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**INSTITUTIONAL ANALYSIS OF IRRIGATION WATER
MANAGEMENT: A CASE OF THE VEA IRRIGATION SCHEME IN
GHANA**

Master's Thesis for the Award of Master of Science (MSc) in Natural Resources
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Abstract

Water, as a fluid resource is inherently a ‘fugitive resource’. Its sustainable and effective management has been a challenging one over the decades since it has constantly eluded a linear or a straightforward management regime. Various attempts have been made to design institutions for its effective governance but this is still inconclusive. This dissertation focuses on the analysis of the institutions that govern water and attempt to understand how water is managed within the Veia irrigation scheme in Ghana. The impact of irrigation on farmers’ incomes was further assessed. Qualitative methods, particularly interviews and focus group discussions were employed to achieve the objectives. Irrigators and irrigation management officials within the scheme formed the research participants. The theoretical foundations of this work is mainstream institutionalism led by Elinor Ostrom and critical institutionalism led by Frances Cleaver.

This research produced a number of interesting key findings. In the first place the research found that different stakeholders had ownership of land depending on the season. The research found that the boundary of the resource and the community of users was fluid and kept changing depending on factors such as canal integrity, the season, rainfall amount and distribution. Farmers operated largely with informal rules. Traditional invisible institutions played a key role in the management of the irrigation scheme. Though farmers operated with rules, these rules were not deliberately crafted and written down. Farmers utilised informal conflict resolution mechanisms to resolve conflicts instead of the formal court system. The sanctioning regimes in place were effective but not fair.

Contrary to popular literature that irrigators downstream are disadvantaged this study found that farmers who were located at the tail end and largely practiced pump farming were better positioned and performed better than formal irrigators upstream who performed canal irrigation. The research further found that the formal and informal irrigation systems existed and operated together under the same official management, an innovation that shows that the informal sector is amenable to formal governance. The research further indicated that irrigation had a positive impact on the incomes of farmers as irrigation provided the incomes for investing in alternative income generation ventures and putting up physical infrastructure such as accommodation. The research argues that in establishing irrigation schemes and irrigation management systems the informal institutions should not be overlooked since their inclusion will go a long way to reduce conflicts within the system.

Declaration

I, Jacob Adongo Anaba, hereby declare that apart from references made from other people's work which have duly been acknowledged and referenced this research is the result of my own research work undertaken with the supervision of Professor Haakon Lein of the Department of Geography, Norwegian University of Science and Technology (NTNU). This work has never been submitted to any other university for the award of an academic degree.

Signature:.....

Date.....

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The journey through this thesis has not been without the support of other people. A number of people have contributed towards the success of this thesis and some deserve a mention.

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Abbreviations

CI	Critical Institutionalism
CPR	Common Property Institutions
DCEs	District Chief Executives
FBOs	Farmer Based Organisation
FGD	Focus Group Discussion
GIDA	Ghana Irrigation Development Authority
GDP	Gross Domestic Product
GoG	Government of Ghana
GSS	Ghana Statistical Service
ISC	Irrigation Service Charges
LAC	Land Allocation Committee
MI	Mainstream institutionalism
MOFA	Ministry of Food and Agriculture
ICOUR	Irrigation Company of the Upper regions
PIM	Participatory Irrigation Management
WRC	Water Resources Commission
WUA	Water User Associations

CHAPTER 1: INTRODUCTION

1.1 Background to the study

The Upper East Region is one of the poorest regions in Ghana (GSS, 2007) with a challenging ecology as a result of erratic and unreliable rainfall amounts and distribution (Antwi-Agyei, Fraser, Dougill, Stringer, & Simelton, 2012). Water is an important resource in a dry savannah environment such as the Upper East Region. The rainfall distribution is highly unreliable and unpredictable in both spatial and temporal terms. Agriculture is the main occupation of the people of the upper east region and thus employs about 60% of the population (GSS, 2015). About 57.6% of the region's population is generally regarded as poor (GSS, 2015).

Irrigation has been identified as one of the major ways of reducing the poverty levels, increasing farmers' incomes and ensuring food security within the region (Akudugu, 2012; Dinye & Ayitio, 2013; Namara, 2011). Irrigation in particular plays a major role in employing rural dwellers especially in the savannah ecological zones. It is also becoming increasingly clear that climate change and its concomitant effects are becoming glaring in Ghana and northern Ghana in particular. This is evidenced by the fact that areas in the region that had never experienced drought and flooding are now experiencing such disasters (Akudugu, 2012). The region is gradually experiencing desert conditions (Antwi-Agyei et al., 2012). It was in this light that the savannah accelerated development authority was established and undertook tree planting and other efforts in a bid to curb the deforestation in the savannah zone. Since the dry (savannah) zone is expanding (Akudugu, 2012) this means that irrigation will play a major role in enhancing food productivity and security (Nyamadi, Namara, Horowitz, & Barry, 2011).

Water scarcity and competing use of water by various stakeholders make irrigation governance problematic. Since water is a scarce resource in the dry season yet faced with farmers competing for it there is the need for an assessment of management strategies to ensure efficient governance.

The chief threat to agriculture production in Ghana has been identified as the high reliance on rainfall, world market prices and depletion of natural resources (Okudzeto et al, 2015). Irrigation development is one of the major ways of investing in agriculture. There is increasing need for enhancing food production and hence food security. Irrigation is one way of achieving this. Also, increasing population coupled with increasing urbanisation means that much agricultural lands are increasingly used for settlement and other development purposes.

Irrigation is therefore a good alternative way of achieving increased food production since the yield per area of land is higher in irrigation than rain fed agriculture (Kyei-Baffour & Ofori, 2007).

Ghana is endowed with abundant water resources from rainfall but this important resource is not evenly distributed (MOFA, 2012). There is variation in the distribution both seasonally and geographically. Ghana's agriculture is largely rain-fed and since this resource is generally unreliable and unpredictable and yet Ghana has to feed the growing population. There is the need for undertaking irrigation. Irrigation is therefore one way of meeting Ghana's food needs supply within this challenging condition (Nyamadi et al., 2011).

Agriculture is an important contributor to Ghana's GDP. Agriculture used to contribute substantially to Ghana's GDP but this contribution has declined from 23% of GDP in 2011 to around 20% in 2014 (Okudzeto et al, 2015). This poses a challenge to the country since the food needs of the country will not be met without undertaking some proactive measures.

1.2 Research Objectives and Research Questions

The general objective of this research is to analyse the institution that govern water and how irrigation water is managed within the Veia Irrigation scheme in the Upper East Region of Ghana.

1.2.1 Objectives

The specific objectives of this work are to:

1. Assess the extent to which water governance follows Ostrom's design principles
2. Critically examine how water is governed.
3. Assess the impact of irrigation on the incomes of farmers.

1.2.2 Research Questions

1. To what extent does water governance comply with Ostrom's principles?
2. How is water managed in the irrigation scheme?
3. What are the impacts of irrigation on farmers' incomes?

1.3 Justification for the Study

Though irrigation is so important in Ghana's quest for development much attention has not been paid to it (Kyei-Baffour & Ofori, 2007). There is a gap in the institutional analysis of

water governance in Ghana(Agyenim & Gupta, 2013).This research contributes to filling this knowledge gap through the analysis of the institutions that govern irrigation in Ghana in particular. This research contributes to understanding how irrigation institutions work and how farmers practice irrigation. The institution(s) in the water governance sector need to be assessed. There has not been thorough assessment and analysis of the institutions that govern the water sector and irrigation water in particular.

Most researchers have theoretically discussed the institutions and theories that govern irrigation but most have not related these institutions or theories with how farmers actually utilise them in their day to day practices. This thesis therefore provides an understanding of how these theories (mainstream institutionalism and critical institutionalism) actually practically apply to farmers in the geographical setting.

Further, most researchers have concentrated on analysing the institutions that govern irrigation water but have failed to relate these institutional analysis with the impact of such institutional analysis. Institutional analysis is aimed at understanding how irrigation institutions operate and how to enable farmers and irrigation authorities achieve better performance. Achieving better performance should therefore be related to the impact of irrigation on the farmers. This makes it possible to understand the outcomes of such institutions that govern irrigation. For example farmers within the study area operate with a mix of formal and informal rules and so assessing the impact of irrigation on farmers makes it possible to understand which irrigation policies to adopt. This provides information to irrigation developers such as governments, non-governmental organisations (NGOs) and donor organisations to know which irrigation policies, designs and typologies are optimal.

1.4 Structure of the thesis

This thesis is divided into eight chapters. Chapter one (1) gives a general introductory background to the study. It spells out the background to the study, research objectives and research questions and the justification for the study.

Chapter two (2) contains the background of the study area. It explains the geography of Ghana in general and the study region in particular. It covers issues on location and size of the region, climate and vegetation, agriculture, environmental issues in the region, background to the Veia irrigation scheme, the study communities.

Chapter three (3) contains the literature review section and reviews literature on Water governance and water management both in a global and Ghanaian perspective. It further reviews literature on Ghana water policy and water management institutions as well as impact and challenge of irrigation.

Chapter four (4) examines the theoretical perspective of the thesis. It discusses mainstream institutionalism and critical institutionalism as theoretical foundations of the work. The nature of institutions are examined in this chapter.

Chapter five (5) discusses the methodology part of this work. This chapter outlines the various research methods employed in collecting data for this work while discussing the number of research participants. The chapter also discusses ethical considerations such as reflexivity, positionality, informed consent and confidentiality.

Chapter six (6) begins the findings and discussion part of this work. The chapter presents the findings and discussion on the institutions that govern irrigation water. It examines the institutions based on Ostrom's design principles thus attempting to find out if the institutions conform to or depart from mainstream institutionalism. Intermittently, critical institutionalism is drawn in during the analysis. The chapter therefore examines the boundary of the resource and the community of users, the conflict resolution mechanisms, monitoring and sanctioning regimes, rule formulation and relationship among water users. This chapter further presents the gender dimensions in irrigation water management by examining women's participation in irrigation.

Chapter seven (7) presents the findings and discussion on the impact of irrigation on farmers' incomes.

Chapter eight (8) concludes this work and presents a summary of the main findings of the research while offering some recommendations regarding irrigation water management. The chapter also gives a brief theoretical reflection of the work.

CHAPTER 2: THE STUDY AREA

2.1 Introduction

Ghana has ten administrative regions which are located within five ecological zones. It has an abundance of water resources from rainfall but this is not evenly distributed in both spatial and temporal terms. The rainfall therefore varies both seasonally and geographically. Ghana has a mean annual rainfall of approximately 1,187mm (Namara et al,2011c; Nyamadi and Barry,2011) while the mean annual temperatures range from 26.1C from the coast to 28.9C to the extreme north eastern part of Ghana. The south western part of Ghana receives more rainfall than any part of the country. The rainfall amount in the country tends to decrease as one moves from the southern part to the northern part of the country. The annual potential evaporation is higher in the north than in the south with 1350mm in the south and 2000mm in the north (Namara et al, 2011) .The northern part of the country experiences a mono-modal rainfall regime which has a long dry season and a rainy season while the southern part of the country experiences a double maxima of rainfall with two rainy seasons.

The climate system in the country is influenced by the dry harmattan winds which take their source from the Sahara desert in the north and the moist south west monsoon winds (south westerly winds) which emanate from the Atlantic Ocean in the south (Nkrumah et al., 2014). See map 1 for the climate (rainfall) distribution in Ghana. The interplay of these two winds tend to alter the position of the inter- tropical convergence zone (ITCZ).When the harmattan winds become dominant over the country, mostly around November to March then dry conditions set in the country with the northern part of the country experiencing much of it. On the other hand if the south west monsoon winds start to blow over the country around May then humidity levels in the country get higher with the atmosphere becoming moist and wet conditions setting in. The variability of the climate especially rainfall makes rain-fed agriculture a risky one hence the need for dry season farming as well.

2.2 The Upper East Region

2.2.1 Location and Size

The Upper East Region is located in the extreme North eastern corner of Ghana. It is located between longitude 0⁰ and 1⁰ west and latitude 10⁰ 30"N and 11⁰N. It borders Burkina Faso in the North and Togo to the North east and to the West it borders the Sissala district of the upper west region and to the south it borders the West Mamprusi District of the Northern Region.

The capital is Bolgatanga mostly shortened to Bolga. It covers a total land area of 8,842 square kilometres with a total population of 1,046,545 and a population density of 118.4 people per square kilometre which is higher than the national average of 103.4 persons per square kilometre (Ghana Statistical Service, 2013). The high population density means that pressure is placed on the scarce land and water resources. The region also experiences high population out-migrations due to the challenging environment. The region for example experienced an out-migration rate of 25.14 from 2000 to 2010 (Ghana Statistical Service, 2013). The region was part of the then upper regions (upper east and upper west region) until 1983 when the upper west region was carved out of it. It then became the Upper East Region. The upper east region is the second poorest region in Ghana with 57.6% of the region's population falling below the official poverty level (GSS, 2015). Apart from the District capitals the settlements are that of rural ones. Agriculture is the major occupation in the region employing over 60% of the population (GSS, 2015). Majority of farmers are dependent on rain-fed agriculture.

2.2.2 Climate and Vegetation

The land is generally undulating with upland soil which formed out of granite rocks. The rocks are formed out of the Birimian, Tarkwaian and Voltaian rocks of Ghana. These rocks contain minerals such as gold, iron, and clay. The climate is classified as tropical and has two distinct seasons. A wet rainy season which runs from May to October, and a long dry season that stretches from October to April with hardly any rains. There is therefore a mono-modal rainfall regime with July and August marking the peak of the rainy season. The mean annual rainfall is 950mm (Dinye & Ayitio, 2013) See [Figure 1](#). The area experiences a maximum temperature of about 45^o in March and April with a minimum of 12^oC in December. Day time Temperatures during the harmattan can go beyond 35^o whiles night temperatures can go as low as 12^o. The dry season is characterised by the long, dry and dusty harmattan winds which come from the Sahara region up north.

The natural vegetation is that of the savannah woodland which is characterised by short scattered deciduous trees. See [figure 2](#). There are also ground flora of grass, but these get dried up during the dry season. Because of this they are easily prone to bush fires which are very common in the region. The grasses also get scorched by the sun during the long dry season. The most common economic trees in the region are the Sheanut, Dawadawa, Baobab and Acacia. Because the ground flora gets dried up in the dry season bush fires are a common

phenomenon which sometimes burns some of these economic trees. Human activities are however, gradually turning the region into a semi-arid conditions while the rainfall amounts are becoming increasingly erratic both in duration and in spatial terms due to changing rainfall patterns. The region is characterised by high rainfall intensities which largely exceed the soil's infiltration rates leading to surface runoff (Liebe, Van De Giesen, & Andreini, 2005).

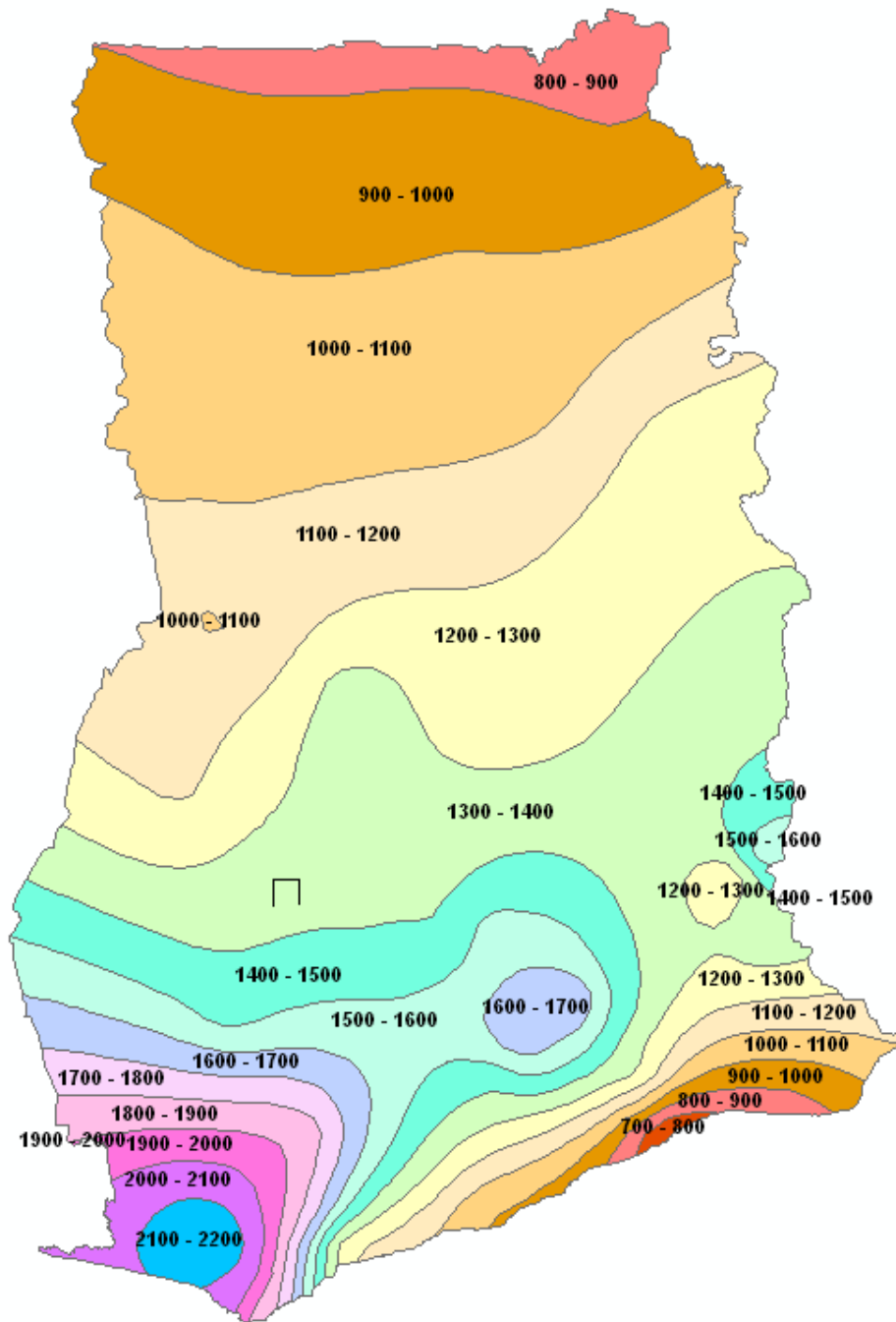


Figure 1: Rainfall distribution in Ghana

2.2.3 Agriculture

Though agriculture is the main activity of the people in the region most of the farmers engage in subsistence farming where most of the crops cultivated is produced for feeding the family and to cater for other needs of the family. Mostly the farming system is either compound farming or bush farming (Namara et al, 2011). Compound farming is most common where the farms are located around the various homes. With bush farming the farms are located some kilometres or distances away from the homes especially in the bush.

The major crops that are cultivated in the region are cereals comprising crops like millet, sorghum, maize and rice. Millet and Sorghum (Guinea corn) in particular have social and religious significance in the region since they are used for sacrifices and for brewing local alcoholic drinks. Other crops such as groundnuts, beans, cowpeas, soya beans, sweet potatoes are also common. A variety of leafy vegetables and other vegetables like tomatoes and onions are also cultivated largely for making soups. Tomatoes and onions are mostly grown in the dry season but for commercial purposes. Apart from the cultivation of crops a lot of farmers also engage in livestock rearing and poultry. Cattle, donkeys, sheep, goats are the common livestock whereas chicken and guinea fowls are the common poultry birds. These Animals are mostly kept for security reasons and sold in times of stress. The cattle and donkeys are predominantly used for ploughing land for cultivation since tractor services are limited.

2.2.4 Environmental Issues in the region

The area abound in resources such as forests, gold, arable land and water resources. Due to the challenging nature of the landscape and the population pressure coupled with the desire to exploit these resources of the region the region is prone to a number of environmental challenges. The region is generally regarded as degraded and is under threat of further degradation due to human activities. Flooding is common in the area during the rainy season since the soils are shallow and the rainfall intensities are higher than the rate of infiltration (Adwubi et al., 2009) leading to high run-off. The run-off also trigger of a lot of soil erosion in the region further leading to the loss of soil fertility. The long dry season coupled with the dry harmattan winds make bush fires very common during the dry season. The grasses which serve to protect the top soil from erosion whiles serving as source of food for the livestock are mostly burnt by fire along with the trees during the dry season. A number of the trees are however fire resistant since they have yearly been exposed to fire.

Silting of water bodies is also another environmental challenge within the region. The region is awash with a number of rivers and other water bodies but these water bodies are increasingly under pressure from human activities such as mining and farming. People farm along the banks of the rivers while others dam the rivers for dry season farming. These competing damming of the rivers lead to the silting and degradation of the rivers. A number of small scale mining miners along some of the rivers also alter the morphology of some rivers leading to de-silting. Most of the environmental problems result from anthropogenic activities such as poor farming practices, illegal mining, and charcoal burning.

2.2.5 Irrigation

As stated earlier there is only one rainy season and this means that most Agricultural activities must be carried out at this time to get the food requirements for the year. As this is normally not achieved, this has to be supplemented with irrigation in the dry season. The region is drained mainly by the White Volta and the Red Volta with their tributaries. These rivers with their tributaries often provide the source of water to farmers for dry season farming. About 160 small reservoirs are also dotted around the region (Liebe et al., 2005) and help make better use of the rainfall by capturing runoff.

The soil is shallow and mostly water is not able to infiltrate the ground hence a lot of run-off which lead into the rivers. Flooding is therefore very common due to torrential rainfalls that occur in the rainy season. The rivers overflow their banks thus flooding surrounding lands and farmlands. The White Volta and its tributaries often experience the worst floods whenever the flood gates of the Bagre dam in Burkina Faso which is located upstream is opened. The Bagre dam is constructed on the upper part of the White Volta which has its source in Burkina Faso. The importance of irrigation in the region is evidenced by the large numbers of small reservoirs and dug outs that are used for irrigation in the dry season.

2.3 Background to the Veia Irrigation Scheme

2.3.1 Location and Description

The Veia irrigation scheme is located some 10km to the north western part of Bolgatanga, the capital of the upper east region. It is situated approximately between longitudes 0°51'0"W and 0°55'30"W and then approximately between latitudes 10°48'0"N and 10°54'0"N at an altitude of 183m above sea level. It is located between two political administrative regions, the Bongo

district and the Bolgatanga municipality .The reservoir is located in the Bongo district and specifically between the communities of Vea and Gowrie with the project office located at Gowrie. Figure 3 shows the location of the project area.

2.3.2 History of the Project

The Vea irrigation Scheme was built by the Government of Ghana (GOG).The construction of the dam started in 1965 under the Convention Peoples Party (CPP) led by Dr Kwame Nkrumah, the first president of Ghana. It is a medium-sized irrigation project. The reservoir was established by the post-colonial state to alter the structure of the colonial export economy and to bridge the regional inequality that existed (Konings, 1981). The aim of the project was to promote the production of food crops and to ensure food security in the region while it was also envisaged that it would supply tomatoes to the Pwalugu tomato factory that had been set up. The initiation of the construction of the dam, unfortunately coincided with the period of political instability in Ghana by then. The CPP government was overthrown in a military coup d'état in 1966 by the National Liberation Council (NLC) and so the construction of the dam stalled and therefore moved at a very slow pace. It was not until 1985 when the construction of the scheme was fully completed.

The originally planned area to be developed was 1660ha(4100acres) but this was later revised down to 760 ha when a new contract was awarded to a British multinational, Taylor Woodrow (International) Ltd. The construction of the dam, canals and development of moved at a slow pace. Since the start of work on the project in 1965 only 120 ha had been done by 1976 and then 560 ha by 1979 (Konings, 1981) until its completion in 1980 (Karsiem & Baba, 1998; Ofose, 2011).This slow pace thus increased the cost of the project. The initial cost of the project was 2.5million Ghanaian Cedis but doubled to 5million and reached 15million Ghanaian Cedis by 1979(Konings, 1981).This scheme and the Tono project are the main irrigation schemes in the region with the Vea scheme being the second largest in the region after the Tono project. The official management mandate of the scheme was transferred from the IDA (Irrigation Development Authority) to ICOUR (Irrigation Company of the Upper Regions) and it has since managed both schemes.

2.3.3 Displacement and Resettlement of people

The construction of the dam affected a number of farmers, their lands and houses which were located in the project area. The lands were expropriated from their owners without full compensation but they were promised that land would be leased to them after the completion

of the project and that such lands were even higher yielding irrigated lands (Konings, 1981). People who lived in the project area were told to resettle and then compensation would be paid for the loss of their houses. Between 4000 and 6000 people were therefore resettled for the project to be constructed. Table 1 shows the number of households from the various villages that were affected by the construction of the dam and had to relocate their houses with some compensations paid. The military government that seized power from the Convention Peoples Party however, attempted to overhaul the ideology and policies of the CPP. It reneged on the previous government's (CPP) promise to lease lands in the project area to the farmers and rather started to allocate the lands to commercial farmers (Konings, 1981). It was not until 1977 that the second military government, the Supreme Military Council (SMC) started to implement the ideas of the CPP by re-allocating the lands of the developed area to the farmers.

Table 1: Number of households affected by the construction of the Veia dam and compensations paid

Compensation paid in	Village	Number of Households	Amount of Compensation in Cedis)
1968	Sumbrungu	194	55,796.00
	Veia	17	4,086.00
	Yikine	62	6,355.00
	Zaare	86	19,538.00
	Yorogo	20	4,306.00
	Gowrie	14	3,729.00
	Nyarega	107	29,923.00
1973	Nyarega	26	
	Veia	1	10,115.00
1976	Nyarega	39	175,937.00
	Total	566	309,785.00

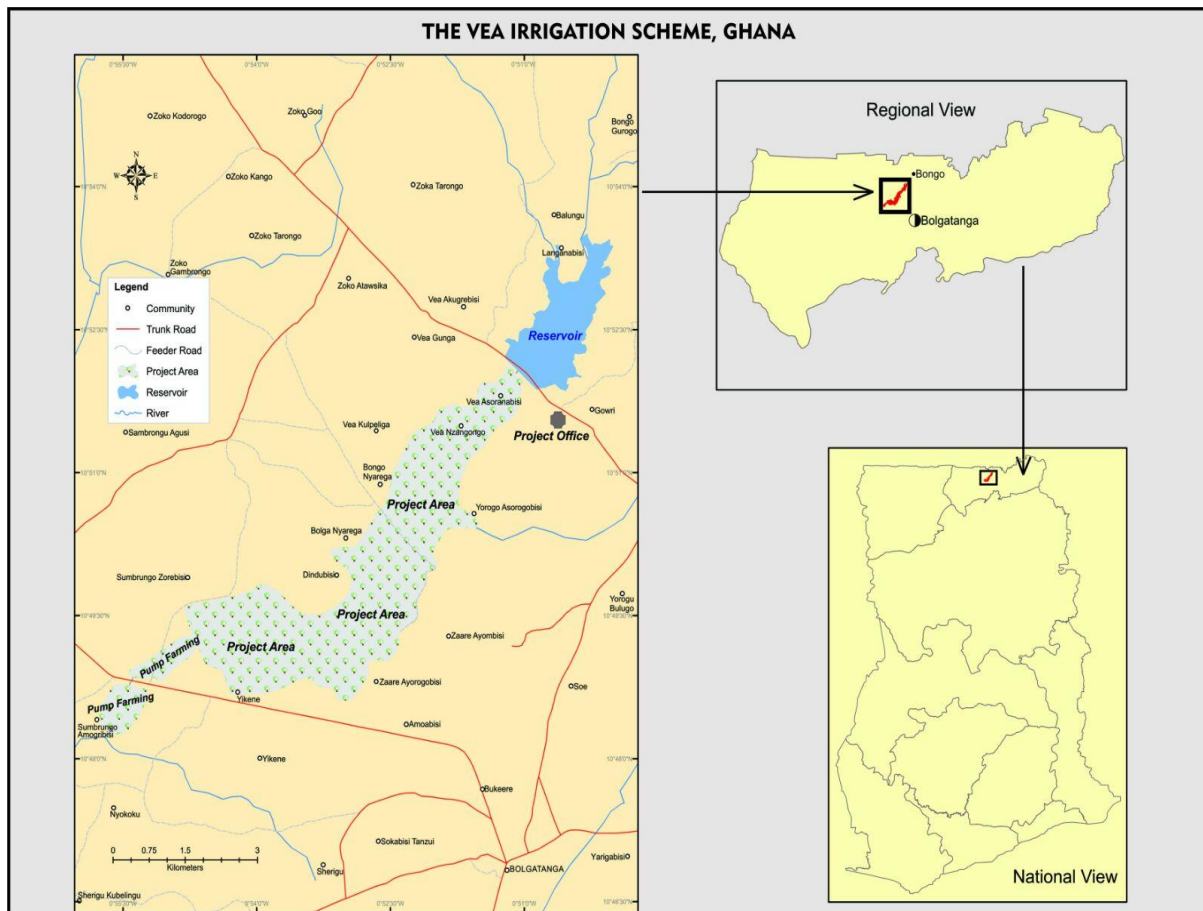
Source: Compiled from files in the Lands Department, Bolgatanga by Konings (1981) .

Note: The Ghanaian cedi was almost at par with the American dollar in 1968; its (official) value was equal to US \$ 0.78 in 1973 and to US \$ 0.87 in 1976.

2.3.4 The Project today

The project area, which refers to the area under the jurisdiction of the scheme is located in both the Bongo district and the Bolgatanga municipality. It has a potential irrigable area of 1,197ha and a developed irrigable area of 850ha. About 450 ha is currently under cultivation. The predominant soil types in the irrigable area are heavy clayey soils and sandy loamy soil which are conducive for the cultivation of a variety of cereals, legumes and vegetables. The topography of the area can be described as level which slopes gently downstream. The scheme is a reservoir-based gravity-system type of irrigation. The dam was to store about 16million m³ of water for irrigation and 4.5 million litres of water per day to the township of Bolgatanga and its surrounding communities¹. The scheme supplies over 2,000 households within its catchment area (Namara et al, 2011; Ofosu, 2011). Women constitute 15%-20% of the farmers (Ofosu, 2011). Water from the reservoir is diverted to the field through canal systems. There are two main (primary) canals-the right bank canal and the left bank canals which transverse the catchment area of the scheme. The left bank canal is 11.3km long while the right bank canal is 14.5km long. There are also a network of secondary canals (called laterals) and tertiary canals (called sub-laterals). There are 62 canals with a catchment area of 136km². The dam has a crest height of 12metres, crest length of 1585m and a reservoir area of 40.5km².

¹ <http://ghananewsagency.org/education/vea-irrigation-facility-in-need-of-major-repairs-research-findings-35921>

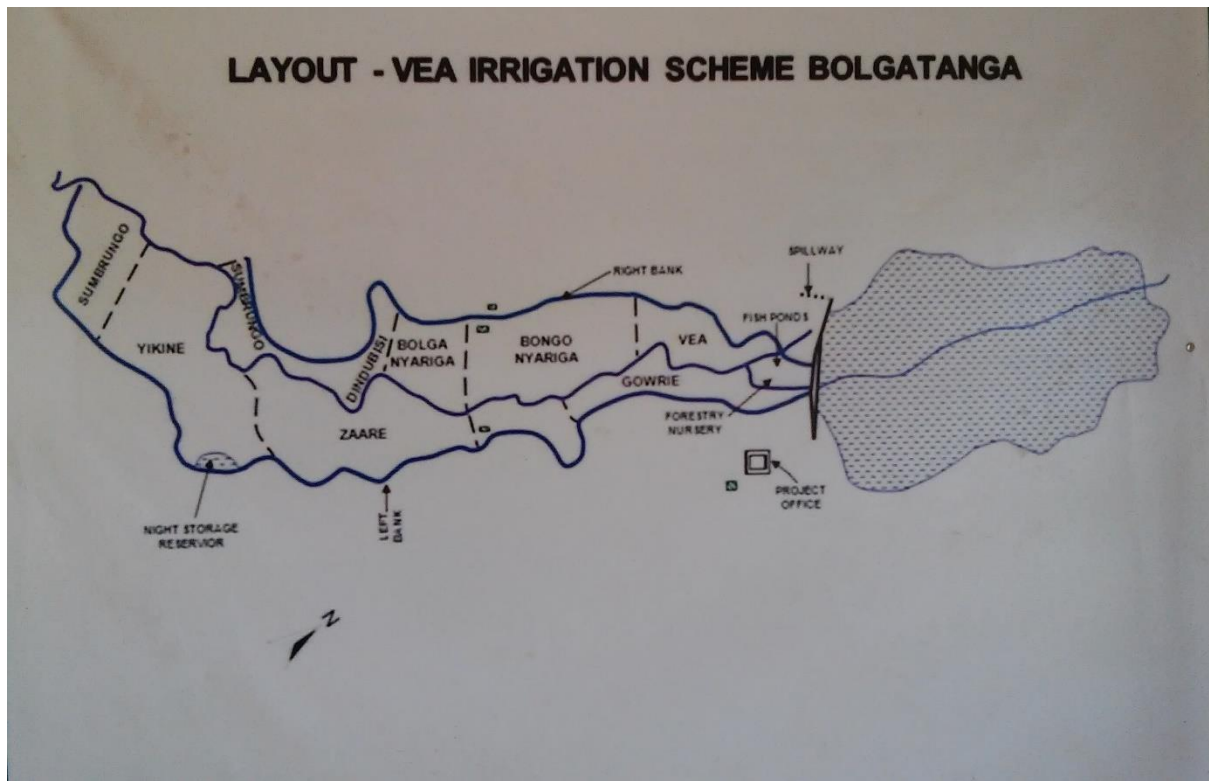


Source: Author's own map

Figure 2: Location of the Veia Irrigation Project

2.3.5 The study communities

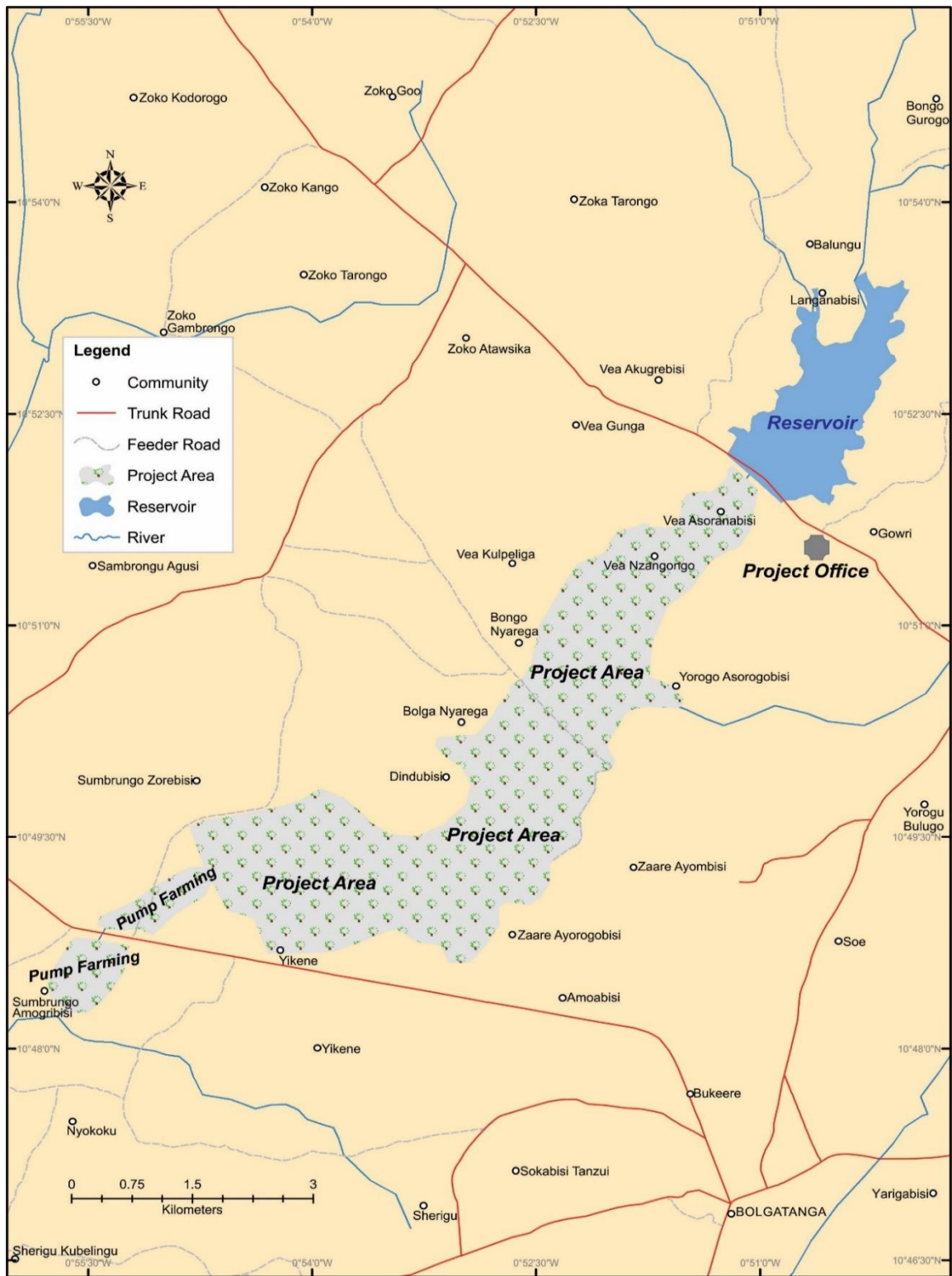
The Veia irrigation project has nine (8) villages under its catchment area. Each of these villages has varying amount of land within the project area. The villages are Veia, Gowrie Bongo Nyarega, Bolga Nyarega, Zaare, Dindubisi, Yikine and Sumbrungu. See map 4 for the location of these villages within the project area. The left bank canal supplies Gowrie, Zaare, Yikine and Sumbrungu whiles the right bank canal has Veia, Bongo Nyarega, Bolga Nyarega Dindubisi and Sumbrungu under its catchment area. Each village has a village committee which assists in the management of the scheme. The scheme therefore has 8 village committees. The village committees meet to elect their executives whiles ensuring that water levies are paid by members. Under the village committees there are lateral leaders who are appointed by farmers within the laterals and who are in charge of managing the secondary canals (laterals) by collecting water levies within the laterals for the ICOUR Officials.



Source: ICOUR Office

Figure 3: Communities within the Veia Irrigation Project

The originally planned area has not remained static following changes that have occurred within the scheme. Some areas that were not part of the originally planned area are now part of the project area due to pump farming. [Figure 4](#) shows the map of the project area with areas where pump farming is practiced. Pump farming predominantly takes place mainly at the tail end of the project where the waste or excess water from the project ends up.



Source: Author's own map

Figure 4: Map showing the project area and areas with pump farming

2.4 Management of the scheme

According to the Ghana agricultural water management investment framework report (2012), the management of public Irrigation in Ghana has been done through the top-down approach with little farmer participation. According to the report, during the 1990s, a Participatory Irrigation Management (PIM) model was however introduced which required farmers to pay irrigation service charges (ISC) for operation and maintenance (O&M) of the schemes. This pertains to all the public irrigation schemes in Ghana (Braumah, King, & Sulemana, 2014). In The Upper East Region in particular, the Irrigation Company of the Upper Regions (ICOUR) was set up to manage the two large schemes, the Tono and Veia schemes with farmers expected to pay water levy as ISC for the upkeep of the schemes. The management of the other public irrigation schemes was however under the ambit of the Ghana Irrigation Development Authority (GIDA).

The Veia irrigation scheme is managed by The Irrigation Company of the Upper Regions thus ICOUR for short. ICOUR is an autonomous company owned by the Government of Ghana (GOG). It works closely with the Ghana Irrigation Development Authority (GIDA). Following the construction of the Veia irrigation scheme and the Tono irrigation schemes, ICOUR was established and mandated to manage both schemes. The mandate of ICOUR include;

- Training and developing village community farms
- Technical and advisory services for crop, livestock, fisheries development
- Providing tractor hire services, irrigation water and farm inputs
- Assisting in the organization of credit and marketing for small scale farmers
- Providing and maintaining necessary infrastructure

ICOUR has a management team and a board. There are also committees that play various roles in the management of the irrigation schemes. The ICOUR board is the highest body that takes decisions on the management of irrigation. Some of the key members of the board are;

- The regional minister
- Representatives from:
 - Ministry of Finance
 - Ministry of Food and Agriculture
 - Ghana Irrigation Development Authority (GIDA)
- Two farmer representatives
- Managing Director of ICOUR

- Finance Officer of ICOUR

The committees or water management institutions are discussed below

2.4.1 Consultative Committee

The committee is comprised of the District Chief Executives (DCEs) of the two administrative areas within the project, that is, the Bongo District and the Bolgatanga Municipality. It also has two farmer representatives, traditional authorities from Bongo and Bolgatanga. The consultative committee meets twice in a year and that is the start of the wet season farming and also the start of the dry season farming. It discusses the challenges of the project hence the activities of the previous season and the incoming season. It also discusses service charges such as; water and land levy fixing. The committee also consults farmers on the challenges they face.

2.4.2 Land Allocation Committee

This committee is made up of DCEs. It is supposed to re-assess the lands in the project area periodically. The LAC was very important during the early part of the project when lands had to be allocated to the various farmers and villages within the project area. The committee in recent times has not been active. It is supposed to reallocate lands that are not performing but this has not happened for a very long time.

2.4.3 Village Committees

There are eight village committees each representing a village within the project area. Each village committee has an elected body of 5 executives who see to the allocation of lands within the area while ensuring that water levies are paid by farmers. They also organise farmers for cleaning the canals. The members of the committee are elected from the villages and could be made of farmers and other members of the village.

2.4.4 Lateral Leaders

The laterals refer to the secondary canals. See figure 6 for laterals. There are leaders who are appointed by the farmers within the laterals. The lateral leaders are more or less the managers of the laterals. They collect water levy from farmers along the laterals and forward the money to the ICOUR office. They then issue receipts to the farmers. The lateral leaders ensure that about 80% farmers within the lateral have paid the water levy and then ICOUR is informed so that water can be delivered to the lateral. There are sixty-two laterals within the project area. The lateral leader is given the key to the lock of the lateral gate or valve. If it is time for that lateral to use water the lateral leader then opens the lateral gate.

2.4.5 Farmer Based Organizations

These are groups of farmers with common interest who come together. At the focus group discussions and the interviews farmers indicated that most of them are part of FBOs. According to an ICOUR official, there are over 100 FBOs but most of them are not active. There are 52 active 52 FBOs with only 14 registered with the Department of Cooperatives (Offosu, 2011). The FBOs have their elected executives, some with bank accounts. The members hold meetings to discuss issues relating to how they can improve on irrigation. According to the farmers it is through the FBOs that they get support from NGOs and other support organizations.

CHAPTER 3: LITERATURE REVIEW

3.1 Introduction

This section gives an overview of the existing literature on institutional analysis of water governance. In line with the objectives of this thesis the literature review focuses on water governance, the institutions that govern water and how irrigation is situated in the context of global, national and local settings. Water governance and management is therefore, discussed both in the global setting as well as in a Ghanaian context. I start this section by delving into the meaning and nature of water governance and institutions. I further review the literature to give an understanding of the policies and institutions that govern water in Ghana whiles looking at the typologies of irrigation and how they relate to Ghana.

3.2 Governance

To understand water governance there is the need to understand what governance entails. The definition of what governance is has been a matter of differing opinions but in all there are shreds of common understanding of what governance refers to (Castro, 2007; Lautze, De Silva, Giordano, & Sanford, 2011; Wouters, 2008). Governance involves the marshalling of resources together with people and institutions to promote the efficient administration of resources. It encompasses institutions, dynamic processes as well as constantly shifting power relations which lead to uncertain outcomes (Franks, 2006; Tom, Frances, Faustin, & Kurt, 2013).

It is said that the world water crises is not that of a technical or natural one but that it is largely “a crises in governance” (UNESCO, 2006 as cited in Castro, 2006 p.98). Castro (2007, p.98) writing about the governance of water in the twenty-first century argues that to some:

“Governance is an instrument, a means to achieve certain ends, an administrative and a technical tool kit that can be used in different contexts to reach a given objectives such as enforcing a particular water policy”

According to him, governance to some is a process and that this process involves not just implementing decisions taken by experts and people with power. It involves implementing decisions taken through democratic means where there is debate of alternative but rival viewpoints about development projects. According to Roger and Hall (2003, p.7), Governance is concerned about the: “manner in which allocative and regulatory politics are exercised in the management of resources” and that it embraces the formal and informal institutions by which authority is exercised.

3.3 Water Governance

The concept 'Water governance' emerged in the international stage in the 2000s at the Second World Water Forum in the Hague in 2000 ((Lautze et al., 2011).

According to the Global Water Partnership (2002):

Water governance refers to the range of political, social, economic and administrative systems that are in place to develop and manage water resources, and the delivery of water services, at different levels of society (Global Water Partnership, 2002 as cited in Rogers and Hall, 2003 p.7)

This definition albeit comprehensive it, however, appears mechanistic and prescriptive while ignoring the environmental component in water resources governance. It does not capture the processes and means by which these ranges of system operate such as issues of democracy and participation. The UN World Water Development Report 3 on the other hand recognises this definition and hence builds upon it when it defined water governance as:

...the political, social, economic, legal and administrative systems that develop and manage water resources and water services delivery at different levels of society while recognizing the role played by environmental services(World Water Development Report 3 2009 p.242).

Lautze et al (2011) examined some definitions of water governance as defined by some scholars in the field and concluded that three concepts are key in water governance and that these concepts run across the literature on governance. First they argue that governance is seen as processes involved in decision making, Second that the processes of decision-making take place through institutions. Third that the processes and institutions of decision making involve multiple actors. In this light, Water Governance therefore revolves around the processes of decision making involving multiple actors with institutions serving as the link. They summed up by defining water governance as consisting of the processes and institutions by which decisions that affect water are made and indicate that water governance does not include the practical, technical and routine management functions such as staffing and construction of infrastructure. The big question however is how does one talk about water governance in a contextual vacuum if issues of staffing and management functions among other things are taken out of the equation of governance?

According to Roger and Hall (2003) there is no single model for water governance but they opine that effective governance systems must fit the economic, social and cultural peculiarities of each country. They however outline some principles of good governance which are necessary for effective water governance. These principles include inclusiveness, transparency, accountability, participation, predictability and responsiveness. This means that for effective water governance institutions must use language that is understandable for the general public and yet work in an open manner. There should also be actor and stakeholder participation through the policy chain from conception to implementation while roles in the management, policy development and implementation as well as the rules be made clear. Responsiveness means that policies must deliver what is needed by virtue of demand and also policies should be implemented in a proportionate manner. Governance systems should therefore seek to facilitate action and not to create obstacles of development (ibid).

Water governance is inherently political (Mollinga, 2008). This means that water governance cannot be divorced from politics. Castro (2007) sums this point up when he argues that there have been attempts at depoliticising the discussion about water governance and presenting them as merely technical with the aim that it will provide opportunities to curtail the issue of water uncertainty and conflicts. Further, Castro (2007) argues that determination of the ends and values related to water management as well as the determination of the means to achieve those ends and values does not take place in a social vacuum. This means that water governance is not only political but it is also a socio-cultural issue.

Apart from these conceptions of governance there are other competing traditions about the practices of water governance. One tradition sees water as a common good arguing that water services are a public good which should not be governed through market forces. Those opposed to this tradition understand water governance as structured around water as an economic resource and a private good and hence water and water services governance must be centred around market principles (Castro, 2007; Yuling & Lein, 2010). One argument for water as an economic good is based on the principle that it will ensure efficient delivery of water while laying the platform for cost recovery (Yuling & Lein, 2010). These positions in water governance appear irreconcilable and the attempt has always been to try to bring these positions to a middle position where some basic or minimum amount of payment is made for water services and delivery. Perhaps this necessitated the emergence of the paradigm shift from sectoral to the integrated water resources management. This paradigm shift is aimed at

promoting the sustained use of water resources while promoting cross-sectoral coordination and partnership among stakeholders (Agyenim & Gupta, 2013). The aim there of is to maximize welfare in an equitable fashion without undermining the integrity of ecosystems (Agyenim & Gupta, 2013). This middle position has eluded water governance experts because it is not easy to achieve spatial, objective, institutional and temporal integration in the water management sector (ibid). That is to say it is not easy to integrate common objectives within a geographical area, integrate multiple objectives in water resources management and integrate all the institutions concerned in water management.

Frank (2006) has identified some key issues that relate to the discussion concerning water governance. They include citizens' rights and entitlement to water, women as key users and managers-in-practice of water, the need for partnership in water service delivery, that water is an economic good and has an economic value in all its competing uses, shared knowledge is essential in good water governance, water should be managed at the basin level and lastly that water is becoming scarce. This means that in order to achieve good water governance these issues need to be integrated in the water governance discourse.

It is however interesting to note that in most of the literature on water governance it is difficult to talk about water governance without mentioning management. According to Frank (2006) water governance has evolved from ideas of managing water wisely and this explains why it is sometimes perceived as being closely connected to water management.

3.4 Water Management

There have been attempts at drawing a distinction between water governance and water management (Franks & Cleaver, 2009). Lautze et al (2010) argue that while water governance refers to the set of processes and institutions through which management goals are identified, water management refers to the implementation of practical measures to achieve those goals. This means that water management is subsumed under water governance. To them water governance provides the framework for deciding and undertaking management activities (Lautze et al., 2011). They argue that water management is aimed at directly improving outcomes but water governance is aimed at defining what good outcomes are and therefore tailoring management practices to those goals. They further add that water governance is at the centre of the planning stage but is still relevant at the level of implementation. Frank (2006, p.3) in discussing water governance defines water management as: “*Controlling the supply,*

distribution, use and disposal of water to achieve specific objectives, and can thus be seen as distinctly different from governance”.

Pahl-Wostl(2009) recognises the ongoing debate about environmental resource management which calls for a paradigm shift in current management strategies which are seen as ‘mechanistic’ and ‘technocratic’ and tend to neglect the complexities and human dimensions in resource management. He contends that this current debate is exacerbated by the fact that there are constantly changing conditions such as the prospects of climate change and global change which alter the grounds upon which management performs hence rendering management unpredictable(Pahl-Wostl, 2009).

The dividing line between the two terms is too thin and so both terms have been used interchangeably by many scholars (Pahl-Wostl, Gupta, & Petry, 2008).

The challenges facing water management is not new. It has been a contentious issue of a global dimension since the 1970s (Castro, 2007).

Tagseth and Lein (2009) discuss competing models of water management and their implications using the Pangani River Basin in Tanzania as an example. They identify three approaches to water management which are ‘state-centred’, ‘market-based’ and ‘the community-based’. They argue that each of these models provides different perspectives as to how water resources should be managed with each focusing on different actors and scales of operations.

3.5 Water management and Challenges

As far back as 1992 the former president of the International Commission of Irrigation and Drainage (ICID) in a keynote address stated that:

Irrigation schemes in many parts of the world are known to be performing well below their full potential . . . [There is now] wide recognition that deficiencies in management and related institutional problems, rather than technology of irrigation, were the chief constraints of poor performance of irrigation systems (Cited in Tibor et al., 2000, p.197).

Tibor et al (2000,p.197) in reviewing the problems of irrigation in developing countries contend that there is no question that irrigation systems are faced with a myriad of problems. These problems they state in a cynical fashion are sometimes referred to as: “*a continuous and vicious*

cycle of rehabilitation, deterioration, rehabilitation, deterioration etc.” However in my opinion this situation is not peculiar to only irrigation but almost every human-made system since systems must periodically be maintained. They however point out that there are some important management-related and institutional deficiencies such as conflicts between farmers and irrigation agencies, farmers’ interference and vandalism, poor coordination between agencies, poor cost recovery of investments as well as recurrent costs and that majority of writers agree that these are the causes of poor performance of irrigation.

According to Kirpich et al (1999) for a solution to the problems of irrigation in developing countries there is the need for institutional change .A change in those institutions of the developing countries, of the developed countries that provide the aid and a change in the international financing and technical assistance agencies. Kirpich et al prefer low level of technology with greater emphasis given to the elimination of deficiencies in management and institutional problems. Their position probably emerges from the fact that high technology requires expertise in maintenance, maintenance programmes and budgets which local farmers may not be able to cope with.

Horst (1998) does not see management as being the crux of irrigation problems but rather the irrigation technology which is the design of irrigation systems (Horst, 1998). Plusquellec et al. (1994) argues that strategies for irrigation development should not only focus on institutional and managerial aspects but should also include the technical aspects since this can have serious consequences on food supply and demand. He stresses on the importance of technology arguing that it is only if the water distribution system is efficiently operated that management objectives can be fully realised. Efficient technology will therefore lead to the achievement of management objectives such as higher water charges, introduction of water rights and quotas.

In water governance financing plays a key role in ensuring the success or otherwise of projects. The discussion around water management often tends to deliberately ignore the issue of funding water resources services and activities. The importance of water funding has been well captured by the United Nations World Water Report which is the most comprehensive document on water resources. The report states that:

Virtually all water-related activities whether structural (infrastructural) or not (planning, data collection, regulation, public education and so on) require money to develop, implement and carry out. Even if all the necessary policies and laws are in

place, lack of funding will bring necessary actions to a standstill (UN, World Water Development Report 3, 2009. P.56).

Lautze et al (2011) in discussing water governance captured this when they stressed that countries may be noted for applying good governance practices such as high level of participation, greater transparency and minimal corruption yet produce poor water resources outcomes due to lack of finances for technologies to achieve efficient and sustainable outcomes. Lipton et al, (2003) in discussing the effects of irrigation on poverty have noted the decline in irrigation funding across regions and within regions by governments and major donors over the years. There has been a funding lacuna in irrigation with declining real lending by the major donors such as the World Bank, Asian Development Bank, Japanese Overseas Development Fund(Lipton et al., 2003).This funding decline in irrigation is attributable to factors such as the falling economic rate of return, high cost of constructing irrigation infrastructure, poor cost recovery, negative health and environmental impacts, technical inefficiency leading to overuse and wastage of water, and corruption(Carney & Farrington, 2005; Lipton et al., 2003; Tibor et al., 2000; UNESCO, 2009).

3.6 Water Management in Ghana

Agyenim and Gupta (2013) in writing about water management in Ghana identify four major paradigm shifts in water management that have taken place worldwide in the last two decades. These include a shift from government to governance, centralization to decentralization, water as a gift of God to water as an economic good, and sectoral to integrated water resource management. They indicate that such paradigm shifts have been adopted due to external pressures. They also argue that there are limited implementation of water management policies in Ghana due to the absence of domestic ownership, inadequate resources, and institutional mismatches. They therefore recommend a type of water governance which is more oriented on prioritization and indigenizing external ideas while operating within existing cultural practices (Agyenim & Gupta, 2013).

Land tenure issues serve as one of the challenges of irrigation management in Ghana. According to the Ghana agricultural management strategy, (2012) about 80% of lands in Ghana is state owned and held in trust by chiefs or family heads (MOFA, 2012).The Ghana irrigation policy strategies recognised the challenges of land tenure issues when it states that *“Land tenure arrangements especially in informal irrigation do not encourage responsible*

management of land while denying an obvious source of collateral for seasonal and other credits” (MOFA, 2011, p.8).

(Akudugu and Issahaku,2013) in writing about danamics[sic] of land ownership and management in small scale irrigations in the Bawku East District of Ghana describe land allocation in the irrigable as chaotic. Land tenure is a complex issue involving the use of both customary and modern legal laws for administration (Akudugu and Issahaku, 2013). Since lands are owned by family heads and chiefs, land becomes fragmentary as a result of growth in the family size which require the family land to be shared among the family yet conflicts often arise due to ownership issues. The existing land tenure does not encourage long term investment in land since lands are leased to land users only on temporary basis. Such lands cannot therefore be used as collateral to secure capital for investments.

Ndemu et al (2009) argue for improved water productivity as a way of addressing water scarcity in the upper east region. They contend that improving water productivity in agriculture will reduce competition for scarce water resources, mitigate environmental degradation and enhance food security since producing more food with less water will save water for other natural and human use. Jonah and Dawda (2014) examine the management and use of water resources for small-scale irrigations in the Garu-Tempene district in the Upper East Region. They argue that to help improve the management of irrigation schemes in the area farmers favour the provision of training to upgrade their knowledge and that farmers were of the view that the expansion of dams in the area will enhance water storage and that this will go a long way to improve challenges associated with irrigation schemes and water management.

According to Koku (2003) the role of local institutions in rural Ghana is worth discussing considering the fact that livelihoods are dependent on the use of natural resources. He asserts that studies and development work tend to indicate that in most rural areas the governing systems of local institutions have often had an impact on the sustainable use of natural resources. He cites that in some communities in Ghana local institutions connected with customary and land tenure arrangements have created structures that restrict access to natural resources whiles others give rise to the tendency of overexploitation among farmers. Koku (2003) identify the shared cropping regime practised in the South Tongu District of Ghana as one of the local arrangements that promote the over exploitation of natural resources. Under this shared cropping system of land acquisition and allocation a piece of land is rented to settler farmers but the produce of the farmer from the land is shared with the land owner after

harvesting in the ratio of 1:1 and 1:2 respectively between the farmer and the land owner. In order to minimize and adopt to the losses incurred, tenant farmers will have to intensify work on the farmlands with the expectation for greater harvests which indirectly leads to overexploitation. Koku however, recognise the role of traditional rules or institutions in the management or conservation of natural resources. These involve the role of traditional authorities to formulate institutions to control, allocate, protect and mediate in conflicts regarding resource use. He further argues that even though such practices are couched in religious beliefs they represent Indigenous strategies for resource protection. He identified some of these traditional institutions as protecting particular ecosystems or habitats such as sacred groves and sacred rivers as well as regulating exploitation of natural resources.

Venot (2014) in assessing the role of water user associations (WUA) as a form of participatory irrigation management (PIM) in small reservoirs in Ghana and Burkina Faso allude that there is a narrow gaze at WUA. He asserts that WUA are sometimes promoted by outsiders on the basis of national or international policy reforms rather than as collective decision-making processes undertaken from the community. He therefore suggests that the insistence to establish a “one-model fits all” (WUA) as a solution amounts to a narrow vision of the commons and participation since such tendencies may overlook the pluralistic nature of common property resources management.

Derbile (2012) writing on water user associations and indigenous institutions in the management of community-based natural resources in the north-eastern part of Ghana observed that the mode of operation and effectiveness of water user associations vary from community to community and that the formation of water user associations in Ghana have often been facilitated by external agencies including the Ministry of Food and Agriculture (MOFA) and NGOs. He argues that the extent to which water user associations become sustainable will depend very much on the degree to which they are crafted on and supported by community-based indigenous governance institutions since WUAs draw their legitimacy and power to function from traditional institutions.

Braimah and Sulemana (2014) writing about community-based participatory irrigation management at local government level in Ghana argue that women have difficulty in owning and accessing irrigated lands and argue that the Ghana Irrigation Development Authority (GIDA) and the district assemblies should adopt gender mainstream policies that encourage the participation of women in irrigated agriculture by facilitating equal access to irrigated plots.

They went further to propose that in order to facilitate this access GIDA needs to build the capacity of women in leadership and hence build confidence to ensure their effective participation in decision making in participatory irrigation management.

3.7 Ghana Water Policy and Water Management Institutions in Ghana

3.7.1 The Water Resources Commission

In view of the importance of water as a resource, the Ministry of Works and Housing in 2005 was re-designed as The Ministry of Water Resources, Works and Housing. The Water Resources Commission (WRC) is one of the agencies of the Ministry of Water Resources, Works and Housing. The Water Resource Commission was established in 1996 under the Water Resources Commission Act, 1996. In the act, it is stated that the ownership and control of all water resources are vested in the president on behalf of the people. Per this policy the president of Ghana is therefore the custodian of all water resources in the country and there is no private ownership of water resources in Ghana.

The Water Resource Commission (WRC) under the act has been mandated as the overall body responsible for water resources management in Ghana. It performs regulatory and management functions in terms of water resources utilisation. Co-ordination of policies in relation to water resources is also under its ambit. It therefore issues licenses for the abstraction of water use and also educates and creates awareness about water conservation and efficient use of water resources².The commission is also charged with the mandate of granting water rights, suspension and termination of such rights.

The Water Resources Commission Act, 1996 prohibits the use of water without authority and therefore states that one cannot divert, dam, store, abstract or use water resources without authorisation. (See the water resources commission act).These rules are however not being adhered to by smallholder irrigators in Ghana since the commission has no capacity to police all water resources in Ghana and to grant and monitor all water related activities within the country.

² <http://www.wrc-gh.org/>

3.7.2 National Irrigation Policy and Strategy

The water sector in Ghana has been beset with several sectoral challenges (MOFA, 2011). The new National Irrigation Policy (NIP) was adopted in 2010 following broad consultations. It seeks to address the challenges within the irrigation sector by capturing not only issues related to the formal sector but the informal sector as well. The National Irrigation Policy and Strategy (NIP) address challenges in the agricultural water sector such as the low agricultural productivity and slow rate of growth, lack of irrigation support services, constrained socio-economic engagement with both land and water services (MOFA, 2011, 2012). It is stated in the policy that the policy is “*predicated on the commitment to decentralize irrigation Services and private sector Participation from individual farmers to commercial operators*” (MOFA, 2011, p.1). This implies that the policy is heavily oriented to the market-centred approach of water management.

The document lays out the policy paths as well as the strategies for implementing the policies. The NIP identified some of the challenges facing agricultural water management in Ghana. It notes that the Ghana Irrigation Development Authority (GIDA) has both human and financial constraints and this has severely compromised the quality and extent of water services delivery to farmers and has constrained the development and productivity of the formal irrigation sub-sector (MOFA, 2012). According to the policy, government has focused on the formal sector and has neglected the informal smallholder and commercial large-scale irrigation. The policy also adds that the formal public irrigation has been supply-driven and that little attention has been paid to stakeholder participation. The policy further cites unclear water services and water allocation arrangements as stifling the water sector while maintaining that the water service delivery needed to maintain the irrigation system is unsustainable.

3.7.3 Ghana Irrigation Development Authority (GIDA)

The Ghana irrigation development authority (GIDA) which was initially under the jurisdiction of the Ministry of Food and Agriculture (MOFA) is now an autonomous entity charged with irrigation development and management. Its functions among others include designing and constructing irrigation facilities, formulating plans for irrigation development in Ghana, develop programmes for the effective use of irrigated lands, provide technical services in Irrigation development and management in Ghana, undertake land use planning in areas designated for development with the aim of conserving water and soil resources³. GIDA has

³ <http://www.gida.gov.gh>

more than 22 irrigation Schemes under its jurisdiction covering about 14,700ha ((MOFA, 2011).

GIDA has been instrumental in irrigation development in Ghana. The national irrigation policy and strategies has proposed a restructuring of GIDA including decentralization of GIDA with the regional offices being elevated to the level of departments. It also proposed the creation of a new department for irrigation technology development which will liaise with research and academia and should also take charge of farmer training and manpower development(MOFA, 2011).The GIDA however appears to have no control over the informal sector as it does not concern itself with farmers in that sector.

3.8 Irrigation Typology in Ghana

There are different categorisations of irrigation in Ghana. Van den Berg (2008) in exploring shallow groundwater irrigation in the Atakwindi catchment area in Ghana identifies some irrigation typologies in the area. These include Pump-irrigation, Wastewater irrigation, Dam irrigation and Bucket-irrigation (van den Berg, 2008)

(Horowitz et al., 2011) categorise irrigation in Ghana into two broad groups. The first category is the ‘conventional systems’ which are mainly initiated and developed by government or NGOs. The second category is ‘emerging systems’ which are initiated and developed by private entrepreneurs and farmers sometimes with or without support from other organisations.

According to them the two common methods for categorising irrigation systems in Ghana is by organisational structure and size. On the basis of structure, irrigation is classified into formal and informal systems. On the basis of size or scale they classified Irrigation into small scale, medium scale and large scale using land sizes ranging from 200ha and below for small,200ha to 1,000ha for medium and above 1,000ha for large scale (Kyei-Baffour and Ofori, 2007; Horowitz et al., 2011).

Namara et al (2011b) outlined some additional criteria upon which irrigation could be categorised. Some of these are:

- ownership or holding and that is whether the ownership is government, community or individual.
- source of water for irrigation and that is whether water comes from shallow ground water, riverine, dam.

■Initiator or financier of the scheme and that is whether government, NGOs, community or individual (ibid)

■Management and operation. That is whether irrigation is managed by GIDA, ICOUR, Private entity, or jointly by farmers.

■Size or scale

■Type of technology or infrastructure involved. That is whether pump irrigation, canal irrigation, and reservoir-based gravity irrigation among others

The new Ghana National Irrigation Policy recognises three principal categories of irrigation in Ghana. These are the:

(a) Informal (smallholder) irrigation,

(b) Formal irrigation, and

(c) Large Scale Commercial Irrigation

By this classification the irrigation policy has combined a number of criteria in the categorisation of irrigation-that is size, organisational structure and ownership.

3.8.1 Formal irrigation

Formal Irrigation is one that is reliant on some form of fixed irrigation infrastructure that is funded by the public sector (MOFA, 2011). It may be designed by and operated by the government or donor agency and is used by more than one farm household (Drechsel, Graefe, Sonou, & Cofie, 2006). The development of the formal irrigation schemes in Ghana dates back to the 1960s under the first republic (MOFA, 2011)

3.8.2 Informal irrigation

This is the type of irrigation that is practiced by individuals or groups of farmers without reliance on irrigation infrastructure that is planned, constructed and operated through the intervention of government or donor agency (Drechsel et al., 2006). It embraces a wide range of investments in equipment, land, social organisations and daily farm activities undertaken by farmers.

According to MOFA(2011) the Informal Irrigation comprises traditional and community initiated schemes and are mostly practised by individuals who cultivate an area of up to about 0.5ha or more by using simple structures and equipment for water storage, conveyance and

distribution(ibid). They are typified in most cases by, manual fetching of water with watering cans and buckets while motorized pumps and hoses are also used along the streams and reservoirs. According to the Ghana Irrigation Policy Strategy, 2010 this subsector has been ignored in the past even though it is larger than the formal one (MOFA, 2011)

3.8.3 Smallholder Irrigation

The term Smallholder refers to a farmer practising a mix of commercial and subsistence production where the family provides the principal source of labour and the farm provides the principal source of income .Small holders often derive their livelihoods from an irrigated holding of less than 0.2 ha but the size of the holding may vary up to 5ha or more(Cornish et al, 1999).Informal (small holder) irrigation farmers are usually responsible for providing the capital investments mostly from their own resources.

The Ghana Agricultural Water Management Investment Framework which was adopted in 2012 also recognised the three categories of irrigation as stated by the irrigation policy. It has however bemoaned that less attention has been paid to the informal sector even though it constitutes the largest part of irrigation in Ghana.

Table 2: The total irrigated area under each of the irrigation typologies

Category	Hectares	Percent (%)
Formal	10,668	4
Informal	186,000	91
Commercial	10,200	5
Total	206,868	100

Source: GIDA (2012)

3.9 Impact of Irrigation

The impact of irrigation on the lives of farmers in the upper east region and Ghana in general cannot be under estimated. Irrigation has had a great impact on the economic and social life worlds of the people.

According to Namara(2011) farmers in the White Volta basin have developed complex water efficient and labour intensive management practices in line with the differential resource constraints during the dry seasons. During the dry season land and labour are relative abundant however water is scarce hence limiting production (Namara, 2011).

According to Namara (2011) the contribution of shallow ground water irrigation to the economy of 35 communities in the White Volta Basin is estimated at 1.62million (1.2million USD) while employment and value added in the upper east region within the three to four months of dry season irrigation created extra labour demand estimated at 359,511 person-days (Namara, 2011). He also found that irrigation had enhanced the food security status of farmers within the region. On the issue of cost it was noted that fixed costs of operating irrigation in the upper east region constituted a small portion of production cost while labour constituted a significant proportion of the total cost of irrigation (Evans, 2012)

According to Evans et al (2012) in both the dry season and wet seasons farmers who irrigate with motor pumps have higher gross margins than bucket or canal users. Farmers with different sizes of landholdings are said to be benefitting from motorised pumps but these users tend to be males, younger and better educated and yet women too tend to get better represented in public irrigation system probably due to government interventions (Evans, 2012).

CHAPTER 4: THEORY

4.1 Introduction

In line with achieving the objectives of this work, Mainstream Institutionalism (MI) and Critical Institutionalism (CI) will form the theoretical foundations of this work. These two theories offer competing ideas about the management of common pool resources even though they also have their points of convergence. Mainstream Institutionalism draws more of its roots from the rational choice and functional assumption of institutions and contends that institutions can be deliberately designed for the purposes of managing common property resources. Critical institutionalism on the other hand is deeply rooted in the critical realist tradition which acknowledges diversity in social phenomena (Cleaver, 2012) and hence stresses the role of social structures in shaping outcomes. It views formalisation and crafting of institutions as overly simplistic arguing that institutions are complex to craft but just operate intermittently in everyday social life (Cleaver, 2012). In this chapter I also discuss institutions, common pool resources and the tragedy of the commons which are all linked to the theory of this work.

4.2 Institutions

In efforts to find the best possible ways of managing natural resources there has been increasing attention on the role of Institutions in natural resources management (Koku & Gustafsson, 2003) since they are assumed to play key roles in determining the sustainable management of resources.

Institutions can be defined as the arrangements between people that are reproduced and regularised within time and space and are amenable to persistent processes of evolutions (Cleaver, 2012). Institutions are not objects they are the things people do (Cleaver, 2012). They are also seen as regularised patterns of behaviour that emerge from the underlying structures or sets of rules in use (Leach & Mearns, 1996). According to Ostrom (1992) institutions are the rules-in-use by a set of individuals to organise repetitive action that produce outcomes affecting those individuals and potentially affecting others. They are the 'rules of the game' and reduce uncertainty by providing a guide to everyday life (North, 1990). In fact they are a guide to human activities (North, 1990).

One of the key features of institutions is that they do not restrict themselves to the formal but spreads their tentacles to encompass the informal, the explicit and the implicit (Rydin, 2006).

The formal institutions are the written laws that govern a system while the informal institutions embrace the unwritten social relations and practices within a society. They include the norms, traditions, taboos and codes of conduct. The informal institutions cannot be overlooked in resource governance because they may pre-date the formal institutions and hence may overlap them or may not conform to formal ones (Agandini, 2015). The formal and informal networks that exist between actors within institutions assist in explaining resource governance process and how things work (Rydin, 2006).

Institutions are the building blocks in natural resources management. They are key in natural resources management because they mediate the links between people, natural resources and society (Cleaver, 2012) and often may act to facilitate or constrain access to resources (Cleaver and Franks, 2005). Institutions are indispensable in resource management because they provide incentives for the way people behave (Capistrano, Samper, Lee, & Raudsepp-Hearne, 2006) and therefore provide insight into how they relate with natural resources. Institutions do not only promote stability of expectations but also consistency of people's actions (Agrawal & Gibson, 1999). Institutions are not static since they may change as a result of persistent challenges always posed on their form by the very actors whose behaviour and actions they are supposed to influence. (Agrawal & Gibson, 1999). They may also change when deliberately negotiated by actors. There cannot be natural resources management without institutions. Institutions and institutional analysis are therefore very important in studying resource governance because they form the platform upon which various actors interact. A critical study of institutions reveals why the management of certain common pool resources in some cases succeed while in others fail. Though there is increasing attention on the role of institutions in general in resource governance there appears to be a yawning gap in the literature regarding the role of local institutions. These local institutions form the landscape upon which the interaction of people and water takes place (Cleaver, 2012). The local institutions encompass both the visible and invisible components and undergo transformations and adaptation by learning from practices within and outside the resource unit. Since water is a 'fugitive resource' (Crase and Gandhi, 2009, p.7) and these institutions are also dynamic in nature and may elude design (Cleaver and Francis, 2005) there is the need for a complex and critical analysis of institutions in an attempt to understand how common pool resources are governed.

4.3 Irrigation Water: A Common-Pool Resource

The term 'common-pool resource' or 'Common Property Resource (CPR)' refers to a natural or man-made resource that is large enough to make it costly to exclude potential beneficiaries from obtaining benefits from its use (Ostrom, 1990).

According to Runge (1986) what appears to the outsider as an open access may actually contain implied operational rules specifying right of joint use. Whereas the major problem associated with open resource is free entry the problem of common property is tension over joint use rights as members extract from the resource (Runge, 1986). The tensions which may arise from CPR are a complexity of causes such as increasing population, climate change, technological changes, political forces and other power relations.

A Common-Pool Resource shares two common characteristics with other resources. It is a resource that is first of all characterised by sub-tractability which means that one person's harvests from the resource is not available for others. In other words what is harvested from it subtracts from the ability of others to do the same. So in the irrigation scheme, if one farmer takes some amount of water, then that water is no longer available to other farmers using the same water resource. It is this characteristic that can lead to the unsustainability of a common-Pool Resource (CPR).

A second characteristic of a common pool resource is the cost of excluding potential beneficiaries from accessing the resource. It is relatively costly to physically exclude potential appropriators from the resource (Ostrom, 1990). Common-pool resources just like public goods face the problem of some beneficiaries being potentially likely to free-ride, that is benefiting or extracting the resource without contributing to the cost of providing, maintaining and regulating it (Ostrom, 2003). It is possible to craft institutions to manage such resources or to exclude potential users. According to Ostrom (2003) such mechanisms of exclusion do not come without a cost but suggests that the governance system of CPR must deal with such costs in some fashion. This means that the very institutions that craft the rules for excluding potential beneficiaries must be able to craft rules to deal with the cost associated with excluding users. However such institutions must be able to deal with the issue of curbing overuse and free-riding. Irrigation water is therefore a common resource since the water within the scheme is shared by a community of users. The water from the reservoir is used by competing stakeholders. The water that is discharged is delivered to the various farmers within the

catchment area and beyond yet it is not easy to exclude other users along the water resource from using it.

4.4 The Tragedy of the Commons and Governing the Commons

In his 1968 work titled “**The tragedy of the commons**”, Garrett Hardin espoused the idea that where a resource was collectively used there was the tendency for its depletion since users were trapped in a continuous overuse and would not make efforts to sustain it. Such a resource was characterised by the issues of free-riders and unsustainability. He intimated that unless an external force such as the state intervened or the resource was privatised the tragedy of the commons will set in, which was ruin to all. (Hardin, 1968).

Hardin illustrates the tragedy of the commons with an allegory of an open pasture where all farmers (herders) can graze their animals. According to him from each herder’s point of view, it is wiser to bring in more animals to graze on the field since the full advantage of grazing extra animals accrue to the herder yet the full cost of stocking the pasture or bringing in more animals is shared by all farmers. In other words the private benefit of grazing an additional head exceeds the private cost, because the cost of maintaining the quality of the grazing field can be shifted to the group as a whole(Runge, 1986).

Hardin argues that since each herder is a rational being they will each bring in more animals in a bit to utilize the full benefits and this will lead to overstocking of the field thus leading to the collapse of the system. That is to say degradation of the system where all the herders suffer. Hardin therefore expressed this when he said: “Freedom in commons brings ruin to all” (Hardin, 1968, p.1244). In proffering solutions to solve or avert the tragedy of the commons and hence prevent a ruin to all Hardin argued for the privatisation of the resource or the government needs to intervene.

This work has since formed the basis for other competing theories regarding common resource management. It has since been pointed out that the property rights regime Hardin referred to was rather “open access” which has no specific rights holders associated with it and not “common property resource”. Since common property resources or the commons are governed by rules and regulations. Other scholars such as Wade (1988), Ostrom (1990), Baland and Platteau (1996) and Agrawal (2001) have since stood against Hardin’s work and have argued and offered favourable conditions for the successful management of the commons. The works of all these scholars is collectively termed by Cleaver (2012) as mainstream institutionalism.

4.5 Mainstream Institutionalism

Eleanor Ostrom's dominant work on mainstream, new institutional school of thought regarding the management of common property resources (Ostrom, 1990) was key in professing solutions to "governing the commons". She has suggested some "design principles" which she argues after some scholarly work could form the basis for the management of common property resources. The principle is that if the secret of a long enduring or sustainable common pool resources management systems are known then it is possible to design local institutions for resource management (Ostrom, 1990).

One of the key pillars of mainstream institutionalism is the 'design principles' which entails a set of essential elements that are key to the functioning of robust and enduring institutions for the management of common property resources.(Cleaver,2012;Ostrom,1990;Venot,2014). Ostrom contends that there have been numerous cases where users have successfully crafted governance systems to sustainably manage their resources collectively (Ostrom, 1990). The characteristics of the robust and enduring institutions termed design principles by Ostrom (1990) will form the bases for the discussion of this work in an attempt to examine robust and enduring institutions for communal irrigation management in the upper east region. These principles are more or less tilted towards viewing institutions as formal arrangements involving the codification of rules and regulations and strong adherence to the system of sanctions against free-riders (Cleaver and Franks, 2005).These design principles range from clarity of resource boundary and community of users, appropriation rules, rules for collective action, systems of sanctions to nestedness or relationships among water users. These design principles will then be juxtaposed with critical institutionalism when analysing the data collected from the Vea Irrigation Scheme in the upper east region of Ghana. In the following pages I proceed to outline the design principles required for the sustainable management of common property resources.

4.6 Institutional Design Principles for Robust Institutions

4.6.1 Clarity of the resource boundary and the community of users

Ostrom argues for the delineation of a clear boundary of the resource unit and the individuals or users who have a right to withdraw units from the common resource. This she sees as the first step in managing common property resources. The definition of a clear boundary for the resource unit itself and the community of users makes it possible to know what is being managed and for whom(Ostrom, 1990).This will serve as an incentive for collective action since it will provide the basis for enclosure of the resource and exclusion thus making it easier

to trace those who benefit from the resource unit. The clear boundary will also ensure that the actions and inactions of others do not destroy the resource. At least it establishes the jurisdictional integrity of collective use arrangements (Cleaver and Franks, 2005; Ostrom, 1990). According to Wade and Ostrom, resources that have well-defined boundaries are most likely to be better managed (as cited in Agrawal, 2001, p. 1659).

The boundaries should be defined by the resource users themselves and not external officials. This may give them the opportunity to have more knowledge about the system and to better monitor it. Defining the boundaries curtails the problem of free-riding since accepting in the first place to take part in determining ones membership will go a long way to develop trust and reciprocity. This principle gives room for participants to know the set of people to cooperate with.

4.6.2 Rules on appropriation and provision

This principle relates to the proportionality of benefits and costs to users. For a CPR the rules should allocate benefits to user and these benefits should be proportional to the inputs of the users. Therefore, for a sustainable CPR the rules should outline how the unit of the resource should be taken. Farmers, for example, should know how much water they can use, when to use that water and how (Ostrom, 2009).

The rules on the other hand should also spell out the cost of appropriating the resource units. Farmers should then know the costs of operating the system on them. This may include the efforts they put in to maintain the system.

This principle promotes the sense of equity and therefore provides the incentive to cooperate. Farmers as rational beings will assess the cost of the system on them as against the benefits that accrue to them. If some farmers realise or feel they pay high cost but get less benefits while others pay less cost but get high benefits then they may not adhere to the rules. This design principle is aimed at enhancing the sustenance of the resource.

4.6.3 Rules formulation and collective action

This principle emphasises the need for individuals who are associated with a resource to participate in formulating and modifying rules that affect them. Once users are able to participate in making and modifying the operational rules they are able to tailor these rules to fit the local circumstances (Ostrom, 1990; Ostrom, 2005; Ostrom, 2009). This makes it possible to consistently revise and modify the rules in accordance with changing conditions as opposed

to officials remotely located from the place who may not be familiar with these changes. The cost of changing these laws should be kept relatively low. When users devise the rules they have a better understanding of them and hence a higher sense of compliance.

It is noted that some local common property institutions empower some local elites to craft some of the collective action rules. It is argued that the policies adopted in these circumstances tend to benefit the elite instead (Ostrom, 2009). This will defeat the second principle which requires the rules-in-use to proportionally allocate benefits and costs.

4.6.4 Monitoring

To ensure sustainable and proper functioning of a CPR there should be effective monitoring of the resource use and compliance with the rules-in-use (Cleaver and Franks, 2005; Ostrom, 1990; Ostrom, 2009). The monitors actually function to check conditions of the resource and to ensure appropriate behaviour. Ostrom suggest that the monitors should be accountable to the appropriators or are the appropriators. Monitoring enables the acquisitions of information regarding instances of cheating and free-riding (Cleaver and Franks, 2005). Ostrom (2008) stresses that an official position for local monitors be created and that this will absolve the resource regime from relying on norms of local right-holders to sanction violators. Monitoring allays the fears of user that some people are taking advantage of the system. This invariably promotes cooperation.

4.6.5 Graduated sanctions

According to Ostrom (1990), appropriators who violate the operational rules should be apportioned graduated sanctions depending on the gravity and context of the offence. These sanctions should be imposed by other appropriators or officials accountable to these appropriators or both (Ostrom 1990). The graduated sanctions notify users that the system is holding everybody accountable.

4.6.6 Conflict Resolutions

This design principle calls for low-cost but rapid arena for conflict resolution among users or between users and official. The rules crafted by the users themselves could in practice face different interpretations by users. Having simple, rapid and low-cost mechanisms for resolving conflicts help reduce the number of conflicts that reduce trust and conversely ensure robustness of the system.

4.6.7 Relationship among water users

“In any irrigation system, location is an important variable...” (Yuling and Lein, 2010, p.126). This statement succinctly captures the design principle on nestedness of institutions. According to Ostrom, appropriation, provision, monitoring, enforcement, conflict resolution and governance activities are organised in multiple layers of nested enterprises (Cleaver and Franks, 2005; Ostrom, 1990, 2009). This principle posits that each layer or level deals with similar issues from progressively smaller scale in detail to a larger scale in less detail. In the irrigation system for example farmers at the field level are smaller in number but share a much closer bond as they negotiate with one another face-to-face on daily basis. Farmers at this level of nestedness share common problems which may differ from those at the secondary canal level and primary canal level. There is the need to establish rules for each of the levels or else an incomplete system will be produced which may lead to the unsustainability of the system.

Having presented mainstream institutionalism and how they perceive resource governance I will proceed to present the rival theory which is critical institutionalism. One of the dominant critical institutionalists is Frances Cleaver. It should be noted that though these theories present competing ideas about the governance of the commons they sometimes agree with each other (Hall, Cleaver, Franks, & Maganga, 2014). For example they both agree that rules are important in natural resources management but they interpret rules differently. While mainstream institutionalists see rules as seeking to regulate use and exclude outsiders Critical Institutionalism interprets rules in a complex fashion and thus seeing rules as existing to potentially promote access to the common (Hall et al., 2014).

4.7 Critical Institutionalism

Critical institutionalism (CI) draws its root from the critical realist thinking which holds the view that there is diversity in social phenomena. It hinges on the broad focus on the interaction between natural and social worlds as opposed to the perceived narrow gaze of mainstream institutionalism on predicting and improving outcomes of particular institutional process (Cleaver, 2012). Critical institutionalism argues that institutions operate sporadically through a mix of informal relationships and formal structures to become robust whereas Mainstream Institutionalism equates robust institutions with clearly defined formal structures. According to Critical Institutionalism institutions that manage natural resources are not explicitly crafted for such purposes since such institutions are multifunctional and dynamic in nature which does not make them susceptible to deliberate crafting or design (Cleaver, 2000). Institutions are

therefore seen as a mix of both formal and informal, traditional and modern processes (Hall et al., 2014) which are intermittently drawn to govern natural resources. Institutions according to Cleaver (2012) encompass various degrees of formality such as committees, associations and user groups. Their interactions are therefore expressed in social networks.

Critical institutionalism examines how institutions in a dynamic fashion mediate the relationship between people, natural resources and society and emphasizes that institutions are complex and intertwined with every day social life. It questions the rational choice assumption as held by mainstream institutionalism which sees people as rational being who will cheat and free-ride in the absence of rules. It further recognises creative human actions which are necessary in shaping resource governance. It is the view of critical institutionalism that it is not possible to craft rules, define boundaries of resources for the governance of natural resources.

They argue that resource governance is associated with complex multiple identities, unequal power relations as well as wider geo-political factors which give direction to outcomes hence it is difficult if not impossible to deliberately craft rules for resource management (Bruns,2009;Cleaver,2012;Cleaver and De Koning,2015;Cleaver and Toner,2006).

Institutions therefore may not deliberately be crafted for a particular purpose but just happen to be randomly adapted from other arrangements that work. A mix of factors such as economic, socio-cultural and moral issues influence people's motivation to undertake corrective arrangements (Cleaver, 2000; Cleaver and De Koning, 2015). There is therefore a complex link between institutions and outcomes.

Institutional bricolage is one of the major concepts of critical institutionalism. The term refers to the process by which people consciously or unconsciously patch together institutional arrangements from whatever resources that are available irrespective of their originally intended purpose (Bruns, 2009; Cleaver, 2012; Cleaver and De Koning, 2015; Cleaver and Franks, 2005). In this case resource governance involves drawing from materials available and making resourceful use of such materials. By this process new arrangements are formed while old arrangements are rehashed to fit new needs. Mainstream institutionalism employs the bounded rationality model which perceives the way individuals shape institutions and how institutions in turn shape individuals in a utility based perspective (Cleaver and De Koning, 2015). But critical institutionalism argues that a range of factors influence peoples choices.

4.7.1 Resource boundary and the community of users

Critical institutionalism rejects the view that the boundary of a resource or the community of users can be clearly defined. It argues that resource boundaries are fluid making it difficult if not impossible to demarcate them. This implies that the community of users of a resource is not easy to clearly define since user communities may rely on social relations such as kingship to draw resources from outside the perceived boundary (Cleaver, 2012). The definition of a hydrological boundary may appear highly unnecessary to local users especially where the interaction between land and water cannot be divorced (Cleaver and Franks, 2005). Land and water resources are laden with social realities and hence transposing strict resource management boundaries over the existing structures might not take into consideration the social realities regarding resource use (Cleaver and Toner, 2006; Cleaver and Franks, 2005).

4.7.2 Rules Formulation

Unlike mainstream institutionalism who are rule-oriented (Cleaver, 2012) and contend that rules strictly seek to regulate use and thus exclude outsiders critical institutionalism argues that rules may potentially serve to enhance access to resources depending on a mixture of variables but that farmers do not deliberately craft rules to govern resource use (Cleaver, 2012). Critical Institutionalism argues that communities are not composed of homogenous people and identities (Hall et al., 2014) and hence question the rationale for deliberately crafting rules since their fairness will be in doubt. They also argue that the heterogeneity of communities imply that it is difficult to produce rules for resource governors. Furthermore, there are different power relations and identities within communities and this does not produce a level playing field for rule formulation for collective action. Poor and marginalised farmers for example may be excluded from rule formulation while powerful but wealthy farmers and local elites may dominate in the rule formulation process. Critical Institutionalism therefore believes that the rules that govern resource use are invisible and tend to surface with everyday life and practice.

4.7.3 Monitoring and Sanctioning

Mainstream institutionalism visualises the formulation of collective rules cum application of sanctions for rules breaking as essential to effective action (Cleaver, 2012). Critical institutionalism contends that it is not easy to monitor the management of natural resources like water since they are complex. Monitoring is not a cost free venture for participants and resource users (Cleaver and Franks, 2005). Monitors may lack the required resources to accomplish the task of monitoring since there are multiple resource users with varied identities and power.

Also, since there are unequal power relations among water users, monitoring may not apply fairly to all. Accountability of monitors as proposed by mainstream institutionalism cannot also be guaranteed. On the sanctioning of resource users who break the rules of collective action, critical institutionalism argues that this approach is adversarial. Negotiated reconciliation is therefore advocated by Critical Institutionalism (Cleaver and Franks, 2005). Sanctions cannot be applied without taking into consideration the social circumstances of resource users.

4.7.4 Conflict resolution

According to critical institutionalism, people relate with natural resources more than just simply as resource appropriators but with diverse social identities (Cleaver, 2007). People share more than just water but multiple resources (Schnegg & Linke, 2015). The sharing of water and land cannot be divorced from the sharing of ancestry, kinship, history, food to mention a few (Schnegg & Linke, 2015). Therefore, the existing social networks are the most preferred avenues for resolving disputes (Cleaver and Franks, 2005; Lecoutere, 2011). Formal avenues for conflict resolution are usually the last resort after the social forms of conflict resolution had failed. The social forms of conflict resolution are mostly relaxed and often attract generous interpretations from arbiters. They are more reconciliatory than adversarial (Cleaver and Franks, 2005). Conversely, most resource users prefer conflict avoidance to conflict mediation (Lecoutere, 2011).

4.7.5 Nestedness of institutions

On the nestedness of institutions, critical institutionalism sees institutions as being nested in multiple but complex overlapping processes and practices of social life and layers of meaning (Cleaver, 2012). Institutions are seen as embodiments of social processes which can ensure that things work locally which could then make them replicable in line with dominant world views. It recognises both vertical and horizontal interlink of institutions.

4.8 Analytical Framework

The analysis of this thesis is woven around a framework which provides the linkages to the various variables involved in the management or governance of communal irrigation. The framework was adapted from Ostrom (2007). She identifies the settings in which resources are located as economic, social and political settings but failed to recognise the ecological setting as identified here. Ostrom failed to explicitly identify institutions and governance systems within the framework. The framework as used here views irrigation or resource management as a complex system involving multi-faceted interactions and relationships among variables.

In the first place the framework identifies four settings-economic, political, socio-cultural and environmental within which every resource system is situated.

This component is premised on the fact that different settings will result in different insights into the behaviour of people in respect of natural resources .The settings provide various perspectives in line with the diversity of people and their values thus throwing more light into their understanding of natural resources. These settings make it possible to capture the complexities and important attributes (Hearnshaw et al., 2014) of the communal irrigation issues in the area and hence providing a comprehensive analysis of the issues in the system.

To get an understanding of the communal irrigation system in the region it has to be understood that the system is situated within a certain environmental ,political, economic or socio-cultural context which could invariably have an influence on the system and hence may distinguish it from other systems. Ostrom for example stressed this after studying a range of case studies of common pool resources. She noted some similarities among the case studies-the fact that they were all situated in complex environments (Ostrom,1990).She pointed out the need for taking into account the specific attributes of the related physical systems, cultural views as well as the economic and political relationships that exist within the system (Ostrom,1990;Ostrom,2005).Yuling and Lein (2009) in writing about water pricing in Xinjiang,China stressed this when they indicated that water management is deeply rooted in the political, social and economic conditions of the state. It should however be noted that these settings do not exist individually but that they are interrelated and interdependent and hence interact with one another. These settings invariably also interact with the other components in the system such as the resource base, governance systems, institutions, users and outcomes.

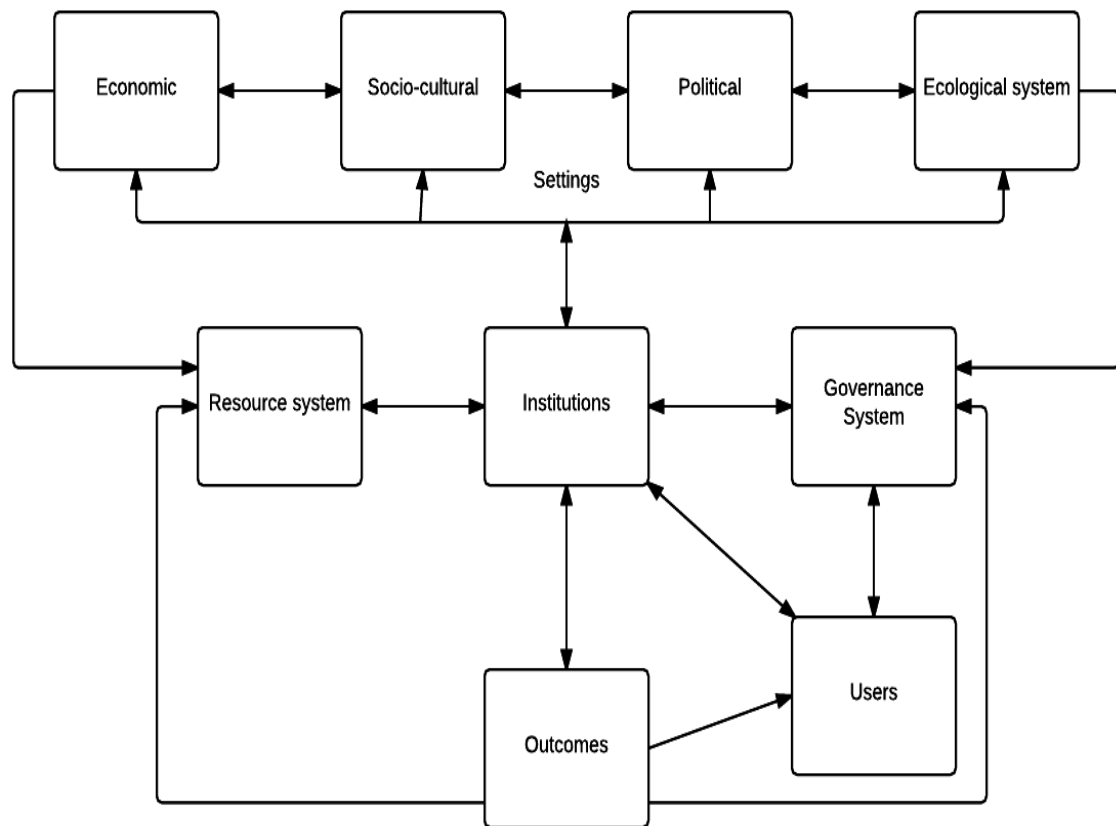
The framework also identifies governance systems which captures the actors and their relationships and how these relationships help in shaping policy (Pahl-Wostl, 2009).The governance component captures the full complexity of the processes of regulation and management and the actors and networks that play roles in the formulation and implementation of environmental policy (Pahl-Wostl, 2009). The governance regimes are strongly linked to the institutions whose strengths go a long way to impact on resource governance.

Institutions are central to this framework since they tend to form the arrangements, provide the medium of interaction for the various components within the system, mediate the roles and generally provide the pathways through which both individual and collective action is shaped (Cleaver, 2012).To understand the behaviour of people there is the need for an analysis of

institutions since they are the shells within which people are contained. They capture the networks that exist within the system and how these networks function to enable or constrain access to the resources.

This framework also recognises people, captured under users, as being important in the management and governance of resources. It recognises that resource management is a product of the way people behave and interact with natural resources (Hearnshaw et al., 2014). Therefore, the complex interrelationships between people and resources is responsible for shaping natural resources outcomes in temporal terms (Hearnshaw et al., 2014). All these interrelationships among the various components must produce an outcome and this is what is found at the base of the framework. These outcomes could be negative or positive and could relate to the ecosystem as well. The outcome do not stand in isolation but are also linked to the resource system, the users, the institutions and the governance regimes. The outcomes produced therefore serve to provide a feedback to the system by interacting with the other components of the framework. It is my view that the study and analyses of any institution is incomplete without assessing how it impacts on the users or actors in particular. This explains the need for the third research objective which is concerned about the impact of the irrigation system on the livelihood of farmers and is therefore captured by the ‘outcome’ segment of the framework.

The diagram below illustrates the framework which places institutions at the centre of resource governance and indicates the complex interrelationships between institutions and users, governance systems, resource system, settings and outcomes.



Adapted from Ostrom (2007)

Figure 5: Analytical Framework

The framework is key to this work because it makes it possible to identify the various components that interplay in the management of the communal irrigation scheme. Also, the framework affords the analysis of the interrelationships between the actors in the irrigation system, the governance regimes and the institutions while on the other hand taking into account the social, cultural, political, economic and environmental issues on the ground which directly or indirectly go a long way to influence the management of the communal irrigation system. The framework, considering the fact that it contains multi-faceted perspectives about natural resources management will therefore function as a vehicle for achieving the objectives of the research.

CHAPTER 5: METHODOLOGY

5.1 Introduction

This section discusses the methods that I employed to collect and analyse the data. As Tracy (2012) states: “The methods section details the context, the participants, the researcher’s role, the participation level, and the data collection and analysis procedures” (Tracy,2012 p.100). In this section I therefore explain the various methods that were used to collect the data and why such methods were used. I also present the various research participants, the data analysis process and also ethical considerations undertaken during the research process.

5.2 Field Work

The field work process lasted for two months from end of June to mid-August, 2015. The period coincided with the peak of the rainy season and so it was quite challenging since the frequent and heavy rains made mobility difficult. There were certain times that scheduled interviews had to be re-scheduled because of rainfalls. This period did not correspond with the period of dry season farming and so farmers were met rather undertaking wet season farming. The fields were however in use by farmers and the canals were rather occupied by rain water. Nonetheless the objectives of the research were achieved since I was able to engage the research participants and collected the necessary information needed. The researcher was already familiar with the area and some parts of the scheme. The researcher had to engage a research assistant to help in the research process. The research assistant was helpful in helping organise focus group discussions as well as locating research participants for interviews. The research assistant was also helpful in taking complementary field notes at the Focus Group Discussions which were later compared with my own notes.

5.3 Selection of study area

The Veia Irrigation scheme in the upper east region of Ghana was selected for the study. Purposive sampling technique was used to select the communities for the study. Three villages along the Veia irrigation scheme were selected. Purposive sampling technique was used because in irrigation location is a very important variable (Ostrom, 1990; Yuling and Lein, 2010). That is to say the spatial location of farmers along the scheme, whether upstream, midstream or downstream play a key role in their practices and experiences. To get a true picture of what happens within the scheme villages were purposively selected so that one community was selected at the upstream, middle stream and downstream. Veia village was selected from

upstream or head end, Nyariga village at middle stream while Sumbrungu village was selected for downstream and tail end.

5.4 Sampling Techniques

The snowball sampling technique also known as chain referral was used in selecting research participants. This is a technique whereby one participant is used to help recruit another who in turn helps the researcher to get in touch with another participant (Bryman, 2012; Clifford, French, & Valentine, 2010). To recruit research participants I had to make contacts with farmers from the project area and they referred me to other farmers they thought would be able to contribute immensely to the research process.

I used the snowball sampling technique because the farmers live and practice together and therefore knew each other better and hence knew who could best give in-depth information about the phenomena under study. According to Crang and Crok (2007, p.14) in selecting the research participants for one's study: "it is not the sheer numbers, typicality or representativeness of people approached which matters, but the quality and positionality of the information they can offer".

In line with this, the farmers were able to recommend other farmers they thought would be helpful in providing quality information regarding the issues. In engaging the Chain referral technique, I was however cautious of the fact that a weakness associated with this technique is that the chain of referral could be skewed towards a particular group of farmers with similar view points. So, I tried to ensure that key informants were not drawn from only one group of farmers.

In some cases, convenient sampling was adopted where the need arose. Convenient sampling is a situation where a researcher interviews a research participant by virtue of their availability. In this case I interviewed farmers I met without any prior arrangement to interview them. This arose because there were instances that farmers expressed interest in taking part in the interviews whenever they got to know the essence of the research and the fact that they wanted their views and voices to be heard in anticipation that it could one day help in improving the scheme.

5.5 Profile of research participants

The research participants in this study were largely farmers. They practice irrigation for commercial purposes and sometimes they cultivate crops in the wet season for subsistence

purposes. They were largely people with mixed levels of education .The majority of them have not had basic education but some research participants were teachers and other professionals. The ages of the research participants ranged from 19years to 65 years. Participants in both the interviews and focus group discussions for this research were aged between 22years and 53 years. The irrigation system is a male-dominant activity. Females are mostly people who are assisted by their relatives or husbands to undertake irrigation.

Table 3: Summary of Study communities, data collection instruments and number of research participants

Community	Research Method	Number of participants	Sex	
			<i>Males/</i>	<i>Females</i>
Vea	Interviews	8	6	2
	FGD	11	11	
	Key informants	2	2	
Nyariga	Interviews	8	4	4
	FGD	5		5
	Key informants	2	2	
Sumbrungu	Interviews	5	4	1
	Key informants	2	2	
ICOOR Officials	Key informants	5	5	
Total		Interviews(32)	Interviews(25)	(7)
		FGD(16)	FGD(11)	(5)
			(31)	(12)

5.6 Choice of Methods

Methodology is concerned about the broader reflections and debate about the general ‘principles of reasoning’ that determine how questions are to be posed and how answers are to be determined. Methodology is the very cog upon which the entire research process rests (Bailey, 2007).To generate answers to questions posed by the researcher one has to employ a research method(s).

In this research I employed qualitative methods in collecting the primary data .Qualitative research is a type of research strategy which emphasise the use of words in the collection and analysis of data (Bryman, 2012).A major critique of qualitative method has been that it is subjective but one must not lose sight of the fact that qualitative method is: “built on the common core assumption that reality is socially constructed and that subjective meaning is a critical component of knowledge building”(Hesse-Biber,2010,p.63).Qualitative methods according to Limb and Dwyer (2001) are useful if we are interested in multiplicity of meanings, representations and experiences. Qualitative methodology hinges on the principle that the world is not static but is constantly changing. According to Limb and Dwyer (2001, p.25) “qualitative methods presume the world to be an assemblage of competing social constructions, representations and performances”. Qualitative methods have the capacity to generate answers to complex experiences and the contexts within which they occur. Qualitative methods are therefore, able to capture the experiences of people in the setting within which they are situated. This explains why Sayer and Morgan (1985) as cited in Clifford et al,(2010,p.104) refer to them as intensive methods of research since they delve deep into processes and social relations constituted in geographical patterns. Irrigation and water management is a complex phenomenon with multiple and diverse stakeholders and experiences. Moreover, irrigation entails a range of activities which have social dimensions. I employed qualitative methodology because it is best placed and able generate an in-depth understanding of the meanings, interpretations, experiences and behaviour of the farmers in the environmental, economic and social worlds within which they operate. The main aim of this study is to do institutional analysis of irrigation and this involves obtaining information from the farmers who operate within the scheme and at the same time the irrigation management authorities who are in charge of the management of the scheme. This means there is the need for an in-depth interaction with these research subjects. The main Qualitative research techniques used for this study were interviews and Focus Group Discussions. Informal conversations and Field Observations were also used.

5.6.1 In-depth Interviews

Interviews were the cardinal research instruments employed for this study. An interview is a face-to-face interaction between the researcher and the research participant. The primary goal of interviews is to answer questions regarding the way practices, events, experiences and knowledge is constructed and performed within space (Gomez & Jones III, 2010).Interviews are mostly used for studies in which the research participants are “experts” and the researcher

hopes to learn from them how certain practices ,experiences and institutions function (Gomez & Jones III, 2010). The interviews were basically individual interviews which were in-depth and semi-structured. Semi-structured interviews are types of interviews where the researcher has an incomplete script as an interview guide and which gives room for improvisation (Myers & Newman, 2007).

An interview guide was prepared as a general guide for interviewing the research participants. The essence of the interview guide as Tracy (2012, p.139) puts it: “is meant to stimulate discussion rather than dictate it “.The interview guide was semi-structured and contained some questions that served as a guide to the researcher. The questions were open-ended and this was to give the research participants the lee way to go into details about their experiences. The questions were however framed in such a way that follow up questions were asked where there was the need for further clarifications of issues by the research participant. The interviews made it possible for the researcher to get a deeper understanding of issues within the scheme.

The interview questions were written in English but since the researcher understood the language of the farmers he asked them in the local language. Each interview lasted about an hour. There were however some few research participants who preferred to be interviewed in English and so the researcher interviewed them in English.

The research participants for the interviews composed mainly farmers and officials of the Irrigation Company of the Upper Region (ICOIR). Some farmers were marked as key informants and identified for the interviews. These were farmers who also served as leaders of the farmer based organizations or farmers who had some special knowledge on irrigation practices.

A total of 32 research participants were selected for the interviews. Among the 32 research participants, 21 farmers were interviewed, 6 key informants and 5 ICOIR Officials also as key informants. There were 20 males and seven 7 females. The table below shows the breakdown of the communities, data collection tools and the number of research participants. The interviews were basically individual interviews. The 6 key informants who were interviewed were either farmer leaders or farmers who were identified as having much experience, knowledge or special skills about irrigation-related issues in the area.

The 5 ICOIR officials who were interviewed were all males and comprised three 3 Officials at the Veia Project office and 2 officials from the head office at Tono.

The interview settings were mostly organized at the instance of the research participants. A tape recorder was used to record some of the interviews while in some cases notes were taken by the researcher during the interview.

At the Vea Project office I had to interview two deputy managing directors. Due to the restructuring of ICOUR a new deputy MD had taken over from the outgoing one who was being retired. As of the time of the research the outgoing deputy managing director was preparing his handing over notes so he could go on retirement but since he had managed the scheme for a long time his input in terms of information was necessary.

When I visited the Vea project with my letter of introduction to interview the officials I was directed to seek clearance and approval from the head office at Tono where the Managing Director operates from and which is located about 45km away from the Vea scheme. At some instances there were also some information the Vea office did not have or said they could not provide so in those instances I had to move back to the head office at Tono.

5.6.2 Focus Group Discussions (FGD)

Focus group discussions were also used to generate information for the study. A focus group is a group of people who meet usually in an informal setting to discuss a topic that has been set by the researcher (Clifford et al., 2010). Focus groups are key means through which the researcher can study how people work out their thoughts and feelings about a certain matter in a social context (Crang & Cook, 2007). In this case the researcher sets up, as Crang and Cook (2007, p.90) put it: "...a situation in which groups of people meet to discuss their experiences and thoughts about specific topics with the researcher and with each other".

I employed the focus group discussion because I wanted farmers to share their experience and give better explanation of the issue under study. The study was aimed at studying among other issues such as gender dimensions in irrigation and also examining the impact of irrigation on farmer's incomes. Therefore, there was the need for a discussion of the various farming activities and practices, the cost of undertaking such practices and the various individual experiences that farmers might have encountered in irrigation. Bringing farmers together in a focus group discussion made it easier to study such issues and also made farmers bring up aspects that other farmer would have inadvertently forgotten.

Two focused groups were organized. One at Vea which was made up of only male farmers and the other at Nyariga which was made up of only women. The women FGD was organised in

order to assess women participation in irrigation. It was therefore meant to find out issues regarding ownership of land, use, management and transfer rights as well as how these relate to women within the scheme. The discussion was also meant to discuss women's role in irrigation among others. This FGD included five (5) female participants.

A semi-structural interview guide made up of open-ended questions was prepared and used for this group discussion. Only women were selected for this discussion because I assumed the fact that women understood gender challenges better within the scheme. Another reason for organising only women in the group discussion was that looking at societal norms in the area, men tend to dominate in public discussions and women are not expected to be out-spoken in public discussions involving men and women.

According to Gomez (2010, p.199) a focus group is: "useful in generating empathy and understanding for different people and ideas, beyond simple pre-conceptions". During the discussion women were able to speak freely and gave their personal experience and some injustices they went through in relation to land issues within the area. One woman explained how the relatives of her late husband attempted to take over her land because she had no male child to inherit the lands. This particular case I thought would be difficult for a woman to say in the midst of men.

The focus group discussion did not, however, last the period envisaged because it was interrupted mid-way by rainfall and had to be hurriedly concluded. I could not reschedule another meeting because of time constraints, the difficulty of organizing women at this time of the year (due to farm work) and the possibility of not getting the same participants back. In all the FGD was successful since some answers were generated which nonetheless helped in the writing of this work.

The second FGD was organized at the Vea and had 11 discussants. This group discussion was aimed at addressing the third research question. That is the impact of irrigation on the farmers' incomes. Since the practices involved in irrigation within the area were complex and varied there was the need for this discussion so that the farmers could share their experiences. The differences and similarities in the practices were therefore brought out during the discussion. These were issues that related to the type of crops and the practices involved in cultivating them. The cost involved in the various practices and how certain farming practices were done to reduce cost, improve productivity among others. During this focus group discussion issues that I was not very clear of during the individual interviews were also brought in for discussion

for further clarity. For example the profile of farmers in the area such as the age ranges and issues about traditional beliefs in the area and how they relate to irrigation were discussed.

This FGD was highly successful and insightful since farmers passionately spoke out about the issues that related to irrigation and to which this research was investigating. The setting of the group discussion was chosen by the farmers and the researcher invited to that venue. The setting was therefore very suitable to the research participants and this made them more comfortable and gave them an opportunity to speak freely. It was also probably because the researcher served as an insider researcher in this community hence the farmers had no difficulty in expressing their thoughts.

In organizing the FGD I contacted one of the farmers who was familiar to me since I had taught him in the junior high school some years back. This farmer therefore, was key in organizing the FGD. I was however, cautious of the fact that there were some challenges associated with being an insider researcher. The fact that the researcher could be blinded by some assumptions that he/she might overlook by virtue of his/her familiarity with the area under study (Tembo, 2003).

Since the farmers belong to some farmer based organizations the research participant suggested that he could have organize members of his FBO but I rather insisted that the group should be composed of farmers from different farmer-based organizations. The thinking behind this suggestion was that organizing farmers of the same group would make the focus group overly homogeneous and will at the same time not reveal the varied experiences the research participants would have had. Since they belong to the same group they would have similarity of experiences than if they belonged to their farmer organizations.

The focus group discussion was able to reveal the power relations that existed within the system. In some instances, farmers who did not explain the event and processes well were interrupted by some farmers while some of the farmers within the discussion would suggest another farmer explains an issue or process since they thought such a farmer had more experience and expertise and could give a better picture of the issue. During the discussion one farmer for example appeared drunk and so his account of issue were mostly challenged by the others but he would insist that I note his point since it was very important. The discussion ended on a good note and the discussants were happy that they each contributed to the discussion. The participants were given some money for refreshment at the end of the discussion.

5.6.3 Field Observation

I also undertook some field observations around the scheme. Irrigation is a physical activity and to get a better understanding of the system I had to go around some sections of the scheme. The interviews with the farmers revealed some complex explanations involving farm lands, plot sizes, canal network, water distribution network, stream systems, among others. There was therefore the need to have a fair understanding of the explanation and how the system works. At Vea which is located upstream I was guided by some farmers round the area and the main canal, secondary canals and tertiary or laterals explained to me. They also explained to me how the plots sizes were determined how water is delivered onto the field among others.

At Nyariga and Sumbrungu which are located midstream and downstream respectively I also went round to observe the farm plots. At Sumbrungu another farmer also went round some of the areas with me and explained the system to me. The field observations apart from giving me the opportunity to understand the whole layout and operations of the irrigation system, also gave me the chance to take pictures of the area. Some of the farmers also did a sketch of the irrigation area showing the layout of a typical field. The field observations together with this gave the researcher a better picture of the scheme. The diagram below shows the layout of the fields (plots) within the area as sketched by farmers.

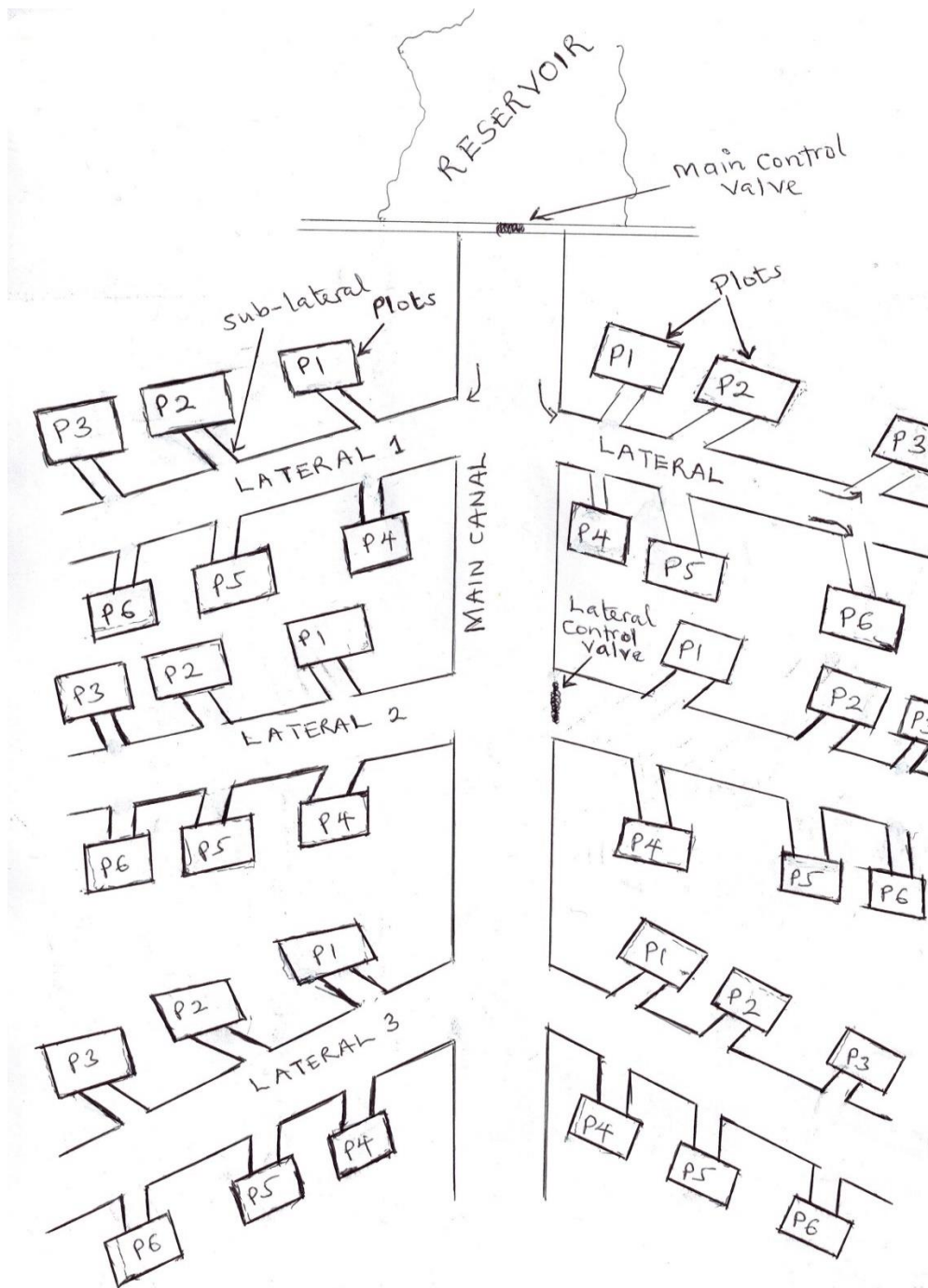


Figure 6: A typical layout of fields (plots) in the Vea Irrigation Scheme as illustrated by farmers. The scheme layout. From figure 7, the water is opened from the reservoir which is located upstream. The water flows through the main canals. There are two of such canals-the left and right canals. From the main canal the water flows into the laterals (secondary canals). The laterals are labelled lateral 1, 2, 3 etc. There are 63 laterals within the scheme. Each lateral has a lateral leader. Within each lateral there are sub-laterals (tertiary canals) which feed the individual farms or plots

5.6.4 Informal conversations

These were interviews that were held outside the normal scheduled interviews. The informal conversations were unrecorded and no interview guide was followed. These conversations were held with some of the research participants but outside the scheduled interviews while some were held with farmers and other people I happen to come across in the area and other people I thought knew something about the issues under investigation. The informal conversations were particularly instrumental in giving the researcher an insight into issues that needed to be incorporated into the discussions and also in locating the research participants. At Nyariga in particular I had a number of casual conversations with people regarding the impact of irrigation on the incomes of farmers, some of the agricultural practices and how water is managed in the irrigation scheme.

Though these conversations were a minor part of the data collection instruments they nonetheless contributed to understanding issues within the area and by capturing certain issues that the research participants had inadvertently failed to mention.

5.6.5 Secondary Sources

This study made use of a few secondary data sources. Some official documents were obtained at the ICOUR office and the necessary information extracted for the purpose of this study. Quarterly reports were particularly important as they helped the researcher to obtain information on crop types cultivated, production trends, number of hectares cultivated per year among others. Other documents also contained information about the state of the scheme, practices within the scheme, management issues and the profile of the scheme. For the quarterly (annual) reports I was however not allowed to take them away for a detailed study but required to extract the information needed at the ICOUR office. I also obtained the layout map of the scheme from the ICOUR office. The secondary sources were vital as they provided additional information about the issues under study and thus complemented the primary data obtained. I however had to crosscheck some of the information received through the secondary sources with other secondary sources such as books, articles, reports, journals among others.

5.7 Data analyses

The data analysis stage is basically concerned about reducing the volume of information which the researcher has gathered so that sense can be made of it (Bryman, 2012). According to Tracy (2012:200) data analysis can take place at different stages of the research process but the focused analysis stage is made up of several primary activities. The data analysis of this work

was messy, complex and tiresome since a variety of methods including interview, focus group discussions, informal interviews, observations and secondary sources were used to collect the data. The data analysis process was therefore not a straight forward one but one that involved going forth and backwards.

In the first place I had to read through all the field notes that were taken such as those from interviews and focus group discussions as well as listen to the audio recordings from the interviews. The audio recordings were then transcribed into textual form.

The data was then coded. Coding refers to the process by which data is labelled and systematized (Tracy, 2012). In this case themes were created and the data placed under each theme. With the interviews for example the data was divided into themes which loosely were based on the design principles by Ostrom. For example the design principles included: clarity of boundary of the resource, rules on appropriation and provisioning, rules formulation and collective action, monitoring and graduated sanctions, conflict resolution mechanisms. These were used as themes and so questions were asked under each of these themes during the interview guide design. This made it easy to fit answers into the themes. The responses of the research participants to the questions were then placed under each theme. During the interviews some key statements participants which were not part of the themes created in the interview guide design stage but stood out were also put into themes. The analysis was then done based on the themes but the researcher still had to go forth and backwards to read over the transcribed materials and the coded text in order to ease the analysis.

5.8 Ethical considerations

According to Dowling (2000) ethics in general is seen as the conduct of researchers and the responsibilities and obligations that they have to those involved in the research, including the subjects of the research. Ethical issues arise at various stages in social research (Bryman, 2012). According to Bryman (2012) ethical issues cannot be ignored in research since it relates directly to the integrity of a piece of research. In the course of this research I had to take into consideration some ethical issues. This research entail asking and preying into issue that have to do with people's lives and how they undertake irrigation among others. This means there is therefore the need to observe some ethical standards. Ethical issues such as informed consent, reflexivity and reciprocity were considered.

5.8.1 Informed consent and confidentiality

Informed consent requires that the research participants be informed of the purpose of the research and their express acceptance of the research sought. “Weak consent usually leads to poorer data: Respondents will try to protect themselves in a mistrusted relationship....” (Miles & Huberman, 1994 cited in Sarah, 2000 p.243). During this research I made sure that research participants participated on the basis of informed consent. In this case before the individual interviews and the focus group discussions they were informed of the purpose of the research, their right to anonymity and even the right to withdraw from the interview or the group discussion if they so wished. Research participants were also be informed of their right to seek clarifications if they were not sure of anything related to this study.

In adhering to the ethical issues I had to also observe the confidentiality of the research participants since some of the issues they disclosed had a bearing on their personal lives. One way I ensured this was to use different names either than the real names of the research participants so as to protect their identities and privacy.

5.8.2 Communal values and Reciprocity

In carrying out the research I had to consider the communal values of the area under study. In line with the cultural values of the people it is very common for people to expect some reciprocity after sacrificing their time take part in a research. In many instances some participants expected to be given some money after the research. With the limited funds available I had to always take a decision as to what to part with. In most instances I had to give them some little money for refreshment after the interviews and focus group discussions since much of their time were sacrificed to participate in this study.

5.8.3 Reflexivity

According to Dowling (2000, p.28), “Reflexivity is a process of constant, self-conscious, scrutiny of the self as a researcher and of the research process”. Reflexivity is largely understood as awareness of the influence the researcher has on the people he/she studies or the topic being studied, while at the same time recognizing how the research experience is affecting the researcher (Probst, 2015). During the field work I was guided by reflexivity. In this case I made sure there was a circular relation between me and the research participants rather than a linear relationship (Probst, 2015) which clearly demarcates a boundary between the research subject and the object. For example as stated earlier in this work one of my focus group organisers wanted to organise farmers from the same farmer organisation for a group

discussion but upon reflecting on the impact this arrangement might have on the outcome of the study I had to suggest that participants be drawn from different farmer groups instead. Also, in an instance I was invited by a research participant to meet at a village drinking pub for an individual interview. While the interview was going on there was this poorly dressed man who was standing some distance away from us. During the interview I asked the research participant if in some instances some farmers sell their lands to others. The research participant said no they do not sell the lands and that they give out the lands to other farmers to farm mostly without charging anything. Not knowing that this man who was standing some distance away was eavesdropping in our interview. So he came over, excused us and told the research participant to tell the truth for he was not being factual since some people in the area had sold their lands before. Though this did not result in any exchange since my research participant ignored him, it however prompted me to be more critical in the answers I got and to compare and crosscheck the information I got. Based on this I had to take some of the issues I asked at the individual interviews to the focus group discussions for more insight.

5.8.4 Positionality

A researcher's position affects the knowledge he/she acquires hence the need to strive for conscious knowledge of the situatedness of one's knowledge (Moser, 2008). According to Dowling (2000), a researcher's ability to interpret certain situations depends on one's own characteristics. Whether the researcher is positioned as an 'insider' or 'outsider' has an influence on the knowledge produced and the research (Dowling, 2000; Moser, 2008; Probst, 2015). An insider is someone who is similar to the research participant in many ways while an outsider differs from the research participants in many respects (Dowling, 2000). There is a debate between outside researchers and inside researchers as to who is privileged to access information. It is argued that inside researchers are able to collect the right information and that their interpretation of the information is more valid than an outsider. This is so because people are more likely to talk freely to them and they are more likely to understand what the people are saying better since they share the similar outlook of the world (Tembo, 2003). On the other hand being an outside researcher too gives the researcher the opportunity to view things from a more objective manner since one is not influenced by the dynamics in the social group. The outside researcher may have the problem of gaining access since they do not belong to the same social group and so will have it more difficult establishing a good rapport with the research participants.

In this research I served as both an insider and an outsider and this was to enable me exploit the insider advantage while at the same time making it possible for me not to overlook some issues I might overlook by studying a community I am familiar with. Three communities were selected for the research and these were Vea, Nyariga and Sumbrungu. I had worked in Vea for three years and hence served as an insider in this community. The problem of access was therefore not a challenge in this community since I was familiar with some community members and also had a fairly better understanding of the practices and experiences within the community. In this community it was much easier for me to locate research participants and organise focus group discussions. In the other two communities I served as an outsider since I was not so familiar with the communities. Overall all the three communities spoke the same language to which I also spoke so this position gave me a better understanding of issues since I did not have to pick a translator.

CHAPTER 6: IRRIGATION INSTITUTIONS AND WATER MANAGEMENT

Social problems are never solved. At best they are re-solved-over and over again (Rittel and Webber, 1973, p.160)

6.1 Introduction

This chapter presents the findings and analysis on the institutions that govern irrigation. It seeks to examine the extent to which water governance within the scheme conforms to Ostrom's design principles. In line with addressing this research question a link is drawn between the findings and discussion with the theoretical framework described in chapter 4.

During the analysis, critical institutionalism is drawn in then juxtaposed with critical institutionalism to ascertain if the findings confirm Ostrom's design principles. A brief theoretical background showing the main arguments of these theories is presented at the beginning of each principle before proceeding to present the findings and analysis under each design principle.

The findings include the views of farmers within the scheme and the irrigation authorities. These findings were obtained using interviews, focus group discussions, informal conversations and field observations and references will be made to these sources of data collection as they relate to the findings being presented.

6.2 Clarity of Resource Boundary and Community of Users

The land I use was rented to me by the land owner. I entered into an agreement with him so I use it for the dry season and the land owner uses it during the raining season. (A 40 year old informant at Nyariga)

Mainstream institutionalism and critical institutionalism offer competing ideas about the resource boundary and the community of users. Mainstream institutionalism under Ostrom argues that the boundary of the resource and the community of users of a resource should be clearly defined and that this serves to ensure the jurisdictional integrity of the resource and to exclude outsiders from the resource. According to them this will go a long way to serve as an incentive for collective action since it will make it possible to trace those who benefit from the resource.

Critical institutionalism on the other hand maintains that the boundaries of resources or the community of users cannot be clearly and explicitly demarcated because of their fluidity. Also

they argue that clearly defined boundaries are not necessarily a guarantee to the management of the resource at a lower cost nor the robustness of the resource. They further argue that the community of users of a resource rely on social relations to draw resources beyond the boundaries especially in times of resource stress or scarcity. Following these two theories the research seeks to ascertain what pertains within the Veia Irrigation scheme in the Upper East Region of Ghana.

6.2.1 Boundary of the Community of users

During the field observations, the boundary of the resource did not strictly correspond with the administrative boundaries and so was the community of users. Though the dam is situated in the Bongo District it supplied farmers in both the Bongo district and the Bolgatanga municipality. It supplied three communities in the Bongo district (Veia, Gowrie and Bongo Nyariga) and five communities in the Bolgatanga Municipality (Bolga Nyariga, Zaare, Yikine, Dinduubisi, and Sumbrungu).

The field observations indicate that members of these villages formed the community of users, however the interviews with the farmers further show that other members or farmers from outside these villages could enter the system or use water provided they paid the water levy and met other rules of entry such as establishing social relations with land owners, contacting other farmers and the officials of the irrigation company called ICOUR.

Interviews with the research participants showed that there were restrictions regarding who can or cannot access water.

During the interviews a 40 year old farmer at Nyariga who was also a leader of the farmers union was asked if there were restrictions regarding who can or cannot access water from the system and he had this to say:

There are some rules one has to follow in order to gain entry to use the water. We have some small farmer groups with leaders and these are meant to serve our interests and keep us together and so to access water one has to join one of these groups. It is no longer as it used to be when we as farmers operated individually and had no voice. You can come from anywhere outside or inside this area but you can access the water when you join the groups but all this depends on your social relations with people. The way you talk and how you relate with people may deny or give you access to a group.

The statement from this research participant together with other interviews indicate that one needed to meet these rules of access in order to extract water from the scheme. These rules of access include:

- 1) Payment of water levy
- 2) Contact ICOUR officials /management
- 3) Contact other farmers within the system
- 4) Contact land owners for land
- 5) Contact leadership of farmer groups

6.2.2 Resource boundary

The field observations and the interviews show that the Vea Irrigation dam is the main source of water. It is therefore the resource system. During the interviews all the farmers were aware of the dam as their source of water. Even farmers who used pump irrigation drawing water from the river that connected the dam recognised the dam as the source of water for their farms with the river seen only as a conduit for carrying the excess water from the dam.

According to Cleaver and Frank (2005) the drawing of a hydrological boundary over a resource unit may appear unnecessary to local users. This was affirmed during the interviews when Moses, a 41 year old farmer at Nyariga who has been farming within the scheme for the past 12 years was asked if he knew the boundary of the dam. He said;

My farm is located at Nyariga, a community in the Bolgatanga Municipality but I know the source of my water is the Vea dam but I am not sure if the dam is located in the Bolgatanga municipality or the Bongo District. What matters to me is getting my water. I am not a geographer to determine the location of the dam

The above statement from the farmer indicates that farmers can continue to practice and use a resource for years without necessarily paying attention to the boundary of the resource. The drawing of a resource boundary is therefore too artificial and may not correspond to the social boundaries of the people.

The interviews and the field observations indicated that farmers were not concerned about the boundary of the resource but just the fact that they received water. Farmers were also aware of the mechanism within which they received water on their farms. They described the channel and layout of the system and how water flows from the dam located upstream to their farms.

The boundary of the resource was not clear. Defining the resource boundary was not an easy issue since the boundary of the resource transcended or overlapped with the administrative boundaries. The boundary was thus fluid as more lands and communities sometimes came under the scheme. The secondary data and the interviews with ICOUR officials also showed that the irrigable area of the scheme has not remained fixed since the construction of the scheme. For example as of the time of starting full operation in 1980 the irrigable area was 850ha but this has reduced to about 500ha as of the time of conducting this research. Seasonality has also contributed to the fluidity of the boundary. Interviews with the ICOUR officials and records from the ICOUR office indicated that during the wet season the irrigable area increased as more farmers and more lands came under cultivation. During the dry season on the other hand the irrigable area contracted sometimes to less than 500ha. Interviews with the ICOUR officials further indicated that if harvests were good in the wet season lower number of farmers and lands came under cultivated because some farmers do not see the need to cultivate their farms in the dry season again since they were secured with the harvests they had in the wet season. However, if harvests were bad during the wet season on the other hand more farming took place in the dry season since farmers would have to cultivate more to supplement what they had and to enable them survive the season.

6.3 Land: A bundle of rights

A bundle of right refers to the set of rights associated with the land. These compose the right to use the land, the right to manage it and the right to transfer (that is assign or reassign) use rights and management rights (Aggrawal and Elbow, 2006). The interviews and the focus group discussions showed that farmers had use rights and this is the right to use the land for growing crops. During the interviews with ICOUR officials they indicated that the management rights of land are vested in ICOUR. According to the officials by this management rights ICOUR is taxed with the right to organise and assign rights to farmers to use the land. Though farmers had rights to use the land, ICOUR could curtail that right if a farmers failed to pay water levy or adhere to the rules within the scheme. ICOUR also makes management decisions regarding the acreage of the land that should be cultivation within a cropping season. It makes this decision depending on the water level in the reservoir since the reservoir is also used for urban water supply.

Transfer of rights was a bit complex as far as land was concerned. Transfer rights refer to the authority to assign or re-assign use rights and management rights. According to the interviews,

both ICOUR and land owners had authority over transfer of use rights. The first priority over transfer of use rights was given to the land owners. A land owner who could not use his/her land for some reasons could transfer the land to another farmer who needed the land to farm. According to farmers and ICOUR officials if a land owner could not use the land and at the same time did not assign the land to another farmer to use then ICOUR would have to assign the land to another farmer. The new farmer in this case was required to pay the water levy to ICOUR. During the interviews some farmers complained that this had always been the point where conflicts occurred. According to them in some cases the land owner may later intend to use the land after it had been re-assigned to another farmer. This was captured by a farmer at Vea when he stated that:

Sometimes as a land owner one may not yet have money to start farming and so ICOUR may hurriedly reassign the land to another farmer because the land owner has not yet paid the water levy. If the land owner happens to get money later and is ready to farm he/she may be reassigned a much more distant plot and this often results in complains by land owners

In the wet season the land owner or farmer had more use rights since ICOUR did not collect water levy during this period. The arrangement is that the land belongs to ICOUR during the dry season (farmers therefore have to contact ICOUR for land if they wanted to irrigate or farm) but belongs to the land owner during the raining season. To farm within the scheme a farmer had to arrange with the land owner or ICOUR. The lands are managed by the lands allocation committee of the irrigation company which sees to it that lands are properly allocated to each farmer who wants to farm within the season.

Some farmers acquired control and use rights by virtue of the fact that the lands were acquired from their owners during the inception of the scheme. This means their parents were the original land owners during the inception of the scheme. Such farmers therefore use the lands during the rainy season for rain-fed agriculture without paying any water levy.

Most farmers did not own land but rented from land owners for the irrigation. They were therefore required per the agreement with the land owner to harvest their produce before the rainy season set in so that the land owner could use the lands for the rain-fed agriculture. This is illustrated in the answers of a 40 year old informant at Nyariga during the field interview.

How did you acquire the land?

Informant:

It was rented to me by the land owner. I entered into an agreement with him so I use it for the dry season and the land owner uses it during the raining season. Mostly, I pay him a token so he can use it to plough the land for the rainy season farming.

This statement implies that there was no clear amount being paid across the scheme for renting or using someone's land. The use of the term "token" by farmers show that the value of what they are offering the land owner is less than what they would have paid if there was an amount set for renting land. The indication is that land acquisition is dependent on social connections between the land owner and the farmer and so the amount offered in return for using the land depends on the relationship between the farmer and the land owner.

On the issue of land management it was observed during the interviews that at the early part of the schemes' operation the land allocation committees were effective in the management of land such as allocating land to farmers who needed them but this time they were dormant. The land owners now had the task to find people who needed land. If a land owner could not farm on a piece of land and also could not get a farmer to rent it to, then ICOUR had to allocate the land to a different farmer in need of land so that ICOUR could collect the water levy. Intermittently the land allocation committees (LAC) functioned when land owners failed to get farmers to rent out their lands to.

An ICOUR official was asked during the interviews if the LAC worked, he stated that:

"The village land allocation committee (LAC) are no longer functioning. Now they only assist land owners rent out their lands or help farmers acquire land. In this case they get a token from the landowner and may also charge some unapproved levy from the farmer in need of land".

There was a kind of mutual relationship between land owners and farmers in terms of access to and use of land. Land owners usually rented out their lands in the dry season whenever they knew they were incapable of irrigating them and paying the water levy.

6.3.1 The bundle of rights associated with land downstream or areas outside ICOUR management

During the interviews there were further dynamics on land management, use and transfer rights in areas downstream which were more or less the informal sector.

From the interviews land owners within the informal irrigation system downstream whose lands lay unused during the dry season because they did not have the capacity to cultivate them often looked for farmers who would need such lands for pump irrigation. The high cost of investing in irrigation such as buying or renting a motorised pump among other costs often constrained such land owners from using their lands. Instead of the land laying unused, they gave the lands out to farmers who needed to use them for dry season farming. The farmer at the end of the farming season in return hired a tractor to plough the land for the land owner to use for the wet season farming. According to farmers, the other alternative was that the farmer gave the land owner some cash amount to help plough the land.

The interviews with the farmers showed that some land owners who were so poor to buy farm inputs for the wet season farming and often cultivated their lands without fertilizer gave out their lands without any fee because the dry season farming required the use of inputs such as fertilizer. Once the farmer used their land the fertilizer used kept the land fertile for it to be used for the wet season farming. This inherent believe that the land will gain some fertility from the fertilizer used during the dry season motivated such land owners to give out their lands even if they were not paid any amount for the lands. A pump farmer at Nyariga during the field interview was asked how much he paid for land and he stated:

I do not pay for the land. The land owner gave it to me to use so that his land will be made fertile from the fertilizer and other inputs I use. I however give him some token of money and some of the produce I harvest for his benevolence

Acquiring land for irrigation is highly dependent on social networks. A farmer must know a land owner or someone who knows a land owner. As one farmer stated:

To get land for farming the land owner must trust you that you will keep your part of the bargain after you have used the land for farming. He or she must know you or you must know someone the land owner knows so that that person can stand in for you. (A farmer at Ve)

This means that reciprocity and trust were therefore very important in the acquisition of land for irrigation. The land owner would readily release his land to a farmer in need of land if he knew the farmer or if he was able to establish any social connection with the farmer. The farmer also had to reciprocate that gesture of releasing the land to him/her by also giving the land owner a 'token' as indicated elsewhere.

6.4 Rules on Appropriation and Provision

During the last meeting with ICOUR we argued that since it is no longer profitable to cultivate tomatoes we could not pay the same levy for tomatoes and rice. So we paid less for tomatoes. We paid GHC40 (\$11) per hectare for rice but GHC 16(\$5) per acre for tomatoes. (A farmer at Nyariga)

According to Ostrom for a common property resource to be sustainably managed then there should be rules and these rules should allocate the benefits and costs of operation proportionally to users. By this the rules should specify the cost of appropriating a resource unit as well as the cost of operating the system. She argues that this will promote the sense of equity and hence the incentive to cooperate (Ostrom, 1990; Ostrom, 2005; Ostrom and Gardner, 1993). If farmers as rational beings feel that the cost of operating the system on them is in tandem with the benefits that accrue to them then they will adhere to the rules of the system and cooperate to make the system sustainable. By this costs such as the payment of water levy and taking part in the cleaning and maintenance of irrigation infrastructure should be balanced with efficient water distribution and access (Ostrom & Gardner, 1993).

Critical institutionalists on the other hand contend that rules are rarely made to balance the costs and benefits of resource use. They further argue that resources are associated with heterogeneous community of users with inequalities and differential power relations hence rules are hardly fair and equitable since they often benefit the wealthy, those who made them and the elite to the detriment of the poor.

6.4.1 Payment of Water Levy

According to the farmers the payment of water levy is by cash. The water levy is paid to the ICOUR officials directly by the farmers. In most cases the payment was made to the lateral leaders (secondary canal leaders) who then forwarded the money to the ICOUR office. The interviews show that the scheme officials were sometimes flexible in water levy collection giving farmers who could not pay the whole levy upfront the opportunity to make part payment and then complete the rest after harvesting.

According to the ICOUR officials and the farmers the payment of the water levy was based on plot size. The interviews with the farmers however showed that some farmers paid the levy based on the type of crop, their location within the scheme and even the type of irrigation they practiced (whether canal irrigation or pump farming). The amount paid as water levy is determined at the beginning of each farming season by ICOUR officials and this was communicated to farmers through their leaders.

With regards to the relationship between plot size and water levy, farmers paid GHC 36 (\$9.5) per acre (Ghc90 per hectare) for upland and Ghc40 (\$11) per acre (Ghc100 per hectare) for lowland. The amount however is dependent on whether the farmer entirely depended on water from the canals or used a motorized pump as well. Farmers who used pumping machines paid half of the amounts as water levy.

Farmers also paid higher water levy for rice since it demanded more water than those crops that required less water such as tomatoes, pepper and vegetables. In some cases farmers negotiated with ICOUR for a reduction in water levy for certain crops. During the interview a farmer at Nyariga stated that:

During the last meeting with ICOUR we argued that since it is no longer profitable to cultivate tomatoes we could not pay the same levy for tomatoes and rice. So we paid less for tomatoes. We paid GHC40 (\$11) per acre for rice but GHC 16(\$5) for tomatoes

Though tomato farming had high returns, ICOUR probably understood the challenges tomato farmers undergo and that might have influenced their decisions to reduce the levy for the farmers. Tomato farmers have been facing stiff competition from farmers in neighbouring Burkina Faso and most of the market women who buy tomatoes from the farmers often patronise tomatoes from Burkina Faso to the detriment of farmers in the area. This has affected their profitability. Another plausible reason for the tomato farming not being so much profitable as indicated by this farmer is the frequent pest and disease infestation.

The interviews also showed that location played a role in the payment of water levy within the scheme. Headenders paid higher water levies compared with tailenders. The canals at the tail end were broken and so farmers did not have good supply of water and so had to use pumping machines to get water to their farms. The irrigation company and its officials therefore made such farmers pay lower water levies.

The field observations and the interviews indicated that there were also a category of farmers who cultivated lands that were not part of the project area. These farmers were made to pay half of the levy paid by project farmers because such farmers have to also use pumping machines to pump water to such lands and this entailed cost to the farmers. During the field interviews a farmer at Sumbrungu who is located downstream and who cultivates lands outside the project area stated that;

I paid GHC 10(\$3) per acre as water levy because I use a pumping machine. The amount is too high because I have to buy fuel for the machine, rent the machine, maintain the machine, buy my own farm inputs and struggle to ward off animals from my farm. All these are costs I have to bear.

This was corroborated by a 28 year old farmer at Nyariga (midstream) during the field interview when he was asked how much he paid as water levy. He stated that during the 2015 farming season, he paid GHC 18 (\$5) because he used a machine to pump water to his farm. These amounts were low probably because the plots of these farmers were small.

6.4.2 Water Distribution and Access

According to the ICOUR officials the dam is a multi-purpose one and is used for irrigation, and also to serve drinking water to the Bolgatanga Township. Officials therefore regulate the water for both irrigation and treatment for drinking. Though priority is given to water for drinking, the primary reason for constructing the dam was for irrigation. If the water level fell below a certain mark then the irrigation will have to cease so that priority can be given for drinking. The water level has however not fallen below the lowest mark up till now.

There are two farming seasons within the scheme. ICOUR officials in fact indicated that the scheme only supplied water to the farmers during the dry season whilst in the wet season farmers depended on rain water for farming. At the beginning of the farming season the scheme officers determine the amount of water that would be needed for the farming season. A key informant at the project office indicated that the determination is done by assessing the number of hectares farmers have registered to cultivate and also by assessing the canals or laterals within which these plots are located. A water schedule is then drawn and communicated to farmers regarding the days water will be allocated to them. The water schedule spells out the water allocation criteria indicating which laterals should use water at a point.

In order to ensure fair water distribution, farmers upstream are not allowed to water their crops until those downstream have received water. During the field interviews farmers clearly understood this arrangement. Though the water is opened from upstream, supply to individual farms operated in a reversed fashion.

To ensure that individual farmers did not violate the rule of waiting till their turn to use water, each lateral leader (secondary canal leader) is given a key to lock the gate supplying the farmers within that sub-canal. The water schedule has changed from how it was when the scheme had less challenges. During an interview with an ICOUR official regarding how water is distributed to farmers he indicated that;

Now we supply water to farmers for 24 hours continuously for two days or three days. Initially when the scheme was in good state the schedule used to be that we opened water in the morning and shut water in the evening then the following day the same morning for water and evening shut down. Then the third day no water. That is two days for water and one day off

This new arrangement is probably largely due to the fact that some of the canals have broken down. Water no longer flows through the normal course and much is wasted and hence the need to pump water continuously for 24hours.

The interviews with the farmers showed that water distribution from the main canals was done uniformly within the scheme. Farmers then have to utilize the water according to their needs and crops once water is opened. According to farmers mostly they receive less water supply during the beginning of the farming season when there is less demand for water but this supply subsequently increases after planting where there is higher demand for water.

6.4.3 Maintenance of the System by Farmers

The interviews show that farmers put in a lot of effort to maintain the scheme especially to ensure smooth delivery of water to their farms. A 36 year old farmer at Nyariga stated this when he said;

We clean, de-silt the canals and clear the weeds for easy passage of water. Sometimes we contribute and buy cement to repair the broken canals.

In an interview with an ICOUR official he complained that no major maintenance or rehabilitation had taken place since the establishment of the scheme in 1985 some of the canals

are in bad state. All the farmers interviewed expressed their sadness over the state of the canals. According to most of them they are often frustrated in an attempt to maintain portions of the canals. A farmer at Nyariga who is also the leader of the farmers' organisation during the interview expressed his frustration when he said;

ICOUR in the past used to let us work on the canals every October [before the start of the farming season] but now this does not happen and the canal are in bad state such that you don't even know where to work on. Unless there is major rehabilitation of the canals else the degree to which the canals have broken down is beyond us farmers. We normally concentrate on areas that we can fix so that the water can flow to our farms.

From the interviews it became clear that farmers paid more attention to the sub-canals that led to their farms but saw the repair and maintenance of the primary canals as the task of the irrigation authorities at ICOUR. Some farmers think that the water levy they pay should take care of the maintenance of the scheme. Indeed some of the farmers took part in canal maintenance only because they thought they had no option since the dam was their source of livelihood. They thought that the maintenance of the scheme should come from external or higher authority. In fact a farmer at Nyariga stated this when he said;

We hear an organisation is coming to repair the canals for us. Since this is not happening yet this is our source of livelihood we have no option than to take steps to repair the broken parts so that water can get to our farms.

According to some of the farmers interviewed though they pay water levy as a way of maintaining the scheme, they commit extra money into buying cement to maintain some section of the canals. The farmers also maintain that notwithstanding these maintenance investments, time and labour is also committed by some of them into maintaining the irrigation system.

The field observations showed that pump farmers whose farms were not supplied by the canals incurred less maintenance cost since they did not take part in cleaning, de-silting canals and clearing weeds in canals. A 40 year old farmer at Nyariga who does pump farming during the field interview stated that;

I do not maintain the system because I pump water from the river so I can't maintain the river.

During the field observations it was realised that farmers who are located at the tail end of the scheme formed the category of farmers who used pump irrigation. These farmers had no canals running through their farms and so did not have to clean the canals. They however had to organise the system so as to receive water. A 47 year old farmer at Sumbrungu stated how they got the system ready at the beginning of the season for water delivery when he stated that:

Before the season begins there is little arrangement and cooperation among us because at this time we rely on the rain water that each of us had impounded. But after the crops are cultivated and there is the need for more water that is the time we hold meetings regarding water levy payment to ICOUR and how to get water to the river. After our meeting we mobilize to dig some channels to allow the water flow through into the river which we then use.

Though these farmers complained about higher operational cost some farmers upstream perceived them as contributing less to the maintenance of the scheme since the maintenance of the canals by those upstream makes it possible to receive water downstream. Pump farmers located at the tail end therefore started paying water levy to the scheme following complaints by those upstream.

In line with Ostrom there were appropriation and provisioning rules as farmers paid for water delivery and yet had to take part in maintaining the scheme. However, in line with critical institutionalism that institutions operate sporadically and that the rules just surface with everyday use as and when the need be (Cleaver, 2012), the rules regarding water levy payment at the inception of the scheme differed from what pertains today. The decision to allow informal irrigators downstream to pay water levy and become part of the system, the decision to allow pump irrigators to pay half of what canal irrigators pay are all recent rules and have emerged because sections of the canals have broken down and the water distribution system has changed. This shows that the rules might not be envisaged and crafted since situations are complex and unpredictable but as and when the need arises farmers and the irrigation authorities would formulate the laws.

6.5 Rule Formulation and Collective Action

We have rules that govern what we do.

The rules are not written down but through practice we know what we can or cannot do (A 33year old farmer at Vea).

Ostrom (1990) emphasis that individuals who are associated with a resource must participate in formulating and modifying rules that affect them. She further argues that the cost of changing these laws should be kept relatively low. And that when users devise their own rules they have a higher sense of compliance. Critical Institutionalism argues that communities are not composed of homogenous people and identities and therefore question the rationale for deliberately crafting rules to govern the commons since the fairness of such rules cannot be guaranteed.

From the interviews with the farmers it was revealed that there were rules governing how water was accessed and distributed. A mix of both formal and informal rules governed water access and distribution within the scheme.

The formal rules were largely formulated by ICOUR at the head office and the area office. These rules were however not visible to farmers. Since farmers were not the crafters of the rules they seemed divorced from them. This could be the source of noncompliance by farmers and conflict within the scheme.

6.5.1 Informal rules

The rules governing farmers within the scheme were largely informal. In line with Ostrom farmers respected these rules probably because they created them. During the interviews all farmers indicated that there were rules they operated with but when asked if these rules were documented they said no. During an interview with an official of ICOUR he stated that there were about 100 farmer-based organisations (FBOs) and cooperatives out of the about 2000 registered farmers (Ofosu,2011 p.82) but that most of them were not functioning. He added that there were however more than twenty of such FBOs functioning. These FBOs form the avenue upon which farmers collectively crafted rules to govern them. The field study showed that farmers had well organized farmer groups to which they elected executives to stir their affairs. Rules are therefore crafted during these meetings.

A farmer at Nyariga who also doubles as a farmer leader was asked how the rules are made and he had this to say:

At meetings we agree on certain practices so that we can have smooth operations but these are not clearly written down. For example we agreed that those upstream should not water their farms until those downstream have informed us that the water has reached them. But this is not written down even though we know it.

Though farmers indicated that there were rules governing them these rules were not clear and were thus messy by nature possibly because they were not documented.

Power relations in the tradition of the area were tied to wealth status and one's age. The interviews and focus group discussions also showed that the wealthy farmers and older farmers wielded more influence during meetings to craft rules for collective action. As mentioned somewhere a younger farmer upon having a misunderstanding with an older farmer over land said he had to relinquish the land because he knew the other farmer was older than him. This reflects the custom of the area where experience and wisdom was associated with older people hence the need to respect them. This probably explained why during conflict resolution the elderly people are called upon to mediate.

6.6 Monitoring and Graduated Sanctions

ICOUR officials monitor but we noticed that it is only when they need their water levy or if it is time to pay water levy. But they do not do any regular checks regarding the proper functioning of the scheme, If they were doing that and maintaining the broken parts the system would not have deteriorated to this level (28year old farmer at Vea).

According to Ostrom for the sustainable governance of a CPR an effective monitoring system must be in place to check resource use and to ensure compliance with the rules-in-use. She further argues that the monitors should be accountable to the appropriators or the monitors should be the appropriators themselves. Monitoring is meant to prevent the instances of cheating and free-riding and thus allaying the fears of other users that some others are exploiting the system. Critical institutionalism on the other hand argue that it is not easy to monitor the management of natural resources like water since they are complex. They argue that monitoring is a costly venture to both the monitors and the appropriators and also that since there are unequal power relations in the system monitoring often will not be fair. They also contend that the argument for accountability of monitors as proposed by mainstream institutionalists cannot be guaranteed.

The interviews showed that there was some minimum amount of monitoring within the scheme. Monitoring was done by the ICOUR officials, lateral leaders and the farmers themselves. ICOURS officials periodically checked the system to ensure that farmers paid their water levies but less attention was paid to the integrity of the canals that supplied water and also whether farmers at their individual farm levels adhered to the rules regarding water use. In fact, a farmer at Vea complained that the company only showed interest in water levy collection but did not care about the other elements that collectively ensured the smooth functioning of the system. The opening quote above from the 28 year old farmer from Vea illustrates the fact that farmers think there was no effective monitoring by ICOUR officials.

According to farmers from the interviews in terms of water distribution, an ICOUR official periodically goes round the canals on a motor bike to see if there were sections that needed more water. There was also monitoring of the dam and the valves especially regarding the water level in the dam and the point of opening the canals.

On the part of the farmers themselves, there was little monitoring of the farms, canals, and water distribution. Farmers did not see the need to go round to monitor their colleague farmers. The plausible reason for this stance or attitude being the fact that they thought it was the duty of ICOUR officials. The interviews revealed that the lateral leaders (farmer leader in charge of a secondary canal) did much of the monitoring. They were in charge of collecting water levies from the farmers and sending such to ICOUR. In this case they knew which farmers did not pay their levies, the plot sizes of farmers, when the laterals will receive water on the schedules and as to whether farmers were allowing those downstream to use water before those who were upstream. As a whole the study showed that there was no effective monitoring.

Even though there was some degree of monitoring in line with Ostrom's views, lack of effective monitoring impacted on the system negatively. Ostrom (1990) argued that for the commons to be sustainably managed there should be an effective monitoring system to ensure that farmers did not cheat or free ride. According to her the effective monitoring seeks to check the state of the resource and to ensure appropriate behaviour. Perhaps if there were effective monitoring mechanisms in place the canals could have been repaired earlier at various points to ensure that there was no major systemic collapse as a result of canal dilapidation.

6.6.1 Sanctions

The interviews revealed that there were sanctioning systems within the scheme. ICOUR was the authority vested with the sanctioning of violators of the irrigation rules. Non-payment of water levy for example was sanctioned by closure of water to the violators. If a lateral (secondary canal level) failed to pay the required water levy, the company curtailed water flow to that lateral (secondary canal). In some instances a farmer or few farmers within a sub-canal may default to pay water levy. In sanctioning such a farmer or farmers, ICOUR closed the water flow to the whole of the sub-canal thus affecting those who had paid as well. A 41 year old farmer at Nyariga was asked during the interview about the sanctions for non-payment of water levy. He stated that:

“If a farmer failed to pay the water levy, mostly the whole lateral is blocked and this helps the neighbouring farmers to put pressure on the defaulting farmer to pay”

This clearly indicated that the sanctioning system in this case was not entirely fair since other farmers were also affected by such water blockage. This often may create acrimony among farmers since pressure will have to be kept on the violators by the other farmers. During the field interviews, farmers were of the view that better mechanisms should be found by ICOUR to always hold such farmers responsible by sanctioning them directly and not the other innocent farmers.

Based on the interviews with farmers there were indications that farmers may also sanction their colleagues for non-compliance with the rules. A farmer who failed to pay the water levy for example was kept under pressure by the neighbouring farmers since his/her actions affected all of them. This social stigma often forced the defaulting farmer to settle their indebtedness. The sanctioning regimes though not fair none the less, was therefore effective.

6.7 Conflict Resolution Mechanism

We have never failed to resolve conflicts here. The ways by which conflicts are resolved are fair and impartial. Even if a native goes wrong and a stranger is right, it will be pointed out accordingly without favour. (A 41 year old farmer and farmers' leader at Nyariga)

Ostrom under mainstream institutionalism argues that to ensure the robustness of the commons there must be low-cost but rapid arena for conflict resolution. They further argue that having simple, rapid and low-cost mechanisms for resolving conflicts conversely reduce the number of conflicts within the system. They more or less call for crafted and formalised ways of resolving conflicts in the process of managing the resource. Critical institutionalists on the other hand argue that people share more than just water but multiple resources and that the existing social networks are the most preferred avenues for resolving disputes since they are more reconciliatory than adversarial.

The interviews revealed that there were conflicts reported within the scheme. The common conflicts within the scheme were:

- i. Conflicts between farmers and ICOUR officials
- ii. Conflicts between farmers
- iii. Water conflicts

- iv. Land conflicts
- v. Conflict between farmers and livestock keepers

6.7.1 Conflicts between farmers and ICOUR officials

The interviews indicated that conflicts sometime occurred within the scheme due to competing claims over resource use and access. Some conflicts occur between ICOUR officials and farmers. Conflicts between ICOUR officials and farmers often occurred in matters of water levy collection and water allocation. When farmers failed to pay the water levy, officials refused to supply them with water in a bid to compel the farmers to pay the levy.

This often resulted in protests by farmers. Also, as stated above, where a farmer failed to pay the water levy officials decided not to supply the entire lateral (sub-canal) in a bid to compel the neighbouring farmers to put pressure on such defaulters to settle their indebtedness. This often result in conflicts between farmers and officials since farmers perceive the strategy as not fair.

Conflicts between farmers and ICOUR officials also occur during the fixing of water levy. The field study also showed that there were often disagreement between farmers and officials when it comes to assessing plot size since. Though officials were supposed to measure the plot sizes some farmers said their plots were not measured by officials before the levy was paid. Conflicts often result when arbitrary units are used by officials to determine plot sizes. According to the farmers the levies paid were not judiciously used especially to maintain the scheme hence do not show much zeal in the payment of water levy.

6.7.2 Conflicts between Farmers

The interviews showed that conflicts between farmers usually occur over access to water and land. Since some of the canals were no longer functional farmers had to devise ways to access water. Some block water where there is insufficient water in the laterals (sub-canals). This often results in conflicts since other farmers expect to also access the water.

The field study revealed that conflicts between farmers over water use was more pronounced downstream where the informal irrigation system was practiced. There was competing blockage of water by farmers so pumping machines could be used to pump the water to their farms. Farmers downstream use bags of sand to impound the water and this often result in conflicts as neighbouring farmers complain.



Figure 7: Photo showing water impoundment by farmers using bags of sand

The interviews however showed that land conflicts had abated in recent times because the competition for access to land had reduced especially within the project areas upstream and midstream. This reduced demand for land was due to the fact that a number of farmers had stopped cultivating tomatoes since it was no longer so profitable due to marketing challenges. This had led to a lot of lands lying fallow without use around Nyariga and Vea.

6.7.3 Conflict over access to land

In the first place, land ownership, control and access was a complex one. Sometimes there were multiple assurances to farmers from land owners which led to conflicts between farmers. The case of a 40 year old farmer at Nyariga who doubles as a teacher and had been engaged in irrigation farming for the past 11 years is worth illustrating. He narrates;

A farmer had indicated his intention to farm on someone's land but never turned up for the land. I needed land to farm so I contacted the land owner over his land and he gave me the opportunity to farm on it. I started clearing the land but the man later came and said he was ready to use it. This resulted in some disagreement.

Sometimes, some land owners or farmers failed to pay the water levy and so ICOUR would have to allocate such lands to farmers who were ready to use them. This often brought about conflicts when such land owners later indicated their readiness to use their lands.

6.7.4 Conflict between farmers and livestock keepers

During the interviews farmers indicated that there was a major conflict between farmers and livestock keepers. As a 32 year old farmer at Sumbrungu explained:

Sometimes you can lose a whole investment just because of the cattle. We incur a lot of cost in warding off cattle. We employ farm boys to take care of the farms and they sleep in the farm largely to protect the farm from the cattle. We discuss with the animal owners to keep their cattle well but with the tradition and practice here cattle are taken care of in the wet season but in the dry season when there is shortage of food for them they are supposed to roam freely and this the time we also farm. So it is a difficult situation. The cattle have destroyed a lot of farms at night and farmers too have secretly killed a number of such cattle.

In the dry season there is scarcity of grasses to feed livestock. Per the traditions of the area livestock are made to roam freely during this period so they could graze. This has mostly been a point of conflict when the animals feed on the crops.

The interviews further revealed that conflicts occurred throughout the cropping season but were rife at the beginning of the season and in the middle part of the cropping season when there was more demand for water. The plausible explanation to this was that at the beginning of the cropping season when farmers needed land, land conflicts became rife. After the planting of crops there was competition for water and hence water conflicts became rampant. But towards

the end of the farming season there were fewer conflicts because there was less competition for water use.

6.7.5 Conflict Resolution Mechanisms

The interviews showed that there were simple and rapid conflict resolution mechanisms as conflicts were largely resolved through mutual cooperation and negotiation. There were multiple conflict resolution mechanisms open to farmers making it possible to choose which method was more convenient to the parties.

The common conflict resolution arenas were through one-to-one negotiation, through lateral leaders and farmer groups' leaders. Also through elderly farmers and ICOUR officials. In line with Ostrom, the interviews further showed that the conflict resolution mechanisms were low-cost, rapid, simple, and effective. Though there were higher conflict resolution arenas such as the chiefs' palace and courts, farmers indicated that they had never travelled that far. According to farmers the conflicts were mostly resolved among themselves. Most farmers were of the view that the conflict resolution mechanisms were fair.

Conflict resolution within the scheme was therefore entirely by informal and traditional means through social negotiations.

A 41 year old farmer at Nyariga who is also a leader of a farmer-based organizations re-enforced the effectiveness of the conflict resolution mechanisms when he stated that:

We have never failed to resolve conflicts here. The ways by which conflicts are resolved are fair and impartial. Even if a native goes wrong and a stranger is right, it will be pointed out accordingly without favour.

His statement gives a vivid picture of the effectiveness and fairness of the conflict resolution mechanisms.

This finding is in line with mainstream institutionalist claim that for the effective management of the commons there should be cheap, fair and effective conflict resolution mechanism among the users of the resource (Ostrom, 1990, 1992). These conflict resolution mechanism were however not formal but informal. As argued by critical institutionalists the conflict resolution mechanisms were not deliberately codified but were based on social relations, tradition and mutual understanding.

6.8 Relationship among Water Users

Mostly we work together in this system. We dig wells in groups to impound water and use together. If we are running out of water we hold meetings within our group here then we contact the neighbouring groups from Yikine to discuss the contributions to make to ICOUR to give us water. We then come together to dig channels to make water ways for the water to flow to our farms. If a member fails to turn up for the work then he/she has to pay ghc5 which will be used to refresh those working. We further cooperate with farmers upstream at Nyariga to allow us get water. We also talk with the livestock owners to take care of their animals since the animals destroy our crops a lot (45 year old farmer at Sumbrungu)

According to Ostrom (1990), appropriation, provision, monitoring, enforcement, conflict resolution and governance activities are organised in multiple layers of nested enterprises. She argues that each level or layer deals with similar issues from progressively smaller scale to a large scale. In the irrigation system for example farmers within the field level cooperate more than farmers at the secondary or tertiary level because they share common challenges. According to Mainstream institutionalism there is therefore the need to establish rules for each of the levels so as to make the system complete and sustainable. Critical institutionalism on the other hand argue that Institutions are embodied in social processes and are nested in multiple but complex overlapping processes and practices of social life and layers of meaning (Cleaver and Franks,2005).

The interviews and the field observations revealed that there were several water users within the scheme since the reservoir is a multiple purpose one. The water users within the scheme were both dry season and wet season farmers. Other users such as fishermen, livestock farmers, and domestic users were observed.

6.8.1 Cooperation based on spatial location

The interviews revealed that the spatial position of irrigators within the scheme played a role in the kind of relationship that existed between them. In this case, the upstream or downstream position influenced the level of collective action and negotiation.

The interviews and field observations showed that in practice irrigators who were located downstream shared common problems and tended to work together as they cooperated more in solving them. Farmers who were located downstream and outside the project area near Sumbrungu were called Jungle Farmers. Since they practiced pump irrigation they cooperated to dig wells to retain water for use. On the other hand, irrigators who were located upstream and had water supply through the canals also cooperated to clean and maintain the canals.

Interestingly, apart from the spatial location of irrigators, there were other factors that influenced the relationship between irrigators. As stated earlier, there were a number of farmer-based organizations existing within the scheme. The interviews showed that most of these FBO were formed around factors such as the crop type farmers grew, the Village farmers reside and Irrigation type farmers practiced. These were factors that influenced the relationship and level of cooperation among irrigators.

During the interviews a number of farmers indicated that they belonged to FBOs or associations to which they had elected representatives and had regular meetings. They also indicated that at these meetings they made rules to govern them. This implies that farmers cooperated and related with each other. During the interviews it was also realised that farmers formed the associations with the aim to solving similar interests or challenges.

6.8.2 Cooperation on crop type

In this case farmers who cultivated similar crops such as rice farmers, tomato farmers, and onion farmers to mention a few formed associations based on the crop type and thus cooperated more to address challenges akin to those crops. This also formed the bases for cooperation and collective action.

During the interviews a tomato farmer at Nyariga said:

We face challenges in marketing our produce because the market queens (wealthy women who mostly buy tomatoes from the farmers) who come to buy tomatoes from us always team up and fix the prices. So we also form the associations so that we can work together and also come up with a uniform price to sell to them.

This shows the importance of collective action. Whenever there was the need to make concessions with the market queens regarding prices such farmers had to cooperate with one another again to arrive at a suitable and acceptable price.

6.8.3 Cooperation based on type of irrigation

A pump farmer at Sumbrungu who is located downstream was asked if they cooperated with one another to which he said yes. He further narrated that:

We are called jungle farmers because we practice irrigation the hard way and mostly use pumping machines to pump the waste water to our farms. At the beginning of the season we dig shallow wells to store water and also use bags of sand to block the water. Mostly a number of us come together to impound the water so we can collectively use. If we are about to run out of water we then meet to contribute money so that our leaders will send the money to ICOUR officials to allocate water to us through the river that runs through here

The narration of this farmer implies that farmers also organized themselves for collective action based on the type of irrigation they practised. Farmers who practiced pump irrigation by using motorized pumps therefore worked together and in most cases negotiated water levies from officials. Farmers who also practiced canal irrigation saw each other as having similar challenges and hence collectively worked and collaborated with one another. Canal farmers often cooperated to clean the canals and to negotiate water levy from ICOUR officials. Even within the canal irrigators, cooperation was intense at the lateral (secondary canal) level since this is the level where water levy collection, water delivery and curtailment to individual farmers were done.

6.8.4 Cooperation on the basis of village of residence

The interviews further showed that farmers also cooperated on the basis that they resided in the same village. Based on this, there were farmer-based organizations that were from Vea while some were also restricted to Nyariga or Sumbrungu. Farmers therefore cooperated in solving challenges of water access, use and other related issues that were peculiar to their villages.

It is worth noting that these levels of collective action which were based on affinity, proximity and shared interests were not so obviously simplistic. They formed a web of network of

relationships. These relationships formed a nested system where each level of collective action and cooperation was linked to another thus from a smaller scale to a larger scale.

There were FBOs such as Nyariga tomato farmers' association, Vea tomato farmers' association, and Sumbrungu farmers' association to mention a few. This means such farmers organised themselves based on the fact that they reside in the same village and also cultivated the same crop. In this case Vea tomato farmers' association, Nyariga tomato farmers' association and Sumbrungu farmers' association could collectively come together under a bigger umbrella of tomato farmers' association within the scheme depending on the type of interest they wish to solve. For example if an NGO wanted to support tomato farmers within the scheme each of the village tomato farmers for example could come together for the purpose of this help.

6.9 Gender in Irrigation Water Management

This section seeks to discuss gender issues within the irrigation scheme. Gender dimensions cannot be overlooked in irrigation since there were certain practices and experiences that were akin to the sexes. During the Focus Group Discussions (FGD) at Nyariga this study attempted to assess the participation of women at different levels within the scheme. The FGD was composed of five (5) female participants. Women's participation at three levels formed the focus of the investigation. Participation at farm (field) level, Association (Farmer-Based Organisations) level and leadership levels were investigated.

6.9.1 Women's Participation at farm level

Activities within the farm level encompassed issues such as right and access to land, water use and other obligations and opportunities.

Land right, ownership, control and access were key aspects that were discussed. The Focus group discussions showed that women did not own land within the scheme. In these villages land is owned by men and women could only have temporary possession of land. Women indicated that the lands they used were either for their husbands, their late husbands or they rented from land owners. Traditionally land is owned by men and if a man died his land was shared among his male children. Women were not part of this sharing arrangement probably because per the cultural traditions it is thought that the woman will have to marry and relocate to their husband's homes. Women therefore had only temporary ownership of land as a form of inheritance from their husbands in instances where their husbands were deceased and the

children were still young to farm the land and in such cases the women had to hold the land in trust for the children until they grew.

During the discussion one woman indicated that after the demise of her husband, the late husband's brother wanted to collect her land and so she reported to the elders and the elders intervened and warned him to stay off the land since the land now belonged to her children. The challenges women had in temporarily holding land for their children was in instances where the man had more than one wife with each of the wives having children. In those instances the land became utterly fragmented since it has to be apportioned among the male children.

The inability of women to own land disadvantaged them within the system since land ownership constituted a source of power. This meant that women had to rely on the support of their husbands, family members or other men in order to access land for irrigation. In line with the customary and traditional institutions, since land is owned by men it is controlled by men.

During the discussions discussants noted that women had good access to rent land .They could acquire or rent land from the irrigation company or land owners if they needed to undertake irrigation. Women therefore had access to land but unequal ownership and control of land when compared with men.

Still at the farm level and on access to water the discussions revealed that women had equal access to water use and rights. Once a woman acquired a plot of land within the scheme she had the same privileges just as the men. The same water schedule was followed within the scheme. Women were however more disadvantaged by canal dilapidation .The broken canals led to poor water delivery to farms and so farmers have to create further channels to their farms or use pumping machines which require a lot of manual energy and cost. These activities did not favour women.

The focus group discussions revealed gender issues in cropping patterns .Women mostly engaged in the cultivation of certain crops especially leafy vegetables and rice whiles men dominated in the cultivation of crops such as tomatoes, onions and cereals. According to

discussants women preferred to cultivate vegetables because they were easier to market and at the same time such crops had shorter maturity period and required little or no farm inputs like fertilizer and other chemicals. These same crops have traditionally been cultivated by women at home during the rainy season. The participation of women in cultivating these crops was in line with the traditional roles of women in the rainy season. In line with long-held conceptions it was common to see women marketing leafy vegetables in basins balanced on their heads whereas a man could not do same without being ridiculed and called a ‘woman’.

When asked during the FGD why she practices irrigation a 38 year old discussant stated that:

When I farm in the wet season the produce went to the whole family and my husband will not allow me to sell some of the produce to buy my needs. But when I farm in the dry season whatever I harvest is mine. I sell some to buy the things I need and also use part to support my family.

Women therefore actively participated in irrigation because their husbands had no control over their farms. The men understood that the dry season farming was largely a commercial one. Some men in fact support their wives in the acquisition of land for irrigation.

The Focus Group Discussions indicated that women basically participated more actively in the formal or project farming whiles the informal irrigation which involved the use of motorized pumps was almost the preserve of men. The explanation to this trend was that the pump farming was more tedious, labour-intensive, and required so much time, attention and capital. These factors did not favour women since they used more time to take care of their households. Discussants however mentioned that there were few women who undertook pump farming but that these women paid men to handle the farming processes for them. If the indication was that women hardly undertook pump farming then the inference is that the spatial distribution of women farmers within the scheme would show the participation of more women in Vea which is located upstream and Nyariga which is located midstream since there was less pump farming here. Fewer women participating in irrigation would be expected at Sumbrungu which is located at the tail end of the scheme where pump farming was dominant.

The discussions showed that women were however dominant in the harvesting and marketing of produce. Women had more power in the marketing of produce and harvesting of crops.

These obligations reflected the existing traditional roles where women were in charge of harvesting produce during the rainy season farming. At the discussions the women indicated that women were good at harvesting farm produce and that that explained why farm owners always hired women to harvest their produce.

6.9.2 Women's Participation in Farmer-Based Organisations (FBOs) and Associations

As mentioned earlier, farmers organized themselves into farmer-based organisations through which they solved challenges. During the focus group discussions discussants had indicated that they belonged to various FBOs. Since these FBOs were organised on different activities within the scheme such as crop types farmers cultivated, village farmers reside among others, women's participation in the FBOs reflected where their interests lay and which of these activities they undertook. Women also had their own groups and these were most used to solve issues akin to women farmers and to obtain support from agencies that supported women farmers.

Discussants revealed that a number of women held leadership roles within the FBOs and therefore had a voice especially on issues affecting them. In most of the associations it became evident that women were mostly entrusted with the management of finances. The explanation as to why women were mostly entrusted with the management of finances was that the women were more trusted and feared to take risks in financial malfeasance.

The active participation of women in the FBOs is illustrated by the statement of a discussant when she said:

I am in TOPAN (Tomato Farmers Association of Nyariga). Our Group is made up of 38 members with 25 men and 13 women. I am the treasurer and therefore handles the associations' money. (42 year old female farmer at Nyariga).

During the interviews and the informal conversations with farmers they confirmed that women were very active and powerful in the associations and were active in taking decisions at meetings.

6.9.3 Participation of women in canal cleaning

During the FGD discussants indicated that women and men had different roles when it came to canal cleaning. They explained that men mostly did the cleaning of the canals because the cleaning of the canals involved the exertion of energy by the use of shovels, machetes and hoes.

Traditionally the men have not allowed the women to clean the canals maintaining that it is men's job. Perhaps this is tied to the culture of the area where women are seen as feeble and not allowed to undertake such jobs as using the shovels. The discussions showed that women were mostly rather in charge of cooking food for the men as they worked on the canals. The women were also in charge of fetching water for the men to drink as they worked on the canals.

6.10 Summary of main findings

6.10.1 Main findings on resource boundary and user community

The hydrological boundary regarding the resource and the community of users was not fixed but fluid. Users could come from anywhere provided they met the rules of entry. To meet the rules of entry one needed social networks or connections. As suggested by Ostrom there were however, clearly defined rules of entry. By this, users could come from any part of the country but they had to meet the rules of entry in order to use water within the scheme. Contrary to Ostrom (Mainstream Institutionalism) there was no clear physical boundary regarding the community of users with right to access water within the scheme. Though there were nine communities within the catchment area of the scheme the right to access water was not restricted to only these villages.

6.10.2 Main findings on appropriation and provisioning

Payment of water levy was by cash. A number of factors influenced the amount of water levy a farmers paid. These factors were spatial location of the farmer, farm size, crop type cultivated and type of irrigation the farmer practised that is whether pump farming or canal farming. Farmers who did pump farming paid less water levy compared with those who did canal irrigation. . Farmers however took part in cleaning the canals. Whiles the cleaning of the sub-canals or laterals was done by farmers the maintenance of the main canals was the duty of ICOUR. In line with Ostrom, there were rules of appropriation and provisioning since farmers paid water levy to access water and yet took part in the maintenance of the canals.

6.10.3 Main findings on rule formulation and collective action.

The formal rules were mostly crafted by the irrigation company (ICOUR). However the informal rules dominated the practices among farmers. Farmers made some rules during the FBO's meetings but these rules were not expressly written down. Some of the rules were not crafted but just emerged with practice and were mostly tied to the customs and traditions of the people.

6.10.4 Main findings under monitoring and graduated sanctions

There was some level of monitoring which was done by ICOUR officials, lateral leaders and farmers. The monitoring was thus not effective especially from the irrigation company. The lateral leaders were more active in monitoring the scheme since they had close affinity with the farmers. In general, even though the sanctioning system was not fair it was nonetheless effective and deterrent.

6.10.5 Main findings under conflict resolution mechanisms

There were conflicts reported within the scheme and the common conflicts within the scheme included; conflicts between farmers and ICOUR officials, conflicts between farmers, water conflicts, and Land conflicts. These conflicts arose because of competing uses of resources. There existed conflict resolution mechanisms and these conflict resolution mechanisms were low-cost, fair and effective. They were however based on traditional or informal means rather than formal means such as the courts.

6.10.6 Main findings on relationship among water users

Farmers cooperated and related with one another within the scheme. Some of the cooperation were done through farmer-based organisations and associations. Farmers related with one another based on the following factors: their spatial location within the scheme, the village they resided in, the type of crop they cultivated, the type of irrigation they practiced. Also from the field level to the lateral (secondary canal) level. The relationship between farmers was not overly simplistic but complex. The cooperation between farmers was nested from proximity to one another outward towards larger groups. These relationships were not however deliberately crafted at each level but were woven in social relationships and emerged as and when farmers practiced and saw the need to address a common challenge.

6.11 Relationship between formal and informal institutions

The formal and informal rules were fused together within the system. The formal rules were largely committees under ICOUR which assisted ICOUR to manage the scheme. See chapter 2 for the committees. The committees were largely not effective since most of them were no more functioning. The land allocation committee for example which was supposed to allocate lands to farmers was not active while the consultative committees which was supposed to consult farmers on the challenges that faced them hardly did.

The informal institutions were rather effective in governing irrigation. The lateral leaders who were elected by the farmers were more visible and active within the scheme as they collected

water levies, opened and closed water to farmers within the laterals, monitored farmers who did not follow the rules and settled conflicts that occurred within the scheme. The lateral leaders were however recognised by the irrigation authorities and they are now treated almost like formal institutions. The FBOs which were also formed by farmers were also effective in bringing farmers together for collective action. Irrigation authorities now cooperate and govern through the FBOs where farmers could easily be met in groups for discussion of governance issues.

There was however, no space for the invisible traditional rules in the formal institutions even though these traditional institutions were very important. There was no space for the earth priest or the *Tindaana* for example even though he wielded so much power on land issues even in the presence of the village chief. This institutional gap often led to conflicts as seen in the case of conflicts related to shrines and fetish groves within the area. On the consultative assembly for example space is made for traditional authorities from Bongo and Bolgatanga and mostly the chiefs were the representatives and not the *Tindaanas*.

6.12 INSTITUTIONAL CHALLENGES AND REFORMS

This part discusses the institutional bureaucracies that engulfed water management within the scheme and the subsequent effort at restructuring the system with external support. According to Ostrom (1990), external agents can give support towards the management of common pool resources but the resource users should craft and enforce the rules for governing the resource

6.12.1 Narratives about water levy payment: Official's Story versus the Farmers' Story

Farmers and irrigation officials held different positions regarding the payment of water levies. These opposing understanding of water levies payment made water governance within the scheme a challenging issue. These positions influenced the attitude of each side towards the governance of the scheme. It is not easy to reconcile the positions of various actors in water management issues. The positions of farmers and officials regarding water levy payment is presented below.

6.12.2 Officials Narrative

During the interviews with the ICOUR officials, management argued that farmers did not take irrigation serious or as a business. According to them this attitude explained why farmers were not willing to pay more for water. Officials complained that the water levy was too low and not enough to maintain the system or make it self-sufficient. This was captured by an official when he stated that:

Irrigation is a serious business and there is money in it. Farmers here do not see it as a business. Governments nowadays give less support to irrigation because they think the system should be able to sustain itself. How can the system sustain itself when farmers are not willing to pay more for water? For the irrigation system here to be able to function well the water levy needs to be adjusted up

Another official indicated that the scheme needed more money to be able to function. He indicated that either farmers paid more levy or government intervened to support the scheme. During the interview he stated that:

Government has abandoned us. There is no meaningful support coming from government apart from paying for the salaries of the staff

Officials also thought that one of the main reasons for the low performance of the system was the negative attitudes of farmers. An official complained that some farmers often stole water while others vandalized the canals.

6.12.3 Farmers' Narrative

During the interviews farmers complained that the water levy was very high. They indicated that apart from the maintenance of the scheme ICOUR did not provide them with any assistance. One farmer at Vea stated that;

The water levy is too high. ICOUR has to reduce it. The canals are in bad shape and I have to use a pumping machine to pump the water to my farm at an extra cost and still pay the water levy. ICOUR does not care much about us. We have been paying water levy for decades now so why are the canals not maintained? Where does the money go?

According to the farmers ICOUR was only interested in farmers paying the water levy but did not care if farmers were able to sell their produce. Farmers complained that they may pay for water levy and at the end experience crop failure. In this case their payment was not connected with (how they performed) the produce they got. The statement from a 28-year old farmer at Vea illustrates how farmers feel:

ICOUR is supposed to help us find market for our produce but they do not help. A lot of farmers here grow tomatoes and make good harvest but do not get people to buy and so the produce get rotten. ICOUR only comes to collect levies but does not help get market for us so that we can sell our produce, make more money, and pay the water levy promptly.

This statement indicates that farmers recognize that they work together with ICOUR but thought that the company was only concerned about the economic or monetary benefits it got but paid less attention to the interest of the farmers. It probably means that if the arrangements were made such that ready market was made available for farmers to sell their produce they could make more money which will empower them to pay higher water levies if the need be.

There was a lacuna between farmers' narrative and the official narrative in which ICOUR sees the water levy as low and farmers see the water levy as being high. ICOUR needs to be given the necessary support to empower it to assist farmers market their produce as well as provide extension services among others to farmers. In this way farmers will also be assured that they will make the necessary profit. In this case they will have the capacity to pay higher water levy. How will farmers be able to pay more for water if they are not financially capable? In attempting to ascertain the main issue that led to the scheme performing below capacity, farmers felt that the management did not perform as it should have. They indicated that the canals had broken

down without ICOUR paying attention to a maintenance culture that could have prevented large dilapidation.

The irrigation officials in this case have annually adjusted the water levies to match with changing conditions yet this is still seen as low. These increases though a somewhat solution to the low levies as indicated by officials it none the less impacts on the incomes of farmers. That means there cannot be an end to the point where both farmers and officials will agree that the levy was sustainable. Since the essence of management is to re-solve challenges other innovative methods may have to be adopted to raise funds. These may include introducing new irrigation methods such as drip irrigation which use less water, seeking more partners such as government and institutions in the water sector, forming and empowering water user associations to manage the scheme among others.

How then can these two competing positions be reconciled in the management of the scheme? The solution appears to hinge on the restructuring and formation of water user associations.

6.13 Rehabilitation, Restructuring of ICOUR and Formation of Water User Associations (WUA)

As of the time of conducting this research ICOUR was undergoing a major restructuring and retrenchment of some of its staff. This appears to be the solution to the challenges facing the scheme. During the interviews with the officials it was indicated that the company initially had 138 staff who were managing both the Vea and Tono schemes. The salaries of the staff were paid by the Government of Ghana (GOG) while the water levy was mainly used in running the scheme by repairing the canals. Due to ongoing intervention by the World Bank and USAID to rehabilitate and modernise the dam (scheme), a restructuring exercise was being undertaken and this involves laying off a number of ICOUR workers. Out of the 138 staff 108 of them have been retrenched and given some retrenchment benefits so that they could establish themselves. This means that only 30 staff will now be managing the Vea and Tono schemes. According to the interviews with the official, 11 more workers will be employed later after the rehabilitation.

The programme involves the rehabilitation and modernization of the dam and is being financed by the World Bank which is providing 30% of the finance and USAID providing 70% of the

funds⁴. According to officials of the scheme the essence of rehabilitate and restructuring of the system is to improve the system by redesigning the system and downsizing the staff.

The management structure of ICOUR has been altered. In an interview with an official he indicated that the project office at Veá will have 9 staff manning it including 2 extension officers, 1 field cashier, 2 water bailiffs, 2 security personnel and 2 labourers. The managing director and other top management will be at the head office at Tono.

During the interview with the officials they indicated that water user associations will now be formed in the management of water within the scheme. This will now be called farmers and officers association in the management of water. There were already draft bye laws on the formation and operations of the water user associations. According to officials the water user associations will include people who own land and those who constantly use land and people who use water. In this case anybody who happens to inherit land or buys land is qualified to form part of the water user association. Farmers who constantly use water are also part of the association. The bylaws did not however, take cognisance of pump owners who happen to own pumping machines but did not take part in farming. The reason was probably that of preventing an influx of all kinds of new member who might own machines from outside the area. The water user associations will be made up of a minimum of 15 people but associations could have more than 15 people. They will elect executives and whatever challenges they have will then be channelled through the executives to the officials of ICOUR. If there is the need for the maintenance of any broken part of the canals the farmers will apply to the office for the 50% of the levy that is kept for maintenance.

The water user associations are meant to involve farmers in the management of water and ensure that more responsibility is given to farmers. According to officers the old management system did not make farmers responsible since the farmers thought it was the responsibility of management to take care of the system and hence farmers did not hold each other responsible for managing the scheme. The formation of the water user associations will make farmers monitor each other so that if someone was stealing water or vandalising a canal for example the other farmers will not allow it. The formation of the WUA is in line with Ostrom (1990) when she indicated that if users are allowed to craft their own rules and manage the common

4 <http://www.a1radioonline.com/2016/03/20/vea-and-tono-irrigation-dams-undergo-rehabilitation-and-modernization/>

resource then the resource will be more robust and sustainable than if it was managed by an external authority.

Ostrom's argument for local resource users to formulate the rules and enforce them was based on the fact that the resource users had better understanding of the system. External agents may overlook some traditional and socio-cultural meanings which will go a long way to create conflicts in the management of the resource. This explains why traditional beliefs are worth considering in the management of common pool resources.

6.14 Invisible traditional beliefs and resource management

Invisible traditional beliefs promote or hinder water resource governance. Some incidences that occurred in the past and present within the area lay credence to the role of traditional beliefs and institutional gaps in water governance.

The bank of the Vea dam was in bad shape so a \$2million Nordic Development Fund facility was secured to rehabilitate the dam wall. This involved using rocks to reinforce the banks of the dam and changing the valves to enhance water processing and production. The contract was awarded to Eunitack Services Limited in 2010 with a consultant from Norway. The contract should have ended in December 2012 but this did not happen. There were however disagreements between the local residents and the contractor. The contractor wanted to break rocks from a rock out crop within the vicinity of the dam to carry out the work but the people did not agree because they said the rocks were their shrines and the abode of the gods and so breaking the rocks from the shrine will incur the wrath of their gods leading to some punishments to the entire community. The contractor's determined efforts to break the rocks led to fierce resistance from the *tindaana*⁵ (earth priest) and the local residents. This led to organised protests from the residents of the Vea community. On Wednesday, February 6, 2013 the contractor came to site to break the rock boulders to carry out the maintenance work. The community members came out to protest against this action. This led to confrontations and in the process one resident who was a final year student of the University of Education Winneba and who was also part of the protestors from the community lost his life when he was shot by

5 The Tindaana literally means 'land owner' in the Frafra language. He is the most powerful person in land matters even where there is a village chief. He is the custodian of the gods and the land and thus pours libation or communicates with the gods. If there are breaches on the traditional rules especially those connected to land or related to the village gods he mediates between the village and the gods.

a police officer who was part of the team at the scene to maintain order⁶. The repair of the dam had to be kept on hold pending the resolution of the conflict. This incident where there is an encounter with tradition is not an isolated case.

Such traditional beliefs play a key role in the management of natural resources. The paradox was that the common resource which is the dam needed to be repaired and kept in shape for use and yet the rocks forming the shrine according to the people also needed to be protected against harvesting through the traditional rules.

Another case in point is the Avea shrine which is composed of a packet of isolated trees protecting the side of the dam near the spillway. The shrine is made up of a collection of trees and a small pond which is mostly left behind when the water level in the dam recedes. The pond and the packet of trees are often covered by the dam water whenever the dam water is at its peak. This shrine is worshipped by the chief priest of the area and the people. It is a taboo to harvest the fish from the small isolated pond and the trees too cannot be felled. The trees form a buffer which protects the edge of the dam. The belief of the people is that this area is the abode of the gods and therefore any activity that harms the continuous existence of this shrine such as cutting down the trees will mean a dishonour to the gods with some dire spiritual consequences to the offending person and the community in general.

Another practice that had a traditional connotation was the unwillingness of land owners and farmers to sell their lands. During the field work it was noticed that the lands that were not managed by ICOUR such as the lands bordering the schemes were hardly sold. During the interviews some farmers indicated that it was a sign of bad omen to sell land since these lands were passed down to their families from generations and hence could not be sold. In an interview with a 45 year old farmer at Sumbrungu who farms on a land not managed by ICOUR, the following interaction occurred:

Question:

How does one acquire land in this area for irrigation?

Participant:

One has to contact the land owner. The land owners do not sell the land. The tradition is that you have to send a life chicken and a bottle of hard liquor to inform the land

⁶ <http://edition.myjoyonline.com/pages/news/201302/101063.php>

owner that you want to use his land. He will make sacrifices informing his ancestors that he was giving the land to you and therefore asking for good yield for the farmer. After harvesting you only need to plough the land for him so he can use it for the wet season farming. You may show further appreciation by giving him some of the produce you cultivated to make him happy since you may need the land the following year

The statement of the farmer indicates that irrigation cannot be divorced from traditional and local institutions. This means that for a successful irrigation management the local traditional institutions will have to be taken into consideration.

These chronicled events show how invisible traditional, informal rules play a part in natural resources management in Africa. These traditional informal rules could be pictured as playing multiple and complex roles which seek to conserve resources but on the other hand could also hinder the smooth governance of resources. The Avea shrine which serves as a grove acts to conserve or protect the dam since the trees are important in protecting the dam. According to Koku (2003), in most rural areas in Ghana the governing systems of local institutions have often had an impact on the sustainable use of natural resources. These traditional or customary institutions in this case serve to conserve resources, restrict access or prevent overexploitation. Land sales in many parts of Ghana have often been bedevilled by conflicts resulting from disagreements and multiple sales of the same lands. The tradition of not selling lands in the area though might be seen in some quarters as hindering the development of irrigation the same tradition has none the less played a role in probably minimizing land conflicts resulting from the sale of lands in the area.

Table 3: Observed comparative findings

Village	Veja(Upstream)	Nyariga(Mid-stream)	Sumbrungu(Tail end)
1.Boundary	Boundary of the resource was less fuzzy	Boundary of resource was less clearer compared with upstream	Boundary of the resource was more fuzzy
2.Water users	There were multiple or varied users of the resource(water) e.g. Irrigators, GWCL(Water treatment plant),ICOUR office, fish ponds, fishermen, livestock farmers	There were fewer water users, mostly irrigators	Water users were less varied. Mostly irrigators
3.State of canals	Canals were in better shape, Main canals and some secondary and tertiary canals were functional	Canals were in poor shape. Main canal and few secondary canals were functional	Canals were almost absent. Apart from the main canal the secondary and tertiary canals were broken
4.Water delivery	Farmers had good water delivery and supply	Water delivery and supply was not as good as Veja	Had poor water supply and delivery due to canal dilapidation
5.Crops grown	Crops mostly grown are rice, vegetables, tomatoes	Crops grown are rice, tomatoes ,onions, vegetables	Crops grown were vegetable ,tomatoes, pepper
6.Typology of irrigation	Canal farming was dominant but pump farming at the periphery of the scheme	Pump farming was more pronounced especially lands closer to the river	Largely pump farming
7.FBOs	Farmer-Based organisations were less active	Farmer-based organisations were very active and more organised	Farmer-based organisations were less active and not well organised
8.Payment of water levy	Paid higher water levies	Paid less water levy compared with upstream	Paid less water levy due to pump farming
9.Cooperation among farmers	Farmers cooperated more to clean canals	Farmers cooperated more to clean and maintain canals	Farmers cooperated more in digging wells and impounding water
10.Land rights	Land use, management and transfer rights were vested more in ICOUR	ICOUR had more land use, management and transfer rights	Land use, management and transfer rights resided in land owners

CHAPTER 7: COST AND BENEFITS OF IRRIGATION

7.1 Introduction

This section assesses the impact of irrigation on the incomes of farmers. It is my firm believe that a study of institutions governing water will be incomplete if one studied the institutions that governed irrigation water without finding out how at the end irrigation impacted on the farmers who are the pivot upon which the institutions were studied in the first place. In the framework presented in chapter 4, resource systems, resource governance regimes and institutions are all connected with outcomes. In this chapter, an attempt was made to assess the outcome of the institutions and governance systems in the form of how irrigation has impacted on the income of farmers within the Vea irrigation scheme. The assessment of the impact of irrigation on farmers' income was done by a focus group discussion involving farmers 11 farmers as participants. A cost-benefit analysis was done with farmers identifying the various elements of cost involving in irrigation and costing them and then assessing the revenue that accrue to them. Farmers also discussed the various dynamics involved in the various activities undertaken in crops cultivation. In this chapter I further present short stories in the form of boxes illustrating the impact of irrigation on farmers' incomes.

7.2 Farming period and preparation

During the Focus Group Discussion an attempt was made to assess the cost of cultivating a hectare of land and the revenue that accrue to farmers as a result of cultivating a hectare of land. Two crops (Tomatoes and onions) were examined because they were popular within the system. Table 4 and Table 5 gives an overview of the cost and operations of cultivating a hectare of land using tomatoes. Table 6 also shows the cost and revenue of cultivating a hectare of land for Onions

Farmers indicated that the farming season lasted approximately four months. During the FGD farmers further indicated that commence farming for the cropping season they first of all needed to purchase certain items such as the Knapsack sprayer for spraying pesticides, working clothing including boot and flash light for use by the caretakers(farm boys) at night. The farm Boys refer to people who were contracted to take care of the farms.

Atanga is a professional teacher and has been teaching for 16 years now. He realized that the salary he receives is not enough to cater for him and his family. He therefore decided to practice irrigation so he could get extra income to supplement his salary. He therefore went into irrigation in 2004. He cultivates onions along the river that carries the waste water from the Veia Dam. He previously cultivated tomatoes and Okro but finally diversified into onions because it is more profitable to him.

He said the decision to go into irrigation has actually helped him a lot. The income he makes from irrigation helps him to cater for some family needs. He does not buy Onion from the market anymore because he has a lot of it for his family. He has opened an account at the Bank and all the profits he makes from irrigation is lodged into that account. Through irrigation he was able to buy a motor bike which he uses to travel. He was able to put up a two-bedroom block house at his village from the money he saved from irrigation.

The story of Moses is not isolated. During the interviews farmers said they were happy they went into irrigation because their living standards had improved because of irrigation. Atambire is also a teacher but he says after closing from School he cultivates tomatoes to support his family. He says doing irrigation has saved him extra money since his family which he is the bread winner does not buy tomatoes from the market again.

Box 1: Impact of Irrigation: An irrigator's short story

There were two seasons in the farming regime-wet season and dry season. The dry season farming usually started from December to April with some farmers starting the land preparation as early as November. But intensive cropping period is January to April. The wet season farming on the other hand started from May to October. The wet season farming is mainly operated and managed by the farmers with rain-fed agriculture. Under the wet season farming ICOUR or the irrigation company had little control or management oversight over the activities of farmers since water was not distributed or allocated to farmers. The dry season farming was managed by ICOUR as it allocated water to farmers.

7.3 Land preparation for farming

There was a mix of methods that were employed by farmers to prepare their lands before planting. Land was prepared by any of three ways. First the use of tractors for ploughing, second by bullock plough where animals were used and lastly by manual labour. The method employed by a farmer depended on their financial ability. Tractor services were much more expensive to use when compared with the other methods. From the focus group discussions farmers indicated that the use of the tractors led to higher yields since the soils were more worked on by the tractor but they indicated that the tractors were not readily available and sometimes farmers did not get them at the time they were more in need of them. The use of the tractor involved ploughing the land and doing a second ploughing called harrowing where the land had to be levelled again by the tractor. Farmers stated that it cost Ghc120 (\$32) to plough a hectare of land and another Ghc70 (\$18.5) for harrowing. Animal plough was less expensive to employ. Animal plough involved the use of a pair of bulls or donkeys and in some cases a mix of a bull and a donkey to plough the land. The use of animal plough normally advantageous since it created furrows which served as mounds for planting. Animal ploughing was therefore much more convenient to employ according to farmers. In some cases the animals were used to create furrows after the tractor had done the first ploughing. It cost Ghc100 (\$26) to plough a hectare of land using animals (bullock plough). Farmers who did not have money to engage tractor services or animal plough used manual labour. This involved a situation in which farmers or labourers use a hoe to weed (clear the land) and create mounds before planting.

The major crops that were cultivated within the scheme were rice, tomatoes, onions, pepper and leafy vegetables. Other plants that were grown in small traces were kenaf, cabbage, beans leaves and groundnuts. During the wet season however, the crops that were grown by farmers vary slightly different from that in the dry season. The popular crops that were predominantly cultivated in the wet season were rice, millet/sorghum, groundnut (peanut) and maize.

7.4 The use of motorised pumps

As indicated earlier, from the field observations a lot of the canals had broken down and hence the use of motorised pumps was very popular among farmers. The motorised pumps were petrol-run engine machines that were fitted with long pipes which were mostly directed to the farms while the machines were connected to the source of water. Once the engine of the machine was started it pumped the water from the source of water through the pipes to the farm.



Figure 8: Photos of a pumping machine and pipes leading to farms



Figure 9: Photos showing farmers' fields

According to discussants at the FGD, the use, ownership and access to motorised pumps was an important enterprise within the system. Pump ownership was varied. Some farmers owned pumping machines while other pump owners were farmers who rented out their machines to other farmers for financial gains. Farmers who did not own machines rented from pump owners. Sometimes a group of farmers also teamed up to buy a machine. Ownership of the machine in this case became a collective one. In this case the farmers made their own arrangements to use the machine in turns. Anybody who wanted to use it in this case had to buy the required petrol for the machine. According to the discussants small numbers of two to

four farmers normally teamed up to buy a machine in situations where each farmer lacked the financial strength to do so alone. According to the farmers a schedule was normally made such that each farmer was entitled to use the machine in turns.

At the FGD a 29 year old farmer captured the arrangement well in a statement when he explained that:

Usually during the peak season the crops need water every three (3) or four (4) days but even five (5) to six (6) days during the non-peak period. Since we are three farmers sharing a machine the first farmer will use it today, the second farmer tomorrow then the last farmer on the third day. The machine becomes free on the fourth day. Then the cycle continues with the first farmer again and so the next time a farmer will be using the machine again automatically coincides with the period his/her crops will need water again.

According to discussants usually the farmer had to fill the tank of the machine with petrol after using the machine so that the next farmer could also use and after using the machine that farmer too would have to fill the tank with petrol for the next farmer. According to the farmers the pumping machine consumed approximately a gallon of petrol to two gallons per hectare of land depending on the efficiency and type of machine. The cost of a gallon of petrol was Ghc18 (\$5).

The maintenance of the machine however was the responsibility of the group of farmers who then had to contribute for the cost of repairs.

Individual farmers sometimes had to save money towards the purchase of their own pumping machine. A farmer at Sumbrungu was asked how he got money to buy his pumping machine and he had this to say:

I migrated to Kumasi in the south and lived there for some time. I saved money from the work I did and so when I was coming home I bought the pumping machine and that is what I used to start irrigation.

Farmers prefer to buy their own pumping machines probably because of the inconveniences associated with borrowing machines or sharing a machine in a group where in some cases the machine could not readily be available for use because another farmer might be using it. It is therefore the dream of every farmer to own his or her own machine since it gave them the

freedom to use the machine at their own convenience and needs. During the Focus Group Discussion a farmer at Vea stated that:

These days everybody wants to own their own machine because there are always disagreements associated with the group use. Some people do not want to follow the rules. In some cases others do not want to fill the tank after use or contribute towards repairs when the machine is broken

Farmers who did not own machines nor join groups to purchase one mostly had to rent the machine from the pump owner for a number of days depending on how long he or she would need it for the required water delivery. From the FGD it became clear that some pump owners who had their own machines but did not intend to use those machines within the cropping season rented them out to other farmers for the entire period of the cropping season. In this case the farmer had to negotiate with the pump owner regarding how much he would be paying for the entire period, mostly after harvesting. The farmer may often be made to pay upfront half of the cost of renting the machine and then pay the remaining amount after harvesting the crops. Discussants also indicated that in some instances some farmers relied on their social relations with neighbouring farmers to borrow pumping machines for use without having to pay fees for renting. In this case they only needed to bear the cost of the fuel for the machine. Such farmers may also reciprocate such gesture by providing other assistance such as labour.

According to discussants a motorised pump costs about Ghc1000 (\$263). This cost was however not a recurrent cost. Once a farmer bought it, it lasted for several cropping seasons. Farmers purchased these machines from the regional capital, Bolgatanga and other towns within the region such as Bawku and Navrongo while others bought the machines from the southern part of the country in towns such as Kumasi and Accra. Others also bought them from Cinkasse, a border town in the neighbouring country of Togo where the machines were said to be relatively cheaper.

In terms of the frequency of water use on the farms discussants stated that water was delivered on the crops every third day if the area was an upland. Uplands were dryer and required frequent water use. On the other hand water was delivered on the farms every fourth day if the land under cultivation was a lowland area. Lowlands according to discussants were wetter and required water delivery less frequently since they did not dry up as quickly as upland areas. Farmers also indicated that at the early and latter part of the crops life the plants required less water and hence water was delivered once in a week during this period.

7.5 Input use

The focus group discussions indicate that farmers used chemical fertilizer for their crops and that fertilizer use was one of the major costs to farmers. The fertilizers used were NPK (15-15-15), Urea and Sulphate of ammonia. They indicated that fertilizer use depended on the crop they cultivated. Crops that required fertilizer use were tomatoes and onions. Tomatoes is therefore the crop that required more fertilizer use. Fertilizer was applied on tomatoes three times before harvesting. Discussants explained that if the plants were young around three weeks the fertilizer called 15-15-15(1515) was applied while a mixer of sulphate and 1515 (or a fertilizer called 2310 or urea) was applied when the plants began to flower or when they were mid-way through their growth. When the plants were matured the last fertilizer called sulphate was applied. Three bags of fertilizer were applied to a hectare of land. Discussants indicated that it cost Ghc120 (\$32) to buy a 50kg bag of 1515, Ghc90 (\$24) to buy the same weight of sulphate and Ghc125 (\$33) to buy a 50kg bag of 2310. From the discussion it became clear that animal manure promoted better yields and higher quality produce but was only used by few farmers who owned land. Farmers who rented the lands said the land tenure system did not promote the use of manure since the land owner could take back his land anytime he or she wished. This did not promote the use of manure since one had to always pick and gather the manure which were mainly animal droppings in the dry season. The manure took a number of months to accumulate and to form compost. The owner of the land could take back his/her land at this time when the manure was ready.

From the discussions farmers also used pesticides to control crop diseases and also some chemicals to promote crop yield. This was another component of high cost to farmers since the crop diseases were rather rampant and often destroyed the entire farm produce of farmers. Farmers applied a pesticide called 'karat' at the early part of the crops growth and then followed by a pesticides called 1919(also called harvest more) which was used during fruiting of crops. Spraying with pesticides was done at two weeks interval. The discussions however showed that the quantity and frequency of use of the chemicals depended on the financial ability of individual farmers and this probably explained the differences in yields.

7.6 Harvesting of produce

Harvesting and marketing of farm produce was a big challenge according to discussants. It was the period of joy and sadness according to the discussion. It was the period when farmers enjoyed the fruits of their labour but only when things went in their favour. Harvesting in the

first place required some labour and mostly with crops like tomatoes women were contracted as farm labourers to harvest the produce. According to discussants about five women were needed to harvest a hectare per day. Each woman was paid Ghc15 (\$4) a day. The challenge was mostly how to find buyers for the produce. Once buyers were found harvesting commenced. From the discussion the price of the produce varied depending on the period of harvesting which was either the period of scarcity of the produce or glut of the produce. For tomatoes the discussion indicated that a farmer could harvest the produce up to about four (4) to five (5) times before the end of the crop. Farmers explained that mostly the first harvest tended to have higher prices which enable farmers to get much revenue because during this period the produce was a bit scarce. With tomatoes the produce were harvested in wooden boxes called crates. A crate of tomatoes weighed about 30kg. Discussants stated that the cost of a crate of tomatoes ranged between Ghc 200 to Ghc400 for the 2015 cropping season. According to farmers sometimes the prices of tomatoes during the period of scarcity could reach Ghc500 (\$132) per crate. The prices however fell during the second and third harvesting since these periods were marked with the glut of the produce. According to the farmers the prices could also rise during the last harvests since this also coincides with the period of low supply or scarcity of tomatoes.

Table 4: Cost-Benefit analysis of cultivating a hectare of land of tomatoes

DESCRIPTION/ITEM	QUANTITY	UNIT PRICE(GHC)	TOTAL(GHC)
Knapsack Sprayer	1	50	50
Working Clothing	3	30	90
Flash Light for night use	3	5	15
Batteries	3	2	6
Cost of buying a pump machine	1	1,000	1,000
Cost of borrowing a pumping machine	1	50	50
Petrol for pumping machine <i>22times of watering</i>	22gallons	14	308
Land Levy	1	70	70
Water Levy	1	70	70
Land preparation	6	15	90
Nursing of seedlings	1	50	50
Ploughing of land per ha <i>Tractor-ploughing and levelling(harrowing)</i>	1	120+70	190
<i>Bullock plough</i>	1	100	
<i>Manual or hand plough</i>	1	100	
Making of beds	1	100	100
Creation of furrows and dressing of crops	6	15	90
Watering and Transplanting	6	15	90
Spraying with pesticides <i>DDT or Karat</i>	3	20	60
<i>HarvestMore</i>	10	15	150
<i>1919</i>	10	10	100
Fertilizer application <i>1st 1515</i>	3	120	360
<i>2nd Sulphate and 1515(2310)</i>	3	125	375
<i>3rd Sulphate</i>	3	90	270
Cost of feeding farm boys/Care takers 3months	300	3	900
Cost of Harvesting	15	15	225
Total cost			4,709(\$1,239)

Table 5: Revenue for sale of tomatoes

Item	QUANTITY	UNIT PRICE(GHC)	TOTAL(GHC)
Revenue: Harvesting	Crate		
1 st harvesting	20	200	4000
2 nd harvesting	30	100	3000
3 rd harvesting	40	100	4000
4 th harvesting and others	25	150	3750
Total Revenue			14,750(\$3,881)
RETURNS(TOTAL COST –TOTAL REVENUE)			10,041(\$2642)

NB: Exchange rate as at April 2016. \$1=Ghc3.8 NB: Ghc=Ghanaian Cedis and \$=US Dollar

A crate of tomatoes weights about 30kg

7.7 Onion cultivation issues

With regards to onion cultivation the land was prepared by the use of the tractor for ploughing. Sunken beds were prepared by manual labour. According to farmers it costs Ghc100 (\$26) to prepare the beds for onion cultivation. With onions fertilizer was applied four (4) times before the crops got ready for harvesting. This involved applying the first one in the first week of planting then the second application was done in the third week then continues in the fifth week and the last application occurring in the eighth week. After this application there was no fertilizer application again until crops were ready for harvesting. The fertilizer application for the onions varied a little bit from the onions. In terms of onion cultivation a fertilizer called 20:10:10 was first applied then followed by a mixture of folic fertilizer and organic fertilizer called ‘Super Grow’. The last fertilizer to be applied before harvesting was called 23:10:5(Yara fertilizer).The common pesticides and insecticides used for onion farming within the scheme were ‘Lamda’ and ‘attack’, According to the farmers both could be used at any stage of cultivation. Table 6 shows a cost–benefit analysis of onion cultivation.

Table 6: Cost-Benefit analysis of cultivating an acreage of land of Onions

Description/Item	Quantity	Unit price	Total
Knapsack sprayer	1	50	50
Working clothing	1	30	30
Flash light for night use	3	5	15
Batteries	9 pair	2	18
Cost of buying a pumping machine	1	1000	1000
Petrol for pumping machine(1.5gallons a week for 4months)	24gallons	14	384
Water levy	1	70	70
Land levy	1	100	100
Land preparation	6	35	210
Nursing of seedlings	2	400	800
Ploughing of land(Tractor and levelling)	1	180	180
Making of beds	1	100	100
Transplanting	6	30	180
Spraying with weedicides	3	30	90
Spraying with pesticides and insecticides	4	30	120
Fertilizer application -(1).23:10:5	6	125	750
2)Top cop(Super Grow)	4	30	120
3)20:10:10	6	125	750
4)Folio Fertilizer	5	30	150
Cost of feeding farm boys	4people	300	1200
Cost of harvesting	12people	15	180
TOTAL COST			6,497(\$1,709)
REVENUE			
Item/Description	Quantity(Mini Bag)	Unit Price	Total Price
1st Sale	80	60	4,800
2nd Sale	60	120	7200
TOTAL			12,000(\$3,157)
RETURNS(REVENUE-COST)			5,503(\$1,448)

7.8 Summary of impact of irrigation on farmers' incomes

The results (cost-benefit analysis) from the tables shows that there was some profit in undertaking irrigation. The cost component in some cases could even reduce considering the fact that some participants indicated that sometimes they used family labour so that there would not be any need of paying money to people outside. The family labour was mostly unpaid and involved family members expending their resting or leisure on the farms. During the dry season there was abundant family and other labour since many people were not engaged in any economic activity during this period due to lack of jobs.

The discussions and the results from the table indicate that the profit from undertaking tomatoes farming was higher than that of onion farming within the scheme. The total profit from cultivating the same size of land for tomatoes was **Ghc10,041(\$2642)** and that of onions was **Ghc5,503(\$1,448)**. These profits were simply averages since some slight changes could exist because some farmers used pumping machines while others did not. These involved some cost variations. According to farmers the returns from tomatoes was higher than the other crops within the scheme but it was associated with higher risks. According to discussants if things worked out well farmers made a lot of money but if there was crop failure farmer made huge losses because of the high investment costs. Tomatoes failure was mostly due to nematode and other pest infections.

Ananga (28 years) comes from Vea. He completed Junior High School in 2003 and has not been able to continue his education due to financial challenges. He is not employed and could not also get employment due to the low level of his education. He decided to go into irrigation after seeing how it was helping his brother and others who practiced it.

He has practiced irrigation for 13 years and cultivates rice, tomatoes, onions, green pepper and maize. He does both the wet season farming and the dry season farming. Mostly he engages in the wet season farming to feed his family. He does the dry season farming for commercial purposes. Irrigation has helped him a lot. He saves the income he makes from irrigation which he uses for a lot of things.

In the first place he used to stay in a mud-built and thatched-roofed house. It was through the money he saved from irrigation that he used to build this three room block house which is roofed with aluminium roofing sheets. These block rooms changed his life because many people see him as a successful person. Through the money he saved from irrigation he bought some livestock. Specifically goats and sheep and also some chicken. These animals which he bought have now grown in number and also give him some income. He also sells these animals to support himself whenever he has financial challenges. If there is crop failure and he does not get capital to start farming within a season he simply sell some of the animals to raise money for farming instead of borrowing.

He cannot imagine life without irrigation since he does not have much education. Some of his friends who also could not continue their education just like him and who did not engage in irrigation have migrated to the southern part of Ghana and are engaged in menial jobs. He is sure that if things continue to work well he can do well.

Box 2: A changed life-A new source of income: A rural irrigator's short story

7.9 How important is this profit?

The profit made from cultivating tomatoes and onions as shown on the table 4 and Table 5 was quite substantial and important to farmers in the area. At the group discussion farmers explained that such profits could help change the life of a farmer substantially. They illustrated the impact and importance of the profit margin from the tomatoes for example with the cost of buying a piece of land in the area for building. The profit of **Ghc10, 041(\$2642)** could buy two plots of land (measuring 100 by 70 feet) in the area for putting up a building. A bag of cement according to them costs Ghc35 and so this profit margin could buy about 254 bags of cement. A farmer could start a two bedroom house with only 100 bags of cement. They indicated that this profit margin could help put up a two bed room block house for a farmer in the area. Farmers tried to illustrate the economic value of such an amount and what it could do. One farmer in fact indicated at the discussion:

Last year I bought a cow at Ghc800 (\$210) which I am rearing. This means that Ghc10,041 could buy about 12 of such cows. Having this number of cows will make you the richest person in this area.

The statement of this farmer and others indicated that irrigation could greatly help improve the incomes of farmers in the area if given the necessary support. Perhaps the importance of irrigation in helping improve the incomes of farmers was responsible for keeping a lot of farmers in the area as against some years back when they used to migrate to the southern part of Ghana to engage in menial jobs. Seeing that some farmers were able to make money from irrigation by staying at home a lot of farmers no longer see the need for migrating to the southern part of Ghana. Even if they did it may largely be aimed at acquiring capital to come and invest in irrigation and other ventures.

Atiamah (42) is a widow from Nyariga who has been practising irrigation for the past six years. She started doing irrigation after her husband's death. She inherited the land the late husband used for irrigation but sometimes she rents land from other farmers if she needs more land for cultivation. She cultivates rice mostly. After the death of the husband she had no other support since she was unemployed. Taking care of her two kids was therefore a challenge. She therefore decided to go into irrigation as a way of supporting herself and the children. With the little money on her she borrowed some money from neighbours and started irrigating.

Through irrigation she is able to save money for unforeseen events. She is able to pay for the school fees of her two kids. Through the irrigation she is also able to cut cost on other food stuff she buys from the market. Rice prices are high in the market but since she cultivates rice she does not buy rice from the market again since she keeps some of her rice for feeding her family. Atiamah says irrigation is now her 'husband' since it is able to give her the support that she needs for herself and her children. She is able to buy her basic needs from the money she makes from irrigation and mostly saves little from the irrigation income for unforeseen events. She says her life would have been uncertain had it not been because of irrigation. Atiamah has already started saving money from irrigation to establish a drinking spot in the village which would give her extra income as well.

Box 3: The impact of irrigation: A widow's story

7.10 Summary of key findings on impact of irrigation on farmer's incomes

The findings indicated that farmers undertook irrigation for largely commercial reasons. There was high profits generated by irrigation and this impacted positively on the incomes of farmers. In other words it was profitable engaging in irrigation. The profits from irrigation had helped farmers to cater for their families and other needs while some farmers had been able to put up better accommodation or housing. The profits from irrigation had also helped a number of farmers to invest in alternative income generation ventures such as livestock rearing and poultry keeping. Irrigation was therefore a major employment avenue to farmers within the scheme.

CHAPTER 8: CONCLUSION AND RECOMMENDATION

8.1 Introduction

This chapter concludes on the study done. This section will revisit the research objectives of this work, summarise the main findings of this research, offer some recommendations based on the findings and a short theoretical reflection on the study.

8.2 Summary of Findings

The overall research objective of this work was to do an institutional analysis of irrigation water governance. The study's first objective focused on assessing the extent to which water governance followed Ostrom's design principles.

The research revealed that the hydrological boundary of the Veia irrigation scheme and the community of users was fluid. Though the dam was located loosely in the Bongo District it served communities in both the Bongo district and the Bolgatanga municipality while the user community was not restricted to only communities within the catchment area of the scheme. The physical boundary of the scheme kept changing depending on the seasonality and rainfall pattern. If there was adequate rainfall within a season, the boundary extended, thus serving more farmers within the neighbouring communities and if the rainfall was inadequate, the boundary of the scheme contracted. In line with Ostrom, there were clear rules of entry within the scheme.

Since water cannot be divorced from land an investigation of land rights indicated that land was a complex bundle of rights. While management rights were vested in ICOUR, land owners and farmers had use rights. Both the irrigation company and land owners however possessed transfer rights. An important finding of this research was that different stakeholders had ownership of land depending on the season. During the dry season the lands belonged to the irrigation company called ICOUR and so any farmer who wanted to farm on the lands had to pay water levy to ICOUR while in the wet season the lands belonged to the land owners who farmed on the lands without having to pay water levy.

The research also revealed that farmers within the scheme were governed by largely informal rules. Though there were rules in place to govern the activities of farmers these rules were not written down or explicitly crafted as suggested by mainstream institutionalists.

The research further showed that farmers largely resorted to traditional informal ways of conflict resolution within the scheme instead of the formal ones like the courts. These informal conflicts resolution mechanisms were however fair, rapid, efficient and less costly. This find was in line with mainstream institutionalism which argues that for a sustainable management of a common resource like water there must be an effective, fair but less costly conflict resolution mechanism among the users of the resource. Related to this, there were also sanctioning regimes for violators of the rules-in-use but these sanctions were effective but not fair. If some farmers within a secondary canal failed to pay the water levy for example water supply was closed to the entire secondary canal (lateral) thus affecting non- violators as well. This made the sanctioning regime unfair.

Lastly on this objective the research revealed that farmers co-operated with one another within the scheme. Farmers therefore related more than just water but through social networks. Farmers related more closely based on their spatial location within the scheme, the Village they resided in, the type of crop they cultivated and lastly the type of irrigation they practiced. These formed the basis upon which cooperation occurred.

Closely connected to the first objective was the second objective which sought to examine how water is governed or managed within the Veia irrigation scheme. This research found that water was managed by a mix of both formal and informal institutions. The Irrigation Company of the Upper Regions (ICOUR) with its committees were the main formal institutions that managed water within the scheme. It was however revealed that these formal committees which were directly under ICOUR were not very active. The research revealed that lateral leaders (secondary canal leaders) who were elected by farmers themselves were the most active governance institution. These lateral leaders were in charge of collecting water levies from farmers as well as monitoring each lateral under their jurisdiction.

Further, a key finding was that farmers and the irrigation authorities had irreconcilable positions regarding some management issues within the scheme. Whiles officials of the scheme thought farmers needed to pay more for water since according to them water levies were not self-sufficient and could not sustain the system. The farmers on the other hand thought the water levies were high since they had continuously paid levies yet there were no marked changes in the system.

The research also revealed that invisible traditional beliefs played a role in the management of irrigation within the scheme. Neglecting or overlooking traditional beliefs in the management of water could result in serious conflicts.

According to popular literature and findings (Ostrom & Gardner, 1993; Uphoff & Wijayarathna, 2000; Yuling & Lein, 2010) farmers whose fields are situated upstream have a locational advantage, but contrary to popular literature, within this scheme farmers whose fields were located downstream rather had a locational advantage and performed better. The lands upstream have been overused because they have been used for crop cultivation since the inception of the scheme in 1965 and have become less fertile. The lands downstream were more fertile because they have been used less and hence farmers downstream had higher yields. Further, pump farmers paid less water levy because of their perceived disadvantage. They paid half of the levy the project farmers paid for the same acreage of land. Farmers downstream also had the advantage of selecting fertile and suitable fields and thus pumping water to such fields for farming.

The third and final objective assessed the impact of irrigation on farmers' income. A key finding was that farmers made some profit in irrigation. Irrigation therefore had a positive impact on the incomes of farmers. Further, farmers had substantial incomes from irrigation to the extent that some put up houses from irrigation while others invested the incomes into alternative income generation ventures.

The research further found that farmers undertook irrigation for largely commercial reasons even though some of the produce were used to feed the family.

8.2.1 Gender Dimensions

This research indicated that women actively participated in irrigation. They participated at farm level as well as association or leadership levels within the scheme.

Women held leadership positions in farmer based organisations (FBO) and associations and were mostly entrusted with financial management issues of the FBOs. At field level women's participation largely reflected their traditional roles at home. Women were mostly associated with the cultivation of particular crops such as rice and leafy vegetables which they traditionally cultivated at the household level during the wet season.

Canal cleaning was also largely done by men while the women cooked food and fetched water for the men to drink, something that also reflected traditional role of women at the household level.

8.3 Recommendations

This study recommend that the informal irrigation sector has to be given the necessary support. According to the Ghana National irrigation policy and strategy (2012) this irrigation sub-sector is the largest sector in Ghana but has been neglected. Yet the research showed that the informal sector which was largely dominated by pump farming performed better than the formal or project faming. This shows that if the necessary support (technical, institutional, financial) is given to this sector there is a high chance of good economic performance in the irrigation sector. This will invariably lead to meeting the food requirements of the country whiles providing jobs to many people.

An assessment of the rules within the scheme indicated that farmers operated more with informal social rules. In establishing irrigation schemes there is the need to rely on the social relations with which farmers operated with. This can be done by transferring management functions to farmers through water users association thus giving farmers the leeway to apply whatever social relations that exist within their operational areas. Irrigation development and management must be tailored towards the local needs and practices of communities. There is a need to do an assessment of the institutions that govern communities and then tailor the management operations and development of irrigation system in line with these local institutions in place. Much attention should therefore be paid to self-management by farmers. Within the scheme for example even though there was an irrigation company with committees in charge of management it appeared the lateral leaders who were elected by farmers could form a key management arm since they were very effective in managing the secondary canals in particular. Financial resources could be channelled through such management aspect where farmers are directly in charge of their own management affairs.

There is growing evidence that governments and donors are investing less in irrigation especially in Ghana. This is largely due to the fact that some irrigation schemes across the world have not performed up to capacity. The arguments advanced for less governmental investment in irrigation has been that of poor cost recovery in irrigation. That investment costs are not recovered in irrigation schemes(Carney & Farrington, 2005).Irrigation should not only be seen as a business but should also be seen as an activity that has various dimensions to

development including the social component. Irrigation is more than just a business but it is also a social activity since people relate more than just water. It provides a platform for social interaction and the advancement of value systems as farmers interact around irrigation in everyday practice.

There is increasing evidence, testimonies and studies in communities where irrigation takes place and the feedback shows positive results. Contributions of irrigation to communities where irrigation takes place cannot be under estimated. In the savannah zones in particular irrigation communities show reduced poverty levels an indication that the contribution of irrigation to such successes cannot be ruled out. The 2010 Ghana Poverty Mapping Report for example shows that in the upper east region the Kasena Nankana districts and the Bolgatanga municipality are the less poorest in the region with poverty incidence of the Kasena Nankana west district being as low as 13.1% as opposed to some districts like the Builsa South district with 84.4%(GSS, 2015). These districts with the low poverty incidence incidentally have the two public irrigation schemes (The Vea and Tono dams) supplying large parts of their areas. Since there is no specific data indicating the cause of the reduced poverty levels in these districts the impact of irrigation in providing employment to farmers, providing fresh food supplies in the dry season and stimulating the local markets cannot be underestimated. Irrigation is also a means through which NGOs and other development agencies can support communities in a bid to reduce poverty and improve livelihoods.

8.3.1 Informal irrigators amenable to formal governance

There is the need for a reassessment of the governance of irrigation. Irrigation has largely been categorized as formal and informal (MOFA 2011) under the Ghana irrigation policy to which the informal sector has been identified as neglected. In this system there was a knitting and mutualistic existence and performance of the two systems, an indication that the two systems of formal and informal can co-exist and be governed together. The informal sector has been perceived by authorities and policy makers as chaotic, unorganized and hence difficult to govern and this explains why the GIDA and other related agencies pay less attention to it. The findings here however reveal that the informal sector is amenable to both formal and informal governance if the right intervention is made. Within this scheme Irrigators downstream are termed as informal because they were not under any formal governance regime. They have however come under the formal governance regime by paying water levies to ICOUR and show signs of good or better performance.

8.4 Reflection on the study

Mainstream institutionalism (MI) and critical institutionalism (CI) are both important theories for studying resource governance. MI appear appealing because they are easy and well organised for studying how irrigation systems are organised and work. They equally make it easy to analyse irrigation schemes and other resource governance systems. MI are however accused of being concerned with only factors that are internal to the institutions being designed while ignoring external factors that might have bearings on the resource governance (Steins, 2001). For example the roles of international donors, world market conditions and other factors remotely located from the resource system are not explicitly captured by Ostrom and other mainstream institutionalists theorists. CI on the other hand provides theoretical insights into the weaknesses of MI. They are able to investigate the complexities associated with social interactions in resource governance. CI is however messy and unorganized for analysing irrigation schemes. This makes their application very difficult. They therefore do not appear appealing to donor and other irrigation support agencies because they are not very clear to understand and apply in resource governance design.

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APPENDIX A: Interview Guide for Farmers on Institutions That Govern Water

The researcher is a master student of the Norwegian University of Science and Technology (NTNU), Norway. The essence of this research is to study how water is managed by farmers and to unearth how farmers collectively manage the irrigation system.

The information solicited is for academic purposes only

SECTION 1

The aim of this section is to address the first research objective which is to examine the institutions that govern water. These questions are meant to elicit information about the institutions around water management and distribution. It therefore aims to find out the dynamics in the system in line with the design principles proposed by Ostrom such as conflict resolution, sanctions, rules of appropriation and provision among others.

I. Defined boundaries of water resources and farms

This section is aimed at establishing the clarity of the resource boundary and the community of users who have rights over it.

1. Where do you get water to supply your crops?
2. Can you explain how the water gets to you?
3. Are there restrictions regarding who can and who cannot access water in this system?
4. If yes explain these restrictions
5. How is land acquired within the scheme? Probe further

II. Rules on appropriation and provision

The aim of this part is to assess the rules governing access to the resource units, the restrictions placed on farmers and how they partake in maintaining the system.

1. What are the ways by which you pay for water? Please elaborate (*Probe whether cash, labour or others*).
2. How is irrigation water charged? Probe whether flat rate, per cropped area, volumetric rate etc.
3. Please explain how water is distributed among farmers?
4. What are the day to day activities that you as a farmer undertake to maintain the irrigation system?

III. Rules formulation and collective action

1. Are there rules governing how water is distributed and how you access it?
2. If yes what are these laws and who formulates them?
3. Would you describe these rules as formal or informal? Explain
4. Do you sometimes run out of water to irrigate your crops? If yes what do you do when you run out of water?
5. In your opinion what do you think are the likely causes of the water shortage?
6. Do you have any form of arrangements with other users upstream or downstream regarding how the water is used?
7. If yes explain these arrangements

IV. Monitoring and Graduated Sanctions

1. Are there regular checks on the irrigation system to ensure that things work properly?
2. If yes who monitors the farmers, farms, water and the system in general?
3. Explain how this monitoring is done?
4. Are there sanctions for farmers who violate the irrigation rules? Explain further.
5. In your opinion do you think the sanctions applied are deterrent enough to violators of the irrigation rules? Elaborate

V. Conflicts resolution mechanisms

1. Can you explain the common conflicts that occur between farmers and the period of the cropping season that they often occur?
2. How do you resolve conflicts when they arise
3. In your opinion how would you describe the conflict resolution mechanisms that are used in this system?
4. Do you think they are rapid and fair enough and why?

VI. Nesting of Institutions/Relationship among water users

5. Can you describe the relationship between the farmers upstream and those downstream?
6. What crops are grown by farmers in the system and why have they chosen to grow these crops?
7. Are there different cropping patterns between farmers upstream and those downstream? If yes, elaborate on these cropping patterns.
8. Do farmers sometimes block the water for their use?
9. If yes explain what farmers do when their colleague farmers downstream or upstream block the water.
10. Do you think the farmers who are upstream and those downstream operate with the same or different rules? Elaborate.

APPENDIX B: Interview Guide for the Irrigation Scheme Management

This is an in-depth interview guide with the management of the formal irrigation scheme (ICOUR)-The Tono and Veia Irrigation Schemes. The aim of this interview guide is to find out how the irrigation scheme is managed and also to assess the performance and challenges of the irrigation schemes.

1. What is the size of the irrigation scheme you manage? How many hectares and communities benefit from the scheme?
2. How many farmers are actively involved in the irrigation system?
3. How many people are employed by the scheme?
4. How is water distributed among farmers in the irrigation system? What infrastructure in place to distribute water from the dam to the farms? Probe further
5. In your opinion would you say the system inures to the benefits or is a disadvantage to the farmers and communities that live at the tail end of the formal irrigation system? Elaborate further.
5. What are the challenges of the irrigation system?
6. How do you see the future prospects of the irrigation system?
7. What are the sources of funds for the irrigation system and are these sources sustainable?
8. Which institutions are your key partners in the running of the irrigation system and what role do they play in the system?
9. What is the trend of crop output within the past few years?
10. What are the main conflicts that often emerge among farmers and what conflict resolution systems are used?
11. Do farmers take part in formulating the rules governing the scheme?
12. Have there been any notable changes in the system in recent times and if so what are these changes?

13. What are your opinions about the informal irrigation system and the formal irrigation scheme? Probe further.

APPENDIX C: Interview Guides for Focus Group Discussions

A. Females

The aim of this focus group discussion is to seek information from female irrigators on gender issues regarding especially women's participation in the irrigation scheme. This group discussion will be made up of seven females.

1. Do you own land?
2. If no explain why you do not own land.
3. If yes explain how you came by the land.
4. Do you have your own irrigated farm? Explain further.
5. Do women engage in irrigation? If yes what is the motivation for engaging in irrigation?
6. What kinds of crops do you mostly cultivate? Explain if there are reasons for the choice of these crops.
7. Are there particular crops that are grown largely by women? Explain further.
8. Do women own land in the rain fed agriculture? Explain further
9. Do women own farms in rain fed agriculture? Elaborate
10. What roles do women play in the irrigation system? Elaborate on these roles.
11. In your opinion how would you describe women's participation in rain fed agriculture as against their participation in irrigated agriculture? Probe further.
12. Do you have farmer associations? If yes are these associations' mixed-sex or only women? Do women participate in these farmer associations?
13. In your opinion how would you describe the power wielded by women and that of men in the irrigation system? Do you think women are being disadvantaged or discriminated against? Probe further.

B. Males

The aim of this section is to assess the impact of irrigation on farmers' incomes by doing a cost-benefit analysis of irrigation. The group will be made up of 11 farmers. The Focus Group Discussion will be centred on some of these issues:

1. What are the first steps when undertaken irrigation? Explain step by step what activities are undertaken? Probe further
2. What are the costs involved in undertaking the agricultural practices? Discuss the details
3. What is the revenue for the sale of crops? Tomatoes and onions. Discuss marketing of produce. Probe further. Calculate the cost and revenue from the activities identified with farmers.
4. Do you think irrigation is a profitable venture to undertake? Explain further. What financial benefits have you had from irrigation?

NB: Discussion centred on some of the following practices:

Land rent/levy, Water levy

Cost of seeds, Land preparation

Nursing of seedlings

Care for nursery

Water supply

Bed making

Transplanting

Weeding

Spraying with chemicals

Staking

Inputs:

Fertilizer, NPK, Manure and others

Ropes

Cost of buckets, Labour

Harvesting and Sale/marketing of produce

Price of crate, bowl, other unit of (tomatoes, pepper, etc.)

Also note:

Farmers to Sketch maps of the irrigation system in general, also map of farms and plots

FIELD PHOTOS

The Vea Reservoir



Focus Group Discussion with farmers



Pounded fields for rice cultivation



Section of rice farms



A Farmer showing a Lateral Gate



A Canal overgrown with weeds



Farm plots prepared for planting



Farms with crops



Farmers fence their farms against animals



Waste water from the Veia dam used by farmers downstream



Water pumping machines



A farmer operating a pumping machine



Water delivery on farms



A motorised pump

