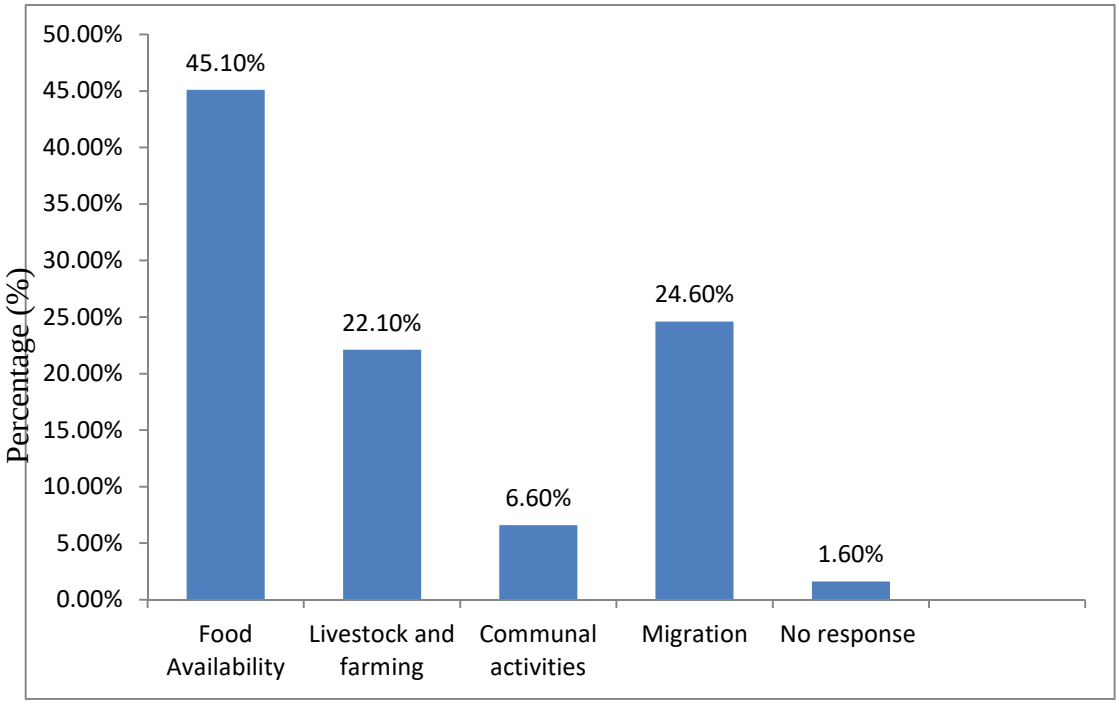
Food Security is the most important impact households' benefit from irrigation infrastructure in their immediate environment as it supplies continuously their food needs making them healthier than households located in areas without irrigation facilities (Apam, 2012; WFP, 2016). This implies that to improve household food security, it is paramount to construct an irrigation facility in these areas or households.

***Impacts of irrigation on Communities***

To determine the impact of irrigation at the community level, the study tries to get respondents scoring on the following headings food availability, livestock and farming, community activities and migration these results are indicated in Figure 4.7. The results shows that food availability was scored higher with about 45% followed by reduced migration with about 24% and community activities and livestock were score lowest with 22% and 6% respectively.



Figure 4.7 Percentages of Score under various headings




Source: Field Survey, June 2017.

High score on food availability suggest that all year round farming engages the youth in agricultural activities reducing their migration rate in communities. This further suggests that farmers have the ability to rear animals as water and fodder are present all year round (Apam, 2012: WFP, 2016: Result, 2017).

Food availability is a factor of food security. It measures the rate of food security and determines the severity of the coping strategies a community would adopt during the lean season. This further suggest that communities with high food availability indicates the healthy food consumption in the community with the potential to reduce child mortality and maternal deaths in communities

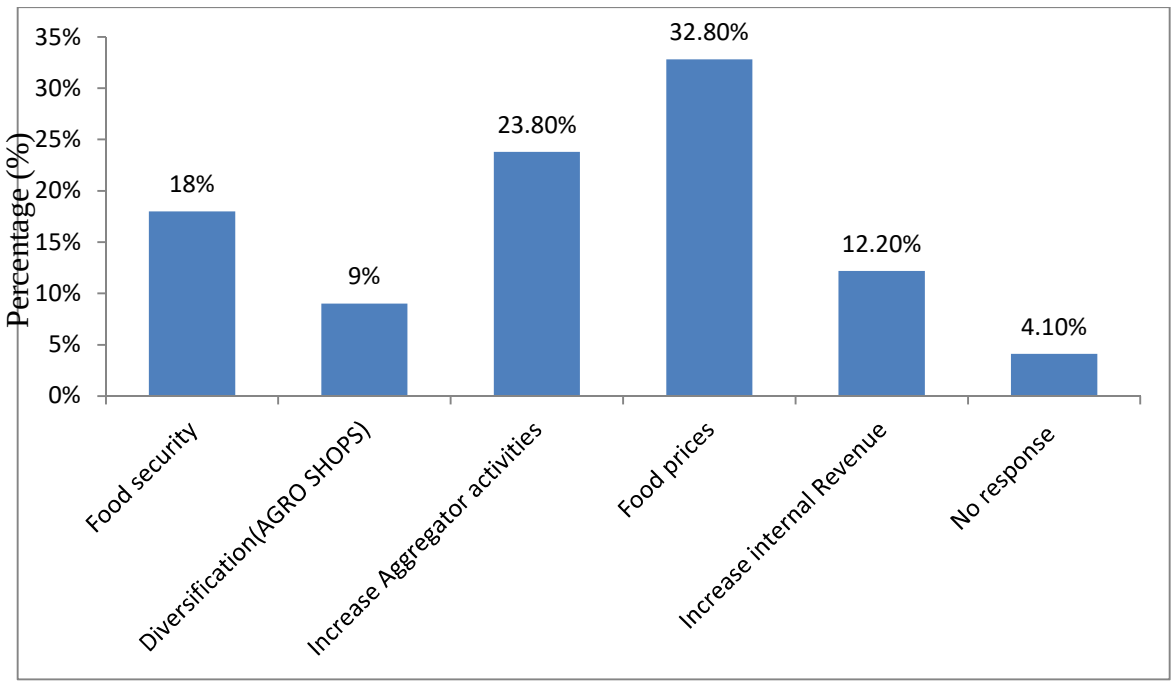
***Impacts of irrigation in Lawra Municipality***

To access the impacts of irrigation in Lawra Municipality, a number of livelihood parameters were considered for scoring. This includes increase in internal revenue, increase in aggregator activities, food prices, food security and diversification. The results in Figure 4.8 indicate that food prices was scored highest with 32.8% and diversification into Agro shops was scored low with 9%. About 4% of respondents did not score at all implying that they cannot take any definite decision on the impact of irrigation to the Municipality. This, they indicate is due to their lack of information. The findings further suggest that food security was scored 18% being third highest score indicating that Lawra Municipality is not food secured while increase in aggregator activities is evident that large amount of food is taken away from the Lawra Municipality to the south through market women. This tends to increase the tolls farmers pay to access these markets.



This therefore suggests that irrigation has the tendency to increase internally generated funds for the Municipality and could also reduce the cost of living as food prices are reduced further for the common man. Less expenditure on food allow farmers or customers to save moneys for other non- farming business such as sales of agro- products are taxable in the market to generate internal generation funds for the Municipal Assembly.

Figure 4.8 Irrigation Impact on Municipality




Source**:** Field Survey, June 2017

The practice of irrigation has the ability to mobilize resources for other business to generate taxes for the MMDAs. For instance sales of farm produce create extra income to farmers, hence their ability to undertake other business such as petty trading to generate income for their individual homes and the Municipality as a whole (Bashiru, 2013).

# CHAPTER FIVE

# SUMMARY OF FINDINGS, CONCLUSION AND RECOMMENDATIONS

## 5.1 Introduction

This chapter presents the summary of key findings, conclusions and recommendations that are forwarded to establish how the following research objectives were achieved. To identify the types of irrigation schemes in Lawra Municipality, how is the influence of irrigation technology on food security in Lawra Municipality, Are there challenges affecting irrigation farming in the Lawra municipality, Are the livelihoods of households improving under the irrigation systems in the Lawra Municipality. These provide the bases for further investments into the development of water resources as it has direct impacts on rural livelihoods empowerment through enhancement of food security and general poverty reduction especially in the Lawra Municipality.



## 5.2 Summary of Findings

Based on the study outcomes, the following findings are made

### 5.2.1 Characteristics of Farmers

Majority of farmers from the Lawra Municipality are within the ages of 27 to 50. The most active population or labour force is within 27 to 49 of total respondents contacted. Male and female farmers were 82 and 56 respectively indicating that farming is male dominated in the Lawra Municipality. The highest household size of farmers is within 5-10 which is a good source of family labour suggesting that households in Lawra averagely have 10 members. Most farmers are illiterates confirming the suggestions that farming is a vocation for the illiterates. The study

finds that farmers with irrigation facilities create more jobs through the farm labour than farmers without irrigation and also farmers without irrigation due to the lower numbers of Agricultural extension staff accesses extension services than farmers with irrigation in the Lawra municipality.

### 5.2.2 Type of Small Scale Irrigation Practice in Lawra Municipality

The findings from the study indicates that most respondents agreed there are four types of irrigation schemes practised in Lawra Municipality and these include Surface irrigation, Drip irrigation, Sprinkler irrigation and Culvert diversion. The study further revealed that majority of respondent practice Drip irrigation and few are into culvert diversion in the Lawra Municipality, hence the need to pay more attention to it.



### 5.2.3 Influence of irrigation on Food security in Lawra Municipality

The study findings from the yield plot results indicate that irrigation farmers produce more yields than non-irrigated farmers. This according to the respondent is due to multiple cropping. Findings on food security further revealed that Lawra Municipality is on the borderline. This suggest that the Municipality is food insecure. But farmers who are engaged in irrigation are better off than farmers without irrigation in terms of household food security resulting in severe coping strategies. Some of the coping strategies includes skipping the entire day without food, reducing portions of food for children to eat, consuming less preferred foods, Borrow or rely on relatives and friends, and consuming stock held for next season

### 5.2.4 Challenges Confronting Small Scale Irrigation Farmers

The study findings indicate that farmers in the Lawra Municipality that are engaged in irrigation farming face numerous challenges and these include Creation of wells and ponds that allows oozing of water for their gardens, and fencing as farmers struggle to

control stray animals in their farms by the construction of mud or straw walls which collapse during the major rains, hence the need for reconstruction after the rains.

### 5.2.5 Impact of Small Scale Irrigation on Rural livelihoods

***Multiple Cropping***

From the yield plot results, irrigation farmers have more yield than non-irrigated farmers. Respondents attributes to multiple cropping annually. It further indicates that in communities with irrigation infrastructure, women are able to own farm lands. This further goes to confirm the continuous presence of food and less coping strategies adopted by farmers with irrigation communities.

***Household Income Generation***

The study findings indicate that farmers with irrigation facilities generate more household income than that of farmers without irrigation due to continues cropping throughout the year. It further reveals that farmers with irrigation have the ability to create other livelihood activities such as trading due to their extra incomes from sales of crops.



***Job creation or Employment and Labour Engagement***

With regard to creation of employment, it was found out that irrigation has the ability to engage farmers all year round hence can engage labour, pay wages and salaries to most youth in the Lawra Municipality. Due to their continues cropping, women engage in activities such as processing, winnowing and Marketing of crops produce at the irrigation site

***Access to Credit***

With regard to credit, the study findings indicate that it is very important as most farming activities require credit to finance. Activities such as labour, wages, purchase of inputs requires credit. Yet few farmers are able to access credit from the banks due to lack of collateral. Irrigation infrastructure is able to serve as collateral for farmers to access credit. Farmers without irrigation are therefore not privileged to access credit since they do not have indentures to place for credit at the banks. This is because most houses or landed property do not have indentures covering them.



***Access to Market and Food Prices***

The study findings found out that continuous supply of fresh food stuffs in an open market economy tend to reduce prices of food stuffs. Glut situations in the market also course low prices of commodities. The study revealed that farmers with irrigation faces these challenges than farmers without irrigation due to their inability to adopt stagger production which ensures a balance between demand and supply situations in an open market economy.

***Food Security***

Food insecurity is more among farmers without irrigation facilities than farmers with irrigation facilities. This is because farmers without irrigation experience more hunger and adopt more copping strategies than farmers without irrigation.

**5.3. Conclusion**

The study was conducted in Lawra Municipality in selected communities with irrigation facilities and those without irrigation faccilities.the study focus on comparing opportunities given to the selected communities or otherwise in terms of

food production to enhance food security and rural livelihoods empowerment. Challenges of irrigation farmers were also examine and the types available in the Lawra Municipality.

These challenges tend to make rural farmers adopt to a number of coping strategies of which some includes manual water transport, wells on river bands, going without food, begging for food, reducing consumption during meals times as strategies for food insecurities hence the conceptual framework that guides the study. Further studies should focus on assessing individual farmers output, scrutiny on resource mapping to better understand their potentials to enhance livelihoods



### 5.4 Recommendation

Small Scale Irrigation is a dynamic tool to ensuring increase food production and food security enhancement. Based on the findings of this thesis, the following recommendations are therefore forwarded.

- GIDA should be empowered to develop the culvert diversion type of irrigation since most roads in rural communities are hosting culverts as channels of runoffs by installing the necessary irrigation system design such as canals and development of irrigable land along site culverts
- GIDA should ensure training of farmers and extension officers on the need to sustain the life span of water resource such as the Black Volta and help to reduce encroachment of the river buffer.
- MMDAs and GIDA should ensure irrigation projects are designed and to meet the basic requirements such as irrigable lands, conveyances belts or systems, pumping machines for farmers close to the river to avoid encroachment of the buffer zone.

- Small scale irrigation has the ability to increase yields of farmers therefore, GIDA and other stakeholders such as NGOs should provide support through the construction of irrigation facilities. This will enable farmers to crop 3times in a year and also make farmers able to produce their own food and be food secured.
- GIDA and other stakeholders such as the Ministry of Agriculture, MMDAs and should build the capacities of Agricultural extension officers and farmers on the management and operation of irrigation farms to back stock the lack of irrigation technologist in the study area.
- The Department of Agriculture should be empowered by their various MMDAs to develop data base for all crops and their annual tonnages for accurate yields of all major crops to reduces projections of yields for the various MMDAs.
- NGOs such as Result and World Food Programme in food security projects should include the development of water resources or irrigation development as part of project targets for implementation.
- Breached dug-outs and dams should be rehabilitated by the Ghana Irrigation Development Authority in collaboration with the Lawra Municipal Assembly and other interested groups such as NGOs.
- GIDA and the Ministry of Food and Agriculture should recruit more irrigation Engineers and decentralize Irrigation Development Authority
- At the MMDAs level to create grassroots level offices within the various MMDAs in Ghana.



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# APPENDIXES

APPENDIX A

## QUESTIONAIRE FOR FARMERS

## UNIVERSITY FOR DEVELOP MENT STUDIES

## DEPARTMENT OF ENVIRONMENT AND RESOURCE STUDIES

**Student Research Work towards the attainment of MPhil Environment and Resource Studies**

Checklist for farmer data collection

**A. Dam location and size**

1. Name of community :(1)……..
2. GPS location (Waypoint) Latitude…….. Longitude……..
3. Reservoir ◘ /Potential location Latitude……..Longitude……..
4. Irrigable area (acres) …….
5. Nam e of community (2) (a) With irrigation (b)Without irrigation

**B. Bio-data of Respondents**

6. Sex of farmer (a) Female ( b) Male
7. Age of farmer (a) 15-20 ( b) 21-26 (c) 27-32 (d) 33-38 (e) 39-44 (f) 45-50 (g) above 50

8. Educational Level (a) No(b) Basic school (c) SHS (d) Middle school (e)Tertiary
9. Household size (a) 1 to 5 (b) 5 to 10 (c) 10 to 15 (d) above 20

**C. OBJECTIVE ONE**

10. Do you practice irrigation (a) yes (b)No
11. Do you use irrigation a) yes (b)No
12. Do you have irrigation facility in your community (a)Yes (b) No
13. Describe the irrigation in your community (a) Dam with canal (b) Dam without canal (c) Dug-out . (d) River (e) Borehole (f) Others
14. Is the described facility functional?
15. Do your part take in irrigation activities in the community (a)Yes (b)No
16. Explain the role you play in the functioning irrigation facility

……

……



**D. OBJECTIVE TWO**

17. Do you farm all year round? (a) Yes (b)No
18. What is the size of rain-fed farm (a) 1 to 3 (b)4 to 7 (c)less than 1 (d) 8 to10 acres (e) Above 11 acres
19. Major crops under rain-fed farm (a)Maize (b)Millet (c)Vegetables (d)Soya (e) Others
20. What is the size of irrigation farm (a)Less than 1 acre (b)2 to 4 acres (c)4 to 6 acres (d) Above 8 acres
21. Major crops under irrigation farm (a)Maize (b)Millet (c)Vegetables (d)Soya (e)Others

22. Do you experience increase in yield per acreof land inrain-fed farm (a) Yes (b)No

23. Do you experience increase in yield peracre of land in irrigation farm (a) Yes (b) N0

24. What is the cost of production per acre in any major crops you cultivate

| Crop production per acre | Activity | Cost |
|---|---|---|
| | **Land** | |
| | **Seed** | |
| | **Fertilizer** | |
| | **Pesticides** | |
| | **Labour** | |
| | **Storage** | |
| | **Transport** | |
| | **Others** | |
| | **Total** | |



26. In which months are your hunger period

27. Do you have availability of food all year round?

28. If yes, how accessible are you to this food?

29. How useful are these foods to children in the household?

30. How many days do you eat the following foods in the past 7 days

a. Vegetables
b. Fruits
c. Pulses
d. Oil
e. Sugar

31 Do you sometimes skip meals due to shortage of food?

32. What copping strategy do you adopt during this hunger period

33. **Measure 3 children ma-nutrition level of the respondent using the Nutrition belt method and record in table below**

| **Childs Number** | **Age** | **Read** | **Yellow** | **Green** |
|---|---|---|---|---|
| | | | | |
| | | | | |
| | | | | |

**D. OBJECTIVE THREE**

34.. Do you have accessed to extension services (rain-fed). (a)Yes (b) No

35. In what forms do you have extension services (a) Training (b) Field visits (c) farmer field schools (c) Field demonstrations

36. Do you have accessed to extension services (Irrigation farm). (a) Yes (b) No

37In what forms do you have extension services (a) Training (b) Field visits (c) farmer field schools (c) Field demonstrations

38. What other challenges confront you at the farm gate

.39. As an irrigation farmer, do you face challenges in practicing irrigation?

40.What form of management do you practice (a) Common Property Regime System (b) Common Pool Resource Sys



43. Do you have market infrastructure in and around you community (a) Yes (b)

44. the market accessible to farmers (rain-fed) (a)Yes (b)No

45 Is the market accessible to farmers (irrigation farms) (a) Yes (b) No

46. Do you enjoy market security with regard to sale of produce?

**E. OBJECTIVE FOUR**

47 How has farming (rain-fed) impacts on food security

47. How has farming (Irrigation farm) impacts on food security

48. Do you engage labour (rain-fed) (a) Yes (b) No

49. What forms of labour do you engage in rain-fed farm (a) Skill labour (b) Unskilledlabour

50. Has farming (rain-fed) improves job security of labour

51. Has farming (irrigation farm) improves job security of labour (a) Yes (b) No

52. How

……..

……..

53. What level of employment has rain-fed farms provide to the community

……

……

54. Has farming (rain-fed or irrigation impacted) on migration (a) Yes (b) No

55. How

……

……

56. Has farming (rain-fedor irrigation) encourages diversification?

57. List other jobs owned by you.

……

……

58. Do you have asserts from farming (a) Yes (b) No

59. Type of asserts (a) Housing (b) Equipments (c) Education (d) Land (e) Marriage (f) transport (g) Others

60. Other occupations apart from farming (a) Trading (b)Carpenter(c) Input dealer (d)Rearing and sales (livestock) (e) Others

61. Irrigation livelihoods (a) Cropping(b) Security(c) Storage (d) Marketing (e) farm labour

**62.**

| **Income from crops** | **CROP** | **SALES** | **Total** |
|---|---|---|---|
| | **Maize** | | |
| | **Millet** | | |
| | **tomato** | | |
| | **Water Melon** | | |
| | **vegetable** | | |
| | **Others** | | |
| | | | |

63. Benefits to household (a) Foodsecurity (b) Employment (c) Wealth creation (d) Increase spending (e) Improve health (f) Diversification

64. Benefits to community (a) Food availability (b) Employment (c) wealth (community assets) (d) Increase spending (e) Improve health(f)Diversification (livestock)

65. Benefits to Districts (a) Improve health records (b) low food prices (c)Food security (d)Reduce migration (e)Diversification

**Name of Community**

**Date of Data collection**



## APPENDIX B

## UNIVERSITY FOR DEVELOPMENT STUDIES

## DEPARTMENT OF ENVIRONMENT AND RESOURCE STUDIES

## STUDENT RESEARCH WORK

## FOCUS GROUP INTERVIEW GUIDE



**Goodmorning.My name is Ibrahim ErasungIssaahaku and I am a student of the University for Development studies. Am conducting a research on the topic Small Scale Irrigation: dynamic tools for rural livelihood empowerment in the Lawra District. This is study is purely for academic purposes and I hope you would participate since views about farming and households are concern.**

**Do you agree to participate?**

| | | | |
|---|---|---|---|
| **Region** | | | |
| **District** | | | |
| **Community** | | | |
| **Name of Interviewer** | | | |
| **Total FGD participants** | **Male:** | **Female:** | **Total** |

- What is the annual farming situation of the community

- What are the sources of water for farming in this community
- Describe the water use type of farming you undertake in this community
- Does irrigation increase food production in this community
- Do you have enough to eat all year round
- When people face shortage of food, what copping strategies do they take
- Does this copping strategy affect children?
- What are your community level strategies
- What challenges do you face in practicing irrigation
- Is irrigation practice able to improve living conditions of

a. households b.Communityc.District

- Does irrigation has an impact on

i. Employment

ii. Migration

iii. Income

- What support do you require to further increase improve on the scale of production for national development.

……

……

……

## APPENDIX C

## UNIVERSITY FOR DEVELOPMENT STUDIES

## DEPARTMENT OF ENVIRONMENT AND RESOURCE STUDIES

## STUDENT RESEARCH WORK

**Interview Guides for Extension Officers**



**Part One**

**A.Bio-data of Officer**

1. District of the Officer

2. Designation of Officer

**B. OBJECTIVE ONE**

3. What is the importance of irrigation to livelihood sources in the District?

4. When is Irrigation practice in the District?

5. What are the sources of water used?

6. What are the water supply and application forms used mostly in the District?

**7**. State the type of irrigation systems practice in the District

**C. OBJECTIVE TWO**

7. Whatis the yield difference between irrigation and without irrigation farms per acre?

| Irrigation farm | | | Without Irrigation farm | |
|---|---|---|---|---|
| No | Crop | Yield | Crop | Yield |
| | | | | |
| | | | | |
| | | | | |
| | | | | |
| | | | | |
| | | | | |
| | | | | |
| | | | | |
| | | | | |



8. Does your organization provide inputs to further improve production to farmers? If yes, what type of inputs are they?

Part Two: GPS Data collection

This entails the use of GPS to locate irrigation sites and potential sites, communities' waypoints, farm waypoints, cutting of yield plots and the use of coordinates to create route map of study communities.

9. What are the waypoints of the study communities, location of reservoir sites and potential sites, reservoir sizes and acreages?

Detail data collection sheet is illustrated below

| Community | Waypoint | Reservoir location | | Potential location | | Reservoir size/potential | Acreage |
|---|---|---|---|---|---|---|---|
| | | Lat, | Log | lat | log | | |
| | | | | | | | |
| | | | | | | | |
| | | | | | | | |
| | | | | | | | |
| | | | | | | | |
| | | | | | | | |
| | | | | | | | |

10.Identify farm waypoint and Cut three yield plot of size(10m×10m) using the following compass bearings 90◦,60◦,30◦ and 180◦.Repeat the procedure for 4 more times with intervals of 10m using the Z-Shape(Angle 60◦) technique shown below.

Figure 1. Z-SHAPE TECHNIQUE (SRID. 2016)

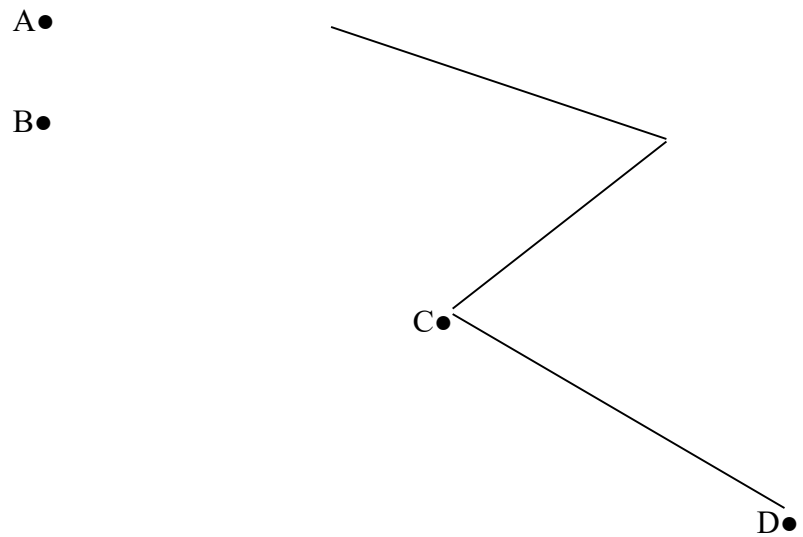

***Table 1. Community/Farm***

| *Community/ Field no* | *Waypoint* | *A* | *B* | *C* | *D* | *E* |
|---|---|---|---|---|---|---|
| *1* | | | | | | |
| *2* | | | | | | |
| *3* | | | | | | |
| *4* | | | | | | |
| *5* | | | | | | |
| *6* | | | | | | |



***Table 2.Record the following data***

| *Community* | *Farm waypoint* | *No of harvest in a year* | *Average No of stands* | *Average No of plants* | *Average Weighed Grain* | *Market value* |
|---|---|---|---|---|---|---|
| | | | | | | |
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**OBJECTIVE THREE**

**11.** WhatChallenges do you think are the reasons for low production levels in Agriculture?

**12. At the farmer level, list five challenges facing**

**(A) Rain-fed Agriculture**

……

……..

……

……..

**(b) Irrigation Agriculture**

……

……..

……

……..

**OBJECTIVE FOUR**

13. List the impacts of irrigation to

(a) Farm households

(b) Farm communities

(c) District



**APENDIX D**

**UNIVERSITY FOR DEVELOPMENT STUDIES**

**DEPARTMENT OF ENVIRONMENT AND RESOURCE STTUDIES**

**STUDENT RESEARCH WORK**

**Questionnaire for Irrigation Development Staff**



## A. OBJECTIVE ONE

1. What is the total number of reservoirs in the District?

| District | Dug-outs | Dams | Total |
|---|---|---|---|
| | | | |
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2. What types of uses are these reservoirs been put to in terms of irrigation?

……

……

3. What other irrigation forms are practices without Dams and Dug-outs in the study District(Lawra)

| District | Streams | Rivers | Wells | Boreholes |
|---|---|---|---|---|
| | | | | |
| | | | | |
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4. What are the modes of water applications practice in the mentioned communities?

| **Number** | **Community** | **Mode of water Application** |
|---|---|---|
| | | |
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**OBJECTIVE TWO**

5. What are the production levels of these types and forms of irrigation in the Upper West Region?

| Type of Irrigation infrastructure | Crop(Maize) | Production |
|---|---|---|
| | | |
| | | |
| | | |
| | | |
| | | |

6. Are farmers in the Upper West Region able to own asserts through the use of irrigation? (a) Yes (b) No

7. List some of these asserts

……

……

**OBJECTIVE THREE**

8. What challenges are confronting the Irrigation Development Agencies that retards its smooth operations?

9. At the farmer level, can you list some challenges of irrigation

**OBJECTIVE FOUR**

8. How has irrigation impacted on the following in the Upper West Region?

i Food Security

……

ii Household incomes

……

……

iii Migration

……

v Employment

……