BARRIERS TO ENTRY AND FARMERS PARTICIPATION IN DRY SEASON IRRIGATION FARMING IN THE UPPER EAST REGION OF GHANA

BY

AWEDAM DERSIDERIOUS WEKEM

(10358934)

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DECLARATION

I, Awedam Dersiderious Wekem, author of this thesis titled "Barriers to entry and farmers participation in dry season irrigation farming in the Upper East Region" do here by declare that the work herein was done entirely by me in the Department of Agricultural Extension, University of Ghana, Legon. This work has never been presented either in whole or in part for any other degree of this university or elsewhere except for references which have been duly cited.

…… ……..

Awedam Dersiderious Wekem Date

(Student)

This thesis has been submitted for examination with my approval as supervisor

…… . ……

DR. O. SAKYI – DAWSON Date

(Supervisor)

DEDICATION

This thesis is dedicated to the memory of my father Peter Wekem and my wonderful and supportive family especially my mother Sylvia Adabuga for their financial and spiritual support and encouragement throughout my education and to all the smallholder farmers toiling to provide food for the ever growing Ghanaian population.

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ABSTRACT

The main objective of the study was to determine if there were differential barriers to entry into dry season farming in the Kassena Nankana East and Bongo Districts of the Upper East Region of Ghana and if so, how this affects participation and to what outcome. The types of barriers identified as important from the literature were categorized into economic, institutional, technical and socio- cultural barriers. The research design was a case study and used both quantitative and qualitative methods. Data collection involved focus group discussions (FDGs) with different categories of farmers, key informant interviews with selected management of Irrigation Company of Upper Region (ICOUR) as well as interviewer administered survey of 300 farmers randomly selected from three (3) communities each in the Kassena Nankana East and Bongo districts. The communities were randomly selected from ones around the Vea and Tono Irrigation Schemes. Analysis of quantitative survey data was carried out using SPSS, and involved frequencies, percentages and ranking, with statistical tests using chi square (χ^2 test) for categorical data and Spearman's Rank Order Correlation (r_s) for ranked data to test the association between different farmer attributes and levels of barriers. Thematic content analysis was used for the qualitative data. The main attributes use for categorizing the farmers are gender, educational levels and wealth status. There was statistically no significant correlation in the ranking of economic barriers based on educational status (r_{cal}=0.68 <rt_{ab} = 0.71) and wealth status (r_{cal}= 0.32 < rt_{ab} = 0.71). Also the institutional barriers were also not correlated and differed among men and women (r_{cal}=0.4 < rt_{ab} = 0.9), educated and non- educated (r_{cal}= 0.3 < rt_{ab} = 0.9) as well as the rich and poor (r_{cal}=0.2 < rt_{ab} = 0.9) farmers. The results also points to non – correlation and differences in ranking of socio – cultural barriers on gender (r_{cal}=0.3< rt_{ab} =

0.9), educational status (r_{cal}=0.6 < rt_{ab} = 0.9) and wealth status (r_{cal}=0.7 < rt_{ab} = 0.9). Thus the finding is that women, non –educated and poor farmers were confronted with higher institutional barriers than their male, educated and rich counterparts. Whereas unfair land allocation was found to be the most important institutional barrier facing them it was found to be the least among the men, educated and rich farmers. Ranking of economic barriers were not correlated and differed on educational and wealth status. Difficulty to assess credit and high cost of inputs were found to be the most important critical economic barrier confronting the non –educated and poor farmers as against low prices of outputs for the educated and rich farmers.The results also points to non – correlation and differences in ranking of socio – cultural barriers on gender, educational and wealth status with the system of land inheritance been the most important barrier confronting the poor, non –educated and women farmers as against family responsibility and workload for the rich, educated and male farmers. Further, the analysis revealed that there were significant relationships between gender (χ^2=6.85, df =1, p = 0.01) and wealth status (χ^2= 20.9, df =3 p = 0.00) of farmers and participation in dry season farming. Significantly more men (92.2%) participated in dry season farming than women (82.2%), while less poor farmers (65.2%) compared to rich farmers (93.5%) participated in dry season farming. Educational status of farmers however had no significant effect on participation in dry season irrigated farming (χ^2= 0.12, df = 1, P=0.73). In addition, farmers' participation was found to be significantly and inversely correlated to economic (r = -0.06), institutional (r=-0.04) and technical barriers (r =-0.02) whereas socio– cultural barriers had a significant positive correlation (r =0.013), especially with increasing family responsibilities. Therefore in general, the higher the barrier confronting a category of farmer the less the participation in dry season irrigated farming.

Further, dry season farming results in additional average income of (GHc1, 436.33) compared with rain- fed farming (GHc 764.81). Social groups who cannot scale these barriers to participate in dry season farming exclusively or in addition to rain-fed farming are disadvantaged with regards to their livelihoods. A higher proportion of dry season farmers were able to acquire assets of high value (20.5%) compared to (16.7%) for rain-fed farmers; improved on their food security situation (65.4%) compared to (41.7%) of rain- fed farmers; and improved on the quality of dwelling (76.9%) as compared with (41.7%) of rain-fed farmers. Therefore participation in dry season farming contributed to enhancing the livelihoods of the farmers in the study area. It is concluded that socio-economic characteristics such as gender, educational and wealth status influence participation in dry season farming and through that on livelihood outcomes to the disadvantage of the women, less educated and the poor. It is recommended that affirmative action in favor of these vulnerable social groups is undertaken as a means of social protection around public irrigation schemes.

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LIST OF ACRONYMS

AEA	Agricultural Extension Agents
FAO	Food and Agriculture organization
FGDS	Focus Group Discussions
GDP	Gross Domestic Product
GIDA	Ghana Irrigation Development Authority
ICOUR	Irrigation Company of Upper Region
IFAD	International Fund for Agriculture Development
IFPRI	International Food, Policy Research Institute
LACOSREP	land Conservation and Smallholder Rehabilitation Project
MOFA	Ministry of Food and Agriculture
NGOs	Non – Governmental Organizations
U/E/R	Upper East Region
URADEP	Upper Regional Agriculture Development Programme

CHAPTER ONE

INTRODUCTION AND BACKGROUND TO THE STUDY

1.0. Introduction

In Ghana, the high levels of poverty in the Northern part of the country have been attributed largely to the unimodal rainy season experienced in the year (GOG, 2002 Cited in Dinye & Ayitio, 2013) compared to the bimodal rainy seasons in the South. In fact rainfall in these regions is lower than the average in the equatorial tropical belt and is variable both spatially and seasonally with very short rainy season of 3 to 5 months and a long dry spell (Table 1 & Table 2) characterized by erratic rainfall patterns. This low and variable nature of rainfall imposes a delicate balance between the on-set, duration and amount of rain and the timing of agriculture activities. Climatic manifestations over the last decade have made it difficult to maintain this balance between climate and agriculture. Among many manifestation of climate instability and change in the region have been floods that devasted large areas of near – ready grains fields, several episodes of late rains during planting seasons and persistent droughts in large portions of the region (Dinye et al 2013).

These climatic limitations imply that under rainfed farming, farmers in Northern Ghana cannot engage in all-year-round farming. Also, the onset of these climate change, the insufficient rainfall and occasional uncontrollable floods results in frequent crop failures which are having a serious effect on the livelihoods of the majority of the population in the region. In connection with this, the notion of an irrigation led strategy

has become paramount for regions where rainfall shortage is the most severe in Ghana (Yakubu, 2008).

Table 1: Agro – Ecological Zones of Ghana

Ecological Zone	Area ('1000 Ha)	% Total Area	Mean Annual Rain(mm)	Crop Growing Periods (Days)	
Rainforest	750	3	2200	150 – 160	100
Deciduous Forest	740	3	1500	150 – 160	90
Transition	6630	28	1300	200 – 220	60
Gunea Savannah	14790	63	1100	180 – 200	Dry Period
Sudan Savannah	190	1	1000	110 - 160	Dry Period
Costal Savanna	580	2	800	100 – 110	60

Source: Adapted from Ghana Statistical Service (GSS 2000:4)

Table 2: Regional Rainfall Distribution of Ghana

Region	2006 (mm)	2007 (mm)	2008 (mm)	2009 (mm)	30 years average (mm)	% Change (2009/2008)	% Change (2009/30 - yr average)
Western	1,350.0	1,678.0	1,518.0	1,734.0	1,558.0	14.2	11.3
Central	1,462.0	1,330.0	1,361.0	823.0	1,252.0	-39.5	-34.3
Greater Accra	689.0	863.0	914.0	674.9	788.0	-26.2	-14.4
Eastern	1,410.0	1,328.0	1,454.0	987.1	1,340.0	-32.1	-26.3
Volta	1,093.0	1,195.0	1,436.0	1,021.4	1,180.0	-28.9	-13.4
Ashanti	1,384.0	1,542.0	1,412.0	1,350.3	1,345.0	-4.4	0.4
BrongAhafo	1,310.0	1,312.0	1,366.0	1,116.0	1,244.0	-18.3	-10.3
Northern	1,014.0	999.0	1,223.0	1,046.5	1,155.0	-14.4	-9.4
Upper East	925.0	1,320.0	902.0	1,138.8	912.0	26.3	24.9
Upper West	982.0	1,089.0	1,171.0	1,089.1	1,022.0	-7.0	6.6
Total	11,618.0	12,656.0	12,757.0	9,501.3	11,796.0	-25.5	-19.5
Average	1,162.0	1,265.6	1,275.7	950.1	1,179.6	-13.0	-6.5

Source: Ghana Metrological Agency (2010)

As an interventional tool for increasing agricultural productivity and reducing rural poverty in the north, the Government of Ghana and other International and Non-

Governmental Organizations (NGOs) have used irrigation development strategies to promote dry season farming. The major justification for this is to improve food security, ensure rural employment and reduce rural poverty (GSS 2000: p.6).

However; poverty levels in the North remain stubbornly high to the extent that it would be a difficult hurdle for these regions to reduce extreme poverty by a range between 11.7 percentage points in the Northern Region and 41.8 percentage points in the Upper West and East Regions to reach the MDGS target of halving extreme poverty by 2015 in the country (UNDEP, 2012). Studies on poverty in Ghana: preliminary results of economy-wide multi-market simulation model constructed indicates that, the poverty rates in northern Ghana are very high and likely to remain high, if the past growth rates are projected into the future (Diao, 2005); Again it is said that the region can only produce 44% of its food requirement and the remaining 56% has to be imported despite the development of irrigation facilities. (MOFA 2007 cited in Yakubu, 2008).

One major reason for the increasing in poverty and migration in this region has been the issue of lack of local involvement in rural development projects such as the Tono irrigation scheme (Asare, 2002). Asare asserted that the model of rural transformation is severely limited because it does not incorporate other dimensions of reality, assuming instead this essentially consists of increased input use and output. These economic considerations overshadow any other aspect of reality. According to Falconer (2002) 'policymakers had still limited experience of farmers' response to environmental incentive schemes and Vanslembrouck *et al.* (2002) stated that 'analyzing farmers' willingness to participate in developmental activities is a rather new research area'.

Wilson (1996) in his studies found out that "external factors' like scheme features, amount of premium, degree of fitting of the contract to the farm organization, social context and 'internal factors' like farm structural features, and finally farmer's specific characteristics, like motivations, attitudes and level of information are generally factors that can influence farmer's participation in development activities. Wynn et al in 2001 also proposed the following classification of factors in order to explain farmer entry/ participation in developmental activities i) physical farm factors (i.e. farm size, labor, farm type etc); ii) farmer characteristics such as the age, sex, educational status, wealth status etc; iii) business factors such as tenure status and proportion of total income derived from farming activities and iv) Situational factors which include a wide range of determinants, mostly linked to the interface of farmers with the policy characteristics (Wynn, 2001).

Though research on the determinants of farmers' participation in rural development schemes have received increasing attention in recent times, gaps however still remain, since published studies have provided little or no information as regards to barriers affecting the participation of different categories of farmers in dry season irrigation farming. Entrants' and non-entrants motivations underlying their participation in dry season farming and the barriers faced by these different categories of farmers is therefore still an open question and a challenge to research (Willock *et al*., 1999; Morris, 2004), especially in the Upper East Region.

1.2. Problem statement

The economy of the Upper East Region of Ghana is largely agrarian with an estimated 72.10% of the population engaged in agriculture as a source of livelihoods (GSS, 2012). However agriculture in the region is beset with a single maxima and limited rainfall pattern which leads to poor yields of crops. This goes to worsen the poverty situation of the people in the region. In order to mitigate the negative impact of this problem, the Government of Ghana and other development partners have provided irrigation facilities in some locations in the region to promote dry season farming so as to ensure all year rural farming activities so as to increase food production (Inkoom, 2011).

Most of the irrigation facilities in the region are however underutilized. Out of a total of 2,632 and 1,417 hectares of irrigable land available at the Tono and Vea irrigation schemes respectively in the region, only 800 and 400 hectares representing 30% and 28% respectively has been actually cultivated. This leaves farmers to idle during the dry season (FAO, 2007). This problem persists even when about 70 % of the Upper East Region's populations are subsistence farmers who are also being described as the poorest and most vulnerable in terms of poverty analysis in Ghana (FAO, 2007).

Studies conducted by Asare (2002) to assess local involvement at the Tono irrigation scheme in the Kassena-Nankana District, showed that there is evidence of alienation due to lack of local involvement in the project. His studies showed that migration from the project area had not slowed down and that out migration had increase rather than slackened. The study showed that 68% of households had lost members through

migration to the southern part of Ghana. He concluded that the potential of Tono Irrigation Scheme to improve livelihoods and be an answer to the harsh environment was greatly reduced and that the success of it to improve livelihood through dry season irrigation farming was only in the records of the bureaucrats and the technocrats and that it was not seen from the eyes of the farmers.

The ineffective utilization of these irrigation facilities for dry season farming has contributed to deficits in the agricultural production and food insecurity, as well as out migration from the region (Ghana News Agency, 2007 cited in Inkoom, 2011). Subsistence farmers experience or are at risk of experiencing food insecurity every year. It is estimated that 15% of the population of the region, which is rural, is food insecure; the second highest in Ghana, and an additional 20% is vulnerable to food insecurity (World Food Programme, 2009). This situation has contributed to migration to other parts of the country during the dry season, to engage in income generating activities to feed their families back home.

These scenarios have therefore left questions in the minds of many as to the factors that account for the underutilization of these irrigation facilities for the purposes of dry season irrigation and why out migration in some of these irrigation schemes had not slowed down, as well as why in many communities in the Region where dams are sited the people still suffer abject poverty and high levels of unemployment.

Studies have shown that in most developing economies, smallholder farmers and especially women find it particularly difficult to participate or enter into profitable or

risk reducing diversification economic activities as a result of certain barriers to entry (Medola, 2008). Agricultural activities, non-agricultural activities or profitable alternative agricultural activities are not easily accessed as a result of some of these barriers which could take the form of absence or limited working capital, skills and other requirements (Medola, 2008). Dercon (1998) shows the importance of these entry barriers to relatively lucrative activities in rural Tanzannia and Ethiopia as being more important than comparative advantage in determining entry into high-return activities.

The Economic theory on barriers to entry postulates how various barriers influence decisions of new entrants into opportunities and how these barriers influence their profit rates. Jasper et al., (2003) in their work hypothesized that barriers to entry have a strong effect on the entry decision of potential entrants and that if the barriers to entry are too high, start-up's might decide not to enter.

Though entry barriers are crucial factors that influence entry into an opportunity, very little empirical research has examined the nature of barriers to entry into dry season farming among different categories of farmers in the Upper East Region. This research therefore explores the nature of entry barriers in dry season irrigation farming around the formal irrigated areas in the Upper East Region of Ghana. The study focuses on entry barriers because it is the other side of the opportunity coin. These barriers may represent some of the criteria farmers use to evaluate opportunities once they are discovered.

1.2.1. Research questions

In order to address the above concerns; the study seeks to explore the following questions;

1. Are different categories of farmers confronted with different entry barriers to participation in dry season irrigation farming?
2. How does the different level of entry barriers influence farmers' participation in dry season irrigation farming?
3. Is there any association/relationship between personal characteristics of farmers and participation in dry season irrigation farming?
4. How does participation in dry season farming impact on the livelihoods of farmers in the region?

1.2.2 Hypotheses

1. H_o: Entry barriers to participation do not differ significantly among the different categories of farmers in the region.
2. H_o: Entry barriers do not have an influence on farmers' participation in dry season farming
3. H_o: There is no association/ relationship between personal characteristics of farmers and participation in dry season farming
4. H_o: Participation in dry season farming does not enhance livelihoods.

1.2.3 Main objective

The main objective of this study is to determine if there are different barriers to entry of farmers into dry season farming in the Upper East region and how this affects participation in the enterprise and to what outcomes.

1.2.3.1 Specific Objectives

Specifically, the research seeks to;

a. Examine the level and nature of entry barriers to dry season farming among different categories of farmers' in the Upper East Region
b. Determine whether differential barriers to entry have an influence on farmers' participation in dry season irrigation farming.
c. Determine whether there is any relationship between personal characteristics of farmers and participation in dry season farming.
d. Determine the contribution that dry season irrigation farming in the region make to household livelihoods.

1.2.4 Justification

It has been recognized the world over that any country that depends on agricultural production as basis for industrial development is most likely to fail if irrigation is not part of its agriculture development plan. Indeed, in some parts of the world, irrigation remains the dividing line between abundant food and limited food security. To promote irrigation farming therefore, it is crucial to closely examine factors that influence local communities/ farmers involvement in it; Attempts to examine the nature of entry barriers to dry season farming among different categories of farmers is therefore of

policy importance. The findings based on the empirical evidence in this study, could provide insights, to inform appropriate policy measures would be needed to enhance equity in participation in dry season farming activities and thereby improve on their income and livelihoods in general. Irrigation is crucial to economic growth, as such sound policies that promote equity in its access are crucial for economic growth and poverty reduction.

This study will also be a useful material to farmers and local communities as first-hand information on the contribution that the different types of farming make to household livelihoods. An understanding of the contribution of dry season and rainy season farming is central to strategic decision making for enhancing household livelihoods. This study will therefore enable farmers to look at what would work to their advantage to improve their livelihoods.

Knowledge acquired through this study will contribute enormously to enhancing civil societies/Non- governmental Organization's role of building farmers capacity to organize, generate and utilize resources more effectively. Results will also assist the civil societies/ NGO's to carry out empirical roles of advocacy which will ensure that barriers to dry season farming are addressed.

Finally, there is scarcity of empirical studies on the nature of barriers to entry in dry season farming among different categories of farmers in the Upper East Region. This study would therefore contribute to knowledge and theory. The results of this work would doubtfully serve as a source of reference to academics' and other researchers interested in dry season farming.

1.2.5. Conceptual frame work of the study

The frame work which is diagrammatized as Figure 1 shows that farmer's choice to participate in dry season farming may be influenced by a number of underlying factors/ barriers which include economic, institutional, technical and socio – cultural barriers with the ultimate aim of achieving their desired livelihood outcomes. According to Jeffrey (2001), when these barriers to entry are low or are easy to overcome, then the decision to participate will be made, "ceteris paribus". When these barriers to entry are seen to be insurmountable because they do not know how to overcome the barriers they see, then the decision will be not to participate in the activity.

When multiple entrepreneurs (farmers) see the same opportunity, all of them will not pursue it. Small business owners, business managers and farmers seeking to enter a market, facing the same opportunity, will need to make a decision: enter by committing their personal, household or the firm's resources towards the new opportunity/market or not. To make this decision, entrepreneurs are influenced by the opportunity and then perform their own risk calculations to choose between the alternatives (Kahneman & Tversky, 1979; Boyle and Shapira 2001 in Jeffery., R, 2001). If the entrepreneurial stance (intentional search) and one's experience are preconditions for opportunity identification, then it is the barriers to entry that influences the decision to pursue an opportunity (Jeffrey, 2001).

According to Diana et al (2000) cited in Jeffery (2001), these barriers in part also have an influence on the profitability of the venture or activity. Thus an entrepreneur deciding whether to participate or penetrate a market or not, compares the benefits and the cost of entry. The benefits are the expected profits and growth of demand connected

with entry. The costs are among other things determined by barriers to entry which may be caused by exogenous factors or by strategic factors.

In addition, other preceding factors such as their personal characteristics are also expected to have their own influence on the nature of entry barriers and farmers participation in dry season farming. According to Von Braun et al (1989) entry barriers differ among different categories of people in society and that some groups such as the poor, women, people with disability etc find some specific barriers as more important than others. Evidence has shown that women and the poor face more constraints as they endeavor to engage with market systems.

Empirical studies on intra household gender dynamics in Africa have shown that when a crop enters the market economy, men are likely to take over from women, and therefore women do not benefit from market oriented production (Von Braun and Webb 1989 cited in Karria et al, 2010). In some instances, women's social and cultural roles may assign productive and reproductive roles to men and women that can limit their access to markets (OECD 2004). Women's role of household provisioning versus the men's role of providing cash requirements of the household, affects women's ability to participate in markets.

Johnson (2003) argues that in remote rural areas markets may fail because they maybe too "thin", or the risks and costs of participating especially for poor people maybe too high, and or there maybe social or economic barriers to participation. Because of the resource constraints of the poor/ small farmers, and as a result of inappropriate low technologies used by them coupled with unfavorable marketing systems, the income of

the poor/ small farmers is generally low and very often irregular. There are limited incentives for the small farmers to increase production. Existing credit policy does not favor small farmers; instead the big and commercial farmers have been benefited. Provision of credit on the basis of single enterprise and also on the basis of collateral does not favor small farmers at all. Small farmers particularly need credit for their entire farming system activities on the basis of cumulative need rather than for a single activity.

The Figure shows that farmers' participation is expected to result into certain livelihood outcomes. The outcomes include increase income, asset acquisition, housing improvement and food security.

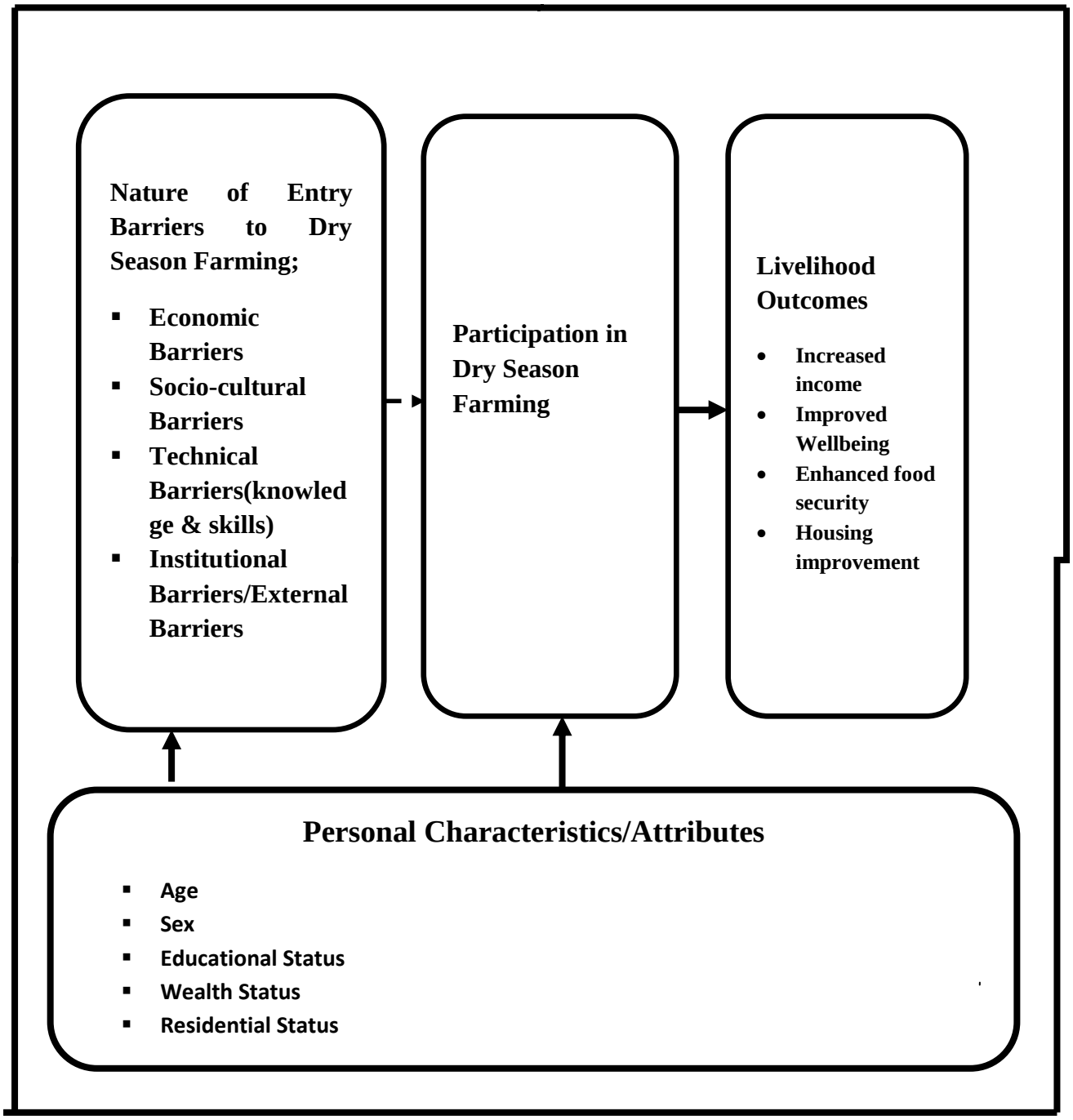

Figure 1: Conceptual frame work: Nature of Barriers to entry in Dry Season farming (Source: Researchers Construct, 2012)

1.2.6. Conceptualization of key terminologies

This section defines or/ and conceptualizes the key terminologies at the heart of the current study. The key concepts that are explained under this section include: Entry Barriers', Livelihood Outcome, Dry Season Farming, Use of Irrigation, and Participation. The fact that different authors define the terminologies differently makes it necessary that the defining of key words be made.

Entry barriers: Entry barriers imply the problems or difficulties that prevent or inhibit farmer's entry or participation in dry season irrigation farming. For the purpose of this study, Barriers to entry have been classified into five categories. These are economic barriers, socio-cultural barriers, technical barriers, institutional barriers. Details of this are discussed in the literature section.

Socio – cultural barriers: This refers to the cultural elements or norms of society that impedes farmers' participation in dry season farming. For the purpose of this study, socio – cultural barriers include the system of land inheritance, family responsibilities of the different categories of farmers, workload and discrimination in remuneration for working in the farm.

Institutional barriers: Are defined as the conditions, rules and regulations by management of the Irrigation Company of Upper Region (ICOUR), Ministry of Food and Agriculture and Government that impedes farmers' involvement in dry season farming. These include high water levy charges, poor extension services, unfair land allocation and unfair water distribution.

Economic barriers: These refer to the set of fundamental information and resources that affects farmers' participation. For the purpose of this study economic barriers include the lack/ difficulty to assess credit by farmers', limited/no irrigated land, low prices of outputs and non – availability of inputs.

Technical barriers: Refers to the lack of skills, technical know –how, and resources that affects farmers participation in dry season farming. They include farmer's knowledge of appropriate technology to use, knowledge of how to use chemicals, inadequate storage facilities, fertilizer availability problems as well as pest and diseases.

Livelihood outcomes: According to Scones (1998), livelihood outcomes are the achievements or outputs of livelihood strategies. Chambers and Conway (1991) also described livelihood outcomes as the outcomes of people livelihood strategies. Five potential outcomes are identified in the Sustainable Livelihood Framework (SLF). These are increase in income, improve wellbeing, reduced vulnerability, and improve food security and more sustainable use of the natural resource base (DFID, 2000). For the purpose of this study, we construe livelihood outcomes as the results/ achievements or outputs of the activities (in this case dry season farming) the households or farmers engage in.

Dry season irrigation farming: This refers to the production, processing and marketing of crops outside the normal rainy season through the use of irrigation

Use of irrigation: the utilization of irrigation facilities such as dams, and the associated use of pumps etc. by farmers for the purpose of providing water for the growing crop production.

Participation: The involvement of farmers in the production, processing and marketing of crops.

1.2.7. Structure of the thesis

This thesis is organized into six chapters, the introduction chapter gives a brief overview of the concern area, motivation for conducting the study (problem statement), objectives and some hypotheses that this thesis aims to explore. The chapter also includes the justification for undertaking the study, conceptualization of key terminologies as well as the focus and structure of the thesis. Chapter two concentrates on review of relevant literature to the study. This includes various definitions of barriers to entry, classification of barriers, barriers faced by different categories of farmers, irrigation farming as an option, and irrigation development in Ghana and the development of the Tono and Vea irrigation schemes. Chapter three describes research methodology used in the execution of the study. It discusses the research design, methods employed in collecting data and the analytical methods used. Chapter four is devoted to the analysis of the data through a variety of tables in which relevant and important details have been compressed. Chapter five discusses the main results of the findings.

Lastly chapter six provides a summary, major conclusion and the implications as well as suggested areas needing further research.

CHAPTER TWO

LITERATURE REVIEW

2.0 Introduction

The concept of barriers is examined and a working definition provided in this chapter. This chapter also discusses the different classification of barriers to entry as well as how these barriers to entry differ among different categories of farmers. The literature review also covers irrigation farming as an option, irrigation development in Ghana and the development of the Vea and Tono irrigation schemes.

2.1 Defining barriers to entry

Although the debate over how to define barriers to entry began decades ago, its definitive meaning is still a subject of discussion. In general, the term means an impediment that makes it difficult for an entrepreneur to enter an opportunity (OECD, 2005). A controversy has persisted, however, with respect to the types of impediments that should qualify as ―barriers to entry. Some scholars have argued, for example, that an obstacle does not count as an entry barrier unless it is something that the entrepreneur did not face when they entered. Others contend that an entry barrier is anything that hinders entry and has the effect of reducing or limiting competition, regardless of its other characteristics (OECD, 2005). A number of other definitions have been proposed over the years, but so far none of them has emerged as a clear favorite. Because the debate over these definitions remains unsettled by scholars, yet they continue to be relied upon as analytical tools.

The debate over how to define entry barriers began nearly 50 years ago when Bain published his book Barriers to New Competition (1956). In what was to become a classic of industrial organisation literature, Bain presented the conclusions of the first thorough study of entry barriers. In doing so, he defined an entry barrier as by its effects on profitability; in particular in terms of the ability to earn above-normal profits without inducing entry (Bain, 1956). This characteristic of his definition created a great deal of controversy because it struck some commentators as being too broad (OECD, 2004).

Fisher (1979) defined an entry barrier as anything that prevents entry when entry would be socially beneficial. Although it attempts to introduce a normative element to the discourse on entry barriers, this definition does not give any guidance for identifying socially harmful impediments (Carlton, 2004 cited in Ramsay and Morgan, 2009). Because of the duelling definitions the term, barriers to entry has become so controversial that it is now difficult to use it in a widely acceptable manner (Ramsay and Morgan, 2009).

In recent years, some commentators have de-emphasised this problem, arguing that the debate over the meaning of barriers to entry is not essential for policy (Carlton, 2004 cited in Ramsay et al 2009, Weden, 2001; Posner, 2002). In a 2004 article, for example, Carlton advised that: rather than focusing on whether an entry barrier 'exists according to some definition, analysts should explain how the industry will behave over the next several years. Posner in agreement noted that the important practical issue is not whether something is or is not a Stiglerian barrier (i.e. a cost of producing at some or every rate of output which must be borne by entrepreneurs' seeking to enter an

opportunity but is not borne by entrepreneurs already in the opportunity), but whether it will delay new entry. Werden (2001) also intentionally left the definitional dispute behind by using the less-controversial term "conditions of entry". These authors concluded that abstract, theoretical pondering on the definition of barriers to entry is unlikely to be very helpful in investigations and policy decisions. Instead, the more useful inquiry is whether and when entry is likely to defeat the anti-competitive effects that an entrepreneur, agency or an individual is concerned about, given the facts and circumstances of each matter.

The varying definitions of barriers to entry reveal that a barrier to entry is not an absolute condition that can be identified. Rather, a barrier to entry is a relative term whose competitive significance is very much dependent upon the surrounding circumstances. For the purpose of this study, barriers to entry are defined as problems or difficulties/constraints or anything that prevents or inhibits farmer's entry or participation in dry season irrigation farming. Some of the overall characteristics of barriers are:

- Barriers have many origins
- Barriers can operate at various levels
- Barriers can be direct effects and can also be indirect and unexpected flow-on effects from other actions
- Barriers are not static
- The same barriers do not necessarily operate for all markets, segments of market or for all products
- Barriers do not operate one at a time but operate simultaneously and interact with each other (Ramsay and Morgan , 2009)

2.2 Classification of barriers

According to Ramsay and Morgan (2009), barriers to entry are located within a complex collection of social, economic and physical interactions embedded in a political environment. Barriers can be described and classified in various ways; they can have their origins in the public and private sectors and can relate to the producer or the purchaser or other components in the market system and value chain.

Categorization and classification of barriers is a difficult task and it is important to note that the naming and categorization of barriers will vary with the perspective and experience of the analyst including the discipline approach being taken. Therefore barriers can be categorized in many ways, for example Steinfeld (2002) cited in Ramsay and Morgan (2009) suggests three categories, namely:

- ✓ Technical
- ✓ Financial, and
- ✓ Social and cultural

In this situation the lack of alignment between a poor producer and the market system could be considered a barrier influenced by all three categories. More specifically there is significant overlap between the three categories for example, the knowledge a farmer has on how to produce is influenced by all three of the factors.

For the purpose of this study, Barriers to entry have been classified into five categories based on the classification by Ramsay and Morgan (2009). These are economic barriers, socio-cultural barriers, technical barriers and institutional barriers.

2.2.1 Institutional barriers

Institutions are the kinds of structures that matter most in the social realm: they make up the stuff of social life. The increasing acknowledgement of the role of institutions in social life involves the recognition that much of human interaction and activity is structured in terms of overt or implicit rules. Without doing much violence to the relevant literature, we may define institutions as systems of established and prevalent social rules that structure social interactions (Hodgson, 2006). Rather, the point is that dysfunctional institutional arrangements and norms are the major (but by no means the only) constraints to agricultural development.

According to Bategeka, Kiiza and Kasirye (2013) there are two categories of social institutions that impact agricultural production – the slow-moving institutions, and the fast-moving institutions. The slow-moving institutions are socially-embedded norms (such as patriarchy). The fast-moving institutions are primarily governance arrangements (such as the flawed architecture of the sector ministry for agriculture). At some stage we need to consider how institutions structure social interactions and in what senses they are established and embedded. In part, the durability of institutions stems from the fact that they can usefully create stable expectations of the behavior of others. Generally, institutions enable ordered thought, expectation, and action by imposing form and consistency on human activities. They depend upon the thoughts and activities of individuals but are not reducible to them. Institutions both constrain and enable behavior. The existence of rules implies constraints. However, such a constraint can open up possibilities: it may enable choices and actions that otherwise would not exist (Hodgson, 2006). Delgado (1999) defined institutional constraints as the Conditions under which individuals are permitted to undertake certain activities.

Hopes that policies would bring about positive and durable results remain unmet. The remaining main policy bottlenecks include those that pertain to land tenure and land distribution to different segments of the population, marketing of agricultural commodities and inputs, and price regulatory frameworks. In Ethiopia, for example, the inappropriate agricultural policies related to land distribution, collectivization and rigid price regulation have been identified as one of the constraints to investment in agriculture and hence a handicap to productivity (FAO, 2009).

2.2.2. Technical barriers

Taking cognizance of the assertion by Schultz (1964), as cited by Ruttan (2002), that smallholder farmers often lack the technical and economic opportunity, it is crucial to examine the technical barriers affecting farmers as is shown in this section. Technical barriers to smallholder agriculture are numerous and include the following: absence of equipment to relieve labor shortages, inadequate supply of complementary inputs (such as seeds, agro - chemicals and water), insufficient human capital, and inappropriate transportation infrastructure among others (Feder et al., 1985).

Sharma, Bangarva and and Sharma (2008) in their study identified six technical barriers that farmers face. The intensity and seriousness of these barriers varied from system to system. Lack of communication of technical know- how to the farm families and untimely diffusion of the latest technical know -how were the major constraints. Lack of practical applicability of technical know- how was perceived as another major constraints.

2.2.3 Socio-cultural barriers

Socio-cultural factors are things that can affect our lifestyles as a society. They can have an influence on individual behaviors' depending on one's' social values. Some of them could be religion, economic status, education, family, politics, cultural values etc. They are the facts and experiences that influence individuals' personality, attitudes and lifestyle. Socio-cultural factors involve both social and cultural elements of the society (Uwakwe, 2004).

2.2.4 Economic barriers

These refer to the set of fundamental information and resources that affects a business or an investment. A study conducted Sharma (1992), identified scattered holdings, limited resources of purchase inputs, unavailability of labor to carry out work, small size of holding, insufficient irrigation, non-availability of loan at proper time and costly inputs as the main economic constraints facing farmers.

According to, Bienabe, Coronel and Liagre (2004), producing for markets calls for production resources that include land, labor force and capital. Poor access to these economic assets affects the way in which small holder farmers can benefit from opportunities in the agricultural markets, and especially in terms of the volume of products traded and the quality of those products. Some small scale farmers lack consistency in terms of producing for markets due to some of these economic barriers.

2.3. The manner in which barriers operate

Barriers to market entry can also be classified according to how they operate. For example the classification of barriers can relate to the way in which the barriers impact on market access and be classed as having either:

• Direct, or

• Indirect effects

In this case direct barriers are those that impact directly on the first sale of the producer (Ramsay and Morgan, 2009). For instance, where investment takes the form of a new enterprise, capital will be required in order to initiate entry. This capital may come from own resources but where credit markets exist, credit is a likely source of capital. In order to obtain credit, interest must be paid on the sum borrowed. Thus, there will be additional costs for investment through interest charges. Therefore, expected profits must be able to cover interest charges.

In countries with poorly developed credit markets with high interest rates, it would be expected that fewer individuals are able to obtain credit and fewer will be able to generate sufficient profit to make the investment worthwhile. High interest charges will increase the risk of investment since a greater sum must be generated in order to satisfy the viability condition. There may also be uncertainty over future interest rates, and therefore, ability to pay back at a future time period. In developing countries, Reardon et al (2000) describe the existence of entry barriers into activities with high returns to labor as being license fees, equipment purchase or rental, and skill acquisition. The following therefore can be said to be direct barriers, they include lack of credit, high cost of inputs and labor.

Indirect barriers are those that have their origin elsewhere in the system and operate via other mechanisms to impact on the producer or entrant. These include 'super profits' from certain non-farm activities and non-farm wages being very high compared

to farm ones, i.e. cases of monopolization such as where a village can provide just enough work for one full-time blacksmith. Demand can be rationed by high prices when it exceeds the capacity to supply (Reardon et al., 2000). In such an instance, there is unlikely to be sufficient work for another individual to start a viable business as a blacksmith, therefore, an entry barrier exists.

In Kenya and Rwanda, the marginal value product of farm labor amongst the lowest quartile of farmers is well below the farm labor market wage which, in turn, is lower than the non-farm wage. This indicates evidence of 'bottling up' of labor on farms, since it would be expected that farmers would sell labor to both labor markets if they were not prevented by skill barriers, transaction costs, risk and other barriers (Reardon et al., 2000).

Opening a domestic economy to international trade, and therefore international competition, may act as a barrier to entry. Producers in other countries will be operating in different markets for factors of production such as labor and credit markets which may combine so that the foreign competitor may be able to produce a cheaper or better quality product. Such a competitor, having already entered its own domestic market, will carry knowledge about market entry and be subject to low entry costs. The existence of such a formidable competitor may inhibit the entry of others into the same market (Mueller, 1991).

In addition it is possible to classify barriers dependent on whether their impacts are

• Immediate or

• Delayed

The delays between barrier and its impact relate to distance in space or time or both. Immediate barriers are those where the effect is close in both space and time to the producer and the first transaction. In contrast delayed barriers can be distant in either space or time or both.

Barriers can also be considered to be intrinsic or extrinsic. Intrinsic barriers are those that exist irrespective of the producer and market and may for example be due to the nature of the product (meat is bulky and highly perishable for example). The majority of small scale livestock production systems have not been developed to align with modern methods for the processing and marketing of livestock products. As a result there are numerous barriers to market entry that form an intrinsic component of the production system. Some of those barriers such as distance to market cannot be removed but the barriers that cannot be removed can be mitigated.

Traditional social structures in many countries have an association with trading relationships and many of those relationships appear fixed reducing the opportunities for the small scale producer to participate in the wider economic system. By their nature small scale producers produce small quantities of produce and therefore any purchaser of that product for a larger market would need to develop a relationship with a large number of small producers. The development and maintenance of each of those relationships imposes a cost. Therefore the need to purchase product from a large number of producers is in itself a large transaction cost that must be borne, unless arrangements are made to mitigate the barriers.

2.4 Barriers to entry differ among different categories of farmers

Barriers to entry are not the same for all the individuals in society. Although some obstacles are common to all people, some groups find specific obstacles, namely, women, young people, people with disabilities, ethnic minorities, unemployed and people living in rural or distressed areas. There is evidence that women and the poor face more constraints as they endeavor to engage with market systems. According to Kelly (2000) women farmers in rural areas carry much of the responsibility for both farm production activities and family management activities. They work long hours and often go unrecognized as participants in family economic activities and decision making processes. Farming is frequently portrayed as an occupation in which men are the farmers and women are farmers' helpers. Women farmers encounter various kinds of constraints as they attempt to access agricultural resources (e.g., land, labor, knowledge, and capital) that men take for granted (Kelly, 2000).

They often lack access to technical assistance from extension services, especially in the process of adoption of new innovations. In some respects, society has not accepted women as agricultural producers (FAO, 2009).

In addition, given the demands on their time, one might posit that women small-scale farmers have little time to pursue training or education. Although conditions vary from one farm community to another, the problems facing women farmers in most instances are similar. The literature indicates that the problems faced by female agricultural producers in small-scale farms are more severe than for male producers, and access to new innovations, training, agricultural extension support and agricultural innovations has been limited for female producers (Kelly, 2000).

Empirical studies on intra-household gender dynamics in Africa have shown that when a crop enters the market economy, men are likely to take over from women, and therefore women do not benefit from market-oriented production (Von Braun and Webb 1989). In some instances, women's social and cultural roles may assign productive and reproductive roles to men and women that can limit their access to markets (OECD 2004).Women's role of household provisioning versus the men's role of providing cash requirements of the household, affects women's ability to participate in markets.

While men and women generally face the same external constraints, they have an unequal access to human-controlled factors. They have different endowments, such as land rights and education, and different access to technologies, labor, capital, support services and credit. This disparity results in differentials in productivity to the detriment of women. According to the World Bank Report (2010) women smallholders face multiple constraints beyond those of men farmers. Women tend to be invisible to policy makers because they are not seen as 'productive' farmers. They often are expected to provide unpaid farm work, and bear a disproportionate burden of care and reproductive roles within the family and community. They are deprived of access to markets, key assets, and inputs, and are frequently excluded from decision-making.

2.5. Irrigation as an option

Irrigated agriculture can be defined as agriculture where the supply of water is increased by artificial means, involving the use of water control technology and including drainage to dispose of excess water. Analysis of information from Asia

shows that yields per area, for most crops have increased by between 100–400% as a result of irrigation, (FAO, 1996a). This has contributed to a reduction in food prices. For example the area under irrigation in India increased by 30% between 1970–1985, from 31.1 million hectares to 41.8 million hectares, whilst food grain prices fell by 20% relative to the price index for all commodities. These reductions have had a positive impact on the real incomes of the urban and rural poor, who spend a large proportion of their income on basic foodstuffs (IPTRID, 1999).

Irrigation projects are designed to help reduce the dependence of crop growth on precipitation, which to a large extent is uncontrollable by man. Irrigation is also the key to developing high-value cash crops, and, by helping guarantee consistent production, it stimulates agro-industry and creates significant rural employment (World Bank, 1997).

According to Food and Agricultural Organization (FAO, 1988), irrigation has put smiles in the face of many people in semi- arid and arid regions where crop production without irrigation is inevitable. In Egypt, 80% of the food requirement of the population comes from irrigated lands (FAO, 1988). The benefits brought about through the introduction of irrigation are undeniable. It has been possible to increase and protect harvest and grow crops that could not otherwise be cultivated under conditions of extreme drought. Irrigation also calls for increased use of labor, leading to higher quality of life for farmers, increasing their income and eliminating the uncertainty that comes from variable yearly and seasonal rainfall (Oriola, 2009). Furthermore, Worlf (1995) as cited in Oriola (2009) observed that irrigation has made higher and more reliable yield possible, as crops can be planted more than once in a year within the tropics, apart from bigger and reliable yield as against yearly

cultivation, which is often at the mercy of the seasonal rainfall. Higher, less risky and more continuous levels of rural employment and income, for both farm families and landless laborers', can result from the higher cropping intensities, higher yields and more intensive and higher value cultivation techniques of irrigated compared to rain fed agriculture (FAO 1996a).

According to shah (1993) as cited in IPTRID (1999) irrigation brings a range of benefits to individuals and households that economists sometimes distinguish between primary and spill-over effects .Primary effects include;

- Increased and more stable flow of income from farming made possible by increased intensity of cropping, improved yields and new farm enterprise / technology mixes.
- Appreciation of the value of land with access to water for irrigation.

Spill-over effects include*;*

- Increased and more evenly spread farm labor opportunities and improved wage rates.
- Reduced out-migration and increased return migration.
- Improved security against impoverishment.
- Lower food prices and better nutrition throughout the year.
- Growth in non-farm employment.
- Greater urban-rural contact and new social networks.
- More water for non-agricultural uses, including domestic uses that improve health.

2.6 Irrigation development in Ghana

Irrigation is central to the intensification strategy. Records date irrigation's beginnings in the country to about a century ago, but serious irrigation efforts date to the past fifty

four years. Between its inception in the 1960s and the year 1980, approximately 19,000 ha of irrigated land had been developed. By 2007 the area in irrigation had expanded to 33,800 ha (IFPRI, 2011). The practice dates back to as early as 1880 in the Keta area on land above flood level between the lagoon and the sandbar separating it from the sea. The first scheme that the government conceived was in 1920 as part of the then Winneba Water Supply Project (Smith, 1969).

Irrigation broadly defined may include sophisticated and automated drip irrigation, sprinkler irrigation, application of water by a watering can or a watering hose, etc., which make it possible for the irrigation of lands on steep slopes (Namara et al, 2010). Thus, the concept of irrigation potential for Ghana may be broadly defined to include a much higher area than as stated in previous estimations. It was only in the late 1950s (soon after independence) that the irrigation sector obtained all-round public support. Historical records indicate that the Dawhenya and Asutsuare projects are among the first batch of irrigation projects that received public support in Ghana. Even though the records date irrigation in the country to about a century ago, it is clear that serious irrigation is a more recent phenomenon.

The pace of irrigation development in Ghana was, raised in the 1970s and all irrigation related activities were institutionalized by the establishment of the Ghana Irrigation Development Authority (GIDA) in 1977 within the then Ministry of Agriculture. Irrigation schemes of varying sizes were developed to provide water for large livestock populations and for vegetable gardening in the dry season (Yilma & Berger, 2005). The Ghanaian government, with the support of the World Bank and IFAD, instituted programs and projects including the Upper Region Agricultural Development Program

(URADEP) in the past and recently the Upper East Land Conservation and Smallholder Rehabilitation Project (LACOSREP) which has and continue to make a significant contribution to irrigation development (Gyasi 2004 as cited in Yilma 2005). According to Agodzo and Bobobee (1994) as cited in Namara et al (2010), some forms of shallow tube well irrigation could also be identified in south eastern Ghana in the 1930s. Estimates of Ghana's irrigation potential are wildly divergent, ranging from 0.36-1.9 Mha (Agodzo and Bobobee 1994). The potential of valley bottoms and floodplains could add another 1.0 Mha of land that could be cultivated mostly with rice by employing water management technologies such as bunding, leveling and puddling (Namara et al, 2010).

Irrigation systems observed in Ghana may be classified into two types: conventional systems and emerging systems, which are initiated and developed by private entrepreneurs and farmers. Little is officially known about emerging systems, but they are expanding at a rapid rate, mainly fuelled by access to relatively affordable pumping technologies and to export markets for horticultural crops (IFPRI, 2011).

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2.6.1 Conventional / public irrigation

The conventional systems are largely supply driven they are mainly initiated and developed by the Ghanaian government or various non- governmental organizations (NGOs). They are developed with an intention to meet multiple objectives including the attainment of food security, domestic water supply, livestock watering, etc. (Namara et al, 2010). Of the irrigated land, slightly less than 9, 000 ha was developed by the Government of Ghana, with the remainder of the irrigated land been developed

by the private sector. Government-developed irrigation includes 22 public irrigation districts in the entire country. Most of the development of these public irrigation districts has been conducted with financial and technological support stemming from bilateral cooperation with China, the former Soviet Union, Taiwan, Japan, and the Republic of Korea. Additional support has come from multi – lateral international organizations, including the UN Food and Agriculture Organization (FAO) and the World Bank (WB) (IFPRI, 2011).

These schemes are basically operated and maintained by GIDA or ICOUR where beneficiaries are charged an irrigation service fee for the service rendered in the delivery of water. The schemes can be further classified into seven subtypes based on the source of surface water, the type of power used for abstraction, conveyance and distribution of water, and the in-field water application technology (Namara et al 2010).

The identified subsystems are:

1. Run – of – the river diversion – based gravity – fed irrigation systems
2. Reservoir or storage – based gravity – fed irrigation systems
3. Lake - pumping – based sprinkler irrigation systems
4. Run – of - the – river – pumping – based sprinkler irrigation systems
5. Resevoiur – pumping – based gravity irrigation systems
6. Small resevoiur – based communal irrigation systems
7. Domestic waste water and storm water irrigation systems (Namara et al 2010)

2.6.2. Emerging irrigation systems

Emerging irrigation systems are eclipsing conventional systems in terms of area irrigated, yield obtained, production levels, and value of production. These systems include tube well irrigation, small motor-based irrigation and others (IFPRI, 2011). They are initiated and developed by private entrepreneurs and farmers. Little is officially known about emerging systems, but they are expanding at a rapid rate, mainly fuelled by access to relatively affordable pumping technologies and the increasing demand for horticultural crops for the export markets.

2.7. Development of the Vea and Tono irrigation schemes

The Vea and Tono Irrigation Schemes otherwise known as Vea and Tono were developed by government of Ghana through a assistance of international donor agencies. The two irrigation schemes are been run by the Irrigation Company of Upper Region (ICOUR). The company administers a total irrigable area of 2490 ha at the Tono and 850ha at the Vea irrigation projects (ICOUR, 1995). The two irrigation schemes include large reservoirs constructed on the Nakambe River of the White Volta River. The purpose of developing these irrigation schemes by the government of Ghana was;

- ✓ To improve food security by increasing agricultural productivity
- ✓ To increase crop yields through improved agrochemical use practices
- ✓ To reduce rural – urban migration by providing employment opportunities for the youth (Ofusu, 2011)

The construction of the Vea and the Tono schemes started in 1965 and 1975 and where completed in 1980 and 1985 respectively. Prior to the construction of both irrigation schemes, parts of the developed area were occupied by inhabitants who lived as communities. During the construction, these inhabitants were resettled outside and along the project area. The resettled inhabitants are currently the main farmers (about 90% of the total) in both schemes (Ofusu, 2011). Both Vea and Tono have eight committees each. Each farmer is allocated a plot of land ranging from 0.2 – 0.6 ha. ICOUR charges a project levy for rainy season farming activities and an irrigation levy for irrigation farming during the dry season. The fees for the different services are usually fixed at the beginning of each season and are posted on the company's notice boards (Yilma, 2005). Other users of the irrigation scheme include contract commercial farmers, farmer groups, private institutions and government institutions.

The Vea and Tono have approximately 2000 and 4000 farmers respectively. Both Tono and Vea are operating at half of their capacity mainly because of the lack of credit for the farmers (Yilma, 2005). Onion, tomatoes, millet, groundnut, sorghum and maize are the major crops grown in the uplands of the irrigation projects, while rice dominates the lowlands. The dam-based irrigation systems are of the simple. The large reservoirs are used not only for irrigation but also to support aquaculture and livestock farming in the area. The Vea reservoirs are also used for urban water supply and supply water to the Bolgatanga municipal which has priority over irrigation water use (Ofusu, 2011).

2.8. Summary of chapter

The chapter has tried to define barriers to entry into economic opportunities. The chapter also discusses the different classification of entry barriers as well as how these barriers differ among different categories of farmers. The chapter has also reviewed literature on entry barriers and entry decision as well as irrigation development in Ghana. Based on this it is concluded that a barrier to entry is not an absolute condition that can be identified. Rather a barrier to entry is a relative term whose competitive significance is very much dependent upon the surrounding circumstance. The literature has also shown that different categories of entrepreneurs and farmers can face different barriers to entry in their pursuit of different livelihood activities as a means of achieving enhanced livelihood outcomes.

The chapter concludes that farmer's decision to participate in an opportunity can be influenced by entry barriers. As such when farmers see these barriers to be low or easy to overcome, then their decision to participate in the opportunity will be made. However, when these barriers are seen to be insurmountable, then their decision will be not to enter or participate in the opportunity.

A general observation is that, these entry barriers may have direct or indirect effects on farmers. Direct barriers are those that impact directly on the first sale of the producer. For instance, farmers may require credit from banks and other sources etc to invest in their farming activities. In order to obtain credit, interest must be paid on the sum borrowed. Thus, there will be additional costs for investment through interest charges. Indirect barriers are those that have their origin elsewhere in the system and operate via other mechanisms to impact on the producer or entrant. These include 'super profits'

from certain non-farm activities and non-farm wages being very high compared to farm ones. The literature has also shown that the effects of entry barriers may be immediate or delayed depending on the space and time, and that policy change may mitigate the level of the barrier.

The chapter suggests that irrigation farming has to become an integral part of the economy, especially to the people of the Upper East Region. The benefits brought about through the introduction of irrigation are undeniable. It can lead to increase and protect harvest and grow crops that could not otherwise be cultivated under conditions of extreme drought. Because irrigation also calls for increased use of labor, it can lead to higher quality of life for farmers, increasing their income and eliminating the uncertainty that comes from variable yearly and seasonal rainfall. However, despite the importance of irrigation farming to the people of Upper East Region, most of the dams are operating at half their capacity with limited farmer's involvement. These studies to contribute to in-depth understanding is required to inform the policy environment to enhance farmer's involvement in irrigation farming in the region

CHAPTER THREE

RESEARCH METHODOLOGY

3.0 Introduction

This chapter describes the methodology of the study, highlighting on the research design, methods and techniques' of data collection methods used as well as data analysis. The need for the methodology is to explain how the field work was organized and why adopting such a perspective.

3.1 Research design

Decision-making behaviour is a complex subject. To address this complexity, a mixed method (dual) approach to the research was adopted i.e. a combination of qualitative and quantitative methodology. The multi-method approach enabled a comprehensive understanding of the barriers facing farmers and those affecting their participation in dry season farming, especially from the perspective of the different categories of farmers. This approach also provided a means of cross-checking and validating information and also providing leads into important areas of inquiry.

It has been argued that using a combination of qualitative and quantitative methods of data collection in research improves its overall strength. According to Kanbur (2001), whereas quantitative approaches such as formal surveys are characterized as having breadth, qualitative approaches such as open interviews are characterized as having depth. The key is however to combine the breadth of one and the depth of the other. Other authors (e.g. Sechrest and Sidani, 1995; White, 2002) have also argued that

combining qualitative and quantitative approaches in a study improves triangulation and complementarity. Current trend in social research also shows a growing tendency towards a synergy between qualitative and quantitative approaches (Bradshaw, Wood, and Williamson, 2001; White, 2002). Using studies from African labor, White (2002) argues that productive synergy may exist between different methods and disciplines and that "the combination of techniques will frequently yield greater insight than either one used in isolation".

Based on the above reasons, it was seen as imperative to use both qualitative and quantitative approaches in the present study. A mix of qualitative and quantitative research methods were flexibly combined during data collection to benefit from the positive side of each of the methods. These methods were used to gather data from varied sources, including farmers', reconnaissance surveys, focus group discussions with community members and interviews with key informants (Management of ICOUR).

3.2 Criteria used in selecting the study area and communities

Three reasons underlie the choice of the Upper East Region for this study. Firstly, the Upper East Region is considered one of the poorest regions in Ghana for more than one decade and the poverty levels of the region continue to rise every year despite several interventions to address this issue. Poverty appears to be concentrated amongst food crop farmers who are particularly dependent on rain-fed agriculture (FAO, 2007). What remains unclear is that the various reasons given to explain this precarious situation are contradictory and needs further investigations.

Secondly, the region is very sensitive to variability of climate elements and is seen as one of the drought prone regions in the country. For instance, the early part of the 2007 farming season (mid-May to June) in the Upper East Region (like the two other Northern Regions) was affected by an exceptionally long dry spell following early rains in April and early May. When the rains resumed, many farmers replanted only for the crops to be washed away by extensive floods. Many of these farmers are unlikely to recover without external assistance (FAO, 2007).

A snapshot of northern Ghanaian livelihoods shows that many households are heavily dependent on agriculture and see limited opportunities outside of the agricultural sector. However, they are unable to emerge out of poverty due to low asset levels (including capital and land) that reduce the possibilities for saving and investment in a highly risky environment where shocks regularly force them to liquidate their assets or divert them away from agriculture simply in order to survive (Sachs, 2008). Those households relying heavily on agriculture for their livelihoods are vulnerable in particular to climatic shocks, such as bushfires, droughts and floods, sometimes with more than one of these calamities occurring in one year.

Thirdly, the Upper East Region is one of the regions where different forms of irrigation farming are practiced. The region has two large scale -managed irrigation schemes, Vea and Tono. The Tono irrigation scheme is the largest agriculture dam in West Africa. However, the region can only produce 44% of its food requirement and the remaining 56% has to be imported (MOFA, 2007: p.57). Also, there is limited involvement of local communities or farmers near the project areas; as such most of these schemes are underutilized (Azare, 2002).

In the study area irrigated crop production is carried with water from dams (large and small scale), dugouts, hand - dug wells and along riverbanks. Data on most of irrigation systems but the larger schemes is scant as a result the study accounts only for irrigation activities on the Tono and Vea irrigation schemes which are located within the Kassena- Nankana East and Bongo districts**.** These two (2) large irrigation schemes are been run by ICOUR. The company administers a total irrigable area of 2490 ha at the Tono and 850 ha at the Vea irrigation projects, which in total benefit about 6000 small-scale farmers who have access to plots in the projects and they come from the village communities around the project (Tono 8 and Vea 8 villages) (ICOUR 1995). A further impetus for selecting these two (2) districts is that there is a lack of efficient utilization of irrigation water and land in these schemes. It was therefore anticipated that a study in these Districts will help in understanding Barriers that farmers face as regards to dry season farming and how these affects their participation.

The initial intension was to carry out the study in as many communities in these districts as possible. However, due to logistical constraints and limited financial resources, six (6) communities were selected, three (3) from each district. The study communities were selected by sampling from a list of communities. Eight communities were each listed in the Kassena- Nankana -district and Bongo district. These are all communities that have access to dry season cropping facilities. A simple random sampling of three (3) communities was made from each district. The names of all communities targeted were written on a piece of paper, folded and placed in a container. They were then mixed up. Each time a community was selected, it was withheld and the rest in the container mixed up again before the next selection. Details are presented in the table below;

Table 3: List of sampled communities

KASSENA –NANKANA EAST DISTRICT	BONGO DISTRICT
Communities	**Communities**
Korania	Vea
Gia	Bongo Central
Bonia	Yorogo
Nangalikinia	Nyariga
Yewagnia	Gworie
Gognia	Adaboya
Nyangua	Dua
Telania	ZokkoGambrogo
Selected Communities	**Selected Communities**
Korania	Vea
Bonia	Yorogo
Nangalikinia	Gworie

Source: Field Survey, 2012

3.3 Research phases, methods and tools employed in the study

The research was divided into three distinct phases as indicated in the Figure 2. The first part (Part1), involved the identification of the research problem, revision of past and current literature, determination of research goals and methods, and the formulation of research questionnaires.

In the second part (Part 2), the selected field enumerators were trained to fully understand the content and procedure of the study, whilst the study farmers were sampled. Pre-testing of the data collection instrument was done to observe the reaction of the target population to the research procedures and data collection tools, assess the robustness and adequacy of issues covered in the questionnaire and to allow the respondents to comment on the issues. Certain changes were made to the questionnaire following the pre-testing, most importantly, the revision of the sequence and wording

of the questions. The results from the pre-test also enabled the researcher to determine the best time (i.e.in the mornings between 6 :30 am – 10 :00 am and evenings between 3: 00 pm – 6 : 00 pm) to get the study respondents at home to provide answers to the questions and how much time is needed to administer the questionnaire. The proposed methods used to establish contact with the study population were modified after the pre-test to conform to the local tradition this included informing the chiefs and assembly men of the various communities about the purpose of the research and subsequently obtaining permission to undertake the study and an announcement by the assembly men to the community members about our presence and the need for their cooperation.

In the last part (Part 3), the various field data were coded and entered into a computer for analysis. The Statistical Product and Service Solutions (SPSS 16.0) was used to analyze the results from the household survey.

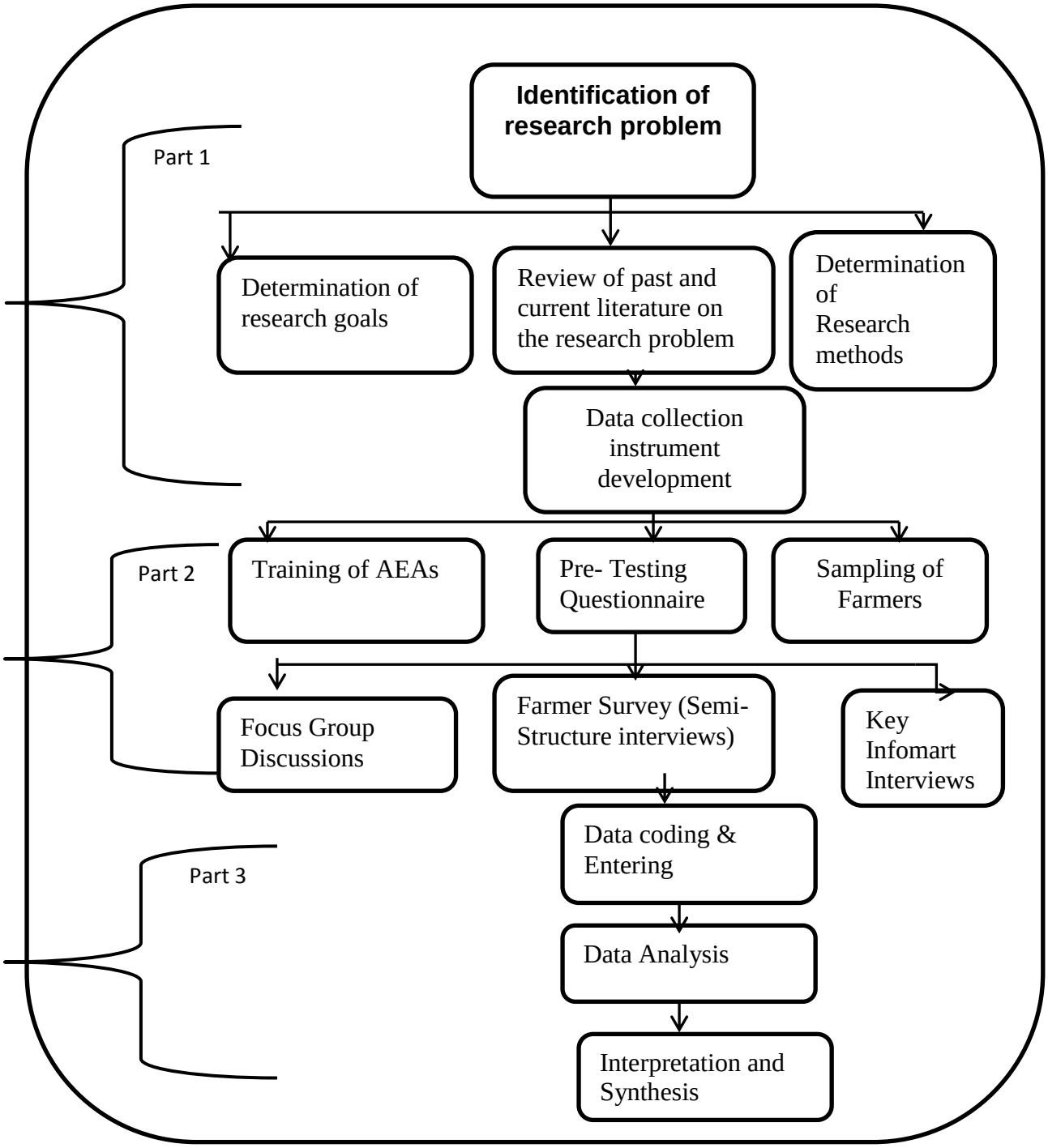

Figure 2: Schematic representation of the research processes (Source: Field Survey, 2012)

3.4. Population of the study

The study consisted of all crop producing farmers (i.e. both irrigators and non – irrigators) from the selected communities.

3.5. Sampling and Sampling Size

Simple random sampling was used to select listed farmers (1,200) (Both irrigators & Non- irrigators) from the Ministry of Food and Agriculture in the two districts who have access to irrigation. Simple Random Sampling method was conducted, where each member of a population had an equal opportunity to become part of the sample (Miller & Brewer, 2003). As all members of the population have an equal chance of becoming a respondent, this is said to be the most efficient sampling procedure.

In order to conduct this sampling strategy, a list of farmers from the selected communities was obtained from the Ministry of Food and Agriculture (MOFA) in both districts. Each farmer was assigned a serial number. These numbers were placed in bowls and mixed thoroughly. The investigator then picked the number tags from the bowl until the required sample size was obtained. This was done separately for each community. In case of non – appearance of selected respondents, replacements were done on a random basis. According to Neuman (2000), random sample drawing does not only help to depict the target population with sufficient accuracy but also enables the researcher to establish a statistical relationship between the sample and the population.

For the survey, a sample size of 300 farmers were interviewed i.e. 50 farmers from each community.

3.6. Measurement of key variables

1. **Test of comparability of constrains:** To find the barriers experienced by the different categories of farmers, barriers identified as important were categorized into economic, institutional, technical and socio- cultural barriers. Different tables for the different types of barriers were prepared separately. Their responses regarding each barrier were recorded and presented with the help of percentages and ranks.The spearman rank order correlation was used to test the association between rankings by the different categories of farmers. With Spearman's rho, the most important barrier was assigned a rank of 1 and the ranks were assigned separately for each barrier. Tied scores were assigned a rank equal to the average of all the tied positions.

2. **Participation:** Firstly, simple percentages were been used to assess whether farmers were engaged in dry season farming or not. Secondly, Correlation analysis was used to establish relationships between barriers and participation. Pearson chi square ($\chi 2$) test was then used to test the association between personal characteristics and farmers participation.

3. **Income:** Simple arithmetic means, rankings and percentages were used to measure the contribution of the different sources of household livelihood strategies to household income. A list of household sources of income was obtained. Farmers

were then asked to recall the income obtained per month from each source if applicable. Total annual average incomes were then obtained from each source by using the following formula.

Total annual average income (HH source of income) = Total annual income/ frequency of farmers

Rankings and percentages were then obtained from each source. With 1 assigned to the household income source contributing more to total household income, 2 to the second highest contributor in that order.

4. **Assets:** A lot of household assets were obtained and placed into three different categories. These are consumer assets of relatively modest value – on average worth less than GHC100 (i.e. bicycle, radio/type, CD/DVD player, chairs/ benches/tables), consumer assets of mid – range value - average worth more than GHC100 but less than GHC1000 (i.e. stove/ refrigerator, television, frame bed/ mattress) and consumer assets of high value – on average worth more than GHC1000 (i.e. motorcycle, car/pickup, tractor). Farmers were then asked to indicate whether the household had any of these items as well as whether these items were obtained within the last two years and whether the obtained these items while undertaking dry season farming. Frequencies and simple percentages were then used to analyze the results and presented in a table form.

3.7. Types of data

Employing various suitable methods of data collection helps a researcher evaluate his/her data source and to detect inconsistent answers. Following a suitable methodology enabled a researcher to collect valuable data for his/her study, analyse and present them in a chronological manner. In the light of this primary data collection method was adopted in order to obtain a reliable data and achieve the stated objectives of this study. Primary data was taken from farmers, management of irrigation schemes and FGDs Participants through the use of semi structure questions, and interview guide. The semi structured questionnaire was designed in such a way as to enable collection of information capable of answering the primary questions in the study. The questions are aimed at assessing the nature of entry barriers among different categories of farmers.

3.8. Reconnaissance surveys and recruitment of Agricultural Extension Agents (AEAs)

Reconnaissance surveys were conducted in all the selected communities to enable the researcher to get a better insight of the study communities and also determine the suitability or otherwise of the communities. This stage was also used to gain acquaintance with the community leaders and to find out their willingness to allow the community members to participate in the study.

The reconnaissance visits were also used to identify enumerators to help in collecting field data. In all, five enumerators together with the researcher conducted the semi – structured interviews, focus group discussions and key informant interviews. The enumerators were mostly used because these were people who already were working with farmers in these communities, as such had a local knowledge about the study area

and selected communities. Aside, their ability to speak the local dialect and their level of education was also taken into consideration. Contacts with the Ministry of Food and Agriculture at the various districts level were made at this stage of the study.

3.9 Participatory rural appraisal (PRA) methods and techniques employed

3.9.1 Focus group discussions (FGDs)

A series of focus group discussions (FGD) were held in each of the two districts. Village leaders were requested to gather individuals into groups of between six and eight for the different categories of farmers in terms of gender, educational and wealth status. The objectives of these discussions were to gather background information about dry season farming (e.g. land and water acquisition and allocation, etc.), generate information on the barriers the face in dry season farming and also to do pairwise ranking of the barriers identified. They were also used to obtain criteria to be used to categorize the study farmers into wealth groups. The FGDs generated valuable information which was incorporated into the final development of the household survey questionnaire. The FGDs were carried out by the researcher, AEAs and the study communities. The FGDs were conducted in the local dialect (i.e. Frafra and Kasem); since majority of the local people did not understand English the official language in Ghana.

3.9.2 Participatory wealth ranking

Participatory wealth ranking was used to obtain the criteria in categorizing farmers into different wealth groups. Participatory wealth ranking exercises have been heralded as a quick and effective means of assessing the socio-economic status of households (Chambers, 1994). It has therefore been recommended to encourage participation of

community members in research activities, for example, to help in stratifying households into wealth categories. According to Balbarino (2001), some researchers rely almost entirely on the use of classification criteria defined by the participants in a study. Other researchers use the local knowledge of participants to refine their criteria after selecting broader topics to be used on the basis of conceptualizations developed from theoretical constructs (Caldwell et al., 2002) and review of existing information about the topic of interest (Busck, 2002).

The study adopted the use of classification criteria defined by participants at the FGD and verified by key informants from the study communities. The reason for using this approach was based on the fact that the local people who live and work in the same community and have also observed others over a long period of time may be a better judge of levels of wealth than the researcher. Furthermore, the local people have their own concepts of wealth, which are not only dependent on cash income. Utilizing local people to determine the levels of wealth therefore helped to bring out the complexities and realities of wealth, rather than using definitions predetermined by the researcher.

The FGD participants in each of the study communities in the two districts identified a number of wealth groups to be used to categorize the study households. About three to five wealth groups were identified by the participants, ranging from the poorest strata up to the richest strata.

There were variations in the number of wealth groups identified by the groups. However, a high degree of agreement was obtained between the groups over the characteristics of the better-off and poor households. There was lack of clarity

regarding the classification of some households as "averagely better-off and "average" as well as those classified as "poor" and "very poor". Therefore, to ensure clarity and also avoid problems during data collection, the participants were made to re-classify the wealth groups into three main groups, namely, "better-off", "average" and "poor" households.

The main criteria used by the participants to classify the households into the different wealth groups included the size of landholding, level of food sufficiency; children's education, household assets, and number of livestock.

Table 4: Criteria used by FGD participants to characterize households into categories

Criteria	Household /Farmer Wealth Group		
	Rich	**Average**	**poor**
1.Size of landholding	Large, good quality landholding (5+ ha)	Possess between 1-4 ha of land holding	Small landholding usually less than 1.0 ha or in some cases landless
2. Number of Livestock	Possesses large size of livestock (10+ livestock) and also maintains animals through tenants	Reasonable number of livestock (between 2- 5 livestock)	keeps few(1) or no livestock,
Children's Education	Children attend good schools and colleges	Children attend good Schools	Children have only primary school education or do not attend school at all
Level of food sufficiency	Able to meet household food needs throughout the year	Able to meet family food needs but sometimes experiences periodic food shortage	Food secured for 3 to 6 months and sometimes experiences chronic food shortage
Assets	Many household assets, bank savings, house with concrete walls and iron roof, car or motor bike, more than one source of income.	Few household assets, some household have bank savings, may have a motor bike or bicycle, house with Mud walls and iron roof, farming as main source of income,	Very few or no household assets (no bank saving, usually borrow, may have a bicycle or none, house with mud wall and thatch roof, one source of income (mainly farming),

Source: Field Survey, 2012

Community assemblymen were then contacted to verify the various criteria used by the FGD participants to rank farm households and then helped to classify the surveyed farmers into the different wealth categories.

3.9.3 Pair – wise ranking

This method was used during the FDGs to determine the most important barriers according to their severity. Lists of barriers to dry season farming were obtained during the Focus Group Discussions (FDGs). These barriers were then classified under Economic Barriers, Institutional Barriers, Technical Barriers and Socio- Cultural barriers. A table was then made with the different barriers under the various categories of barriers listed above written both in the columns and the rows: Per barrier, the farmers where asked which one is more important. Only half of the table (the upper or lower half) needed to be filled out. In the researcher's case, the farmers voted with a show of hands, because not all farmers agreed on the same item. This way the researcher got an indication of the share of farmers who felt that for instance barrier 1 was more important than barrier 2.

3.9.4. Interview with key informants and experts

A number of key informants including officials of ICOUR and assemblymen were interviewed during data collection. The discussions with the various key informants and experts offered the opportunity to obtain further information and also cross-check information given by other respondents. This process helped to ensure that the data obtained were an accurate reflection of the situation. The discussions usually lasted between one to two hours depending on the time availability of the informant. In some cases, more visits were required if comparable responses were not found from other

informants within the same community and also for the informants to explicitly clarify the information given to ensure correct interpretation. Community assemblymen were contacted to verify the various criteria used by the FGD participants to rank farm households and then helped to classify the surveyed farmers into the different wealth categories. The ICOUR officials were also interviewed to give information relating to the scheme and how it operates

3.9.5 Semi - structured interviews

Interviews were conducted using semi-structured questionnaires. The instrument consisted of both close-ended and open-ended questions. Open-ended questions allow the respondents to make comments or suggest a range of other possibilities. This allows researcher to gather data to explain responses to close-ended questions.

The contents of the questionnaire were drawn up on the basis of a review of existing literature and discussions with key informants and FDGs. Areas covered in the questionnaires included personal-demographic characteristics(i.e. details of the age, education, wealth status, sources of income, residential status and Gender etc.), information on farmers participation in dry season farming, land tenure, the different categories of barriers and their influence on participation, household livelihood activities and contribution to household livelihood outcome .

The semi-structure interviews were mostly conducted during non- market days since it was difficult getting most farmers on these days as a result of the fact that most farmers send their produce to sell on these days. On market days however, the surveys were

carried out in the evenings after dinner from the residence of the respondents. Responses to the various questions were immediately recorded on the questionnaire papers during the interviews. Each interview lasted between 1 and 1.5 hours. It must be emphasized that the accuracy of responses to quantitative questions could sometimes not be fully ascertained, as some of the information was based on memory recall. Nevertheless, with the experience and familiarity of the enumerators with the area, this risk was minimized.

3.10. Method of data analysis

According to Crabtree and Miller (1992), data analysis strategies can be categorized along a continuum. At one end of the spectrum, they see some techniques of analysis as 'objective' in the sense that they tend to isolate the researcher from the object of the research. At the other end, techniques exist that are subjective, context-dependent, interpretative and generative. The present study employed a combination of qualitative and quantitative methods to analyze the field data. Data analysis was carried out using the Statistical Product and Service Solutions (SPSS) for the survey whilst thematic content analysis was used for the qualitative data. In most of the analysis descriptive statistics were computed for variables for each objective in the form of percentages, and means and presented in the form of tables.

A number of statistical techniques were used to explore differences and relationships between selected variables and groups of respondents. Correlation analysis was used to establish relationships between variables and farmers participation. Pearson chi square ($\chi 2$ test), a non-parametric test and Spearman's Rank Order Correlation (r_s) were used to test the association between different groups /two variables and between different

rankings of barriers. These tests have the obvious advantage of not requiring the assumption of normality or the assumption of homogeneity of variance. They compare medians rather than means and, as a result, if the data have one or two outliers, their influence is negated (Bryman and Cramer, 2002).With Spearman's rho, the most important barrier was assigned a rank of 1 and the ranks were assigned separately for each barrier. Tied scores were assigned a rank equal to the average of all the tied positions.

The formula for Spearman's Rank Order Correlation (r_s) is given by;

$$r_s = 1 - \frac{6\sum D^2}{n(n^2 - 1)}$$

Where d is the difference between ranks and n is the total number of constraints. The correlation coefficient (or "ρ") ranges from -1.0 to +1.0. The closer ρ is to +1 or -1, the more closely the two variables are related.

3.11. Limitations of study

Some limitations were encountered in the execution of the study. Some were expected, but others were quite unexpected. A prior understanding of these limitations may help in understanding the shortfalls that may arise in later chapters and also on conclusions drawn at the end of the study. The study failed to interview the planned number of about 400 respondents through individual interviews. Due to logistical constraints and financial resources, the researcher was only able to interview 300 farmers (i.e. 50 form each community). The lower than planned figure was also caused by the fact that some respondents were sometimes reluctant to participate when approached, or when briefed about the actual study by the researcher.

Notwithstanding the various measures that were taken to cross-check and verify information on household income (e.g. discussion with other household members), the accuracy of responses to quantitative questions could sometimes not be fully ascertained. This problem was attributed to firstly farmers low level of comprehension of numerical questions. Secondly, the information required needed a memory recall of farm households 'income. The exercise of recalling information proved to be quite challenging to some respondents and therefore the validity and reliability of the data collected need to be taken with great caution. Despite pre-testing the survey questionnaires prior to the conduct of the survey and making changes to reduce the number of questions, some respondents found the questionnaire to be too long to complete in one section which usually lasted for one to one and half hours. Some households could also not give answers to some questions during the interview, which required further meetings to be scheduled to give them the opportunity to provide answers to those questions.

Another limitation was the fact that most farmers were busy preparing their fields; this made it difficult at times to get the selected respondents. Some of them were unavailable as they were busy in their farming plots, which in some cases were far away from the village where interviews were being conducted. The spearman rank order correlation was calculated according to the constraints that appeared between the different categories of farmers and used to test the association between rankings. With Spearman's rho, the most important barrier was assigned a rank of 1 and the ranks were assigned separately for each barrier. Tied scores were assigned a rank equal to the

average of all the tied positions. The different categories of farmers that are looked at include gender, education and wealth status.

3.12. How key information was operationalized

Table 5 provides a detailed picture of matrix of issues, objectives, information required in the study, sources of data, data collection instruments and methods of data analysis.

- **Issue 1: Socio – economic characteristics: -** The main aim of this was to enable the researcher describe the different categories of farmers in the study area. The key indicators/ information were the percentages of farmers engaged in the different types of farming by their wealth status, educational status, sex and age as well as the land size. To obtain this information semi – structured interviews were conducted with farmers while simple percentages and means were computed.

- **Issue 2: Participation of farmers in dry season farming:** - Participation was looked at in terms of farmers' involvement in the production, processing and marking of crops. The main aim was to determine farmers' involvement in dry season farming and the intensity of involvement as well as whether their personal characteristics had any influence on their decision to participate. The key indicators were the percentages of farmers involved in dry season farming or not and the frequency of participation. A structured questionnaire was therefore designed in a way to first of all collect information from farmers as to their involvement in the activity. The likert scale type was then used to measure their frequency of participation. Frequency of participation was kept on four scales. i.e. 1 = once in 5 years, 2 = between 2 – 3 times in 5 years, 3 = between 4 – 5 times in 5 years and 0

= Non – participation. Simple percentages were been used to assess farmers involvement while Pearson chi square ($\chi 2$) test was then used to test the association between personal characteristics and farmers participation.

- **Issue 3: Nature and levels of barriers:** The main aim of this was to obtain information so as to determine the barriers experienced by the different categories of farmers in the study area and the extent to which these barriers influences their decision to participate in the farming activity. Barriers identified as important were categorized into economic, institutional, technical and socio- cultural barriers. Different tables for the different types of barriers were prepared separately. Farmers' responses regarding each barrier through FGDs were recorded and presented with the help of percentages and ranks.The spearman rank order correlation was used to test the association between rankings by the different categories of farmers. With Spearman's rho, the most important barrier was assigned a rank of 1 and the ranks were assigned separately for each barrier. Tied scores were assigned a rank equal to the average of all the tied positions. The Correlation Coefficient was then used to establish the relationship between barriers and farmers participation.

- **Issue 4: Contribution to livelihood outcomes:** The main aim of this was to determine the contribution of the different types of farming to household livelihood outcomes. The key livelihood outcomes that were looked at included; income, asset acquisition, housing improvement and copying with food situation. Information was obtained using survey and semi – structured interviews. With regards to the contribution of the different types of farming to household income different sources of household income were obtained and placed into seven main sources. This

included livestock keeping, off – farm casual labor, paid formal employment, remittances; trade in off – farm goods, dry season and rainy season farming. Farmers were then asked to recall the income obtained per month from each source if applicable. Total annual average incomes were then obtained from each source while rankings and percentages were then obtained from each source. With 1 assigned to the household income source contributing more to total household income, 2 to the second highest contributor in that order.

On asset acquisition, a lot of household assets were obtained and placed into three different categories. These are consumer assets of relatively modest value – on average worth less than GHC100, consumer assets of mid – range value - average worth more than GHC100 but less than GHC1000 and consumer assets of high value – on average worth more than GHC1000. Farmers were then asked to indicate whether the household had any of these items as well as whether these items were obtained within the last two years and whether the obtained these items while undertaking dry season farming . Frequencies and simple percentages were then used to analyze the results and presented in a table form.

With regards to the contribution of the different types of farming to household housing improvement, farmers were asked whether they had improved their houses within the last two years and whether they did that while undertaking dry season farming. Housing improvement was looked at in – terms of farmer's ability to expand their houses, improve on their water and sanitation systems, improve on their lighting or electricity systems as well as their ability to make repairs to their house. Frequencies and simple percentages were computed while the Person Product Correlation Coefficient was used to test whether there was significant difference as regards to the different types of farming to household housing improvement.

Table 5: Matrix of issues, objectives, information required, sources, data collection instruments and methods of analysis

Main Issue	Objective	Information required	Source	Instrument	method of data analysis
Socio - economic characteristics of farmers	To describe the different categories of farmers	wealth status of farmers based on wealth ranking, age , sex, educational status, land size	Farmers	Structured questionnaire	Descriptive analysis & relationship
Participation in dry season farming	To determine farmers involvement in dry season farming and the intensity of involvement	Type of farming undertaking i.e. typically dry season & rainy season farming only & a combination of dry season and rainy season farming Type of function in the value chain that farmers are involved in (i.e. Production, processing or marketing etc.) Frequency of participation (i.e. non- participation, Occasionally, frequently or very frequently)	Farmers	Structured questionnaire	Descriptive Analysis & Liket- scale type
Nature and Levels of Barriers to Entry	Examine the nature and level of entry barriers to dry season farming among different categories of farmers' in the Upper East Region	Barriers that affect their involvement Criteria for accessing land at the irrigation scheme Transparency in land allocation How water is obtained for irrigation Economic, Socio- cultural, Technical & Institutional barriers farmers face Intensity of barriers (by importance)	FDGs, key Informant interviews, Staff of irrigation schemes , and farmers	. Interview Guide, Semi-Structured questionnaire , key informant interviews	Descriptive analysis Chi - Square & Spearman rank order correlation
Contribution to livelihood outcomes	Determine the contribution that the dry season farming make to household livelihood outcomes	HH sources of income % contribution of dry season farming to ;(1) HH income (2) HH asset acquisition (3) HH housing improvement (4) HH level welfare	Farmers	Semi-structured questionnaire	Descriptive analysis and Chi-square

1.13. Summary of chapter

The purpose of this chapter was to describe the research methodology of this study. This included explaining and describing the sample selection, the procedure used in designing the instrument and data collection as well as the statistical procedures used to analyze the data. The study relied on a mixture of data collection methods to collect survey and in-depth information. The later involved the use of PRA tools at the community level to augment data at the individual farmer level. Field surveys, using closed and open – ended structured questionnaire were used to collect in-depth information on the socio-economic characteristics of the study farmers. These surveys enabled us to collect information in relation to barriers affecting farmer's participation in dry season farming as well as issues regarding the contribution of the different types of farming to household livelihood outcomes.

Key informants and experts were interviewed to augment information collected from the individual survey interview. Furthermore, a series of focus group discussions (FGD) were held in each of the two districts to gather background information about dry season farming (e.g. land and water acquisition and allocation, etc.), and to generate information on the barriers they face in dry season farming and also to do ranking of the barriers identified.

The FDGs were also used to obtain criteria to be used to categorize the study farmers into wealth groups. The use of these methods was considered appropriate as against relying solely on one method due to their advantage to enable the collection of diverse information from the study subjects. Quantitative data obtained from the field have

been analyzed using SPSS for the survey whilst thematic content analysis was used for the qualitative data. Descriptive statistics, specifically Pearson chi square ($\chi 2$ test), ranking and Spearman's Rank Order Correlation (r_s) were used to test the association between different farmer attributes and levels of barriers.

CHAPTER FOUR

RESULTS

4.0. General introduction

This chapter reports on the major findings of the study carried out in the Upper East Region on barriers to entry and farmers participation in dry season irrigation farming. Areas that are looked at in this chapter therefore include; the socio-economic characteristics' of surveyed farmers, their participation in dry season farming, the nature and levels of barriers facing the different categories of farmers, barriers influencing farmers participation in dry season irrigation farming and the contribution of dry season farming to household livelihood outcome.

4.1 Socio-economic characteristics of surveyed households

This section of the chapter gives a broad view of the socio- economic characteristics of farmers. These are age, sex, educational background, wealth status and residential status of farmers. Other characteristics that were reviewed included their ability to access irrigated land and the sizes of these lands by the different categories of farmers.

As identified in literature, different categories of farmers are faced with different barriers to entry which intent affect their participation in dry season farming. An understanding of the various socio-economic characteristics of the surveyed farmers involved in the study will therefore help in understanding the empirical findings. Discussions of these are presented in subsequent sections.

4.1.1 Sex

Table 6 shows that in totality a majority of farmers (62.0%) were males with 38.0 % being female. The percentage of female farmers in the Kassena Nankana District was the highest (41.0%) among the two districts, while Bongo district had the highest percentage (65.0%) of male farmers'.

4.1.2 Educational levels of farmers

Majority (51%) of surveyed farmers have never been to school whilst 20% have only been to basic school. Of the rest, some 19% had been to the Junior High School (JHS), 7.0 % of the farmers have been to Senior High School (SHS) or Technical as their highest level of education attained whilst 3 % had tertiary education. The observed education levels suggest farmers in the study area may be disadvantaged. Much literature shows that education can influence a households/individuals choice of a livelihood strategy and that an increase in an individual's years of education is expected to increase one's range of work-related skills and hence the ability to acquire new skills (Minot et al., 2006). According to Minot et al., a higher level of education is expected to be associated with the production of higher value crops and more commercially oriented agriculture.

Table 6: Scio – economic characteristics of farmers

Variable		Bongo District		Kassena-Nankana District		Total Freq.	Total %
		Freq.	%	Freq.	%		
Sex	Female	53	35.3	61	40.7	114	38.0
	Males	97	64.7	89	59.3	186	62.0
	Total	**150**	100.0	**150**	100.0	**300**	**100.0**
Education	No- Formal Education	81	54.0	73	48.7	154	51.3
	Basic	26	17.3	34	22.7	60	20.0
	JHS	27	18.0	29	19.3	56	18.7
	SHS/Technical	11	7.3	10	6.7	21	7.0
	Tertiary	5	3.3	4	2.7	9	3.0
	Total	**150**	100.0	**150**	100.0	**300**	**100.0**
Age	youth (<38)	55	36.7	53	35.3	108	36.0
	Adults(38 - 59)	92	61.3	94	62.7	186	62.0
	Aged(60 and above)	3	2.0	3	2.0	6	2.0
	Total	**150**	100.0	**150**	100.0	**300**	**100.0**
Wealth Status	Poor	76	50.7	79	52.7	153	51.0
	Average	60	40.0	60	40.0	120	40.0
	Rich	14	9.3	11	7.3	27	9.0
	Total	**150**	100.0	**150**	100.0	**300**	**100.0**

Source: Field survey

4.1.3. Age of farmers

The table 6 above show that majority (63%) of the farmers in the Kassena Nankana East District where within the middle age group (i.e. between 38-59 years) while 35% fell within the youth group (i.e. < 38 years). The rest of the respondents (2%) are aged (60 + years). Also, majority (61%) of respondents in the Bongo District fell within the middle age group while 37% fell within the youth group. The rest (2%) of the farmers where aged (60+ years).

In totality the average age of respondents for the two districts was 40.47 years with a standard deviation of 9.7. The influence of age on farmers participation in certain activities such as the type of farming activity to undertake, crop production and choice of crops grown has been reported by many (Altman et al., 1998; Abdulai and CroleRees, 2001; Iwanaga, 2001 and Minot et al., 2006). For example Abdulai and CroleRees have shown that age influences participation in the production of certain crops; reporting from their Mali case study they point out that farmers 'likelihood of participation in crop production first rose with age, and peaked at 41 years when it then declined. This could be attributed to many factors including barriers that farmers may face at different points in the life-cycle.

The mean age of 40.47 years from the study implies that most of the farmers are within the middle age group and moving towards the aged group. This means that as time passes by most of these farmers would not have the strength and ability to carry out with farming activities in the study area. This finding has serious implication for the sustainability of irrigation schemes in particular and food security generally in the study area. The mean age of 40.47 years also reflect that many of the youth are not engaged in farming and possibly have migrated to the urban locations.

4.1.4. Wealth status

Poor farmers constituted the highest percentage of the total number of farmers surveyed (51%) while the better-off households represented the least percentage (9%). The average farmers accounted for 40 %. The percentage of better-off farmers in Bongo District was the highest (14%) among the study districts while Kassena Nankana East District had the least

percentage of better – off households (11%). In terms of the percentage of poor farmers, Kassena Nankana East District had the highest percentage with 53% of the households considered as poor while Bongo had the least percentage (51%).

4.1.5 Access to land

In the study, area irrigated crop production is carried out with water from dams (large and small scale), dugouts, hand - dug wells and along river banks. Data on most of irrigation systems but the larger constructions is scant as a result the study accounts only for irrigation activities on the Tono and Vea irrigation schemes. In the Tono and Vea irrigation schemes plots are operated two times a year, during the dry season, referred to here as irrigated plot and during the rainy season, referred to as supplementary irrigation period / plot.

According to officials of ICOUR during the key informant interviews, the land is formally state property, but it is now rented out to scheme famers on 5 years basis with priority given to farmers who were displaced during the construction of the infrastructure. Acquiring arable land for cultivation under the Tono irrigation scheme was not much of a difficulty if the farmer could pay the service fees for the use of the infrastructure. The wet season water levy is charged per acre irrespective of the type of crop grown (GHc 30). But the dry season irrigation water levy depends on the type of crop cultivated (35Ghc/ acre for vegetables such as lettuce, cabbage etc., GHC65/acre for pepper and tomatoes and GHC60/ acre for rice). A village committee made up of selected beneficiary farmers manages and leases some of the irrigable land to farmers fairly. The rest of the land is managed by ICOUR resulting in equal access to irrigable

land. Similarly, farmers of the control group had no difficulty in acquiring land for cultivation (Jacob Pwawuvi, ICOUR staff, 22nd May, 2012).

4.1.5.1. Farm size

The average farm size was recorded to be 2.1 acres. About 9 percent of the irrigated lands are less than 1 acre while 91 percent of the lands are between 1 to 9 acres. In general, the operated lands operated by the sample farmers was very small with the associated standard deviation indicating that there was no significant variation in operated land among the sample farmers.

Table 7: Land holding

Variable		Bongo District		Kassena-Nankane District		Total Freq.	Total %
		Freq.	%	Freq.	%		
Land size (acres)	<1	5	4.9	16	11.7	21	8.8
	1 - 2.9	82	79.6	92	67.2	174	72.5
	3 - 4.9	13	12.6	20	14.6	33	13.7
	5 and Above	3	2.9	9	6.6	12	5.0
	Total	**103**	**100.0**	**137**	**100.0**	**240**	**100.0**

Source: Field survey, 2012 n=240 mean= 2.1 SD= 1.4 Max= 9 Mini = 0.25

Farmers in Kassena Nankana East District had the largest farm size (5 acres and above) representing 7% as compared to farmers in the Bongo district with 3%. The results again shows that farmers' in the Kassena Nankana East District had the smallest land farm size as 12% of farmers in this district had less land than 1 acre, where as only 5% of those in Bongo were in this category.

4.1.5.2 Mode of land acquisition among Farmers

The method of land acquisition between the study farmers therefore varied amongst them. In general, the majority of the farmers (50%) acquire land through family inheritance whilst 32 % of farmers had acquired land through village committees. The rest were either purchased or rented from ICOUR representing 3% and 15% respectively. From the findings family / inherited land can be said to be the best mode of access for productive use since majority of farmers in the study area acquired land through this mode.

Table 8: Mode of land acquisition among famers

Mode of Land Acquisition	Bongo District		Kassena-Nankana East District		Total Freq.	Total Percentage
	Freq.	%	Freq.	%		
Family/Inheritance	81	57.9	60	42.0	141	50.0
Village Committee	39	27.9	52	37.0	91	32.0
Purchased	5	3.6	2	1.0	7	3.0
Rented from ICOUR	15	10.7	28	20.0	43	15.0
Total	**140**	**100.0**	**142**	**100.0**	**282**	**100.0**

Source: Field Survey, 2012 n= 282

In general, the majority (58%) of farmers in the Bongo district acquired land through family/ in heritance whilst 42% in the Kassena Nankana East District acquired land through family/inheritance (see table 8). On the other hand 37% of farmers in the Kassena Nankana East District acquired land through village committees compared to 28% from the Bongo District. The rest of the farmers in the Bongo District acquired

land through renting and purchasing representing 11% and 4% respectively as compared to 20% and 1% from the Kassena Nankana Districts.

4.2 Nature and level of barriers among different categories of farmers

This section provides information on the different types of barriers faced by farmers and the nature and level of these barriers among the different categories of farmers.

4.2.1 Economic barriers facing different categories of farmers

Gender: Based on group discussions with farmers in the study area, among the seven economic barriers that the study considered (refer to Table 9), high cost of inputs was seen as the most important economic barrier (ranked = 1st) by both male and female farmers. Ranking for the other barriers however differed slightly, for men, the 2nd most important economic barrier was low prices of outputs (ranked 2nd) whereas difficulty to access credit was the second most important barrier (ranked 2nd) facing women farmers. This indicates that women have higher level credit serving as entry barrier to participation in dry season farming. For the men the entry barrier has to do with low prices of output.

These findings agree with studies by Lyimo – Macha (2002) that women in Africa generally face major difficulties getting credit and other forms of financial assistance. Although poor men as well as women confront obstacles, women have less access to credit than men. Financial institutions seldom take women's constraints and needs into account, so women cannot qualify for loans because they lack the capital and collateral or because their businesses are very small Lyimo – Macha (2002).

Table 9: Ranking of economic barriers by different categories of farmers

Categories of Farmers		Economic Barriers							r_s
		Difficulty to access credit	low prices of output	High cost of input	Market price fluctuation	High cost of transportation	Li-mited access to irrigat-eted land	Unavaila-ble for dry season farming	
Gender	Male	3.5	2	1	5	6	3.5	7	r_{cal} = 0.8 sig
	Female	2	4	1	6	5	3	7	
Educational Status	Educated	3.5	1	3.5	6	5	2	7	r_{cal} =0.68 not sig
	Non - educated	3	5	1	6	4	2	7	
Wealth Status	Poor	2	3	1	6	4	5	7	r_{cal} = 0.3 not sig
	Rich	5	2	3	4	6	1	7	

Source: FGDs * Significant level = 0.05 * r_{tab} = 0.71 * n = 7 *Individual scores = Ranks

The spearman rank order correlation was however statistically significant at 5% level ($r_{cal.}$ = 0.84> r_{tab}= 0.71). This means that the inter gender ranks were highly correlated and did not differ amongst them.

Educational Status: The discussions with focus groups revealed that whereas low prices of outputs was the most important barrier (ranked 1st) faced by educated farmers, high cost of inputs was regarded as the most important barrier (ranked 1st) for the non-educated. The implication of this is that non –educated farmers have higher level of credit servings as barrier to participation in dry season farming while with the educated it has to do with low prices of output. No – or limited access to irrigated land was however regarded as the second most important barrier (ranked 2nd) faced by both

educated and non- educated farmers. The spearman rank order correlation coefficient was not significant (r_{cal} = 0.68< r_{tab} = 0.71) implying that the rankings of economic barriers by the educated and non – educated farmers were apart and economic barriers differed amongst them.

***Wealth status*:** The study revealed that high cost of inputs (ranked 1st) and no/ limited accesses to credit (ranked 2nd) were the most pressing economic barriers faced by poor farmers in the study area. They rich farmers however felt that no or limited access to irrigated land was the first most important economic barrier the face in undertaking dry season farming. This was largely attributed to the fact that most of the rich farmers in the study area where non – natives as such did not have the same opportunity to irrigated land like the natives. The complained that most of the irrigated land which they obtain from ICOUR where very far away and it was always difficult getting labor and water to those areas.

Low prices of outputs were however ranked as the second most important barrier faced by the rich farmers. The correlation coefficients showed that the inter wealth ranking of the barriers was not significant and that ranking of economic barriers were not associated and did differ among the poor and the rich farmers (r_{cal}=0.32< r_{tab} = 0.71).

4.2.2 Institutional barriers faced by different categories of farmers

Gender: Regarding institutional constraints, it is clear from Table 10 that among the four institutional barriers that were considered by the study; high water levy charge was ranked as the first most important institutional barrier (ranked 1st) faced by both men

and women. Poor extension service was however seen as the second important barrier (ranked 2nd) faced by men, whereas women had unfair land allocation as the second important barrier (ranked 2nd).

The correlation coefficient was not significant (r_{cal} = 0.4 < r_{tab} = 0.9) depicting that the institutional barriers faced by men and women were not correlated and did differ amongst them.

Educational status and institutional barriers faced by farmers: The results from Table 12 shows that high water levy charges was seen as the most important barrier (ranked 1st) faced by both the educated and non – educated. Rankings for the other institutional barriers however differed amongst the farmers. Whereas unfair water distribution (ranked = 2.5) and unfair land allocation (ranked =2.5) where both seen as the second most important barriers faced by the non-educated farmers. The educated farmers however said that poor extension service (ranked 2nd) was the second most important institutional barrier facing them. The correlation coefficient (r_{cal}) =0.3 was less than r_{tab} = 0.9, implying that the ranking of institutional barriers were not correlated and differed amongst the educated and non – educated farmers

Wealth status and institutional barriers faced by farmers: High water levy charge was regarded by all the different wealth categories as the first important barrier (ranked 1st) to them in undertaking the farming activity. The poor however felt that unfair land allocation was the second important barrier and this was attributed firstly to favoritism on the part of ICOUR management and that higher land or plot sizes were allocated to the rich farmers as compared to them. The second reason was that payment of water

levy was part of the requirement by ICOUR before one could obtain rented land for cultivation, however the fee for water levy was high/ acre thus compelling some of them to either reduce the size of land for cultivation or delay in payment by which time the good lands are already allocated.

Table 10: Ranking of institutional barriers faced by different categories of farmers

Categories of Farmers		Institutional Barriers				r_s
		High water levy charge	Poor extension services	Unfair water distribution	Unfair land allocation	
Gender	Male	1	2	3	4	r_{cal} = 0.4 not sig
	Female	1	3	4	2	
Educational Status	Educated	1	2	3	4	r_{cal}= 0.3 not sig
	Non - educated	1	4	2.5	2.5	
Wealth Status	Poor	1	3	4	2	r_{cal} = 0.2 not sig
	Rich	1	3	2	4	

Source: Source: FDGs * Significant level = 0.05 * r_{tab} = 0.9 * n = 5 *Individual scores = Ranks

The rich on their part however felt that unfair water distribution (ranked 2nd) was the second important constraint with most of them complaining that their lands were far away; as such it was difficult getting water to those areas. The correlation coefficient was not significant when the rankings of the rich and poor farmers were compared with r_{cal} been 0.2 and r_{tab}= 0.9 .Depicting that the rankings of barriers were not correlated and differed between the rich and the poor.

4.2.3. Technical barriers faced by different categories of farmers

Gender and technical barriers faced by farmers: Six technical barriers were investigated and presented in Table11; it was realized that for both men and women fertilizer availability problems were the first most important barriers (ranked 1st by both) facing them, followed by unavailable labor (ranked 2nd). The spearman rank order correlation (r_{cal}=1> r_{tab} =0.82) reveals that the ranking between men and women were significantly the same and that technical barriers did not differ amongst them.

Educational status and technical barriers: Inadequate fertilizer (ranked 1st), unavailable/high cost of labor (ranked 2nd). The spearman correlation coefficient (r_{cal} = 0.83 > r_{tab}= 0.82) was significant at 5% level. Depicting that the ranking of technical barriers by both educated and none educated farmers was highly correlated with each other and did not differ amongst them.

Wealth status and technical barriers faced by farmers: Regarding the ranking of technical barriers among the rich and poor, fertilizer availability problem was ranked as the first most important barrier by all the two wealth groups. While the poor had their second most important barrier as unavailable labor (ranked 2nd) the rich felt that pest and diseases was their second important constraint (ranked 2nd). Spearman's correlation coefficients showed that the ranking of technical barriers by both the poor and rich farmers (r_{cal} 0.89> r_{tab}= 0.83) was significantly the same and barriers did not differ amongst them.

Table: 11: Ranking of technical barriers faced by different categories of farmers

Categories of Farmers		Technical barriers						r_s
		Pest & Diseases	Inadequate storage facilities	Fertilizer availability problems	knowledge of appropriate technology to use	Knowledge of how to use chemical	Unavailable labor	
Gender	Male	4	5	1	6	3	2	r_{cal} = 1 .0 sig
	Female	4	5	1	6	3	2	
Educational Status	Educated	3	4	1	5	6	2	r_{cal} 0.83 sig
	Non - educated	3	5	1	6	4	2	
Wealth Status	Poor	3	4	1	6	5	2	r_{cal} =0.89 sig
	Rich	2	5	1	6	4	3	

Source: FGDs * Significant level = 0.05 * r_{tab} = 0.82 * n = 6 *Individual scores = Ranks

4.2.4 Socio – cultural barriers faced by different categories of farmers

Gender and socio – cultural barriers faced by farmers: From Table 12, it gets revealed that land inheritance was seen as the most pressing barrier (ranked 1st) for women whereas family responsibility was regarded as the first most important barrier (ranked 1st) for men. Workload however was regarded as the second important barrier (ranked 2nd) by both men and women. The spearman rank order correlation (r_{cal} = 0.3< r_{tab} =0.9) was not significant. Implying that they ranking of socio-cultural barriers by men and women were not correlated and did differ amongst them.

Table 12: Ranking of socio-cultural barriers by different categories of farmers

Categories of Farmers		socio - cultural barriers					r_s
		Work load	Family responsibility	Inheri -tance of land	Control of income	Discrimina -tion in remunerat ion in the field	
Gender	Male	3.5	2	1	5	6	rcal = 0.3 not sig
	Female	2	4	1	6	5	
Educational Status	Educated	3.5	1	3.5	6	5	rcal =0.6 not sig
	Non - educated	3	5	1	6	4	
Wealth Status	Poor	2	3	1	6	4	rcal = 0.7 not sig
	Rich	5	2	3	4	6	

Source: FGDs survey * Significant level = 0.05 * r_{tab} = 0.90 * n = 5 *Individual scores= Ranks

Educational status and socio – cultural barrier: Workload was the first important barrier for educated farmers (ranked 1st) followed by family responsibilities (ranked 2nd). On the other hand, land inheritance was found to be the first most important barrier (ranked 1st) for the non-educated. The second important constraint was found to be family responsibility and control of income with equal ranking of 2.5 each. Spearman correlation coefficient (0.6) was not significant at 5% level; depicting that the ranking of socio- cultural barriers were not correlated and did differ between the educated and non- educated farmers.

Wealth status and socio-cultural barriers faced by farmers: As shown in Table 12, family responsibility was ranked as the first most important barrier to poor farmers while the second important barrier was workload (ranked 2nd) .The rich however ranked land inheritance as its first important barrier while the second important institutional barrier was family responsibilities. Spearman's correlation coefficient showed that the rankings between the poor and the rich (r_{cal} = 0.7) was not significant and that ranking of socio – cultural barriers were not associated and did differ among the different wealth categories.

4.3 Relationship between economic, institutional, technical and socio-cultural barriers and farmers participation in dry season irrigation farming

The purpose of this section is to examine the relationship between barriers to entry and farmers participation in dry season irrigation farming. Pearson product moment co-efficient and chi – square test were computed and placed in the tables.

4.3.1 Economic barriers and participation

The results from the bivariate analysis shows that economic barriers had a significant negative but low correlation (r = -0.06) between farmers participation in dry season irrigation farming and entry barriers (Table 13). This means that the higher the barrier the lower the participation of farmers in dry season irrigation farming and the vice-versa. A chi – square test did show that the specific economic barriers that affected farmer's participation were lack/difficulty to access credit (p = 0.01), low prices of commodities (p = 0.05), high cost of inputs (p = 0.00), market price fluctuation (p = 0.00) and no/limited access to irrigated land (p = 0.01). High cost of transportation and unavailable during the dry season period were however not statistically significant (Appendix 5).

Table 13: Correlation analysis between barriers to entry and farmers participation in dry season farming

Barriers to entry		Participation in dry season farming
Economic barriers	Person correlation	-0.06**
Institutional barriers	Person correlation	-0.04*
Technical barriers	Pearson Correlation	-0.02**
Socio cultural barriers	Pearson Correlation	0.01**

NB: **. Correlation is significant at the 1% level (2-tailed) and *. Correlation is significant at the 5% level (2-tailed).

4.3.2. Institutional barriers and participation

The bivariate results (r = -0.04) also indicate that the higher the institutional barrier the lower the participation of farmers in dry season irrigation farming and the vice versa. High water levy charges (p = 0.00), unfair water allocations (p = 0.00) and unfair land allocations (p = 0.01) were found to be the specific institutional barriers that affected farmers decision to undertake dry season irrigation farming whereas poor extension services did not taste statistically significant (p = 0.84) (see Appendix 6).

4.3.3. Technical barriers and participation

Regarding technical barriers the bivariate results was statistically significant (r = -0.02). This implies that as technical barriers increases farmers participation in dry season irrigation farming reduces and vice versa. Pest and diseases (p = 0.00), storage problems (P = 0.00), fertilizer problems (p = 0.00) and unavailable labour (p = 0.00) were the specific technical barriers that had a significant influence on farmers decision to participate in dry season irrigation farming. Knowledge of appropriate technology to use (p = 0.15) and knowledge of chemicals to use (p = 0.06) (see appendix 7) where however found not to have an effect on farmers decision to participate in dry season irrigation farming.

4.3.4. Socio – cultural barriers and participation

As shown in Appendix 8, family responsibility was the only socio – economic barrier that had an effect on farmers' decision to participate in dry season farming. The chi – square was statistically significant (p = 0.03). Workload, inheritance of land, control of income and discrimination in remuneration for working in the field did not have any

statistical significance as such they do not have any influence on farmers' decision to engage in the activity. The bivariate result (r = 0.013) was positive and very low correlation. Since family responsibility was found to be the only socio – cultural barrier affecting farmers participation. It can be deduced from the bivariate result (r = 0.01) that as family responsibility increases as a barrier, farmers will still engage in dry season farming more so as to gain income to be able to overcome the challenges and the vice versa.

4.4 Personal characteristics and farmers participation in dry season irrigation farming

Table 14 shows that 93.5% as against 82.2% of male and female farmers respectively were into dry season farming. The Chi-square result was statistical significant (χ^2= 6.85, d=1 p=0.01). This means that gender difference is an important variable influencing the participation of farmers into dry season irrigation farming.

Table 14: Personal characteristics and participation in dry season farming

Personal Characteristics of farmers			Participation in dry season farming		χ^2 test
			Freq.	%	
Gender	Male	Yes	174	93.5	χ^2 = 6.85 df =1 P= 0.01 Significant
		No	12	6.5	
		Total	**186**	**100**	
	Female	Yes	96	82.2	
		No	18	12.5	
		Total	114	100	
Educational status	No- Formal Education	Yes	142	92.2	χ^2 = 0.12 df =1 P= 0.73 Not significant
		N0	12	7.8	
		Total	**154**	**100**	
	Educated	Yes	133	91.1	
		N0	13	8.9	
		Total	146	100	
Wealth status	Poor	Yes	101	65.2	χ^2 = 20.9 df = 2 P=0.00 Significant
		No	54	34.8	
		Total	**155**	**100**	
	Average	Yes	110	91.7	
		No	10	8.3	
		Total	120	100	
	Rich	Yes	23	92	
		No	2	8	
		Total	**25**	**100**	

Education is seen as perhaps the most basic ingredient to stimulate for example local participation in a variety of development and natural resource management initiative.

Comparing the proportion of the educated and non-educated as regards to their participation in dry season farming, the study reveals that educated (91.1%) and their non – educated farmers (92.0%) had almost equal participation in dry season irrigation farming. The Chi- Square results was statistically not significant (χ^2= 0.4, d=1, p=0.5). This implies that the educational status of farmers did not have any significant influence on farmers' participation in dry season farming.

Also a comparison between the different wealth categories of farmers in teams of their participation in dry season farming and rainy season farming using chi-square did show that there was statistically significance in terms of wealth status and participation (χ^2= 20.9, d= 2, P= 0.00). This implies that the wealth status of farmers was an important variable influencing participation in dry season farming with the proportion of the rich been the majority representing 92.0 %, followed by the average with 91.7% while the poor represented 65.2 %.

4.5 Contribution of dry season farming to household livelihoods

4.5.1 Contribution to household income

Analysis of the study household's income portfolio provided important insight into the financial contribution of the major economic activities to the household's income especially dry season farming. There is the need for caution when interpreting the amount of income generated from the various economic activities due to the sensitive nature of information concerning household income vis-a-vis the difficulty in determining precisely the level of income collected through data from the farmer survey. Notwithstanding these difficulties, efforts were made to cross-check and verify information on household income from farmer's spouses and children.

Table 15 shows that the total annual mean income of the study area was GHc11, 574.7. Average annual income for paid formal work was the highest contributor to household income with an annual average income of GHc 4,070.8 representing 35.2% whereas trade in off farm goods was the second highest contributor with an annual average income of GHC 2,045.4 representing 17.7%.

The contribution of remittances to households 'livelihoods income appears important in the study compared to some of the household income sources in the study area contributing about 16.2% of the total household income. Remittances mostly came from children who have migrated to urban areas, where they have secured employment in either the formal or informal sector. In other cases remittances came from children or other relatives who have migrated or, in the case of females, married and moved to other villages or districts.

Table 15: Annual average net income per sample household in terms of income sources (GHC)

Income Source	Frequency	Total Annual income(GHc)	Mean(GHc)	Rank of contribution	% of mean
Livestock	161	131,792	818.6	5th	7.1
off -farm causal labor	51	26,208	513.9	7th	4.4
Paid Formal Work	26	105,840	4,070.8	1st	35.2
Remittances'	30	56,380	1,879.3	3rd	16.2
Trade in of Farm Goods	71	145,220	2,045.4	2nd	17.7
Dry season Farming	275	402,174	1,462.5	4th	12.6
Rainy season Farming	274	214,911	784.4	6th	6.8

Source: Field survey 2012 Total annul mean = GHc 11,574.7

Annual average income for dry season farming was the fourth highest contributor with an annual average income of GHC 1,462.5 representing 12.6% of the total average

income of households where as rainy season farming was the sixth highest contributor (GHC 784.4) representing 6.8% of its total contribution to household income. In livestock keeping households normally rear variety of animals which included cattle, pigs, sheep, goats and poultry (chicken and ducks). The current study found out that livestock keeping contributed 7.1 %. The low contribution of livestock to household income could largely be because most of these household were not selling their animals and only do so when it was so pressing for the household.

4.5.2. Household asset acquisition

Asset ownership by a household is a good proxy indicator of wealth, URT (2001). Assets‘ value can potentially be used by households/farmers as collateral for loans which could at times be necessary for enhancing a household‘s well-being, either for production purposes, or to address emergency needs such as illness or calamities such as floods and droughts. Therefore, knowing a households asset base gives a better picture of the capacity of individuals to manage their vulnerability to poverty. This section aims to examine the contribution that dry season farming made to surveyed farmers households ‘ownership of assets between 2010 and 2012.

Table 16 shows that farmers who were into a combination i.e. both dry season and rainy season farming were the majority to have consumer assets of relatively high value –on average worth more than GHc1000, assets of relative mid – range value – on average worth more than GHc 100 but less than Ghc1000 and assets of relative modest value - on average worth less than GHc100 representing 77%, 68% and 63% respectively.

There was however a variation, whereas majority of dry season farmers constituted the second majority (21%) as regards to consumer assets of relatively high value and consumer assets of relative modest value(14%) compared to 17% and 9% for rainy season farmers. The study revealed that farmers who were into rainy season farming only were the second majority to own consumer assets of relative mid – range value representing 17% compared to 15% for dry season farmers only. The observations suggest two things. First, farmers who were into dry season farming only had in totality high number of assets owned as compared to those who were involved in rainy season farming only. Observations also show that those who were into a combination (i.e. both dry and rainy season) had the highest number of asset acquisition and that it was prudent doing a combination of the two farming activities in the study area.

Table 16: Contribution of the different types of farming to household asset acquisition within the last 2 years*

Tape of Farming	Consumer Assets of relatively modest value-on average worth less than GHC100				Total	%
	Bicycle	Radio or Type	CD/DVD/ Player	Chairs/Benches/tables		
Dry Season Farming (n=26)	16	22	14	16	**68**	**13.6**
Rain season farming (n=25)	11	12	22	11	**45**	**9.0**
Both dry and rainy Season Farming (n=249)	140	109	30	107	**386**	**77.4**
Tape of Farming	**Consumer assets of mid- range value- on average worth more than GHC100 but less than GHC 1000**				**Total**	**%**
	Stove/Refrigerator		**Television**	**Frame bed/Mattress**		
Dry Season Farming	7		14	12	**33**	**14.9**
Rain season farming	2		22	14	**38**	**17.1**
Both dry and rainy Season Farming	12		64	75	**151**	**68.0**
Tape of Farming	**Consumer assets of high value- on average worth more than GHC1000**				**Total**	**%**
	Motor Cycle		**Car/pick Up**	**Tractor**		
Dry Season Farming	13		3	0	**16**	**20.5**
Rain season farming	10		3	0	**13**	**16.7**
Both dry and rainy Season Farming	49		0	0	**49**	**62.8**

Source: Field survey 2012 NB: * Multiple responses applicable

4.5.3. Household level welfare indicators: Housing improvements

Out of a total of 299 farmers, 215 of them representing 72% said they were able to improve on their housing during the last two years as compared to 28% of them who said they could not improve on their housing (see Table 17). The chi – square results was statistically significant. This suggests that the proportion of the contribution of dry season farming, raining season farming and those doing a combination to household housing improvement was different amongst them with a large proportion of dry season

farmers (76.9%) being the majority to have improved on their houses followed by those who did a combination (74.3%), while they least farmers to have improved on their houses were the rainy season farmers representing 41.7%.

Table 17: Housing improvement between 2010 – 2012

Housing Repairs, Improvement or additions	Response	dry season farming		rainy season farming		both dry season and rainy season farming		Total	%	χ^2 *Test*
		Freq.	%	Freq.	%	Freq.	%			
	Yes	20	76.9	10	41.7	185	74.3	**215**	**71.9**	χ^2 = 10.27 df=2 p=0.05 significant
	No	6	23.1	14	58.3	64	25.7	**84**	**28.1**	
	Total	**26**	**100**	**24**	**100**	**249**	**100**	**299**	**100**	

Source: Field survey, 2012

Table 18: Household housing improvement by different farming system

Housing Repairs, Improvement or additions	Type of Farming							χ^2 *Test*
	Res-pones	dry season farming		rainy season farming		both dry season and rainy season farming		
		Freq.	%	Freq.	%	Freq.	%	
Fixed/ improved existing roof,floor or walls etc.	Yes	20	100.0	7	70.0	184	98.9	χ^2= 32.71 df=2 p= 0.00 significant
	No	0	0.0	3	30.0	2	1.1	
	Total	**20**	**100.0**	**10**	**100.0**	**186**	**100.0**	
House expansion(e.g. built new room, shed, attic or fence	Yes	16	80.0	9	90.0	87	46.8	χ^2=20.52 df=2 p= 0.00 significant
	No	4	20.0	1	10.0	99	53.2	
	Total	**20**	**100.0**	**10**	**100.0**	**186**	**100.0**	
Improve water sanitation system(e.g. new well, drainage/sewage system or shower – latrines	Yes	3	15.0	1	10.0	28	15.1	χ^2= 10.68 df=2 p=0.03 significant
	No	17	85.0	9	90.0	158	84.9	
	Total	**20**	**100.0**	**10**	**100.0**	**186**	**100.0**	
Lighting or electricity	Yes	7	35.0	0	0.0	71	38.2	χ^2= 14.3 df=2 p= 0.06 not significant
	No	13	65.0	10	100.0	115	61.8	
	Total	**20**	**100.0**	**10**	**100.0**	**186**	**100.0**	

Table 18 shows that 100% of dry season farmers were able to repair /improve on their houses such as improving on their existing floors, roofs or walls. However, 99% of farmers doing a combination (both dry season & rainy season farming) and 28% of rainy season farmers were also able to improve/repair their houses.

The test results was statically significant χ^2 (2, N=215) = 32.71, p=0.00. This suggests that the proportion of the contribution of dry season farming, raining season farming and those doing a combination was different amongst them.

The findings also show that that 90% of rainy season farmers were able to expand their houses such as building new rooms, shed or fence while 80% and 46.8% of dry season and a combination of dry season and reason farmers were also able to expand their houses. The results tested significant χ^2 (2, N =215) = 20.52,P = 0.00. This suggests that the proportion of the contribution of the different types of farming activities was not the same.

A comparison between the different farmers regarding the contribution of dry season farming, rainy season farming and those doing both to improvement in household water and sanitation systems showed that there was statistical significance χ^2(2, N= 215) = 10.68 P = 0.03. Farmers who were into dry season farming only representing 15% and those doing a combination of both dry season and rainy season farming constituted the majority in terms of proportion as regards to them improving on their water or sanitation systems such as building a new well, drainage/sewage system or showers etc. Rainy season farmers only constituted 10%.

The findings also show that 38% of farmers doing a combination of dry season and rainy season farming were able to improve on their lighting and electricity system while 35% of dry season farmers were also able to improve on their lighting/ electricity systems. None of the rainy season farmers were however able to improve on their lighting system. The test results however was statistically not significant χ^2 (1, N =215) = 14.4 P= 0.06. This suggests that the proportion of contribution of the different types of farming in the study area to the improvement of household lighting or electricity system was not different.

From the study it is released that farmers in the study area generally invest more in house repairs and expansion as compared to improving on their sanitation and watering system as well as their lighting system. Interaction with surveyed farmers showed that most of the farmers did not see the need, to for instance, build toilets since they were nearby bushes one could go for free range. This notion could largely be attributed to ignorance or the lack of education. Secondly, farmers complained that it was difficult getting the electricity company to connect to their homes, in fact some complaint of going to the office several times to no avail.

4.5.4. Household level Indicators: Diet coping with difficult times

The study revealed that out of a total of 299 farmers, majority of them representing 66% said their food situation had improved over the last twelve months, 26% said their food situation had stayed while the rest of the farmers representing 8% said their food situation had worsened.

Table 19: Household food situation

Household Food Situation	Frequency	Percentage (%)
Worsened	24	8.0
Stayed	77	25.8
Improved	198	66.2
Total	**299**	**100.0**

A chi square analysis was done to ascertain whether there was any statistical difference between the different types of farming and household food situation within the last twelve months. The results as shown in Table 20 below tested significant among the different types of farming χ^2 (4, N =299) =17.57, 4 p=0.001. This signifies that the proportion of the different types of farming and the food situation of households as to whether it has improved stayed or worsened differed with farmers who were doing a combination (i.e. both dry season and rainy season farming) being the majority (68.7%) whose household food situation had improved, followed by farmers who were into dry season farming only (65.4%) and lastly with the rainy season farmers only (41.7%).

Table 20: Household welfare indicators: Diet Situation

Type of Farming	Household Food Situation						Total	%	χ^2
	Worsened		Stayed		Improved				
	Freq.	%	Freq.	%	F	%			
dry season farming	1	**3.8**	8	30.8	17	**65.4**	**26**	**100.0**	χ^2=17.57 df= 4 P=0.01 Significant
rainy season farming	7	**29.1**	7	29.1	10	**41.7**	**24**	**100.0**	
both dry season and rainy season farming	16	**6.4**	62	24.9	171	**68.7**	**249**	**100.0**	

Source: Field survey 2012 N=299 multiple responses applicable

However only 4% and 6.4% of dry season farmer's only and those doing a combination (i.e. both dry and rainy season farming) said their food situation had worsened

compared to 29% of rainy season farmers only. The fact that chi- square was statistical significant means that the proportion of the different types of farming and the food situation of households who were engaged in them was different.

4.5.4.1. Household diet: Food improvement situation

Table 21 shows that of the majority of farmers who said their household food situation had improved, majority of them (25%) were able to buy more condiments, vegetables& legumes to eat with stables, 19% of them were able to eat better during the hungry season while the rest of the farmers respondent that there were able to buy more convenient foods(17%), buy animal products(14%), eat two meals a day(13.42%) and buy more cooked foods(11%) within the last twelve months.

Table 21: How household food situation improved

How Household Food Situation has improved	Freq.	%
Ability to buy animal/dairy products(fish, meat, milk, eggs)	72	14.4
Ability to buy more condiments, vegetables, legumes to eat with stables	123	24.7
ability to buy more convenient foods(like Gari, kulikuli, Zumkum)	86	17.2
Ability to buy more cooked foods	56	11.2
Ability to eat better during Hungry season	95	19.1
Ability to eat two meals a day	67	13.4

Source: Field survey 2012 n= 198 multiple responses applicable

4.5.5 Summary of chapter

This chapter painted a picture of the nature and level of barriers among different categories of farmers. A number of inferences can be drawn from the onset. First, the results show that high cost of inputs, lack/ difficulty to access credit, low prices of commodities and no/limited access to irrigated land were generally the most important economic barriers facing farmers in the study area. Also high water levy charges, poor extension services and unfair water allocation were generally found to be most important institutional barriers facing farmers while fertilizer availability problems, unavailable labor and pest and diseases were generally the most important technical barriers facing farmers in the study area. Finally, land inheritance, workload and family responsibilities were also found generally to be the most important socio cultural barriers facing farmers in the study area.

Second, the findings show that though some barriers were common to farmers, different categories of farmers were confronted with different barriers to entry into dry season irrigation farming. The differences are as follows, while the most critical economic barrier is low prices of output four men, the women indicated access to credit as their main/ pressing economic barrier. With people of educational status, both educated and non – educated indicated access to credit as their common economic barrier. However, educated farmers indicated low prices of output as the most important economic barrier compared with high cost of inputs with their non – educated counterparts. In terms of wealth status, there was no common barrier between the rich and the poor. The poor were faced with high cost of inputs while the rich were confronted with limited access to irrigated land.

Regarding institutional barriers, high water levy charge was found to be an important institutional barrier facing all the different categories of farmers. However, whereas the women were faced with unfair land allocation as the most critical/ important institutional, the men were challenged with poor extension services as the most important institutional barrier. In terms of educational status, poor extension service was seen as the most important/pressing barrier facing the educated farmers whereas the educated farmers were challenged with unfair land allocation and unfair water distribution as their most pressing problems. With people of different wealth status, the poor had had unfair land allocation as their most pressing problem as compared to rich who had unfair water distribution as their most important barrier.

The results also points to differences in socio – cultural barriers among the farmers. Though work load was a common socio – cultural barrier facing both men and women. Family responsibility was seen as the most important socio – cultural barrier facing the men whereas inheritance of land was seen as the most important socio- cultural barrier facing the women. Also, workload was the most important socio – cultural barrier faced by the educated farmers against the non – educated farmers who had inheritance of land as the most important socio – cultural barrier. With regards to the different wealth categories, there was no common barrier amongst them. The rich however felt that family responsibility was their most important socio- cultural barrier as compared to the poor who were encountering inheritance of land as their major problem. Technical barriers however did not differ among the farmers.

Using Person correlation and chi –square, the chapter provides evidence to show that farmers' participation in dry season farming is negatively and positively influenced by the different categories of barriers to entry. The results showed that economic, institutional and technical barriers were the barriers having a significant negative influence on farmers' participation whereas socio –cultural barriers had a significant positive influence. The findings validate the research hypothesis that barriers to entry have an influence on farmers' participation in dry season farming.

The chapter has examined the personal characteristics of farmers and their influence on farmers' participation in dry season farming. The study revealed that there was a relationship between participation and personal characteristics. The chapter has shown that participation was not associated with educational status. It could therefore be said that though confronted with different barriers to entry, participation in the study area was not the domain of a specific educational group.

The analysis have shown that dry season farming is vital to household wellbeing by enabling households to earn more income, improve on their food situation and improve/repair their houses as compared to rainy season farming. Dry season farming was also associated with better mean asset value as compared to rain fed farming which is vital for their wellbeing.

CHAPTER FIVE

DISCUSSION OF RESULTS OF THE STUDY

5.0 Introduction

This chapter discusses the results of the study. The results have been discussed comprehensively to make it possible for a meaningful conclusion to be drawn, to either accept or reject the hypothesis of the study. It aims to examine the nature and level of barriers among different categories of farmers, to examine whether these barriers to entry have any influence on farmers participation in dry season irrigation farming, to examine whether the personal characteristics of farmers have an influence on their participation and to examine the contribution of the different types of farming to household livelihood outcomes in the region.

5.1 Nature and level of barriers among different categories of farmers

The findings suggest that high cost of inputs, lack or difficulty to access credit, low prices of commodities and no/limited access to irrigated land were generally the most important economic barriers facing farmers in the study area.

One of the main factors attributed to high cost of inputs could be explained since there is no government subsidy during this period; as such most of these farmers were compelled to buy their inputs at a full cost. According to Yilma et al.,(2008) ICOUR has to charge irrigation levies from the farmers and cannot anymore provide inputs at a subsidized price. Another important factor was the smuggling of these inputs to the neighbour countries like Burkina Faso and Togo in the study area, were higher prices

are been paid for the inputs. Thirdly the ability of non-farmers to acquire inputs at low government (controlled) prices also leads to the development of a thriving black market, where prices are as high as twice the official price, further reducing access to inputs.

Farmers' inability to access credit could partly be attributed to the lack of collateral security. A branch of the Ghana Commercial Bank, Agricultural Development, Naara Rural Bank etc. located in the district capital give credit to farmers on conditions that need to be met. Farmers need to provide collateral security for the loans and must also be in groups. But most farmers find it difficult to meet these conditions. The interest rates to the tune of between 25% to 32% are too high and make repayment difficult. The inability for farmers to access credit negatively affects dry season irrigation farming in the study area.

Regarding low prices of commodities, farmers usually record bumper harvest especially with regards to tomatoes at the end of each farming season. No- ready market for produce, very low support price fixed by government, competition of local commodities with imported once, the perishability nature of some of the commodities and cheating by middle men were some of the major factors that accounted for the low prices of commodities. Getting neither ready market for these produce is always a problem, thus compelling farmers to sell their produce at a lower cost. Farmers from Togo and Vea have a common target market, market queens from the southern part of Ghana, in recent times prefer to buy their produce from Burkina Faso and Togo thus usually compelling farmers from Tono and Vea to sell their produce at a lower cost. Information gather from FGDs indicate that the market queens prefer to buy the

tomatoes form Burkina Faso not because their tomatoes is of low quality but because they smuggled items such as drugs, cement and local gin into Burkina Faso and then use the money to buy their tomatoes. However, according to an official of ICOUR (Jacob Pwawuvi, ICOUR staff, 22nd May, 2012), the market queens prefer to buy the tomatoes from Burkina Faso and Togo because they feel the tomatoes from these countries is of good quality and capable of withstanding long journeys for days.

Land was also considered as an important economic barrier facing farmers, aside family land one has to pay water levy in other to be able to access land. However, the high water levy charge by management of ICOUR makes it difficult to access land in the study area.

The findings revealed that the ranking of economic barriers by farmers were not correlated and differed among the educated and non- educated (r_{cal}=0.68 <r_{tab} = 0.71) as well as the poor and rich farmers (r_{cal} = 0.68 < r_{tab} = 0.71) but however did not differ among men and women (r_{cal} = 0.80 > r_{tab} = 0.71).

High cost of inputs was the most important economic constraint facing poor farmers in the study area (ranked first). Poor farmers usually lack the cash to buy inputs when they are needed at the start of the crop season; and, to make matters worse, have no chance of getting a loan to buy the inputs (lack of credit ranked 2nd) because of the lack of collateral security. Aside that, inputs on credit from MOFA/ICOUR are mostly channeled to the rich farmers because of their influence.

The most important economic barrier however facing the rich farmers in the study area was however no/ limited access to irrigated land (ranked 1st). This was largely attributed to the fact that most of the rich farmers in the study area were non – natives as such did not have the same opportunity to irrigated land like the natives. The complained that most of the irrigated land which they obtain from ICOUR were very far away and it was always difficult getting labor and water to those areas.

Regarding the educated and non- educated farmers, whereas low prices of commodities was the most important economic barrier facing the educated farmers, high cost of inputs was the most important barrier facing the non- educated farmers in the study area. Non – educated farmers did not have much influence to acquire subsidize inputs from MOFA and ICOUR. Aside majority of the uneducated farmers were poor as such did not have the capital to acquire these inputs. Though prizes of commodities was the same for the educated and non – educated, the educated farmers however had low prices of commodities partly because most of them were cultivating more on a large scale to sale but as a result of the marketing problems such as the lack of ready market etc. they usually had to sell their produce at very low prices.

Institutional Barriers: Regarding institutional barriers, the study suggest that high water levy was the first most important barrier in the study area ranked first (1st) by all the different categories of farmers. The other important institutional barriers facing farmers in the study area were poor extension services and unfair land allocation. (See Table 15)

Water supply to the study area is controlled by management of the irrigation scheme. Farmers have to contribute to the cost of services and maintenance by way of payment of a development levy (wet season) and an irrigation water levy (dry season). The wet season water levy is charged per acre irrespective of the type of crop grown (GHc 30). But the dry season irrigation water levy depends on the type of crop cultivated (35Ghc/ acre for vegetables such as lettuce, cabbage etc., GHC65/acre for pepper and tomatoes and GHC60/ acre for rice). The fees had to be paid before the irrigation commences, this high water levy charges therefore affected their involvement.

Poor extension service was another important institutional barrier facing farmers in the study area. Irrigation farmers relied on extension services from the district agricultural extension division (MOFA), ICOUR and some NGOs in the form of extension know – how. This finding vias corroborated by Dinye and Ayitio (2013) who stated that as a result of poor extension services at the Tono irrigation scheme, farmers relied mostly on their accumulated experience rather than their usual extension services. According Dinye and Ayitio the Tono irrigation scheme had a farmer population of 3,000 at the service of three agricultural extension agents. The length of the main canals in Tono is 42 km. The long distances make the work of the extension officers difficult.

With regards to unfair Land allocation, it is allocated between 1-2 acres to farmers at the project site. However, according to the surveyed farmers, the reality on the ground is different. Some farmers get less whiles others get more than what is required. This unfair land allocation according to FDGs was largely attributed to the high water levy charges and favoritism on the part of ICOUR officials

The study revealed that Institutional barriers differed among men and women (r_{cal}= 0.4< r_{tab} = 0.9), among the educated and non- educated (r_{cal}= 0.3 < r_{tab} = 0.9) and between the poor and the rich (r_{cal}= 0.2 < r_{tab} = 0.9).Whereas women were faced with unfair land allocation by the management of ICOUR as the most important barrier facing them it was the least important barrier for the men. Information gathered from the FDGs (women) indicates that one of the main reasons for this is that there is fierce competition for irrigated land at the project site and because women have less social and political power, they tend to lose out in the struggle. Secondly, it was difficult for women in the study area to contribute or pay for the water levy which was a requisite for land allocation.

The study suggests that poor extension service was the second most important institutional barrier. This is partly as a result of the fact that some NGOs in the study area in other to empower women provided some extension services especially in the area of processing to only women farmers. This finding however contradicts the World Bank (2012) studies in Nigeria which suggest that agricultural extension service throughout the country have traditionally focused on men and their production needs, while most extension massages targeted at women emphasize their domestic role and fail to consider the important role that women play in food production.

The findings suggest that though high water levy was the most important institutional barrier confronting both the poor and rich farmers and the educated and non-educated farmers. The study reveals that unfair land allocation at the project site was the second (ranked 2nd) most important barrier confronting the poor and non-educated farmers. This is attributed to firstly the lack of influence and secondly the fact that water levies

were high as such the poor and non - educated farmers(most of whom constitute the poor) were compelled to either reduce their lands or do not take these lands for irrigation purposes at the project site.

Technical barriers: The findings suggest that the ranking of technical barriers were highly correlated and did not differ among men and women (r_{cal}= 1 >r_{tab}= 0.82), among the educated and non–educated (r_{cal}= 0.83> r_{tab}= 0.82) and among the rich and the poor farmers (r_{cal}= 0.89 > r_{tab}= 0.82). The implication of these is that the ranking of technical barriers among the different categories of farmers was highly consistent with each other.

The findings however suggest that fertilizer availability problem was the first (1^{st}) most important barrier (ranked 1^{st}) among all the different categories of farmers. The fertilizer availability problems have been compounded by accessibility constraints facing the industry. Farmers often have no access to enough quantities of fertilizer and simply use whatever amount they can get. They are usually oblivious to any consideration as to what type of nutrients a given plant needs and at what stage it needs them. Sometimes this problem is the direct fallout of late supply of fertilizer by government and many farmers only get fertilizer late into the farming season when many of the crops are already at the advanced stages of maturity. Also, limitations on the quantities one can acquire from the government subsidize fertilizer has met farmers who have the resources and skill to be able to plant larger not been able to do so. The third factor is that fertilizer from private companies was found to be expensive as such making it difficult for farmers to buy.

The findings again suggest that generally, unavailable labour was the second most important technical barrier facing farmers in the study area. There is usually a shortage of labour during the dry season and farmers struggle to cope. One of the major reasons attributed to this has been the migration of the youth to the southern part of the country during these periods.

High incidence of pest and diseases was found to be another important technical barrier facing farmers in the area. The presence of birds which destroy crops and diseases results into poor yields.

Socio-cultural barriers: The findings suggest that socio-cultural barriers differed among men and women with the Spearman rank order correlation (r_{cal}= 0.3< r_{tab} = 0.9) not being significant at 0.05% significance level.

Inheritance of land was the major socio- cultural barrier facing women. Family lands tend to be in the hands of men who can either give part or all to their wives, friends or rent it out. In general, land ownership in both the Kassena Nankane East and Bongo district is communal and the land holding group is in most cases the family under the supervision of the village chiefs. Culturally, women are not allowed land ownership in both communities. A woman is allowed to either cultivate her husband's land, her fathers or both as the specific case allows. This means that women have no sole ownership over the lands they cultivate and ownership rights can be withdrawn by the husband or the father at any time. The implication of these practice is that long term planning is not possible for many women as whatever their plans for the land is has to

be in line with the targets set out by their husbands. The woman is not guaranteed use in successive seasons.

With regards to the men, family responsibility was seen as the first most important socio- cultural barrier (ranked 1st) affecting their participation. According to the men (FDGs) income from farm is usually used to pay school fees, take care of health needs, clothes for children and attending other social activities which are mostly done by them as compared to their women counterparts.

The study revealed that socio- cultural barriers differed among the rich and the poor ($r_{cal} = 0.7 < r_{tab} = 0.9$). The most important barrier confronting the rich farmers was land inheritance (ranked 1st). Most of the rich farmers in the study area are non- natives. The problem of land ownership rights is similarly faced by "outsiders" as it is difficult to get land for agricultural purposes outside one's own indigenous community. Fluidity in land ownership is therefore a significant challenge as most farmers and intending farmers are restricted to particular areas and their potentials for expansion into more fertile lands are severely curtailed. For one to lay claim on the land, the consent of the village head is an imperative and not always easily forthcoming.

The findings however show that the most important socio- cultural barrier facing the poor farmers in the study area is family responsibility (ranked 1st). Income from produce is invested in other family responsibilities. As such in the coming season they usually do not have enough or are with nothing to invest in their farms.

As regards to the educated and non- educated farmers, the findings suggest that socio-cultural barriers differed amongst them (r_{cal} = 0.7< r_{tab} = 0.9). The study found that land inheritance (ranked 1st) was found to be the most pressing socio- cultural barrier facing non – educated farmers. This is partly as a result of the fact that non – educated farmers lack the power and political influence when it comes to issues of land as compared to the educated farmers.

Workload was however found to be the most important/pressing barrier facing the educated farmers. Most of these educated farmers where either involved in formal works or involved in other off– farm activities as such did not have the time needed for their farms.

5.2 Relationship between barriers to entry and farmers participation in dry season irrigation farming

Economic barriers: The results show that participation in dry season irrigation farming is negatively and significantly influenced(r = -0.06) by economic barriers faced by farmers in the study area. This means that as these economic barriers increase farmers' participation in the study area reduces. Economic barriers limit farmer's ability to acquire credit, purchase inputs, acquire or expand lands as well as adopt new technologies etc. This will have a potentially detrimental impact on production with it been lower for less constraint farmers.

Among the seven economic constraints faced by farmers, the chi- square results show that difficulty in accessing credit (p= 0.008), low prices of commodities (p = 0.045), high cost of inputs (p = 0.004), market price fluctuation (p = 0.00) and no or limited

access to irrigated land were the specific economic barriers affecting farmers participation in dry season irrigation farming.

Lack of credit affects farmer's ability to purchase inputs and invest in their farms. This thus can affect their productivity and profitability. According to Olawepo (2010) the lack of fund and access to credit facilities reduces the incentives of farmers to increase productivity, even when there are opportunities for farm investment.

Observations also show that low prices harm farmers who put their money, labour and time to produce them. As a result of this farmers usually find it difficult to get money to invest in the farming activity the coming year. They are therefore usually compelled to either reduce their land sizes, do not purchase certain inputs or become discourage to engage in the activity at all. According to Olawepo (2010), the poor sales of food stuff may relate to the unstable nature of prices of agricultural produce, poverty level of the people and at times there is excess production on the part of the farmers leading to farm glut. This discourages farmers from increasing their yearly output on some occasions.

High cost of inputs such as fertilizer, fuel, pesticides, herbicides etc. were generally responsible for the rise in total cost of production which in part tends to have a negative effect on farm profitability. Some farmers thus are compelled to reduce their farm sizes or did not involve in the activity at all since it was difficult affording the necessary inputs that are required to undertake the farming activity. The findings conforms with Matles (1991) that the lack of inputs as well as the problems in obtaining inputs inhabits or affects progress of farmers in agricultural activities.

Also market price fluctuation adversely had an effect on farmers' decision to participate in dry season irrigation farming. It affects farm receipts and the ability of producers to maintain operations. Some farmers lose motivation to engage in the activity again.

Finally the study revealed that access to land also has a significant effect on farmer's decision to participate in dry season irrigation farming.

Institutional barriers: The study suggest that institutional barriers had a negative relationship with farmers participation in dry season irrigation farming with a correlation coefficient of (r) = -0.044. The significance level shows that there is enough evidence to show that institutional barriers are influencing farmers' participation in dry season irrigation farming. The chi – square results showed that high water levy charges ($p = 0.00$), unfair land allocation ($p = 0.004$), and unfair water allocation ($p = 0.005$) were the specific institution barriers that had influence on farmers decision to participate in dry season irrigation farming.

Water levy had to be paid before the irrigation commences. The study found out that as a result of these high water levy charges, they were compelled to sometimes reduce the size of their lands since they could not afford the monies. Some farmers also had to do late cropping because the usually do not have the money to pay early and this sometimes leads to poor production.

Lands are allocated between 1 to 2 hectares at the ICOUR project site. However, according to farmers the reality on the ground is different and that most of them usually find themselves getting less while some get more than what is required. The plausible

explanation for (P = 0.005) this is that if farmers do not get fair access to irrigated land, there is the tendency that farmers who want to undertake the farming activity or expand their lands to increase their production may not get that opportunity to do so.

Unfair water distribution adversely had a significant effect on farmers' decision to participate in dry season irrigation farming. Broken canals, bad sub - laterals, unfair water distribution and location of plots were found to be the major cause of these barriers. According to the surveyed farmers this sometimes delay their production, leads to poor yields and sometimes even leads to some of the crops dying.

Technical barriers: The findings reveals that technical barriers had a significant negative relationship (r = -0.02) with farmers participation in dry season irrigation farming.

From the chi – square analysis, it was shown that lack of fertilizer (p = 0.00) was among the specific technical barriers that had an effect on farmers participation in dry season irrigation farming.

The lack of fertilizer is probably the most important technical barrier that farmers in the study area face (ranked 1st by all categories of farmers) as quite a number of them did not have access to fertilizer. It is not only costly but far within the reach of actual farm producers. This discourages farmers from cultivating more land and puts them at a disadvantage level over the other counterparts who have access to fertilizer. According to Olawepo (2010), the lack of fertilizer and high yielding seeds is a very formidable constraint to increase productivity on the farm. He further stated that the lack of it results into farmers using less land and reducing annual output.

Another important technical barrier that affected farmers' participation in dry season irrigation farming is the lack of storage facilities (p = 0.00). Lack of storage facilities is an important barrier to increase food production as a result of high cost of crop damage. When asked to comment on this, most of the farmers in the study area indicated that high cost of crop damage resulted from spoilage on farms and during transportation. This usually discourages them from producing in the following year.

The study revealed that high cost of labour in the study area is another important technical barrier affecting farmers participation in dry season irrigation farming (p = 0.004). Adedayo (1985) reported that there is wide spread exodus of abled bodied men from the rural areas to the urban centres, leaving the old who cannot stand the rigor of traditional farming. This therefore results into high charges by itinerant labourers. It could be inferred that high cost of human labour are great deterrents to the acreages cultivated

The last specific technical barrier that affected farmers' participation in dry season irrigation farming was pest and diseases (p = 0.00). Pest and diseases pose a significant challenge to increase productivity among farmers in the study area. It significantly reduces yields and leads to significant economic loss and sometimes total death of crops.

The other remaining technical barriers did not have an influence on farmers' participation.

Socio – cultural barriers: The study suggest that socio- cultural barriers positively affected farmers participation in dry season irrigation farming (r = 0.013). However,

out of the five socio – cultural barriers that where encountered by farmers, only family responsibility (p = 0.032) was found to have an influence on farmers participation. When farmers were asked to comment on it, most of the farmers in the study area indicated that, they were paying fees for their children, buying books, providing money for food and clothes among others. This the contended were difficult to do as such as family responsibilities increased they were compelled to increase their involvement in the farming activity so as to get income to be able to afford and take care of these responsibilities

5.3. Personal characteristics and farmers participation in dry season irrigation farming

Gender of farmers has been found to be an important barrier that affects farmers participation (p = 0.01) with the proportion of males dominating with a percentage of 93.5%. This finding conforms to a similar study by Aseyehegen, Yirga and Rajan (2012) who found gender of household head to have an influence on participation decision in irrigation. With only 20% of the female headed households engaged in irrigation as compared to 80% of their male counterparts. According to Asyehegen et al, male-headed households hardly faced labor shortage for irrigation due to physical, technological, socio-cultural and psychological fitness of farm instrument to males than females.

The high percentage of males in the study could be suggestive of the fact that women in the study area were confronted with certain pressing barriers that affected their participation as compared to their male counterparts (see section 4.2). These differential barriers includes their inability to access land, difficulty in accessing credit, payment of

high water levies, unfair land allocation among others. According to studies by IFPRI(2008), women in general are often constraint in access and control of land, water and other natural resources; complementary inputs such as seeds and fertilizer and credit that are more pressing to them and affects their participation than their male counterparts.

The study reveals that education is not an important variable influencing participation (P = 0.73). As mentioned by a number of authors (e.g. Higman et al, 1999), education is seen as the most basic ingredient to stimulate for example local participation in a variety of development activities and initiatives. Higher educational attainment could enable people to become aware of the potential benefits from dry season irrigation farming and therefore induce them to participate in it. Also the social and political influence of the educated and their advantage of using their knowledge to overcome some of the barriers they were facing as compared to their non – educated counterparts put them more in an advantage situation as compared to their non – educated counterparts. It was however surprising that their participation in the farming activities in terms of proportion was however not different from their non – educated counterparts.

Discussion with sampled farmers revealed that unlike the educated counterparts who aside farming and had links to other sources of income such as local wage work. The non – educated had no such opportunity other than engaging in dry season farming as their source of livelihood despite the numerous differential barriers that they were facing. Also, an interaction with people in the community revealed that most people have realized the potential benefits of dry season irrigation farming to diversify their

income activities. This has led to farmers from different educational status to incorporate dry season irrigation farming into their current land use. It can therefore be said that the participation in irrigation farming in the study area is not the domain of specific educational group. This finding is in contrast with the logical expectation that higher educational attainment could enable people to become aware of the potential benefits from dry season irrigation farming and therefore induce them to participate in it more than the educated ones.

By employing a 0.05 criterion of statistical significance, the study revealed that there was statistical significant difference (P =0.00) in participation between the different wealth categories with a large proportion (92.0%) of them engaging in the farming activity as compared to the proportion (65.2 %) of their poor counterparts. The logical explanation is that rich farmers do have control of assets such as labour and capital than their poor counterparts who often lack the needed labour and capital.

Interactions with community members also show that though both the rich and the poor were facing differential barriers. The rich because of their wealth, education, social and political powers are usually able to work a way out to overcome some of these barriers facing them as compared to their poor counterparts. It was therefore not surprising that the rich farmers were more engaged in the farming activity than their poor counterparts.

5.4 Contribution to household livelihoods

As the study seeks to determine which type of farming contributed most to household income. Comparison was made on how much of income came from dry season irrigation farming and rainy season farming. The findings suggest that dry season irrigation farming contributed most to household income with an annual average income of GHC 1,436.33 representing 12.46% of the total average income of households compared to rainy season farming with an annual average income of GHC 764.81 representing 6.6% of its total contribution to household income. The study reveals that the contribution of dry season farming to household livelihood is 65.25 % higher than that of the raining season farming. This somewhat goes to confirm studies by Ali and Pernia that in the past rural household incomes is 77 per cent higher with irrigated agriculture than those who resort to rain fed agriculture (Ali and Pernia, 2003). Yilma and Berger (2006) showed in their econometric analysis that reliable irrigation increases both crop yield and application of fertilizer, which in turn contributes to higher land productivity and improve incomes of households as compared to rain fed farming. High income improves the standard of living of farmers; hence irrigation improves welfare of farmers as compared to red fed farming.

The analysis show that in total, farmers who were into dry season farming only had the highest number of assets as compared to raining season farmers only . The study revealed that the proportion of farmers who were into dry season farming only had consumer assets of relatively high value worth more than GHC1000 representing 20.5% as compared to 16.7% for rainy season farmers. Observations also show that a large proportion of farmers who were doing a combination of both dry season and rainy season farming were the majority to own consumer assets of relatively high value

representing 62.8%. This Implies, that it was prudent doing a combination of both dry season and rainy season farming in the study area. Better possession of household assets would give dry season farmers a comparative advantage in time of emergency needs such as illness and calamities such as floods or droughts, thus making dry season irrigation farmers less venerable to poverty than rainy season farmers

The analysis showed that about 72% of farmers in the study area reported having made improvement and repairs to their houses. The contribution of the different types of farming to housing improvements differed significantly among them ($p = 0.06$). It can be inferred that as income increases with irrigated farmers, some of them start to rehabilitate their houses. The findings revealed that 100% of dry season farmers were better able to improve on their existing floors, roofs, floors and other minor repairs as compared to rainy season farmers.

From the analysis, it is revealed that farmers in the study area generally invest more in house expansion and house repairs as compared to improving on their sanitation and watering system as well as their lighting system. Interactions with surveyed farmers showed that most of the farmers did not see the need to for instance build toilets since they were nearby bushes one could go for free range. This notion could largely be attributed to ignorance or the lack of education on the part of farmers. Secondly farmers complained that it was difficult to get Electricity Company to connect electricity to their homes even when they had the money to do so.

Also farmers differed with regards to household food situation ($p=0.001$) implying that the proportion of the different types of farming and the food situation of households as

to whether it had improved stayed or worsen differed. The study reveals that farmers who were into dry season farming only (65.4%) and those who were doing a combination (68.7%) had a higher proportion of their household food situation improved as compared to those who were into rainy season farming only. Irrigation, which allows farmers to grow reliable and plentiful paddy crops and also to diversify into cash crops such as vegetables, has contributed not only to an increase in the quantity of food available for household members in the study area, but also to the quality of foods eaten.

Farmers reported that they were able to buy more condiments, vegetables and legumes to eat with stables and also eat better during the dry season as well as buy more convenient foods, buy animal products and eat two meals a day.

CHAPTER SIX

SUMARY, CONCLUSION AND RECOMMENDATION

6.0 Introduction

This final chapter provides summary, major conclusions and some broad policy recommendations as well as suggested areas needing further research. The thesis had mainly aimed at examining barriers to entry and farmers participation in dry season irrigation farming.

6.1. Summary

In other to achieve its objective, the study employed a mixed method design in data collection. To this end, both primary and secondary sources of data collection were used. The primary data was collected using a semi-structured questionnaire administered on six (6) communities in the Kassena Nankane East and Bongo districts. A sample of 50 farmers from each community was interviewed. In addition to primary data from farmers, FGDs and key informant interviews were conducted with key expects of MOFA, ICOUR, assemblymen and chiefs. Finally secondary data was obtained from MOFA, journals, books etc. to supplement the primary data. Primary data collected by the study was analysed using statistical package for social sciences (SPSS version 17) and excel. In most of the cases descriptive statistics were computed for variables for each objective. Correlation analysis was used to establish relationships between variables and farmers participation. The other analysis included chi-square and spearman rank other correlation to test the association between different groups /two variables and between different rankings of barriers.

Objective 1: To examine the level and nature of entry barriers to dry season farming among different categories of farmers' in the Upper East Region.

The study has shown that economic, institutional and socio – cultural barriers were found to differ among the different categories farmers in terms of gender, educational status and wealth status. Some barriers were generally found to be more important to some groups than others.

First, the results show that high cost of inputs, lack/ difficulty to access credit, low prices of commodities and no/limited access to irrigated land were generally the most important economic barriers facing farmers in the study area. Also high water levy charges, poor extension services and unfair water allocation were found to be most important institutional barriers facing farmers while fertilizer availability problems, unavailable labour and pest and diseases were generally the most important technical barriers facing farmers in the study area. Finally, land inheritance, workload and family responsibilities were also found generally to be the most important socio cultural barriers facing farmers in the study area.

Generally these barriers were found to differ among the different categories of farmers. The differences were seen as follows, while the most critical economic barrier was low prices of output four men, the women indicated access to credit as their main/ pressing economic barrier. With people of educational status, the study revealed that educated farmers indicated low prices of output as the most important economic barrier compared with high cost of inputs with their non – educated counterparts. In terms of

wealth status, the poor were faced with high cost of inputs while the rich were confronted with limited access to credit.

Regarding institutional barriers, high water levy charge was found to be an important institutional barrier facing all the different categories of farmers. However, whereas the women were faced with unfair land allocation as the most critical/ important institutional barrier, the men were challenged with poor extension services as the most important institutional barrier. In terms of educational status, poor extension service was seen as the most important/pressing barrier facing the educated farmers whereas the educated farmers were challenged with unfair land allocation and unfair water distribution as their most pressing problems. With people of different wealth status, the study revealed that poor farmers had unfair land allocation as their most pressing problem as compared to rich who had unfair water distribution as their most important barrier.

The results also points to differences in socio – cultural barriers among the farmers. Though work load was a common socio – cultural barrier facing both men and women. Family responsibility was seen as the most important socio – cultural barrier facing the men whereas inheritance of land was seen as the most important socio- cultural barrier facing the women. Also, workload was the most important socio – cultural barrier faced by the educated farmers against the non – educated farmers who had inheritance of land as the most important socio – cultural barrier. With regards to the different wealth categories, the rich however felt that family responsibility was their most important socio- cultural barrier as compared to the poor who were encountering inheritance of

land as their major problem. Technical barriers however did not differ among the farmers.

The findings support the arguments of Braun at el (1989) that barriers to entry are not the same for all individuals in society. Though these barriers may be common some people find some specific barriers as more important than others.

Objective 2: Determine whether entry barriers have an influence on farmers' participation in dry season irrigation farming.

The study has revealed that farmers' decision to participate in dry season irrigation farming is negatively and significantly influenced by economic barriers. Farmers depend on credit/finance, inputs, land among others to invest in their farming activities. This means that in the absence of these resources, farmers will not be able to invest in irrigation farming irrespective of the potential of irrigation farming.

The study revealed that institutional barriers and technical barriers also had a significant and negative relationship with farmers' participation in dry season irrigation farming. High water levy charges, unfair land allocations and unfair water distribution, fertilizer problems, unavailable labour, pest and diseases etc. results into reduction in farm acreages, poor yield and sometimes total death of crops or farmers will not even be able to involve in the activity at all. The study also revealed that socio – cultural barriers had a positive and significant influence on farmers' decision to participate in dry season irrigation farming. Family responsibility was found to be the only socio-cultural barrier that affected farmers' participation in irrigation decision. The

implication of these is that, as family responsibility increases, farmers' decision to participate in the farming activity increases too. The evidence therefore supports the hypothesis that ***"barriers to entry do have an influence on farmers' decision to participate in dry season irrigation farming*".**

Objective 3: To determine the relationship between personal characteristics and farmers' participation in dry season farming.

The study also has revealed that gender and wealth status are important variables that influences farmers' participation with the men and the rich dominating in participation than their women and poor counterparts respectively. These differences are attributed largely to the differential barriers faced by these different categories of farmers and their ability to overcome them.

Women in general were found to be constraint in access and control of land, water, credit, complementary inputs such as fertilizer and workload that were more pressing and affected their participation. The men though were challenged with certain barriers too, their procession of some of these resources kept them in a better situation to participate in the farming activity than their women counterparts.

With regards to the rich and the poor, rich farmers have control of assets such as labor and capital than their poor counterparts; also the rich farmers because of their wealth, education, social and political powers were usually able to work a way out to overcome some of these barriers facing them as compared to their poor counterparts. The study however revealed that participation between the educated and non – educated was in different. It could therefore be said that that though confronted with different barriers to

entry, participation in the study area was not the domain of a specific educational domain.

This finding is contrary to logical expectation that higher educational attainment could enable people to become aware of the potential benefits from dry season irrigation farming and therefore induce them to participate in it. Also the social and political influence of the educated and their advantage of using their knowledge to overcome some of the barriers they were facing as compared to their non – educated counterparts put them more in an advantage situation as compared to their non – educated counterparts.

Objective 4: Determine the contribution that dry season irrigation farming in the region make to household livelihoods.

It has been shown from the study that dry season farming is vital to farmers/ household's wellbeing, for it enables households to earn more income than the rain fed farming which is vital for their wellbeing be it meeting health or other needs. Observations from the study have shown that farmers who were into dry season farming were better able to improve on their household food situation and improve or make repairs to their houses than rain fed farming. Dry season farming was also associated with higher mean asset value as compared to rain fed farming. The results are supported by Nhudu et al (2012), who argue that irrigation farming is a good way of ensuring household food security and general wellbeing.

6.2. Conclusion

Dry season farming is vital to farmers/ household's wellbeing, by enabling households to earn more income which is vital for their wellbeing, be it meeting health or other needs. More so, irrigation utilization supports households to obtain higher mean asset value, improve on their food and housing situation than their non – irrigated counterparts in the region.

However, Farmers are faced with certain important barriers to entry in terms of their nature and level which hamper their participation in the activity and are found to differ among the different categories of farmers in terms of gender, education and wealth status. These barriers include economic, institutional and socio – cultural barriers.

In addition, economic, institutional and technical barriers negatively influence their participation. A significant increase in these barriers results into a significant decrease in participation of farmers in the study area. Farmers depend on credit, inputs, land among others to invest in irrigation farming. In the absence of these resources, farmers will not be able to invest in irrigation farming irrespective of the potential of it. Similarly the high increase of water levies, unfair land allocations, fertilizer problems, unavailable labour and pest and diseases in the study area results into the non – participation of farmers in the activity, reduction in acreages, poor yields and sometimes total death of crops.

Gender difference and wealth status of farmers are major determinants of participation in the Upper East Region. Women farmers are faced with certain important barriers that are difficult to overcome than their male counterparts. These include their inability to access irrigated land and credit etc. Similarly poor farmers lack the needed capital and labor to undertake their farming activity. The rich because of their wealth, education, social and political powers are usually able to work a way out to overcome some of the barriers facing them as compared to their poor counterparts.

6.3 Recommendations

1. There is the need to provide and intensify social protection Programmes to farmers through agricultural targeted subsidize inputs Programmes especially during the dry season. For this to succeed, there is a need to design a targeting criteria so that it recognizes the vulnerable groups as the main target group provided such households have cultivatable land. For instance, using a point system on the existing criteria for fertilizer subsidy to farmers by MOFA has the potential to increase access to subsidized fertilizers to the vulnerable groups. While possession of land and been a farmer should be the basic condition for access to fertilizer coupons, households/farmers should gain additional targeting points if they also qualify as vulnerable households/farmers. For instance, an elderly female-headed household/farmer would get two additional targeting points while an elderly male-headed household /farmer would only get one additional targeting point. Farmers with high targeting points should then be prioritized in the allocation of coupons using an open forum held in the community. This will in a long way strengthen the ability of the vulnerable especially the poor and women farmers to manage risks and adopt improved technologies with higher productivity.

2. Special attention for female farmers, considering their gender mainly in the criteria of accessing irrigable land will facilitate women participation in irrigation farming.

3. Credit is an important institutional service to finance poor farmers and women for input purchase and ultimately to adopt new technology. There is therefore the need to encourage private investment in irrigation through provision of credit and financial incentives targeted to poor and women farmers. Also the government and international donors should explore government and donor backed schemes to increase the provision of rural credit to these target groups, such as providing subsidize to credit schemes or loan guarantees to banks.

4. There is the need for government to create policies that facilitate poor farmers becoming irrigation entrepreneurs'. This involves farmers been trained to respond to challenges posed by volatile market conditions and climate change. It make farmers their own security seekers and enterprising in market search and marketing.

5. There is the need for management of the irrigation schemes to review water levies together with farmer representatives to come out with acceptable water levy charges that will be to the benefit of all. Also mechanisms should be put in place were farmers are allowed to pay water levies in installments whiles they are been allocated lands. This will encourage more farmers especially the poor and women farmers to engage in the activity as compared to the current system were farmers must pay the full cost of water levy before they are allocated land.

6. There is also the need for researchers to develop efficient and cost effective ways of dealing with insects/pest that destroys the produce just after harvest and better ways of controlling diseases and pest that destroy the produce while on the field.

7. Provide training opportunities and education to farmers as a way of discouraging socio-cultural factors that discriminate against certain categories of farmers especially women in the study area

8. The research focused only on large scale irrigation schemes. Future research needs to be taken to fully account for the barriers that farmers face in other forms of irrigation such as hand-dug wells, micro-dams etc.

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Appendices

UNIVERSITY OF GHANA – LEGON

DEPARTMENT OF AGRICULTURAL EXTENSION

Appendix 1: Informed consent form for the MPhil research titled: Barriers to Entry and Farmers' Participation in Dry Season Irrigation Farming in the Upper East Region of Ghana.

This research you are about to participate in is being conducted in partial fulfillment of Requirement for Awedam Dersiderious Wekem, a student who is currently studying for an MPhil (Agricultural Extension) at the University of Ghana Legon..

The research neither has direct potential benefits nor potential hazards to you as a respondent. However, benefits to you as a respondent might come at a later stage should the thesis emanating from the research reach policy makers who may then use some of the information generated in policy formulation in relation to agriculture in Ghana.

Data protection

Primary data from the research will be summarized in table or any other suitable form (charts, graphs) which will then be presented in the thesis. And this will be the only form that third parties may have access to it.

Confidentiality and anonymity

The research being undertaken expects to keep all information given by respondents confidential and anonymous. The information gathered from the questionnaires and any in-depth interviews will be reported as that of a group and not as from a particular individual.

Participation in this research is on a voluntary basis. Please if you agree to participate in the current research tick in the box below.

I do agree voluntarily to participate in the research ☐

UNIVERSITY OF GHANA – LEGON

DEPARTMENT OF AGRICULTURAL EXTENSION

Research title: Barriers to Entry and Farmers' Participation in Dry Season Irrigation Farming in the Upper East Region of Ghana.

Appendix 2: Survey Questionnaire for Farmers

The research you are about to participate in is for an MPhil research at the University of Ghana - Legon .The research seeks to determine ; If there are different barriers to entry of farmers into dry season farming and how this affects participation in the enterprise and to what outcomes.

General information

Questionnaire No: _____ District: _____

Village: _____ Date of interview: _____

Name of interviewer _____

Personal information

1. Name of Respondent _____
2. Sex of respondentMale1=[ ] Female 2= [ ] Male
3. Age of respondent _____ years
4. Level of formal education

   0= No – Formal Education 1= Primary 2= JHS 3= SHS/Technical 4 = Tertiary
5. Other occupation (apart from farming) _____
6. Wealth status of farmer _____
7. Are you a native/were you born in this place?1= Yes 0= No

Information on farmer's participation in dry season farming

8. Which season(s) farming do you undertake? 1= Dry season Farming 2= Rainy Season Farming 3= Both Dry Season and Wet Season farming
9. Which of these farming activities are you involved in? 1= Production 2= processing 3= marketing 4=Combination (Specify)……..
10. How often do you practice dry season farming? 1= Once in 5 years 2= Between 2-3 times in 5 years 3= between 4 – 5 times in 5 years 0= Non- Participation

Assessing Land at the irrigation scheme

11. Do you have access to irrigated land? 1=Yes 0= No

12. If yes, how did you get access to irrigated land?1= family/ inheritance, 2 = community usage right, 3=Purchased 4= rented from ICOUR ☐

13. How much irrigated land do you have access to?……..acres

14. If you do not have access to irrigated land, have you ever tried to access land and you did not get? 1= yes 0= No ☐

15. What are some of the problems you encounter when trying to access irrigated land?

_____

_____

Economic Barriers

16. Below is a list of economic barriers. For each indicate the intensity/level of the barriers you face/ likely to face when participating in dry season farming. Use the following three-point scale for intensity of barriers. 3= Very High 2= High 1= low

Barriers	**Intensity**		
	Very High	**High**	**Low**
Lack/Difficulty to access credit			
Low prices of commodities			
Non – availability of inputs			
Market price Fluctuation for produce			
High Cost of transportation of produce after harvest			
High Cost of inputs relative to revenue from farming			
No or Limited access to irrigated Land			
Unavailable for dry season farming			

17. ***Reasons for barriers and how barriers affect participation in dry season farming****(Kindly fill in the table below)*

Economic Barriers	**Affects participation**		**Reasons/causes for Barrier**	*(If yes)* **How it affects involvement**
	1= Yes	**0= No**		
Lack/Difficulty to access credit				
Low prices of commodities				
Non – availability of inputs				
Market price Fluctuation for produce				
High Cost of transportation of produce after harvest				
High Cost of inputs relative to revenue from farming				
No or Limited access to irrigated Land				
Unavailable for dry season farming				

Institutional Barriers

18. Below is a list of institutional barriers. For each indicate the intensity/level of the barriers you are likely to face when participating in dry season farming. Use the following three-point scale for intensity of barriers.3= Very High 2= High 1= Low

Barriers	**Intensity**		
	Very High	**High**	**Low**
High water levy charges			
Poor extension services			
Unfair water distribution			
Unfair land allocation			
Lack of helpfulness from ICOUR			

19. ***Reasons for institutional barriers and how barriers affect participation in dry season farming****(Kindly fill in the table below)*

Barriers	**Affects Particip-ation**		**Reasons/Causes for Barrier**	*(If yes)* **How it affects involvement**
	Yes	**No**		
High water levy charges				
Poor extension services				
Unfair water distribution				
Unfair land allocation				

Technical Barriers

20. Below is a list of technical barriers. For each indicate the intensity/level of the barriers you face/ likely to face when participating in dry season farming. Use the following three-point scale for intensity of barriers. 3= Very High 2= High 1= low

Barriers	**Intensity**		
	Very High	**High**	**Low**
Pest and diseases			
Storage problems			
Fertilizer problems			
Knowledge of appropriate technology to use			
Knowledge of chemicals to use			
Knowledge of how to use chemicals			
Inadequate knowledge of disease control			
Unavailable labour			

21. ***Reasons for technical barriers and how barriers affect participation in dry season farming****(Kindly fill in the table below****)***

Technical Barriers	**Affects Participat-ion**		**Reasons/causes for Barrier**	*(If yes)* **How it affects involvement**
	Yes	**No**		
Pest and diseases				
Storage problems				
Fertilizer problems				
Knowledge of appropriate technology to use				
Knowledge of chemicals to use				
Knowledge of how to use chemicals				
Inadequate knowledge of disease control				
Unavailable labour				

Socio- Cultural Barriers

22. Please , kindly tick*(according to intensity)* the following Socio-cultural barriers you are likely to face in participating in dry season farming according to the extent to which they are pressing to you

Barriers	**Intensity**		
	Low =1	**High=2**	**Very High=3**
Poverty			
Work load			
Family responsibilities			
Inheritance of land			
Control of income			
Discrimination in remunerations for working in the field			

23. ***Reasons for socio-cultural barriers and how barriers affect participation in dry season farming****(Kindly fill in the table below****)***

Socio-cultural Barriers	**Affects Participation**		**Reasons/causes for Barrier**	*(If yes)* **How it affects involvement**
	Yes	**No**		
Poverty				
Work load				
Family responsibilities				
Inheritance of land				
Control of income				
Discrimination in remunerations for working in the field				

Contribution of the different types of farming to household livelihoods outcomes

24. ***Respondents sources of income and their proportionate contribution to HH income***

S/N	**Source of income**	**Yes**	**No**	**Period Undertaken**	**Income per cycle**	**Income per Month**	**%contribution to HH income**
1	Livestock Keeping						
2	Off – farm Casual labour						
3	Paid formal employment						
4	Remittances' (from relatives)						
5	Trade in off- farm goods						
6	Dry season farming						
7	Rainy season farming						
8	Others (specify)						

Household Level: Physical Assets

25. Now I have some questions about items that your household might own. *(An appropriate list of assets must be created for each site)* I will read a list of items and I would like you to indicate if you or anyone in your household owns any of these items

Item (Read across by row a.-d. item by item)	a. Does anyone in the Household own this item and is in a good working or use condition?(read and Check box if *"yes"*)	b. Was this item(more of this item) acquired during the last 2 yrs*?(Mark with an X)*		Where you undertaking dry season farming when this item (or more of this item was acquired	
		1= Yes	0= No	1= yes	0= No
Consumer Assets of Relative Modest Value- On Average worth less than GH¢100					
Bicycle					
Radio or Tape					
CD/DVD player					
Chairs/benches/ tables					
Consumer Assets of Mid – range Value- on average worth more than GH¢100 but less than 1000GH¢					
Stove/refrigerator					
Television					
Frame bed/mattress					
Consumer Assets of High Value- on average worth more than GH¢1000					
Motorcycle					
Car/pick up					
Tractor					

Household Level welfare indicators: Housing Improvements

26. During the last two years, were any repairs, improvements or additions made to your home that cost more than GH₵50? 1=yes 2=No 99=Don't know ☐

27. *(If yes to #25)* which of the following have you done in the last two years?

Housing Repairs, Improvements, or Additions*(for clients, read across the row by item)*	a. *("Read and check if yes")*	Where you undertaking dry season farming when this was done?*(mark with an X)*	
		1=yes	2=No
a. House repairs or improvements(e.g., fixed or improved existing roof, floor, or walls)			
b. House expansion(e.g. Built new room, shed, attic, or fence			
c. improve water or sanitation system(e.g. new well, drainage/sewage system, or showers-latrine)			
Lighting/electricity			

Household Level Welfare: Diet coping with difficult times

28. During the last 12months has your households diet *(read the answers and indicate response).* 1= worsened 2= stayed 3= improved 99=don't know ☐

29. *(if worsened)*How has it worsened? _____

30. (*if improved)*How has it improved?*(Do not read answers. Multiple answers possible.probe by asking. "and anything else)*

1= Able to buy more cereal stables

2=Able to buy more Animal /dairy products- Fish,meat,milk,eggs

3= Able to Buy more condiments,vegetables, legummes to eat with staples

4= Able to buy more Convinienient foods Like gari, Kulikuli, zumkum

5= Able to buy more cooked foods

6=able to eat better during the hungry season

7=Able to eat 2 meals in a day

99=Don"t know

31. During the last 12 months, was there ever a time when it was necessary for your household to eat less or eat else well either because of a lack of food or a lack of money to buy food?

    1=yes 0=No 99=don't know

32. How long did this period last?Specify number of months…… 99=don't know

33. What did your household do to get through this difficult situation?*(read answers. Multiple answers possible)*

    1= Borrowed money /food from family/friend at no cost 2=Borrowed money/ food at cost 3= Sold personal property 4= Self or some one else in the family left area to seek empolyment 5= Self or someone else in the family got local employment 6=Other(specify) 99=Don't know

34. During the last 12 months, was there ever a time you did not have enough money to conduct your enterprise? 1= yes 0= No 99= Don't know

35. How long did this period last?Specify number of months 99= Don't know

36. Did you face any difficulty repaying your loan taken for your enterprise?

    1= yes 0=No 99= don't know

37. *(if yes)* what caused your repayment problems?*(do not read answers)*

    1= loan activity was not profitable 2= I/others in my family had been sick

    3= Used some of the loan for food or other items fo the household

    4= Sold on credit and did not get paid back in time 5=other(specify)

    99= Don't know

38. Name 3 things you like most about dry season farming? _____

39. Name 3 things you like least about dry season farming?_____

40. If you could change something about dry season farming to make it even better, what would you change?_____

Thank you very much for your cooperation in this research

UNIVERSITY OF GHANA – LEGON

DEPARTMENT OF AGRICULTURAL EXTENSION

Research title: Barriers to Entry and Farmers' Participation in Dry Season Irrigation Farming in the Upper East Region of Ghana.

Appendix 3: Guided Interview Questions for Key Informants

The research you are about to participate in is for an MPhil research at the University of Ghana - Legon .The research seeks to determine ; **:** If there are different barriers to entry of farmers into dry season farming and how this affects participation in the enterprise and to what outcomes.

Participants would include staff of ICOUR, MOFA and Some Opinion Leaders. Simple random sampling would be used to obtain respondents from each scheme.

1) What types of irrigation systems do we have in this region?
2) How do people get access to irrigated land?
3) What criteria are used in the acquisition and allocation of land to farmers?
4) What is the quantity of land farmers are allowed to acquire?
5) In your view are the any exceptions in the allocation of land to farmers?
6) If yes what are they?
7) Do you charge project levy for farmers into dry season farming?
8) If yes how much do they pay?
9) Do you control water allocation?
10) If yes how is water allocated?
11) How frequent do you allocate water to farmers?
12) How much do you charge for water levy?
13) What types of crops do farmers grow here?
14) Do they grow the crops by their own or by your outfit's discretion?
15) Which of the above mentioned crops are the most important and why?
16) What are some of the problems farmers in the area face?
17) What are the measures been undertaken by your outfit to address some of these problems?
18) In your view, Give possible solutions to each problem stated above…….
19) Do you experience problems in your organization? If yes can you tell what these problems are?

20) What support do you give to dry season farmers in the area?
21) Are there conditions for farmers to meet before receiving support?
22) If yes what are they……..?
23) Do you think your support has helped to improve farmer's involvement in dry season farming?
24) In your view, do you think a lot of farmers are involved in dry season farming? If yes reasons……if no reasons
25) Other observations……

Thank you very much for your cooperation in this research

UNIVERSITY OF GHANA – LEGON

DEPARTMENT OF AGRICULTURAL EXTENSION

Research title: Barriers to Entry and Farmers' Participation in Dry Season Irrigation Farming in the Upper East Region of Ghana.

Appendix 4: Group Interview Questions Guide for FDGs

The research you are about to participate in is for an MPhil research at the University of Ghana - Legon .The research seeks to determine ; **:** If there are different barriers to entry of farmers into dry season farming and how this affects participation in the enterprise and to what outcomes.

Village leaders would be requested to gather individuals in groups of between six and eight for all the different categories of farmers.(these will include all adults (above 35 years) men's and women's groups, youth (18 – 35years) groups, educated farmers and non-educated farmer groups as well as natives and no natives.

1) How do people get access to irrigated land?
2) What criterion is used in the acquisition and allocation of irrigated lands to farmers?
3) What is the quantity of land farmers are allowed to acquire?
4) In you view are they any exceptions in the allocation of land to farmers?
5) If ***"yes"*** what are they?
6) What are some of the problems you encounter when trying to access irrigated land?
7) Who controls water allocation/ distribution?
8) How is water allocated?
9) How frequent is water allocated to farmers?
10) In you view are they any exceptions in the allocation /distribution of water to farmers?If***"yes"*** what are they?

11) ***(same question for each Focus group)*** Below is a list of economic barriers. Compare each barrier in a row and match them to those in each Colum. In each case select the most important barrier by assigning their respective numbers

Economic Barriers	**Economic barriers**							**Total**	**Rank**
	1	**2**	**3**	**4**	**5**	**6**	**7**		
1.Lack/Difficulty to access credit									
2. Low prices of commodities									
3. Non – availability/high cost of inputs									
4. Market price Fluctuation for produce									
5. High cost of transportation of produce after harvest									
6. No or Limited access to irrigated Land									
7. Unavailable for dry season farming									

12) Reasons and possible solutions

Economic Barriers	**Reasons**	**Possoble solutions**
1.Lack/Difficulty to access credit		
2. Low prices of commodities		
3. Non – availability/high cost of inputs		
4. Market price Fluctuation for produce		
5. High cost of transportation of produce after harvest		
6. No or Limited access to irrigated Land		
7. Unavailable for dry season farming		

13) ***(same question for each Focus group)*** Below is a list of institutional barriers. Compare each barrier in a row and match them to those in each Colum. In each case select the most important barrier by assigning their respective numbers

Institutional Barriers	Economic barriers				Total	Rank
	1	2	3	4		
High water levy charges						
Poor extension services						
Unfair water distribution						
Unfair land allocation						

14) Reasons and Possible solutions

Institutional barriers	Reasons for barrier	Possible solutions
High water levy charges		
Poor extension services		
Unfair water distribution		
Unfair land allocation		

15) ***(same question for each Focus group)*** Below is a list of technical barriers. Compare each barrier in a row and match them to those in each Colum. In each case select the most important barrier by assigning their respective numbers

Technical Barriers	Technical barriers						Total	Rank
	1	2	3	4	5	6		
1. Pest and diseases								
2. Storage problems								
3. Fertilizer problems								
4. Knowledge of appropriate technology to use								
5. Knowledge of chemicals to use								
6. Unavailable labour								

16) Reasons and Possible solutions

Technical Barriers	**Reason for Barrier**	**Possible Solutions**
Pest and diseases		
Storage problems		
Fertilizer problems		
Knowledge of appropriate technology to use		
Knowledge of chemicals / how to use		
Unavailable labour		

17) ***(same question for each Focus group)*** Below is a list of socio – cultural barriers. Compare each barrier in a row and match them to those in each Colum. In each case select the most important barrier by assigning their respective numbers

Socio - cultural Barriers	**Socio -cultural barriers**						**Total**	**Rank**
	1	**2**	**3**	**4**	**5**	**6**		
1. Poverty								
2. Work load								
3. Family responsibilities								
4. Inheritance of land								
5. Control of income								
6. Discrimination in remunerations for working in the field								

18) Reasons and Possible solutions

Barriers	**Reasons for Barriers**	**Possible Solutions**
Poverty		
Work load		
Family responsibilities		
Inheritance of land		
Control of income		
Discrimination in remunerations for working in the field		

19) In your views what do you think are the opportunities dry season farming bring to your area and why?

20) Kindly label the different wealth categories of community households in your area? (e.g. Very poor, poor, Medium, rich and very rich)

21) What should be the criteria or indicator for wealth ranking?

22) Could you please provide more details for each criterion? (Fill the table below)

Category	Criteria
Very Poor	
Poor	
Average	
Rich	
Very Rich	

23) Other observations……..

Thank you very much for your cooperation in this research

Appendix 5: Economic Barriers affecting Participation in Dry Season Farming

Economic Barriers		Type of Farmers								χ^2
		Dry season farmers only		Rainy season farmers only		Both rainy and dry season farmers		Total		
		Freq.	%	Freq.	%	Freq.	%	Freq.	%	
Difficulty to access Credit	Yes	22	84.6	19	76.0	232	93.2	273	91.0	χ^2= 9.60 df=2 p=0.01 sig.
	No	4	15.4	6	24.0	17	6.8	27	9.0	
	Total	**26**	**100.0**	**25**	**100.0**	**249**	**100.0**	**300**	**100.0**	
Low prices of commodities	Yes	16	61.5	12	48.0	177	71.1	205	68.0	χ^2= 6.20 df= 2 p= 0.05 sig.
	No	10	38.5	13	52.0	72	28.9	95	32.0	
	Total	**26**	**100.0**	**25**	**100.0**	**249**	**100.0**	**300**	**100.0**	
High cost of inputs	Yes	21	80.8	18	72.0	228	91.6	267	89.0	χ^2=10.854 df=2 p= 0.00 sig.
	No	5	19.2	7	28	21	8.6	33	11	
	Total	**26**	**100.0**	**25**	**100.0**	**249**	**100.0**	**300**	**100.0**	
Market Price Fluctuation	Yes	13	50.0	5	20.0	150	60.2	168	56.0	χ^2=15.34 df=2 p= 0.00 sig.
	No	13	50.0	20	80.0	99	39.8	132	44.0	
	Total	**26**	**100.0**	**25**	**100.0**	**249**	**100.0**	**300**	**100.0**	
High Cost of transportation	Yes	15	57.7	12	48.0	153	57.0	180	60.0	χ^2= 1.7 df= 2 p=0.41 not sig.
	No	11	42.3	13	52.0	96	43.0	120	40.0	
	Total	**26**	**100.0**	**25**	**100.0**	**249**	**100.0**	**300**	**100.0**	
No or limited access to irrigated land	Yes	20	76.9	17	68.0	219	88.0	256	85.0	χ^2= 8.84 df= 2 p=0.01 sig.
	No	6	23.0	8	32.0	30	12.1	44	15.0	
	Total	**26**	**100.0**	**25**	**100.0**	**249**	**100.0**	**300**	**100.0**	
unavailable for dryseason farming	Yes	1	3.9	3	12.0	11	4.5	15	5.0	χ^2= 2.83 df= 2 p= 0.24 not sig.
	No	25	96.1	22	88.0	238	95.5	285	95.0	
	Total	**26**	**100.0**	**25**	**100.0**	**249**		**300**	**100.0**	

Source: Field survey, 2012

Appendix 6: Institutional Barriers affecting Participation in Dry Season Farming

Institutional Barriers		Type of Farmers								χ^2
		Dry season farmers only		Rainy season farmers only		Both rainy and dryseason farmers		Total		
		Freq.	**%**	**Freq.**	**%**	**Freq.**	**%**	**Freq. %**	**%**	
High water levy charges	Yes	19	73.1	16	64.0	231	92.8	266	88.7	χ^2=25.6 df = 2 p= 0.00 sig.
	No	7	26.9	9	36.0	18	7.2	34	11.3	
	Total	**26**	**100.0**	**25**	**100.0**	**249**	**100.0**	**300**	**100.0**	
Poor extension services	Yes	19	73.1	19	76.0	176	70.7	214	71.3	χ^2= 0.36df= 2 p= 0.84 not sig.
	No	7	26.9	6	24.0	73	29.3	86	28.7	
	Total	**26**	**100.0**	**25**	**100.0**	**249**	**100.0**	**300**	**100.0**	
Unfair water Distribution	Yes	13	50.0	9	36.0	166	66.7	188	62.7	χ^2= 11.08, df =2 and p= 0.00 sig.
	No	13	50.0	16	64.0	83	33.3	112	37.3	
	Total	**26**	**100.0**	**25**	**100.0**	**249**	**100.0**	**300**	**100.0**	
Unfair Land allocation	Yes	18	69.2	15	60.0	209	83.9	242	80.67	χ^2 = 9.38 df= 2 p= 0.01 sig.
	No	8	30.8	10	40.0	40	16.1	58	19.33	
	Total	**26**	**100.0**	**25**	**100.0**	**249**	**100.0**	**300**	**100.0**	

Source: Field survey, 2012

Appendix 7: Technical Barriers affecting Participation in Dry Season Farming

Technical Barriers		Farmers Decision to participate								χ^2
		Dry season farmers only		Rainy season farmers only		Both rainy and dry season farmers		Total		
		Freq.	**%**	**Freq.**	**%**	**Freq.**	**%**	**Freq. %**	**%**	
High incidence of pest and diseases	Yes	19	73.1	24	96.0	131	52.6	174	58.0	χ^2= 20.21 df=2 p=0.00 sig
	No	7	26.9	1	4.0	118	47.4	126	42.0	
	Total	**26**	**100.0**	**25**	**100.0**	**249**	**100.0**	**300**	**100.0**	
Storage Problems	Yes	22	84.6	23	92.0	117	47.0	162	54.0	χ^2=33.42 df=2 p=0.00 sig.
	No	4	15.4	2	8.00	132	53.0	138	46.0	
	Total	**26**	**100.0**	**25**	**100.0**	**249**	**100.0**	**300**	**100.0**	
Fertilizer availability Problems	Yes	17	65.4	18	72.0	231	92.8	266	88.7	χ^2= 15.90 df=2 p=0.00 sig.t
	No	9	34.6	7	28.0	18	7.2	34	11.3	
	Total	**26**	**100.0**	**25**	**100.0**	**249**	**100.0**	**300**	**100.0**	
Knowledge of appropriate technology to use	Yes	19	73.1	11	44.0	114	45.8	144	48.00	χ^2= 3.78 df= 2 p= 0.15 not sig.
	No	9	34.6	14	56.0	135	54.2	158	52.67	
	Total	**26**	**100.0**	**25**	**100.0**	**249**	**100.0**	**300**	**100.00**	
Knowledge of how to use chemicals	Yes	5	19.2	0	0.0	44	17.8	49	16.33	χ^2 = 5.37 df=2 p=0.07 not sig.
	No	21	80.8	25	100.0	205	82.3	251	83.67	
	Total	**26**	**100.0**	**25**	**100.0**	**249**	**100.0**	**300**	**100.0**	
Unavailable labor	Yes	21	80.77	19	76.00	232	93.17	272	90.67	χ^2=11.21 df=2 p=0.00 sig.
	No	5	19.23	6	24.00	17	6.83	28	9.33	
	Total	**26**	**100.00**	**25**	**100.0**	**249**	**100.0**	**300**	**100.0**	

Appendix 8: Socio - cultural barriers affecting Participation in Dry Season Farming

socio - cultural barriers		Farmers Decision to participate								χ^2
		Dry season farmers only		Rainy season farmers only		Both rainy and dry season farmers		**Total**		
		Freq.	**%**	**Freq.**	**%**	**Freq.**	**%**	**Freq. %**	**%**	
Workload	Yes	5	19.2	6	24.0	83	33.3	94	31.3	χ^2= 2.86 df=2 P =0.240 not significant
	No	21	80.8	19	76.0	166	66.7	206	68.7	
	Total	**26**	100.0	**25**	100.0	**249**	100.0	**300**	100.0	
Family responsibility	Yes	17	65.4	12	48.0	181	72.7	210	70.0	χ^2=6.88 df = 2 P= 0.03 significant
	Total	**26**	100.0	**25**	100.0	**249**	100.0	**300**	100.0	
inheritance of land	Yes	7	28.0	8	32.0	96	39.3	111	37.8	χ^2=12.22 df = 2 P= 0.06 not significant
	No	18	72.0	17	68.0	148	60.7	183	62.2	
	Total	**25**	100.0	**25**	100.0	**244**	100.0	**294**	100.0	
Control of income	Yes	6	24.0	1	4.0	55	22.7	62	21.2	χ^2= 6.52 df = 2 P =0.163 not significant
	No	19	76.0	24	96.0	187	77.3	230	78.8	
	Total	**25**	100.0	**25**	100.0	**242**	100.0	**292**	100.0	
Discrimination in remunerations	Yes	6	23.1	1	4.0	23	9.5	30	10.3	χ^2 = 6.29 df = 2 P= 0.18 not significant
	No	20	76.9	24	96.0	218	90.5	262	89.7	
	Total	**26**	100.0	**25**	100.0	**241**	100.0	**292**	100.0	