UNIVERSITY FOR DEVELOPMENT STUDIES

THE EFFECTS OF AGRICULTURAL MODERNISATION ON POVERTY REDUCTION: A CASE STUDY OF THE TONO IRRIGATION SCHEME IN THE KASSENA-NANKANA DISTRICT OF THE UPPER - EAST REGION OF GHANA

BY

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ABSTRACT

Over the past three decades, there has been increasing recognition of irrigation development as a source of sustainable poverty reduction. This argument is rooted in the fact that poverty is endemic among food crop producers in the rural areas. The central argument has been that, if the poor have access to water throughout the year, they would be able to produce two or three times in a year, especially in the savannah regions. Thus, accelerating the provision of irrigation infrastructure is one of the intervention areas for modernization of agriculture as captured in Ghana's Agricultural development policy framework.

This study sought to ascertain the effects of irrigated agriculture on poverty reduction among the people in the Kassena-Nankana District, from the perspective of the Tono Irrigation Scheme. The district is located in the Upper-East Region of Ghana where nine out of ten people are considered poor, which puts poverty at 90 percent. The mainstay of the local economy is mostly rain-fed agriculture with a few dug-outs and dams used mostly in the dry season. Majority are in the food crop sector The Tono Scheme was established in 1985 by the Government of Ghana as an integral rural development strategy, to enable farmers crop twice in a year, through the adoption of modern farming techniques. The overall objective was to reduce poverty through rural employment creation and to ensure food security.

The objectives of the study were to; to ascertain the productive activities that leads to poverty reduction; to determine the level of participation of the beneficiaries in the organisation and Management of the Scheme; to find out the unintended negative consequences of the irrigation scheme; and lastly to identify other pathways out of poverty, irrigation can provide other than

The information gathering techniques used included collection of primary and secondary data; which were collected from various sources and subjected to rigorous analysed.

Among the major findings of the study are that; Irrigation farming has a positive effect on the socio-economic conditions of the beneficiaries by way of improvement in their income levels, food security, education of their children and reduction of out-migration of their household members to the Southern part of the country. On the whole, the scheme has improved the standard of living of the people.

A critical challenge facing irrigated agriculture in particular and agriculture in general is the lack of adequate markets, pollution of the environment as a result of the rampant use of agro-chemicals, and the prevalence of water-borne diseases all year round due to the presence of water. An important recommendation from the study is that the Value-Chain Approach should be adopted to improve marketing of agricultural produce, especially produce from irrigation schemes where the cost of production is relatively higher. In addition, aqua-culture and the Tourism potential of the irrigation scheme should be enhanced to create more jobs for the youth.

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DEDICATION

This work is dedicated to the memory of my late brother Haruna, my wife Judith, and my children, Jamila, Hakeem, Mariam and Selma for their love and support.

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LIST OF ABBREVIATIONS

C.H.l.P .....Community Health Improvement Project

D.E.S ..... Dietary Energy Supply

D.H.M.T .....District Health Management Team

D.l.S.C.A.P ..... District Capacity Building Programme

E.R.P .....Economic Recovery Programme

F.A.O .....Food and Agricultural Organisation

F.A.S.D.E.P .....Food and Agricultural Sector Development Policy

F.B.O ..... Farmer Based Organisation

F.C.U.B.E .....Free Compulsory Universal Basic Education

F.G.M ..... Female Genital Mutilation

G. D.P .....Gross Domestic Product

G.L.S.S ..... Ghana Living Standards Survey

'G.P. R. S ..... Ghana Poverty Reduction Strategy

H.I.P.C. ..... Highly Indebted Poor Country.

H.l.V./A.I.D.S..... Human Immune Virus / Acquire Immune Deficiency Syndrome

ICOUR..... Irrigation Company of Upper Region

I.C.R.I.S.A.T ..... International Crop Research Institute for the Semi Arid Tropics

l.L.O ..... International Labour Organisation

I.M.F ..... International Monetary Fund

I.P.M..... Integrated Pest Management

I.S.O.D.E.C .....Integrated Social Development Centre

I.T.C.Z..... Inter-Tropical Convergence Zone

K.N.D.A..... Kassena-Nankana District Assembly

L.E.A.P..... Livelihoods Empowerment against Poverty

L.E.I.S.A..... Less External Input and Sustainable Agriculture

M.D.Gs..... Millennium Development Goals

M.0.F.A..... Ministry of Food and Agriculture

N.D.P.C..... National Development Planning Commission

N.G.0..... Non - Government Organisation

O.D.I..... Overseas Development Institute

P.A.M.S. C. A. D. Programme of Action to Mitigate Social Cost of Adjustment

P.F.I..... Prevalence of Food Inadequacy

P.T.A..... Parent-Teacher Association

R. &D	Research and Development
S.A.D.A	Savannah Accelerated Development Authority
S.T.M.C	Science Technology and Mathematics Clinic
U.N	United Nations
U.N.D.P	United Nations Development Programme
U.N.l.C.E.F. ...	United Nations Children Fund
V/C	Village Committees
W.D.R	World Development Report

CHAPTER ONE

GENERAL INTRODUCTION

1.1 BACKGROUND

The world's irrigated areas almost tripled between 1950 and 1982. Although it represented only one-sixth of the worlds cultivated areas, it accounted for one-third of the world's food crops production. Population growth rates and increasing food requirement, as well as the quest to modernize agriculture in the developing world to reduce poverty, will further increase humanity's dependence on irrigated agriculture

Ghana basically has an agrarian economy, agriculture is predominantly practiced on smallholder, family-oriented basis, using rudimentary tools to produce about 80% of total agricultural output. According to the 2000 census, 50.6% of the labour force is directly engaged in agriculture, with about 90% of farm holdings being less than 2 hectares in size.

Agricultural production is generally dependent on rainfall, although an estimated 6000 farm enterprises nation-wide were using some form of irrigation in 1999. In 2002, the total area under irrigation was estimated at 11000 hectares, whereas the potential area that could be developed for irrigation is roughly 500,000 hectares. (G.l.D.A., 2000)

Ghana's irrigation policy is enshrined in the overall national agricultural policy, thus, The Food and Agricultural Sector Development Policy (FASDEP) provides the policy direction as to the development of irrigation. The policy observed that less than 1 % of arable land is under irrigation, and poor management of existing systems further limits their effectiveness. The policy objective therefore is to enhance production potential of the existing schemes by raising productivity of irrigation water from30% to 80% in the next ten years. This is part of strategies to modernize agriculture to attain food security, especially in regions where food insecurity manifests. (FASDEP, 2009)

According to the policy, irrigation development would provide avenues for solving problems related to rain-fed, and provides employment to people all year round. It would

also help in curbing rural-urban migration and raise the productivity levels of agriculture in the country.

The Northern part of Ghana lies in the Guinea and Sudan Savannah region of Africa, with its characteristic of climatic variability and recurrent drought conditions, Of all basic needs and pressing problems faced by the people of this area, one of the important needs is the availability of improved water supply. As in all arid and semi-arid environments, the ability to grow food crops, to produce livestock, and the ability to support minimum human life itself, depends on the availability of adequate water.

These climatic conditions have placed irrigation farming at the centre of agricultural development policy of most governments in Africa. Despite the importance of irrigation however, much of the work done on the subject has failed to address the multifaceted impact of irrigation, especially on the life of the resource-poor peasant farmers. (Quiroga et al 1990). Most write-ups on irrigation are concerned with the technical, administrative, and economic aspects, with little or no reference to the welfare impacts on the livelihoods of beneficiary farmers. (Chambers, 1983).

General economic growth which brought unprecedented levels of well-being and prosperity to many millions of people in the latter part of the twentieth century, has nevertheless, left many other millions in poverty, hunger, fear and oppression. The neoclassical faith that such growth will trickle down to the poor and dispossessed and lift them out of their misery has proved futile. (World Bank, 2000)

Poverty is basically a rural problem and revolves around the low productivity of the millions of small-scale subsistence farmers. (McNamara, 1973). Agriculture is the only source of real income savings and growth, it sets out to bring about and or help bring about increasing production and productivity of the small subsistence farmer. McNamara (1980) also notes that the two principal goals of development - to accelerate economic growth and to eradicate absolute poverty- are intrinsically linked, neither pursuit, taken by itself can lead to sustained successful development.

There is a growing notion that if agriculture can be modernized with the provision of irrigation and allied services, the small-scale farmers can produce more than enough to create wealth and reduce poverty, and contribute to national development.

In Ghana, the incidences of poverty have continuously shown a marked degree of consistency. In particular, the already poorest part of the country, (the three northern regions) derived very little from economic growth the country experienced in the past two decades. (GLSS 2007) The region is the poorest with homes experiencing perpetual food shortages annually. Available statistics from the fourth round of the Ghana Living Standards Survey (GLSS4) shows that the incidence of poverty for the Upper East region is 88% with 79% classified as extremely poor which is worst compared to any other region.

It is also worthwhile to note that the regional poverty profile of the Upper East region, according to the Ghana Poverty Reduction Strategy Document (2003-2005), increased by incidence from 67% in 1990/92 to 88% by 1998/99. From about 33% in 1991/92, the contribution of rural savannah to total poverty increased to 37% in 1998/99, and has increased further to about 50% in 2005/2006. (Ghana Statistical Service, 2007) The situation even looks more compelling when one considers the disparities in poverty among occupational groups, poverty is highest among food crop farmers compared to other occupations. Their poverty remains nearly 19% above the national average of 40% in 1998/99, and they, together with those in non-farm self-employment experienced the least reduction, (9%) in poverty

Meanwhile there is enough evidence to the fact that the Agricultural sector has a central role to play in promoting growth and poverty reduction in the Ghanaian economy. An effective Agricultural revolution based on productivity growth will raise a million Ghanaians out of poverty by the year 2015, improve rural livelihoods significantly, and make a dent in the poverty of rural savannah, especially in northern Ghana (Nankani, 2008).

Revelations of this nature gives much concern for development partners, for it is increasingly becoming evident that agriculture is not receiving the needed investment and

attention necessary to help create wealth and reduce poverty. It is precisely in the light of this that the Tono Irrigation Project in the Kassena- Nankana District of the Upper-East region has attracted much attention to ascertain whether the provision of irrigation among small-scale food producers can provide pathways out of poverty.

At the UN Millennium Summit in 2000, world leaders made a series of Declarations which led to the evolution of a set of eight goals known as the Millennium Development Goals (MDGs). The MDGs are geared towards improving human conditions by 2015. Its central theme is to create a world free from poverty and suffering. Of the eight MDGs, the first is to halve the number of people under extreme hunger and poverty by the year 2015. The 2003 Human Development Report charged national governments to formulate national plans and commitments to achieve the MDGs. Thus, the Ghana Poverty Reduction Strategy (GPRS) II, which has the overall goal of ensuring sustainable equitable growth, accelerated poverty reduction and protection of the vulnerable and the excluded within a decentralized democratic environment, is quite laudable

The GPRS II has laid a lot of emphasis on the modernization of agriculture as a way forward to increase production. Given that majority of those living in poverty are in the rural agriculture sector, investment in irrigation, mechanization and the provision of improved seed would catapult an increase in production in that sector.

In addition, against the backdrop of the unreliable and erratic rainfall pattern as a result of global climate change, harvesting water to be used in the long dry season would drastically reduce the vulnerability of rural livelihoods and ensure an all year round production regime, thereby contributing to the achievement of the MDGs.

1.2 STATEMENT OF THE PROBLEM

For the three Northern regions in general, and Kassena- Nankana District in particular, food insecurity is almost synonymous with poverty .The lack of food or the inadequacy of it is a direct result or consequence of poverty. Simply put, poverty refers to the inability of the head of a household to provide adequately (on the basis of an assumed minimum expenditure level) for the household, combined with the lack of incomeearning capacity of other adult household members. Various factors have been responsible for this, including the following;

- Low levels of food production as a result of inadequate and poor distribution of rains
- Poor soil conditions.
- The reliance on rudimentary tools, limited labor, poor health, and bush fires.
- Low levels of education and subsequently poor management of resources which include food harvests
- Lack of modernized irrigation facilities.

Other factors responsible for food insecurity are the sale of most grain at harvest time, wastage during funerals and other festivals.

In order to turn the situation round, interventions should be targeted towards increasing production in a sustainable manner. Such increases will contribute immensely to bringing about food security and reducing poverty levels.

The United Nations Human Development Report (1997) sought to find useful insight into what might be called the "nature of poverty" by involving the poor themselves. The interesting observation that emerged was that, those conventionally classified as poor made a distinction between those who are disadvantaged but economically active, and the destitute poor who either because of extreme helplessness (resulting from say; disability, widowhood, or old age) or lack of effort are unable to fend for themselves. The nondestitute poor- the majority, are certainly a good deal less passive, more proactive about

their condition than the impression created by conventional, material and quantitative estimates of poverty, which incidentally fail to make this distinction. Thus poverty can be measured not only directly by lack of capabilities but also indirectly by lack of opportunities, the latter being the main factor responsible for poverty in the Northern part of the country. Therefore, poverty reduction should be aimed at creating opportunities and agriculture being the main source of employment for the majority of the population, must be modernized to create more opportunities. In doing this, it is imperative to take the following into consideration;

The first point of entry is to recognize that given the breadth of poverty, actions would need to focus on creating and expanding opportunities for the poor to earn a decent income to enable access to the essentials of life.
Given that majority of the poor reside in the rural areas and are primarily engaged in agriculture, the strategy would be to provide avenues for increased productivity in this critical area, by investing in irrigation to engage the people all year round.

- The third point is to recognize that improved livelihood capacities have a spread effect on the education and health status of the poor.
- Irrigation would also hold families together and curb the incidence of the poor seeking for opportunities in the southern part of the country during the lean seasons.
- Access by the poor to productive physical resources is fundamental to engagement in productive activities, given the dominance of agriculture in the provision of livelihoods to the poor, access to irrigable land and credit is pivotal.

This study therefore seeks to investigate the effects of irrigation as a pathway to poverty reduction, using the catchment area of the Tono Irrigation Scheme as a case study. This area is chosen precisely because the scheme has been in operation for the past two decades, with its beneficiaries being small-scale farmers. It is expected that the food security situation among beneficiary communities should witness a marked improvement

compared to communities without irrigation facilities who depend solely on rain fed agriculture for their sustenance.

1.3 RESEACH ISSUES

In order to formulate the research objectives the following research questions are being posed based on the research problem

The main research question is;

What are the effects of irrigation farming on poverty reduction?

The other sub-questions are;

- What institutional factors in irrigation regimes promote poverty reduction?
- What is the level of participation of farmers in the Operation and Management of the irrigation scheme?
- What are the unintended outcomes {both positive and negative} of citing irrigation facilities in poor communities?
- What other pathways out of poverty can irrigation provide other than farming?

1.4 OBJECTIVES

The goal of this study is to examine the extend to which irrigation, typically, the Tono Irrigation Project , has contributed to poverty reduction using the Kassena Nankana District of the Upper East Region of Ghana as a case study. More specifically the study would,

1. To identify the institutional factors in irrigation projects that promote poverty reduction
2. To ascertain the level of participation of farmers in the Operation and Management of the scheme.

3. To identify the unintended consequences (both positive and negative) of citing irrigation facilities in poor communities.
4. To examine other pathways out of poverty irrigation can provide other than farming.

1.5 ASSUMPTION (PROPOSITION)

Irrigation farming has contributed positively to the reduction of poverty in the Kassena Nankana District, and the Tono catchment area in particular.

1.6 RESEARCH SCOPE

The area of studying in the geographical context is the Kassena Nankana District in the Upper East Region. The research would touch on identifying stakeholders in agriculture and irrigation in the district. Viewpoints of farmers and management of the Tono scheme, as well as those of administrators of the district would be analysed. The study would also ascertain viewpoints of farmers at the western part of the district, specifically, Chiana, who have no irrigation facility and depends solely on rain fed agriculture

Thus, a comparative analysis of issues would be done to ascertain the levels of poverty reduction in the two situations to enable informed inference be made.

The study would concentrate on the period between 1990 to 2008. This is because it was within this period that the project was fully in operation and recorded maximum participation of farmers in both crop production and the operation and management of the project. It is also within this period that issues of modernization of agriculture became topical in the agriculture policies and the development agenda of the country.

1.7 JUSTIFICATION/ RATIONALE FOR THE STUDY

Write-ups on poverty in Northern Ghana dates back to the colonial period. By the 1960s Hunter studied the problem of seasonal hunger in the Nangodi area in the Upper East Region, (Hunter, 1967). Since then there has been considerable research work on the Northern poverty situation. Good examples includes Ewusi (1978), UNICEF (1986),

Songsore and Denkabe (1991), Songsore (1992) Ghana Statistical Service (1995, 2000 a, b), Asenso-Okyere et al (1993), Tonah (1993) Whitehead (1996) and many others.

Songsore (1992) and Tonah (1993) argued strongly that Northern Ghana poverty is embedded in the colonial and neo-colonial exploitation of its human resources in the form of labor reservoir to service cocoa farms, the mines, the army, etc and the continued marginalization of the people. While that is a historical fact, it is worthwhile to state that the continued and increasing poverty in Northern Ghana could be attributed to a number of factors. They include

1. Poor natural resource endowment in some areas.
2. Natural resource degradation, including degraded farmlands.
3. Insufficient supplies of water for humans, animals, and crops.
4. Lack of off-farm and off-season productive activities.
5. High rates of population growth
6. Poor marketing opportunities for all commodities
7. High levels of illiteracy.

One of the fundamental reason for the citing of the irrigation facility was to address some of the above stated causes of poverty.

The post-colonial government considered the unreliable weather conditions, in particular the unreliable and irregular rainfall pattern as a major obstacle to the development of agriculture in the Northern regions and proposed the establishment of irrigation schemes. These schemes, it was envisaged, would facilitate the cultivation of grain and other cash crops, thereby reducing poverty and raising the standards of living of the people, and turn the Northern regions into one of the largest grain basket of the country (Tonah, 1993).

It was however not until the National Redemption Council regime (1972- 78) that concrete measures were taken to increase the tempo of implementing the irrigation

schemes. As contained in the Ghana Five Year Development Plan (1975-1979, part 11; pg107), *"the rising national food import bills and the drought in the Sahelian regions demonstrated the importance of the development of the water resources of the country for agriculture, livestock production, and human uses as well as for industry"*

It was realized that the policy of poverty reduction and national self-sufficiency in crop and livestock production could be achieved with the implementation of a vigorous and viable programme for the development of irrigation facilities in the Northern Ghana. In pursuit of this policy, several irrigation schemes of various sizes were established throughout the country, one of which was the Tono Irrigation Project in Navrongo, in the Kassen-Nankana district.

Despite the noble ideas behind the establishment of the scheme, poverty is still endemic in the district and Northern Ghana as a whole. It is against this backdrop that the study seeks to learn at first-hand how the Tono Irrigation Scheme has contributed to poverty reduction and suggest a way-forward for a sustainable strategy to continue harnessing the potential benefits of irrigation.

Poverty reduction refers to designing and implementing institutional capacities to ensure that scarce resources are allocated to activities that are likely to yield the greatest impact on the poor and to decrease their levels of deprivation and vulnerability. For the case of the Kassena Nankana district, and Northern Ghana for that matter, it is realised that agricultural development and the modernization of agricultural activities is the most viable target capable of yielding the greatest impact on the poor in terms of decreasing levels of deprivation and vulnerability. (It is in response to the above issues that has set the rationale for this study).

1.8 SIGNIFICANCE OF THE STUDY

This study seeks to evaluate the effect of irrigation on poverty reduction in a poverty endemic district. It is envisaged that the study will provide evidence to all stakeholders in poverty reduction about the significance or otherwise of irrigation agriculture

Government and policy makers would benefit from the study by getting evidence-based report on the feasibility of irrigation schemes to support and enhance planning of rural development initiatives.

The District assemblies, MOFA, and ICOUR would be informed by the report of this study about the efficiency level and effectiveness of the Tono Irrigation Scheme, as a rural development project geared towards poverty reduction.

It is hoped that suggestions and recommendations made would add to existing academic knowledge by serving as reference material for further and future research

It would constitute an important document for farmers, students and the general public as a tool for poverty reduction and wealth creation.

1.9 LIMITATIONS

A study of this nature would have required an exhaustive enquiry in all irrigation facilities, both small-scale and major schemes in the Northern sector of the country, however, time and resource constraint would not permit one to do that, hence the concentration on the Tono Irrigation Project as a case study. Another limitation could be the sample size in relation to the population of farmers operating on the project. In addition, the study only covered four communities of both irrigation and rain-fed farmers, and lastly, the assumption that source of water is critical in determining poverty levels of rain-fed and irrigation farmers could also pose a limitation. This does not however derail the significance of the study, as it seeks to uncover situations on the ground, with the hope that the findings could be applicable in other areas.

CHAPTER TWO

LITERATURE REVIEW AND THEORETICAL FRAMEWORK

2.1 Introduction

This chapter presents the conceptual and theoretical outlook of the study. First, it examines irrigation systems generally, and looks at irrigation in Ghana, issues of poverty, causes of poverty in general, poverty reduction strategies, the chapter would look at the causes of poverty by examining some theories and perspectives, and link it with how agricultural modernization through irrigation can be designed to optimize the achievement of sustainable poverty reduction and development. Following this, the chapter looks at how these theoretical issues feed into providing a conceptual framework from which the provision of irrigation facilities can provide pathways to food security and poverty reduction.

2.2 IRRIGATION SYSTEMS

There is enough evidence to support the fact that water is more crucial than land when considering improvement in agriculture production, especially in the arid and semi-arid regions of the world. Irrigation therefore is conceptualized as the process of getting water to the root zone of crops for better plant growth. It is generally referred to as the supply of water for crop growth to supplement deficient rainfall. (Thornton 1978).

This supply of water is provided in a variety of systems, which have basically three main components; (a) acquisition, which may involve diversion of water from a river, with or without ponding of gravity flow, or lifting of ground water. (b) Transport through canals or pipes to the area of use, and (c) distribution over irrigable fields by water causes and field canals, sprinklers or drip equipment.

The different systems found in the tropics have their justification in such variables like the nature of the water source- its size, seasonal regime, and year to year fluctuations, the distance and the nature of the terrain between the source of water and the area of use, and the nature of the irrigable surface; - its flatness, soil quality, and the potential value of the

product. Clearly all this physical factors will have a bearing on how the system is organized and controlled, and may affect the way other agronomic factors can be integrated into the cropping regime.

Acquisition; this involves action with high technological content, it could either be a simple canal diversion or a small-scale water lifting design, like the *shad duffs* in Egypt and the Arab Middle East, or units requiring few men or bullocks like the *charas* in India, where homemade equipment may be adequate enough to lift water. As scale and technology are raised, more sophisticated engineering organisation are required which can only be at the state or parastatal level.

Transport; similarly may be organized by individuals or groups on a modest scale, but may require high level engineering for larger schemes, as well as strong central bureaucracies to ensure sanity in the operations of the system.

Distribution; this will require increasingly elaborate organisation as the number of those receiving the water increases. The most popular way is to organize the users themselves to receive and allocate the water among them.

Generally the larger the scheme in terms of acreage irrigated, quantity of water, size of the catchment area. The length of the seasonal spread, and the distance the water has to travel, the more complex is the organisation required.

Historically the Indo-Gangetic Plains in South Asia has a rich and long tradition of irrigation. Irrigation here started and followed in stages, from small-scale diversions and lifts, through inundation canals, barrages, dams and perennial canals, to a stage which characterizes the current regime of a more complex integration of gravity flows and recycling of ground water through tube wells. At each stage of irrigation development of the Indo-Gangetic Plains, large number of people and areas became involved, until a point where entire river basins were considered as a whole.

Thornton (1976) classified irrigation systems into private or/and public systems, and further broke them down into various categories based on the level of decision- making. Under the private classification the following categories can be identified;

- **Self- contained irrigation units serving single farms**- here decisions about operations and management are integral part of farming. The individual determines weather to use a tube well, a pumping machine, or divert water from a river, etc.

- **Self-contained estates;** where there are shared interests between a big time owner and a group of tenants in irrigation and farming activities. A typical example is the *Saqias* pump system in the Sudan.

- **There is also the system of private suppliers and independent users,** where the individual farmer pay to a private person for water for irrigation purposes, example of this system can be found in the tube wells in India and Pakistan.

- **There is also the modest scale reservoirs or diversions organized by village groups,** whose members may have little independence about the quantity and timing of irrigation. Decisions concerning operations is vested in a committee selected by users .This system is popular with India and Sri-Lanka.

- **There are also private schemes ran by co-operative;** typically of Indian village co-operatives.

On the other hand, there are schemes constructed by public funds, they are bigger and may serve multi-purpose development objectives. Typically in most public schemes a central bureaucracy takes decisions with farmers taken part at various levels of decision making. They are categorized under the following;

- **Unitary;** here a government or a parastatal body is responsible for both irrigation and cropping pattern in the form of state farms or plantations. This system was practiced in Ghana in the 1960s, but has since changed. It is also a popular system in the Sudan.

- **Unitary,** but with land divided among farmers with little freedom of action in both irrigation and cropping. The Vuvulane scheme in Swaziland and the Mwea Tewbere in Kenya represents examples under this system.

- **Unitary** but with farmers interest represented in the central decision making body, like farmers having representatives on the board and management system of the scheme. The current irrigation regimes in Ghana are fashioned on this system, the Gezira scheme in Sudan is another example of the typology.

- **Split responsibility-** government or parastatal body responsible for acquisition, transport and main water distribution, while farmers responsible for cropping pattern and water distribution to their fields. Example of this can also be found in Ghana, India and the Philippines

- **Split responsibility,** but farmers themselves organized locally into distributive groups, while the parastatal is responsible for the main head works. Typical examples can be found in the Philippines, Sri-Lanka and India.

- **Split responsibility,** but with farmers association taking responsibility for distribution of water, maintenance of canals, training of staff, collecting levies, supported by farmers groups. Taiwan provides a suitable example under this system.

Engineers and Agriculturists have the tendency of categorizing irrigation systems according to the physical observable issues such as structures, field layouts, and methods of water application., .In categorizing irrigation systems according to physical structures, Chambers, (1977), identified the first category as irrigation by surface gravity flow, most often from a storage reservoir; the water is from various combination of catchment runoffs and possibly from river diversions. The commonly used classification of gravity flow irrigation is either a "major" and/ or a "minor", corresponding with the differences in scale of operation, not with difference in physical type of source, conveyance or storage capacity.

Most often the management of water under major schemes is the responsibility of a bureaucracy, organized by government, whiles the management of water under minor schemes is the responsibility of village water-users associations, which organizes the distribution. Again under a major scheme there are usually several cultivation committees, whereas under minor schemes there is only one

Another category is the use of wells and dugouts for lift irrigation. Three forms of lift are used- human power, ox power, and pump set, these wells are usually found both on dry lands and wetlands, and are used when there is clear case of drought or inadequate rains.

In addition to the above, and with advancement in technology, the field application of water is very crucial in irrigation, hence tools like basin flooding, furrow irrigation, sprinkler irrigation, underground and border strips, and more recently drip irrigation are other ways to facilitate an effective irrigation regime.

Chambers went further to suggest that irrigation could also be classified according to how communication is channeled in the structure. Thus the system could be bottom-up, middle outwards, or top-down, depending on the focus of concern and the orientation of the typologist. The top-down approach uses formal and bureaucratic procedures in the distribution of responsibilities within the organisation to separate out categories. The bottom-up view of irrigation starts with the farmer and his preoccupations, it differentiates between irrigation systems according to cost, adequacy, convenience and reliability of the supply of irrigation water to the farms. A middle-outwards view would start from the organizational and geographical standpoint in the middle of water distribution. It might differentiate systems according to the decisions, communications and allocations which affects distribution, looking both upwards towards the source from which water is derived and downwards to the farmers.

Another source of classification that can be used in irrigation is to answer the questions who get what, when, and where. The focus here is on the processes of allocation and acquisition, which determines the access of users to the irrigation water. These processes can be classified as follows;

- Direct acquisition; where the user acquires water directly from a natural source such as a private dam or a well.
- Acquisition through contract; Here users acquire water through agreement with a supplier in exchange for goods or service.

• **Community allocation;** A communal source of water is allocated to a community of users.

• **Bureaucratic allocation;** water is allocated by a bureaucracy directly to individual users.

- **Bureaucratic - Communal allocation;** water is allocated by a bureaucracy to one or more communities of users, each of which manages distribution to its members.

In practice however, the above classifications sometimes overlap and must only be used for convenience and for analytical purposes (Chambers, 1982 Leach, 1961).

Theoretically the above classifications are vital for us to venture into how irrigation is organized and operated with the view to ensuring efficiency and equity.

Wittfogel (1957) suggested a totalitarian management structure for large-scale irrigation systems, in order to muster the labor force necessary for the maintenance of the huge flood control works. However, technology and advancement in irrigation negates this thinking, for Wittfogel assumed that human labor was the main means used to build and maintain irrigation works, with modem irrigation, it is only at the lower levels of aggregation in the system that labor is needed but not the whole system.

Lowdermilk and Freeman (1985) conceptualized the creation of middle-level organizational linkages between farmers and irrigation bureaucracies through a four section task oriented models, which includes; construction, water allocation and drainage, system maintenance and conflict resolution. They further argued that the task-oriented models needs to be applied analytically at three different levels - at the farm, the command area, and the bureaucracy- and that the organisation of these activities in the system determines the extend of farmers control over water and other issues.

On the other hand, Coward (1985) proposes a framework that identifies five critical social operations to be performed in each irrigation system; water acquisition, water allocation, system maintenance, resource mobilization, and conflict management. Identifying and involving farmers in each of the operations is crucial in determining

On their part, Bagadion and Korten (1985) also proposed the need to incorporate local irrigators associations or organizations' with the agencies in charge of national irrigation systems, using the learning process approach. Through this, the agency learns how to address social needs at the village level and how to interact with water users, and together they develop the necessary support systems for field activities. This will not only foster a smooth operation of the scheme but will also afford technical experts and social analyst to co-operate with beneficiary communities.

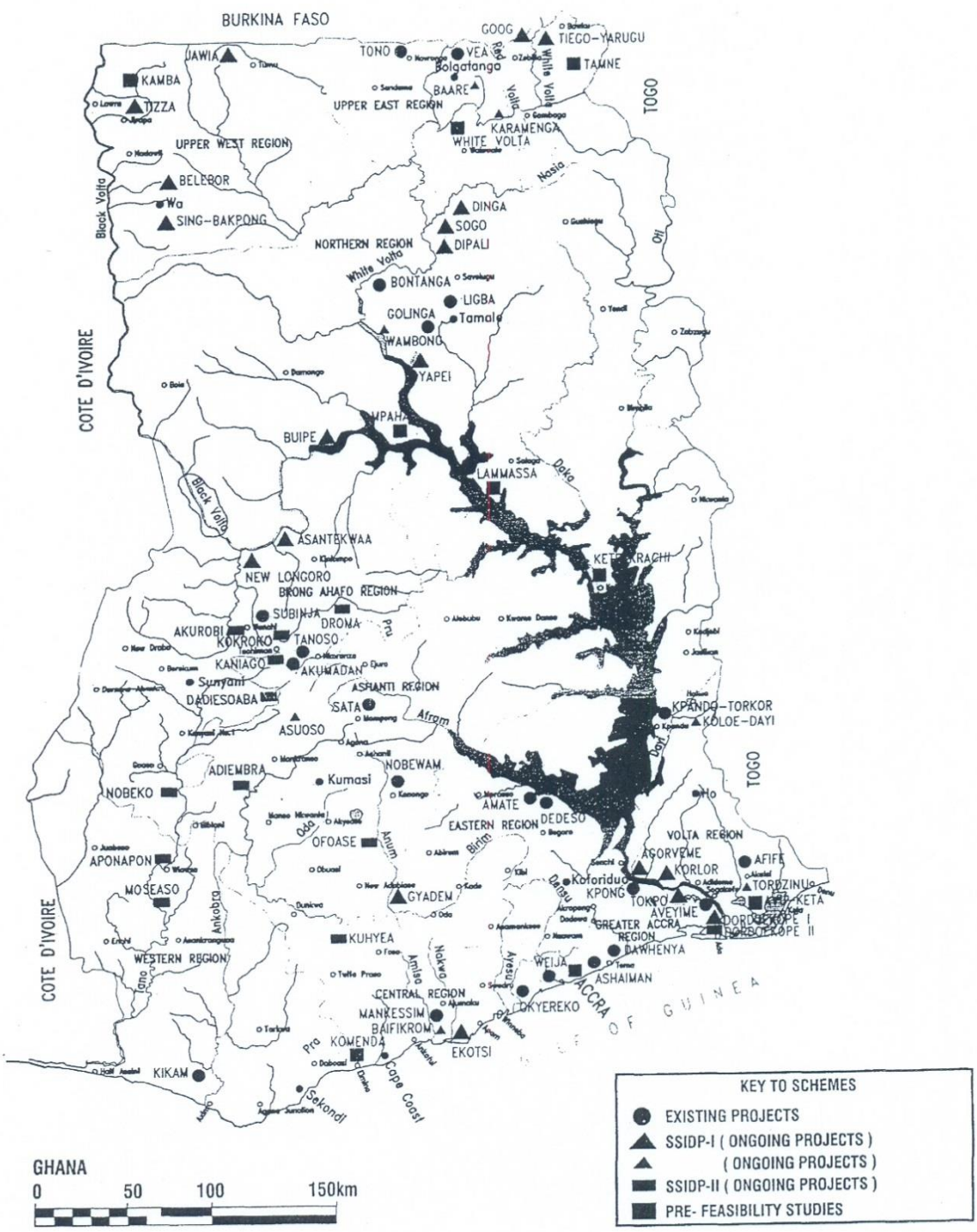
In modern irrigation management local participation need not only be recognized but also institutionalized in a socially appropriate manner. Harnessing local organizational patterns in project design has the additional advantage of avoiding the cost and bureaucracy associated with unnecessary government involvement in field matters. Social variables, if well inserted in the management system are able to construct strong and viable organizational linkages to assist optimize the potential of the scheme (Cernea, 1985).

Chambers (1982) observed that the type of management system for a particular scheme depends strongly on the social structure and the culture of the irrigation community, where there are controls and somewhat a hierarchical structure of social organisation, it would not be necessary for a bureaucratic structure to extend down the system, and the need for a stricter controls would be less obvious. However, in communities of egalitarianism with a propensity for chaos and conflicts, bureaucracy extends further down the physical system and the case for a tighter bureaucratic control seems obvious and clear.

Maintenance of the system also has a bearing on the technology used for water acquisition, storage, distribution, and for the management and operation of irrigation. Direct acquisition from wells and use of pump sets is less technical and can be managed by farmers or a committee if it is serving a community. When large-scale technology is used, there arise multifarious problems of allocation and appropriation, which is where a central body like a bureaucracy is needed to control from the physical structure down to

the field level, whiles living space for farmers participation in social and local issues related to irrigation.

IRRIGATION MAP OF GHANA



2.3 IRRIGATION IN GHANA

In Ghana irrigation is under the responsibility of the Ghana Irrigation Development Authority of the Ministry of Food and Agriculture, Their activities are not only limited to irrigated agriculture, the authority is also in charge of land and water resource development, dams, dug-out development for irrigation and rural water supply, in addition, they undertake topographical surveys and mapping for water shed development and also aqua cultural systems development.

Irrigation in Ghana has a short history, most of the dams were constructed in the 1960s, though majority of the dug-outs and the small-scale dams started earlier as community and individual structures but with time, they were developed with public funds for use by the communities. As indicated in the irrigation map of Ghana, majority of the facilities are small-scale and dugouts which are scatted throughout the length and breadth of the country. These are developed to irrigate areas between Sha- 50ha.

The minor and major schemes which have Tono, Vea, Kpong, Bontanga and Afife, etc are designed to irrigate areas above 50ha. Most of the dams were also constructed with multi-purpose intentions, apart from irrigation; they are used for the provision of water for domestic and industrial use. Weija in Accra and Vea in Bolgatanga are typical examples.

There are equally potential sites where feasibility studies are completed, and only awaiting funding for the projects to be executed. Examples of such potential sites includes the Kamba dam in the Upper West region, Mpaha in the Northern region, and Lamassa in the Afram Plains

All the minor and major irrigation projects in Ghana, except the Tono and Vea schemes are under the management of the Irrigation Development Authority. Thus, a project management team, made up of engineers and agronomists and extension staff are on site, responsible for the main head works, the drains and the canals whiles farmers takes care if field level activities. Typically, apart from the small, community level dug-outs where ater users associations takes overall management responsibilities, the minor and major

schemes are managed with spilt responsibilities between a project management which is a parastatal and farmers local organizations, purposely formed as part of the management structure of the scheme. In Tono, this institution is known as the Village Committees, who play a crucial role in land allocation, water distribution, and repairs of lateral canals and general organisation of farmers.

In recent times, government policy in irrigation management is tilted towards relinquishing the day-to-day operations to farmers and only concentrating on major repairs and rehabilitation of the systems. Thus, irrigation bureaucracies would be concern with the physical structure, like the main dam, the main canal works and the drains, while beneficiaries' take-up the field management of operations. This is very important for participation, for community participation has been observed to play a key role in the effective operations and management of development projects, with irrigation not an exception.

Uphoff, (1985) reviewed and analysed three rural development projects in Nepal, Ghana, and Mexico, which adopted non-participatory approaches, he observed that all the projects collapsed because of overweighting problems they encountered during implementation which could have easily been solved by involving the beneficiaries in the planning and implementation of those projects.

2.4 Concept of Poverty

Poverty is blessed with many definitions with some closely related to lack of income and basic services, while others argue strongly for a multi-dimensional view, which includes lack of economic, social, and environmental assets and resources.

Poverty is defined as a state of being poor, scarcity, or lack, and a state of being inferior. (Oxford Advanced Learners Dictionary, 1990). Thus, poverty refers to a state or condition, a lack of something, either material, or an intangible, and a state of inferiority. It is however important to note that the definition of poverty is changing rapidly, the purely monetary approach is being supplemented by concepts that seek to portray the extent to which people are being excluded from the social and political spheres.

The history of poverty studies can be traced back to medieval times, starting with the codification of poor laws in England, through to the pioneering empirical studies at the turn of the 19th century. Booth (1901) published a thesis which was first to lay-out standards for poor families in London, based on estimates of nutritional requirements and other parameters.

Poverty focus shifted to the level of income reflected in macro-economic indicators like the Gross Domestic Product for head in the 1960s. This was associated with an emphasis on growth as an indicator of development. In the 1970s, poverty studies became a household pursuit, especially, following the famous speech to the World Bank Board of Governors in Nairobi, Kenya, in 1973 by Robert McNamara, leading to the subsequent publication of the book "Redistribution with Growth".

Townsend, in the 1970s helped redefine poverty, not just as a failure to meet minimum nutritional or subsistence levels, but rather as a failure to keep up with the standards prevalent in a given society. There was also attempts to shift the concept of income poverty to a step further and to a wider spectrum of "basic needs" including those provided socially .Thus, as a result of a pioneering work done by the International Labor Organisation in the middle 1970s, poverty came to be defined not just as lack of income, but also lack of access to health, education, and other essential services that makes life worth living .However, it must be buttressed that the concept of basic needs inspired policies like integrated rural development, its influence and relevance is still manifested in various discourses about human development

There was a further change in orientation in poverty studies in the 1980s. The principal works were the incorporation of non-monetary aspects, typically, following the works of Robert Chambers, who stressed on powerlessness and isolation as major ingredients in defining poverty. Stressing that the poor are voiceless and resides at the periphery of the social organisation of communities. This gave impetus to the idea of involving people of the various social spectrum in decisions concerning their development, thus, the concept of community participation became a topical issue in poverty alleviation.

There was also a new interest in the notion of vulnerability and security associated with a better understanding of seasonality and the impact of shocks, particularly drought on poor people. This pointed to the importance of assets as buffer and the importance of social capital as coping strategies for the poor. (Chambers, 1983)

The Brundtland Commission Report (1987) on Sustainable Development also provided another strand and broadened the concept of poverty to a wider construct, livelihoods. This popularized the term sustainable livelihoods when addressing poverty issues. A livelihood comprises the capabilities, assets, (including both material and social resources) and activities required for a means of living. A livelihood is said to be sustainable when it can cope with and recover from stresses and shocks and maintain or enhance its capabilities and assets both now and the future, while not undermining the natural resource base. (Chambers and Conway, 1992). The framework views people operating in a context of vulnerability, and within this context, they have access to certain assets or poverty reducing factors. Therefore poverty reduction strategies should focus on policies and actions which promotes sustainable livelihoods, thus, helping to create a supportive social, physical and institutional environment for the elimination of poverty.

Perhaps the most celebrated works on poverty during the 1980s was the theoretical writings of the Nobel Laureate Amartya Sen, who had earlier contributed the notion of food entitlement, or access, and emphasized that income was only valuable in so far as it increases the "capabilities" of individuals and thereby permitted the" functioning" of society.

The 1990s witnessed the coming on board of world bodies like the United Nations Development Programme (UNDP) in the poverty debate. They developed the idea of coming out with a yearly human development report, they define poverty as; "the denial of opportunities and choices to lead a long, healthy, creative life and enjoy a decent standard of living, freedom, dignity, self-esteem and respect of others". In more recent times however, thoughts about the state of human development gave rise to the issue of social exclusion, this concept might have started in France in the 1970s, but it found its wider expressions in other rich countries like the United Kingdom where a social

exclusion unit was set up in the Cabinet Office in 1997. The focus here is people falling into a multi-dimensional deprivation trap (low income, poor housing, poor access to health and education e.t.c.) The key elements for social exclusion includes the democratic and legal systems, liberalized markets, welfare state provisions, the family and community rights to resources and other related issues, these are all important in analyzing poverty.

2.5 CONCEPT OF POVERTY REDUCTION.

The development of the concept of poverty reduction was as a result of the clear disillusionment with trickle down theories of the Neo-classical thinking of the 1960s. These supposed that development at the national level would automatically improve the well being of all sectors of the population. Experience however, showed that even in those cases in the Third world where growth occurred, by and large, it did not benefit the poor. In Sub Saharan Africa, the situation was even worse. Not only have the economies stagnated since the end of the 1960s but also the number of poor people increased rapidly. The situation was also true of Latin America and most of Asian countries as well, despite measurable growth. This led to the recognition of poverty reduction or alleviation as a development objective in itself in the 1970s

Poverty reduction has a twin function of increase in the rate of growth, and changes in income distribution. Additional key factors includes the reduction in inequality and the reduction in income differentials in a given society (ODI, 2000)

In order to adequately understand what poverty reduction entails, it is imperative to understand the various aggregations and classifications of those who constitute the poor in a given society, so that its reduction can be made meaningful.

Monetary Poverty; the poor are defined as individuals or households with an expenditure level below a threshold. This threshold correspond to the cost of a minimum basket of wages and foodstuffs (on the basis of daily energy requirements) The poverty line or lines separate the poor from the non-poor The proportion of the population below these lines gives a measure of the depth of poverty.

A major flaw of this approach is that the construction of the poverty line is ambiguous, especially since many aspects of well-being do not involve monetary transactions, which is why the concept of essential goods has been introduced.

"Basic Essentials" Poverty; The United Nations define a Human Poverty Index (HPI) based on non-monetary criteria, consisting of ten unsatisfied basic needs, including access to housing, drinking water, schooling, sanitation, health, a right to living accommodation with a minimum of square meter per person.

A new definition; The World Bank 2000 report goes from lack of goods- monetary or essential- to the lack of ability to choose, being considered as the essential factor for wellbeing. This approach is based on the concept of security, empowerment and opportunity

1. **Security;** the concept of security raises the question of the vulnerability of the poor to risk of all kinds, (ill health, economic dislocation, and natural disasters). The poor are the most vulnerable to these events which thus form aggravating factors of poverty.
2. **Empowerment;** (Integration, demarginalisation); Empowerment refers to the relations between the poor and the institutions in a given society. General corruption and the misappropriation of public funds weaken poor people even further. The situation of marginalization is even worst when there are conspicuous absence of activities that shows active participation of people in community life (exercising your franchise through voting, belonging to an association, etc.). The integration of the poor will require targeting a better supply of public services towards them, developing citizen participation and decentralizing towards the district and community level.
3. **Opportunity** (capabilities, capacities); This concept also addresses the link between the individual and the rest of society, this time via his relationship capital; .The deterioration of this capital may cut the individual off from possible aid or opportunity, it may adversely affect his dynamism and his ability to respond, and may ultimately make loose all hopes and make him feel excluded.
4. **Exclusion;** Poverty is thus increasingly perceived from the viewpoint of exclusion, which defines the poor person as someone who does not have the means to participate in the

activities of the community to which he belongs or to attain the most widespread standards of living in society. This social exclusion is explained not only by lack of financial resources but also by low standards of education, lack of access to information or an inability to establish social links. It results to fewer opportunities to productive life, benefit from public service and participate in public decision-making processes.

Poverty takes several forms, which individually and collectively generate many stifling social and psychological effects. These effects can result in apathy and lethargy among the poor. As such, poverty is a condition that prevents people from realizing their potential. A significant manifestation of poverty includes material deprivation, lack of assets, isolation, vulnerability and lack of decision-making power and freedom of choice.

The most cardinal point of departure of the concept of poverty is of a criterion as to who should be the focus of conceptualization (Borah, 2001). An effective analysis, policies and programmes for poverty reduction require not only a mere description of poverty but also the problem of measurement and aggregation. In other words, the conceptualization of poverty reduction would require two things;

1. A method of identifying a group of people as poor
2. A method of aggregating the characteristics of the set of poor people into the overall image of poverty aggregation.

Borah (2001) has done significant works on issues concerning the identification and aggregation of the poor. The following classifications are based on his works;

Head Count Ratio (HCR)

With the Head Count Ratio, aggregate and identification is done by simply counting the number of poor persons and expressing poverty as a ratio of the number of the poor to the total number of people in the community or an area under study. It however does not take into account the number and magnitude of poverty and it is insensitive to the distribution of poverty.

Poverty Line

This is by far the most widely used tool for measuring poverty, In this case, an individuals standard of living is measured against a minimum acceptable standard known as the poverty line. The poverty line is drawn based on income or consumption on a per capita basis. However, shortcomings arise as to concerns over how objective the yardstick to be used in assessing living standards and determining who the poor are. There is also the problem of drawing the poverty line itself. - the cut off minimum living standard.

The Biological or Nutritional Approach

In his famous study of poverty in York, Rowntree (1901) defined families as being in primary poverty if their total earnings are sufficient to obtain the minimum necessities for the maintenance of merely physical existence. It is not surprising that biological and nutritional considerations are widely used in defining the poverty line. This approach however has some shortcomings, firstly, the translation of minimum nutritional requirements into minimum food requirements depends on the choice of commodities .While it may be easy to solve programming exercise of a diet problem, choosing a minimum cost diet and its relevance is not clear. This is because people's foods habits are not, in fact, determined by such a cost minimization exercise .The actual incomes at which specified nutritional requirements are met will depend on the consumption habits of the people in question (Rajaraman, 1974).

The Inequality Approach

This conceptualization asserts that poverty is essentially as a result of existing inequalities in the society .In this case, even the poverty line become relative to the contemporary standards of the community in question. Myrdal (1970) for instance observed that social and economic inequality stand as the main cause of poverty of a nation. According to this view, poverty is to be understood in terms of economic forces, social relations, property rights and power. However, the limitation of the approach arises as to the possibility of confusing the conceptual differences between poverty and

inequality, in spite of the close relationship between the two concepts. They are not the same especially considering the dynamics and the causes of the two concepts.

The Marxist Approach

This approach postulates that in order to understand poverty, it is necessary to look at the ownership and distribution of productive assets in the society. According to the Marxist theory, society as a whole is more and splitting up into two great classes directly facing each other; Bourgeoisie and Proletariat (Marx et al 1888). In a capitalist society, the bourgeoisie own the means of production· and the very logic of capitalism concentrates wealth in fewer hands thereby depriving the majority class the fruits of capitalism. In this sense, poverty is the result of exploitation or depriving one class by another by means of owning and monopolizing the means of production. A later generation of Marxist also came to interpret the world order as being the cause of poverty in the third world countries. They shared the belief that the exploitation of the poor by the rich both at the domestic and international levels is the primary cause of poverty and underdevelopment in the third world. The Marxists held the view that this problem would be solved only when the capitalist mode of production in the developing world and the world economy are brought to an end (Frank, 1967 and Amin, 1983).

The Entitlement Approach

This approach was popularized by Amartya Sen to explain the phenomenon of famine in particular. However, in his own words, entitlement applies more generally to poverty as such, and more specifically to famine as well (Sen, 1981) The entitlement approach to poverty evaluates the ability of people to command an income through the legal means available in the society including the use of production possibilities, trade opportunities, entitlements vis a vis the state and other methods of acquiring an income.

Chambers Cluster of Disadvantages and Deprivation Trap

Robert Chambers, in conceptualizing poverty, takes the household as a unit of analysis. His approach is to identify cluster of disadvantages of households that are interlocked and causes and results in poverty. He identified five clusters of disadvantages; poverty,

physical weakness, isolation, vulnerability, and powerlessness. He asserts that the household is poor because it has few assets. It is physically weak because there is a high ratio of dependents to able-bodied adults who are seasonally hungry and thin, and its members weakened by sickness and malnutrition. The household is isolated from the outside, both spatially and informationally. The household is vulnerable because it has few buffers against contingencies. The household is powerless because it is ignorant of the law, without advice and low social status. These cluster of disadvantages interlock and give rise to what Chambers call "the deprivation traps" (Chambers, 1983).

The World Bank has established the following as the key elements in formulating strategies for poverty reduction. These elements are;

- The first point is to recognize that given the breadth of poverty, action would need to focus on creating and expanding opportunities for the poor to earn a decent income to enable access to the essentials of life.
- Another important point to bear in mind is the fact that the majority of the poor resides in the rural areas and is primarily engaged in the agricultural sector. The growth strategy to be adopted therefore would necessarily have to place high priority in the sector to uplift productivity.
- The third point is to recognize that improved human capabilities and their wide spread effects are crucial for raising the productivity and hence incomes of the poor
- Access by the poor to productive physical assets is fundamental to engagement m productive activities. Given the dominance of agriculture in the provision of livelihoods among the poor, access to land and credit is essential.
- Finally, the pressure of rapid expansion of demand on the limited means of the economy, occasioned by the high population growth and its high dependency structure must be considered. Therefore higher growth of the economy and education are important elements in the efforts to stem rapid growth of the population.

2.6 POVERTY SITUATION IN AFRICA

Poverty in Africa is multidimensional and multifaceted in nature, the different dimensions interact in ways that reinforce each other, such that the poverty trap it creates becomes as much a social phenomenon as well as an economic one. Data on poverty since the late 1980s shows Africa's share of those living on less than a dollar a day to have risen,. The absolute number of the poor in Africa has grown five times more than the figure for Latin America, and twice that for South Asia .The poor economic performance of many African countries accounted partly for the endemic trend of poverty on the continent. Despite the fact that social indicators have improved globally, the process have been slower in Africa than elsewhere.

Twenty years ago, infant mortality was lower in Africa than South Asia, today, it is substantially higher. Primary school enrollment in South Asia have risen from just over 70% in the early 1980s to 100% today, in Africa they stagnate at the same level as over twenty years ago, having deteriorated in the 1980s at under 80% (White and Killick, 2001).

The last three decades have witnessed the weakening of economic and political systems of African countries. Within this period, 28 countries have been involved in conflict in the mid-1990s, rendering close to 4% of the population displaced. The devastating effects of HIV / AIDS are far from having worked through, robbing families of their livelihoods, draining families and health services resources and leaving children orphaned. In addition, many African economies are faced with a fragile environment, with poor soils and frequent drought that further exacerbates the poverty situation on the

The issue of who constitute the poor in Africa is very important; this can be looked at from three perspectives; the chronic poor, the destitute poor, and the economically active poor. The destitute, many of who are dependents such as the elderly, the disabled, widows, also count among the chronically poor. However, many of the economically active may move in and out of poverty, being vulnerable to spells of poverty on account of either personally specific (idiosyncratic) shocks such as illness, theft or accidents or

more general (structural) shocks such as conflicts, drought, floods or economic crises. (UNDP, 1997). Households are also prone to poverty at certain stages of the households' life cycle, especially when there are many young children, (being partly responsible for the link between large household size and poverty).

The key element of the traditional poor in the African context is the lack of able-bodied adult male in the household. The poor is characterized by under-nourished male adults, the elderly, (particularly widows) female-headed households, the disabled, and orphans.

Conflicts and HIV / AIDS are giving rise to an increasing chunk of street children and child-headed households in Eastern and Southern Africa; these people are marginalized from the productive opportunities offered by economic growth and further worsening the poverty situation of the continent. (Baulch and Hoddinor, 1999).

There is no one established cause of poverty in Africa, one can only find a combination of centrifugal and centripetal forces within a particular context that precipitates the phenomenon. Thus, the causes can be classified into three ways; first, they may be classified by social processes; economic, political, social/demographic, and situational. Second, they may be classified by levels; international, national (macro) and household (micro). Finally, they may be classified as being either primary or proximate. It is also worth noting that most of the causes interact, and no single cause is mutually exclusive, such that cause and effects are not always easy to determine.

By and large, the causes of Africa's poverty can thus be found partly in the causes for the relative decline in African economic performance that began in the mid- 70s. The slow economic growth coupled with poor distribution of the gains of growth has contributed to worsening the poverty situation in Africa, even with those countries which recorded appreciable high growth, reduction in poverty is contingent on both the initial distribution and subsequent changes in the system, thus, the need to adopt pro-poor growth strategies cannot be overemphasized (Teal, 1999).

The major cause of the slow growth can be attributed, for many African countries, to political instability and outright conflicts, in others in which stability has been preserved,

the fundamentals of economic growth- investment in both physical and human capital has remained weak. Another factor is the inability of African economies to respond positively to the possibilities offered by globalization, as a result of inadequate attention accorded to market signals (Killich, 1995).

In more recent times, it has been observed that the issue of low growth is more pronounced in the most important sector for poverty reduction; agriculture. Given that majority of Africa's poor are engaged in this sector, African agricultural performance lags behind that of other regions and the level of inputs and investment to the sector leaves much to be desired. For instance, in Sub- Saharan Africa, the percentage of irrigated lands to the total cropland only moved from 3.6% between 1979/81, to 3.8% in1995/97, whereas in Latin America there was an increase from 9.8% to 11.2% within the same period, and from 27.8% to 37.2% for that of South Asia. (World Bank, 1999)

The World Development Report (2008) has observed that agriculture and rural sectors have suffered from neglect and underinvestment over the past two decades, whiles 75% of the worlds poor live in the rural areas, a mere 4% of official development assistance goes to agriculture in the developing countries. In Sub Saharan Africa, a region heavily reliant on agriculture for overall growth, public spending for farmers is only 4% of total government spending, meanwhile, the sector is still taxed at relatively high levels.

The report further asserts that agriculture can provide pathways out of poverty if efforts are made to increase productivity in the staple food sector, and connect smallholders to rapidly expanding high value markets. (World Bank 2008)

For Africa to map out an antipoverty agenda, and to realize sustainable reduction in poverty, the poor must be included in the growth process; pro-poor growth. This has to be broad base enough to include sectors where the poor eke out their livelihoods, more importantly; experience in Africa has revealed that policymakers' capacity for commitment is very crucial for any meaningful and sustainable poverty reduction strategy to be successful. What is therefore needed is the necessary political challenge and pressure on governments to stay committed to poverty reduction strategies, for by so doing governments would be responding to the needs of the majority of the people (Greeley and Jenkins, 1999)

2.7 POVERTY AND POVERTY REDUCTION IN GHANA.

Poverty in Ghana for the purpose of the Ghana Poverty Reduction Strategy 1 (GPRS) has been defined as "unacceptable physiological and social deprivation" which may be caused or exacerbated by;

- Lack of macro-economic stability that erodes the resources of the poor through inflation and other variables.

- The inability of the national economy to optimize benefits within the global system.

- Low capacities through lack of education, vocational skills, entrepreneurial abilities, poor health and poor quality of life.

- Low levels of consumption through lack of access to capital, social assets, land and market opportunities.
- Exposure to shocks due to limited use of technology to stem the effects of drought, floods, pest and environmental degradation.
- Habits and conventions based on superstition and myths giving rise to anti-social behavior.
- Lack of capacity of the poor to influence social processes, public policy choices, and resource allocation.
- The disadvantaged position of women in society.
- Other factors leading to vulnerability and exclusion.

Whiles such a definition is wholly true, it does not lend itself to easy operation.

Poverty in Ghana is better understood as a situation of limited choices, caused in the main by lack or low capacity to earn a steady and sustainable income, which in itself is as a result of ones employment status. Giving that majority of the poor are engaged in the agricultural sector and are in the rural areas, the ability to create productive employment that would engage the poor all year round is the central issue to Ghana's poverty reduction programme, and it is in this light that the provision of irrigation in the poverty endemic North is of paramount importance.

Ghana's poverty can be described as a composite of both personal and community life situations. On the personal level, it is defined as a situation where basic needs to sustain daily livelihoods is not sufficiently satisfied. At the community level, poverty is manifested in the absence or the low level of basic community services such as health, education, and water and sanitation facilities. Thus, whereas personal poverty is related basically to employment and incomes, community poverty is related to the provision of basic services. (ISODEC, 2005)

Poverty reduction can therefore be defined as the processes of decreasing the incidence or degree of people's vulnerability by raising the socio/economic status of citizens, on the other vein, providing basic community/social services.

Ghana with a population of around 22million people and a per capita income of around $350 is certainly a poor country, the average Ghanaian lives on less than one dollar a day. The proportion of the population defined as poor dropped from 52% in 1991-92 to 39.5% in 1998-99, based on an expenditure definition of poverty, this decline is concentrated in Accra and around the forest areas with very modest falls elsewhere. Poverty in Ghana is a rural phenomenon (80%) concentrated among food crop farmers (60%). By geographical zones, the rural savannah tops the list as the poorest zone in Ghana; this area comprises Upper East, Upper West, and the Northern Regions. Some of the rural forest zone is also poverty endemic with areas like Central, and parts of Western and Eastern Regions being major areas of concentration. (G L.S.S, 2007)

In the rural savannah and rural forest areas, more than 40% of their population were classified as poor in 1999, within these areas, the Upper East, Northern and Central

regions experienced increase in poverty and extreme poverty in the 1990s, reflected in malnutrition, and perennial food shortages; this indicated that about 30% of under five year olds are stunted, 26% underweight, with boys slightly more than girls to be stunted. Though absolute poverty generally continued to decline in the 1990s through the 2000s (from 36% in 1991/92 to 29% in 1998/99), the figure of the absolute poor in rural savannah and the depth of their poverty increased. (ISODEC, 2005)

In the 1990s economic growth averaging 4% per annum was by far below the 5.8% per annum the World Bank estimated was required to eliminate absolute poverty in 40years, and the growth which occurred, by and large, bypassed the poor Northern parts of the country. (GLSS 4, 1998/99)

It is pertinent to emphasize that despite the reduction in the overall poverty figures to date, there are still limited benefits accruing to many of the poorest groups in the country, and even almost resulting to increased differentials between localities over the period. This situation is not only attributed to poor macroeconomic performance, but also raises questions about the overall policy stance over the period and the extent to which it focused on the poor, and more remote regions especially those engaged in food crop agriculture. (Coulumbe and McKay, 2003)

Since independence successive governments have undertaken a lot of programmes and initiatives aimed at poverty reduction. These include the following;

- Increase agricultural production approach, for example, through, agricultural input support, infrastructure, marketing facilities and credit to farmers.
- Community development approach, where by effective machinery at the regional level will accelerate prompt and efficient implementation of various projects and programmes, for instance, the establishment of Regional Development Corporations was an attempt to bring together a wide range of activities to promote development in a particular region.
- Decentralization, which is meant to promote development at the grassroots

- **P AMSCAD** hailed by donors as successful in terms of generating employment, building infrastructure and creating public awareness and participation.

• District Assembly Poverty Alleviation Fund.

In addition to the above, various policy documentations and formulations, in more recent times, have been prepared and pursuit purposefully to address poverty issues in the country. These includes the 1992 Constitution, The Ghana Vision 2020, the Policy Focus for Poverty Reduction of September 1996, the First Medium Term Development Plan 1997-2000, the Ghana Poverty Reduction Strategy 1 (2003-2005), the Ghana Growth and Poverty Reduction Strategy 11 (2005-2008) and just recently the Livelihoods Empowerment Against Poverty (LEAP) programme.

Efforts to reduce poverty have always been the concern of all governments in Ghana. The root causes of poverty are believed to relate, among others, to the state of the economy, and lack of skills and commitment required to implement, monitor and evaluate poverty reduction programmes, activities and practices. All governments have made poverty reduction the cornerstone of their social policies, however, poverty reduction efforts have faced serious problems since independence, and this is believed to be due to the dramatic reversals in economic and social development, in the face of instability experienced by Ghana in the 1970s and 1980s. For instance, expenditure on health fell from 8.2% of public expenditure in 1974 to 4.3% in 1983. There were severe shortages of drugs and other materials and by1984 up to 50% of medical practitioners were reported to have left tlie country. Hospital attendance dropped by 40.9% in Accra and by 66% in Cape Coast. Poverty related diseases became widespread, and others such as yaws, which was previously eliminated, re-surfaced. Food supplies were severely limited per capita, and food availability was 30% lower in 1983, than in 1974. (Ghana National Human Development Report, 2000)

In spite the abysmal performance of the economy in the 1980s, the situation has improved dramatically in more recent times, GDP is estimated to have grown on the

average 4.65% per annum during 1991-1999 period and 4.98% between 1999 and 2006. Most parts of the country benefited from this growth, although the Southern cocoa producing regions seem to have benefited the most.

The Ghana Living Standards Survey from the 1990s found a significant reduction in poverty levels for the entire country as a whole, although some regions were completely left out, in particular, it was found out that the already poorest part of Ghana (the savannah zone) did not benefit much from the economic growth. (GLSS 2007)

Owing to a huge and unsustainable debt overhang in 2001, Ghana decided to take advantage of the Enhanced HIPC Initiative. Thus, the Ghana Poverty Reduction Strategy document was prepared, targeted at preparing a participatory poverty profiling and mapping in all the 110 districts to contribute towards a more effective pro-poor targeting of development initiatives. The GPRS 1 was modified in 2004 to the Ghana Growth and Poverty Reduction Strategy 11 (2004-2008). This new version is geared towards merging growth with distribution, thus re-distributing the benefits of growth to enhance equity. Under the agricultural model of the GGPRS 11, emphasis is placed on modernization of agricultural activities as the way forward for increasing the productivity of the food-crop rural smallholders. This entails the provision of irrigation, mechanization of land preparation, provision of improved seed and fertilizers, and linking producers to high value markets. This is geared towards solving the imbalances emanating from previous growth that characterized the 1990s where the country experienced growth without equity, thereby entrenching and in some cases exacerbating poverty, especially in the savannah zones of the country (GGPRS, 2003-2008).

Another novelty poverty reduction measure which is being implemented currently is the Livelihood Empowerment Against Poverty (LEAP) programme, which is a social protection intervention to complement relief measures for various categories of poor people. Under the LEAP, direct cash transfers will be made available to 18.2% of the population categorized as poor people and captured by the Ghana Living Standards Survey (GLSS 5), falling into the category of the extreme poor. The amount to be disbursed per month ranges from GH¢5 to GH¢15 depending on if the extremely poor

household also has an orphan, severely disabled person and persons aged more than 65years old. The philosophy behind LEAP is that, poverty is a multi-dimensional phenomenon and there was a need to adopt a multi-structural social protection measure to tackle it. *(The Mirror, Feb.* 2 *2008, page 3).*

Other poverty reduction interventions which is currently in operation in the country includes; the National Health Insurance Scheme, the Capitation Grant, the School Feeding Programme, the Mass Transport, the Free Bus ride for School Children, and the Micro credit for people living with disabilities. These programmes are social protection mechanisms to enhance livelihoods and provide welfare for the vulnerable and the excluded in the Ghanaian society.

The Ghana National Human Development Report (2007) has it that the country is the first in the sub-region to achieve the MDG number one, that is , halving the proportion of people living in extreme poverty from 36% in 1991/92 to 18.2% in 2005/2006, with a decline in overall poverty incidence from51.75% in 1991/92 to 28.5% in 2005/2006.The various forms of social exclusion has also seen significant progress from 31.4% in 1991/92 to 17.6% in 2005/06. These achievements have been attributed to good governance, improvement in socio-economic development initiatives, youth and gender empowerment.

In an effort to equitably distribute the gains of growth and bridge the yawning development gap between the North and South, a Northern Development Fund was given a budgetary allocation in the 2008 budget,. for the purposive development of the three Northern regions in the area of infrastructure and creation of employment avenues.(*The Mirror, Feb.16th 2008. pg 46.)*

From the above analysis, it is clear that Ghana is on course in poverty reduction initiatives, it is however pertinent that overall reduction in the incidence of poverty in the Northern Ghana can only be achieved if agriculture is modernized, harnessing the water resources of the region for irrigation farming to escape from the vulnerability of rain fed agriculture would boast the capacity of the sector to increase productivity. When people productive capacity is boasted, food security and incomes would be enhanced, and

poverty would be reduced drastically. Perhaps Dittoh, (2007) could not have put it better, when he pointed out that," the area with the highest potential for poverty reduction in the North is the agricultural sector, where the North has a comparative advantage in land, water and people*".(Daily Graphic, Oct 26, 2007, page 48.)*

For poverty reduction strategies to impact positively on the poor, it is important that productivity-enhancement programmes should be designed and implemented. In Ghana, the incidence of poverty is basically rural and concentrated in the food crop sector, efforts to address poverty therefore, should target the capacity of the sector to raise production. Measures should also be taken to promote pro-poor growth strategies, thus, economic growth should be tied with the equitable distribution of the gains of growth, to ensure that people can escape from their vulnerability and participate fully in the social processes.

Poverty has many dimensions; it is characterized by low income, malnutrition, ill health, illiteracy, and insecurity. There could equally be also a sense of powerlessness and exclusion. These different aspects interact and combine to keep households, and at times whole communities in perpetual misery. As evidenced by actions taken to combat poverty globally, policies on poverty reduction must be comprehensive and based on timely information on the living standards of the population.

It is in this vein that the study seeks to ascertain the effects of harnessing the potential of irrigation, especially in Northern Ghana, to boast food crop production, provide all year round employment, and raise the incomes of smallholders to enable them live a decent life with the view to escaping the poverty trap that bedeviled them over the years.

2.8 CHANNELS THROUGH WHICH AGRICULTURAL MODERNISATION OF IRRIGATION CAN FACILITATE POVERTY REDUCTION.

There are basically three ways through which the poor (or anyone else for that matter) can improve their real incomes. First is through increases in the productive assets they own. This can be done either through their own investments, out of their own savings or borrowing, or through increases in publicly provided but privately appropriated assets, such as health and education.

The second mechanism is by improved employment and returns to the assets the poor already own. Such improved returns could be obtained, for instance, through increased utilization of unused land, profits from increases in prices for the products the poor produce and sell, or increases in employment and wages.

The final channel is through increased productivity of the assets the poor own. This could involve, for instance, increased land or labor productivity, namely increased output per unit of land or labor at unchanged prices.

How can poverty be reduced through these three channels?

The answers to the above question depend on the structure of assets of the poor, on the structure of their income sources, on the structure of various institutions that mediate between the poor and the rest of the economy (such as markets, family networks, NGOs, etc.), and on the dynamic economic and social processes that create and maintain poverty. In other words they depend on the static and dynamic profile of poverty. Concerning the sources of income of the different classes of the poor in a country, it is useful to classify them as income from agriculture (normally divided by income from crops and livestock, or as income from food and non-food, or income from tradable and non-tradable products depending on the data and context), income from farm and non-farm labor employment, profit income from own enterprise activity, income from land rentals, and income from various other sources such as transfers, remittances, dividends etc.

The profiles of the poor differ considerably in different countries and regions. For instance many of the poor in South-East Asia are rural smallholders, with substantial portions of their income coming from agriculture, but also many others are rural landless, relying primarily on farm and non-farm labor income. In much of Sub-Saharan Africa, the poor are mainly rural with the bulk of their incomes from rain-fed agriculture. In Latin America a large part of the poor are urban based, relying for income on informal enterprise activity and non-farm labor.

Another differentiating aspect across countries is the existence of different farming systems in different agro-ecological zones and parts of the world. The recent F AO

farming systems study, done for the World Bank (FAO, 2000) exhibits the heterogeneity in farming systems across the world, but also highlights the fact that even within the same agro-ecological zone there may be several farming systems that coexist.

Along with the static description of poverty, of significant importance are the dynamic poverty processes, namely institutional features that create and, more importantly, maintain poverty. An early description of a variety of such mechanisms, as they apply to the rural sector, is given by Jazairy, et. al (1992), based on the experiences of IFAD in dealing with rural poverty related projects. They include dualism, population pressures, resource management and environmental degradation in fragile settings, natural production cycles inducing production risk, social marginalization of women, cultural and ethnic factors, and exploitative intermediation mechanisms. In that volume, an attempt was made to indicate the importance of these various mechanisms in different countries. Overall they managed to characterize the rural poor as falling largely into the following functional classes.

- Smallholder farmers
- Landless rural residents
- Nomadic pastoralists
- Ethnic indigenous groups
- Artisanal fishermen
- Displaced or refugee populations
- Households headed by women

It should be clear from this characterization that agricultural modernization has different poverty reducing and growth implications under different settings, and for different poor groups.

Consider increases in private productive assets. One mechanism through which such assets can be augmented, and especially benefiting the rural poor, is land distribution, land reform, or general enhancement of property rights to land.

For this survey it will be assumed that the landed poor own or have access to given amounts of land, through some form of tenure. The landless poor, of course, do not have agricultural land. However, a major issue, which is related to agricultural development and its role in reducing poverty, is security of land ownership or tenure rights. These rights are far from secure in many developing countries, and this may be a major impediment to land augmenting technical change, that will enhance the value of land. This could be, for instance, a major problem in most African countries, where the land tenure systems are such that they provide very weak private ownership rights. Access to land has many advantages for poverty reduction, and often for achieving efficiency gains. For instance access to farm land can give value to many factors that are underutilized otherwise by the poor (e.g. family labor), can lower the cost of using household factors of production (e.g. family labor through the lower transactions and supervision costs), can provide food security and insurance when food prices rise, etc.

Thus the poverty and growth implications of any land augmenting technical change in agriculture will depend considerably on the existing land tenure system, because it is the appropriation of the benefits of technical change that is at issue. As Adams and He (1995)

Showed, agricultural development concentrated on technological change, i. e. irrigation in crop production tended to worsen income distribution in rural Pakistan, as most of the poor were landless, and as increased crop income tended to favor the owners of land.

Hayami (2000) illustrates vividly the different growth paths of agricultural development since the nineteenth century in the Philippines, Indonesia and Thailand, and attributes the different agricultural growth trajectories to the evolution of agrarian structures in these countries. In the Philippines, bimodal and dual agrarian structures, while initially efficient due to the early substantial expansion of the land frontier, eventually turned into a disadvantage because of the inefficiencies of large-scale irrigated agriculture with its monitoring needs for hired labor.

On the contrary, in Thailand and Indonesia, despite similar early vent-for-surplus agrarian development, the agrarian structure that was maintained was largely unimodal

and smallholder based, that facilitated later agricultural growth and development. Consider increases in private productive assets through investment. It is well known that most poor people face credit constraints, hence most of their investments are made using own funds out of personal savings. To have savings, of course, implies that households can meet their basic food and other needs first, out of whatever income they have. The evidence from household surveys suggests that the poor do have savings, often of the order of 20-30 percent of their gross incomes. If there are variations in the incomes of the poor, and of a magnitude that can reduce basic needs satisfaction below some minimum acceptable levels, then there is vulnerability. That there is considerable vulnerability among the poor around the world is well documented in World Development Report (WDR 2000,) in chapter 8.

Under vulnerability the poor may devote a considerable portion of whatever savings they have into liquid forms of non-productive assets, as insurance. Such assets can take the form of grain stocks or animals in rural areas, gold and jewelry in non-farm households, etc. The poor, in response to external risks, may devote a disproportional portion of their savings to such unproductive self-insurance and hence reduce their investments in more productive activities. Thus, the need for precautionary savings may reduce the growth opportunities of the poor, and may create poverty traps.

For instance, Rosenzweig and Wolpin (1993) found that in rural semi-arid India, poor farmers are less likely to invest in irrigation equipment than in bullocks, despite the fact that the return to the former is higher than the return on the latter, because bullocks can be sold in times of need, while irrigation pumps cannot. Similarly Fafchamps and Pender (1997) showed using similar panel data from I CRIS AT that the indivisibility of profitable investments, such as wells for irrigation, coupled with the need to have cash on hand for insurance purposes, made it very difficult for poor households to undertake such investments.

In the same vein, in many parts of the world, the need to maintain some income when adverse shocks occur, induces parents to pull children away from school (an acknowledged profitable investment) and send them to work. This clearly prevents

human capital accumulation and leads to persistent poverty across generations. It is clear that under such conditions, what is needed is some institutional mechanism to provide in a reliable and credible way cheaper insurance to the poor, in order to let them utilize in a more productive way their own savings.

The second major way in which the poor can expand their own assets is through acquisition of human capital such as education and better health. The role of the government in provision of such assets is crucial and has been reviewed extensively in WDR2000 (chapter 5). It will not be discussed further here, as it does not pertain directly to action to improve agricultural growth. However, it must be mentioned that human capital assets by households such as education can make for more efficient use of other productive services. An example is the use of irrigation equipment, which was found in Vietnam to be more efficient by better-educated farmers. (Van de Walle, 2000). Thus it appears that there are complementarities between human capital variables and the productivity of physical capital.

This implies that agricultural modernization enhancing measures, such as irrigation, provision of infrastructure and new technologies, will produce higher returns when implemented by more educated producers, or when accompanied by action to strengthen the education of those affected. Another aspect of public sector provision of human capital services is that it appears that the poor do better with some of all, rather than with a lot of one type of service and little or none of the others. (Lipton, 2000).

Agricultural development involves productivity increases, and this can occur through either new techniques of production, or through productivity enhancing infrastructure and human capital investments. These are the main mechanisms identified earlier that create agricultural growth, and it is these mechanisms that must be considered in their possibility to reduce rural and urban poverty.

There are direct as well as indirect ways in which agricultural development can contribute to poverty reduction. The direct way involves direct improvement in the incomes of the rural poor, through adoption of improved techniques, or increases in the productivity of their agricultural assets such as land. Such increases in productivity can

come about through agriculture-related research, and extension, as well as agriculture related infrastructure investments, such as irrigation., The extent to which such agricultural productivity improvements lead directly to income increases of the poor depends on the extent to which the poor produce the products for which improved techniques become available, as well as the degree of adoption of the new techniques by the rural poor. Consider new techniques of agricultural production in the area of irrigation. These normally involve the possibility of higher crop yields. For crops this can involve-improved yields for food or non-food crops. While both can lead to improved incomes, increased yield of staple foods has the advantage that a portion can be consumed directly by poor producing households since the income elasticity of demand for staples is normally larger than zero. This implies that the increase in marketed surplus out of increased production of foods by poor rural producers will be smaller than the increase in production, and this avoids large price declines of staples when the products are not perfectly traded, the markets are imperfect, or the price elasticity of demand in the rest of the economy is small. That such imperfections are prevalent in the rural areas of developing countries is by now well accepted, and a substantial part of development economics research over the past two decades has been devoted to examinations of the implications of such imperfections.

Concerning adoption, it is not at all assured that the poor agricultural smallholders will adopt the improved techniques so as to benefit directly. The major reasons involve uncertainty and risk about the new technology, plus issues involving the availability of the minimum initial capital that may be needed to implement the new techniques.

Under conditions where adoption is perceived as risky, and in addition requires capital outlays, it is quite likely that the early adopters are the better off farmers. This may create initially adverse consequences for the poorer farmers if the increased production of the progressive farmers depresses domestic prices. This may either marginalize the poorer farmers or may accelerate their tendency for adoption. In any case historically the Green Revolution seems to have had negative initial effects on the smaller farmers, but the later impacts were positive.

Thornton, (1978), Chambers and Harriss (1980) have reviewed the issues of agricultural technological change and poverty alleviation. They noted that country experience suggested that the introduction of irrigation as a result of agricultural technological change, coupled with better infrastructure to improve commercialization of the increased production has been crucial to expanding agricultural growth, food supply and employment, all of which are crucial to the poor.

While there are cases that may be cited where technological change and commercialization has been blamed for the decline of welfare of the poor, they show that in all such cases there are other factors that have been responsible for these adverse effects. They note that uneven regional agricultural development, while it may lead initially to adverse consequences for the residents of the regions that have not adapted, due to the treadmill effect, will probably benefit the poor through consumption improvements. They also showed that late adoption by the poor, something that may be expected in view of the higher relative risks faced by the poor, does not necessarily put them in a disadvantage. They also cite examples from Ethiopia and Sudan, where agricultural technological change led to substantial increases in the returns to land, and led to eviction of tenants, thus marginalizing the poor. However, the impoverishment in such cases was not due to the development of agricultural technology, but rather to other accompanying anti-poor policies.

Binswanger and Von Braun (1993) also reviewed the issue of targeting technological change to the poor, and they found that the scope of targeting technological change to the poor is limited. The major way, however, through which the poor may benefit from agricultural technological change is indirect. Mellor (1999) makes the point that while ' recent empirical evidence, such as in the papers reviewed above, " ... make a powerful case that it is agricultural growth and essentially only agricultural growth that brings about poverty decline in low income countries with a substantial agricultural sector", the explanation for this relationship is older and associated with the work of Johnston and Mellor (1961), Mellor (1961, 1976, 1995), Mellor and Johnston (1984), and Mellor and Lele (1973). Mellor (1999) has reiterated this explanation, pointing out that the main channels through which agricultural productivity increases impact on poverty reduction

are non-agricultural employment generation, increases in staple food output through yield increases so as not to increase unduly domestic prices for the foods that are the major wage goods, and shifts towards more high valued labor intensive agricultural commodities, that stimulate demand for agricultural labor.

Concerning employment generation of agricultural productivity increases, Mellor (1999) makes the point that agricultural employment is not likely to be very much stimulated by improvements in land or labor saving technology of production of staple foods, because the elasticities are rather low, normally much smaller than one. He suggests that a much more likely contributor to agricultural employment generation is the stimulation of production of high value labor-intensive commodities such as fruits and vegetables. However, such a stimulus must come from increases in demand for these products, which are in turn stimulated by higher incomes. Thus, one needs higher incomes to generate such rural employment growth. He then goes on to suggest that the major stimulus to rural employment is not from agriculture, but from rural based non-agricultural activities. He suggests that employment elasticities from rural non-farm activities are close to one.

The major way that has been identified by the literature, in which agricultural growth contributes to overall growth and simultaneous poverty reduction, is the stimulation of demand for non-tradable labor-intensive non-agricultural activities, through the demand linkage effect mentioned earlier. Supply of such activities is normally assumed to be very elastic under the hypothesis of underutilized labor resources in rural areas of developing countries. Hence, the increase in demand is assumed to lead to an almost one-for one increase in supply, and this is what accounts for the large multipliers. The estimated multipliers from increased agricultural output to overall output are in the vicinity of 1.4- 1.8 in most studies (Hazell and Roell, 1983, Haggblade, Hazell, and Brown, 1989, Delgado, et. al., 1998,), and can reach values as high as 3. However, in cases where the price elasticity of supply of labor is not infinite, then these multipliers are smaller (Haggblade, Hammer, and Hazell, 1991).

Mellor (1999) also makes the point that development of urban-based formal sector manufacturing in the absence of agricultural growth is not likely to reduce poverty. The

reason is that formal sector manufacturing growth through borrowed techniques from abroad, is most likely to be capital intensive. This implies that while the wages of some lucky formal sector employees may be high, the reservation wage of those who supply the pool of potential employees, namely the average product of labor in agriculture will not rise. The consequence is that more rural people may migrate to the cities in search of high paying formal sector employment, with the result of larger urban unemployment, lower urban wages, and higher urban poverty. This is a pattern that seems to have been followed in many Sub-Saharan Africa countries.

Of course, the demand stimulus for higher valued agricultural products, and for rural based nonagricultural activities does not have to come strictly from the agricultural sector. Broad-based increases in urban incomes can also lead to a stimulus for rural incomes, especially if the marketing margin from rural to urban areas is small. This indicates the two conditions that must be fulfilled so that urban-based growth can stimulate poverty reducing rural income growth, namely the broad based nature of urban growth, and the reduction of the cost of rural-urban marketing.

The channels through which agricultural growth and public investments in agriculture contribute to overall income growth and poverty reduction have been made the object of empirical analysis by two recent studies by Fan, Hazell and Thorat (1999) for India, and Fan, Zhang, and Zhang (2000) for China. In both studies an econometric multiple equation model is estimated that attempts to explain rural poverty, total factor productivity in agriculture or simply agricultural production, rural wages, rural non-farm employment, the agricultural terms of trade and several infrastructure variables. It is found in both studies that rural poverty is negatively and sigaificantly associated with agricultural total factor productivity (or growth in agricultural production), rural wages, and non-farm rural employment. Agricultural total factor productivity is explained by a sequence of infrastructure related variables, such as irrigation, rural roads, literacy, electrification, as well as by expenditures on agricultural research and development. Wages and non-farm employment in turn are determined by both agricultural and non-agricultural production variables, as well as infrastructure spending variables. The most important variables in these empirical analyses in terms of both growth improvements, as

well as rural poverty reduction are investments in irrigation, agricultural research and development, and investments in rural roads, followed by education. The elasticity differ by country, which attests to the fact that local conditions and institutional specificities matter. The results are, nevertheless, compatible with the view that it is not only agricultural productivity growth that is important for poverty reduction, but also complementary human and nonhuman infrastructure investments. The results also tend to corroborate the view that it is through the stimulation of non-farm rural non-tradable activities that agricultural growth helps to reduce poverty and at the same time enhance overall growth.

All the above raises the question of the conditions that are conducive for agricultural growth to have beneficial impact on overall growth. Delgado, et. al (1998) have outlined these conditions as follows;

The first condition is that agriculture must account for a large share of aggregate employment. The second is that agricultural growth must be equitable and evenly distributed. In other words it must allow a large number of rural people to increase their incomes and hence demand. This condition will be fulfilled when agricultural growth is targeted to products that are produced with labor-intensive technology and by a broad range of rural producers. Initial asset distribution, especially for land matters. The third condition is that the consumption patterns of the direct beneficiaries of agricultural growth must be such that large shares of the increments to income are spent on labor - intensive local non-tradable goods and services. In other words the growth multipliers are likely to be larger the less open the rural economy is, in the sense that the bulk of the local economy consists of production and consumption of non-tradable. The final condition is that there must be a supply of underutilized local resources to make the supply of local non-tradable elastic, so as not to choke the increased demand for local non-tradable by undue increases in prices. Note that one of the key conditions is that agricultural growth must be broad based, in the sense of benefiting a large share of the rural people. It is in this sense that agricultural growth facilitated by the provision of irrigation is poverty reducing.

In order for such a condition to hold, the productivity changes induced by whatever interventions are made must be such as to touch a large share of the rural producers. Nevertheless, Mellor (1999) points out that an initial skewing of the benefits of agricultural growth towards the higher income rural producers is not in conflict with poverty reduction. He points out that if these producers spend a large portion of their extra incomes on local non-tradable, then eventually the poor will benefit through local employment creation. This, however, may take some time.

Another aspect of the relationship between agricultural development and poverty reduction is the relationship between agricultural development and nutritional improvements. At low levels of income, rural households in developing countries are not very well nourished, they spend a large share of their income on own produced staples, and the income elasticity of demand for such staples is high. Thus agricultural productivity growth, especially for staples, apart from improving incomes, can improve the nutritional status of many of these households. Better nutritional status can in tum improve overall labor productivity. Better labor productivity can have growth implications. In a recent empirical analysis Arcand (2000) finds a significant relationship between the initial level of the prevalence of food inadequacy (PFI) or the dietary energy supply per capita (DES), and subsequent overall growth.

Given that these two nutritional variables are normally strongly associated with the overall levels of poverty in a country, Arcand's results suggest that the initial degree of under nutrition and poverty is detrimental to growth. Arcand subjected his results to a battery of robustness tests, which preserve a significant relationship between the level of under nutrition and subsequent growth. He further found that there are nutritional growth traps, in the sense that at low levels of undernourishment, growth rates are sensitive to improvements in nutrition, while at higher levels of undernourishment the relationship is much weaker. This suggests that at low levels of overall nutrition, it is efficient for a country to adopt policies that improve the overall nutrition level of the population. Given the normally large shares of undernourished rural populations in most of low-income developing countries, such policies almost invariably include agricultural productivity growth for the rural poor. It is not clear whether Arcand's nutritional variables are proxies

for the overall degree of poverty in a country. Even if they are, however, they still imply that poverty reduction in the form of decreasing the number of undernourished is efficient, in the sense of improving growth. The results of Arcand are consistent with historical work accounting for growth in now developed countries. For instance, Fogel (1994) claims that improved nutrition may have accounted for 30 to 50 percent of the growth in per capita income in Great Britain between 1790 and 1980. It thus appears from the above review of the literature that the conditions that can make agricultural productivity growth, through the provision of irrigation, to be both overall growth enhancing as well as pro-poor are the following.

- Agriculture must account for a large share of aggregate employment.
- Initial distribution of land must be equitable and property rights must be well specified.
- The irrigation technology improvements must not be risk increasing, nor should they require substantive private capital to be implemented.
- The marginal budget shares of the direct beneficiaries of agricultural growth for laborintensive local non-tradable must be large.
- There must be an excess supply of underutilized local labor resources.
- There must be complementary improvements in the provision of human capital assets at the local level (education and health), as well as improvements in marketing infrastructure (e.g. roads).

The consequences of agricultural development for the poor can be direct, through improved agricultural incomes, or indirect, through the impacts on employment, wages, prices of products, and productivity of non-farm assets. A major contribution of the research on agricultural growth and poverty over the past decades has been to point out that the indirect impacts can be as large or even larger than the direct ones, but may take some time to be realized. DeJanvry et. al (2000) have shown that the shares of direct and indirect effects on poverty reduction from agricultural growth are vastly different in different institutional and economic settings. They note that in an Asian context the

indirect effects are likely to be much larger than direct effects, and this implies that most of the benefits from agricultural growth on the poor arise from increased employment and unskilled wage increases, as verified by the various studies of agriculture and poverty reduction in India.

In Africa, the direct effects are much more important, and this suggests that targeting technological change on poor farmers is essential for poverty reduction. In Latin America by contrast the indirect effects are much larger than the direct effects, but there the benefits to the poor from technological improvements are likely to come through the declines in food prices. What if the above conditions that make agricultural productivity growth have a beneficial impact on overall growth and poverty reduction do not hold? Should one abandon agriculture and public investments that favor it? Should one adopt policies to set the initial conditions right before investing in agricultural development? The answers to the above questions are certainly not dear-cut or generalizable, as they imply a real world where only second best policies can be applied, but certain points may be made.

First, if agriculture does not account for a large share of aggregate employment, then it cannot easily be a leading sector for growth or poverty reduction. Investments in agricultural productivity growth must then be judged by comparison with investments in productivity growth of other sectors. Perhaps the best policies under such circumstances maybe investments in human capital, so as to allow agricultural producers to adapt more efficiently to technological changes.

Second, if it is difficult to change the initial conditions in the short run, then, while working toward changing them in the medium to long run, one may want to avoid the types of productivity growth that may favor adversely factors that are unequally distributed. For instance, if the land distribution is skewed, then public investment in agricultural development may be better targeted towards labor-intensive techniques rather than land augmenting ones.

Third, if there is no large local excess supply of labor that could be mobilized when the demand for rural non-tradable increases, then perhaps it is prudent to concentrate on

improving the marketing infrastructure, and hence lower the marketing cost between rural and urban areas. This would prevent the prices of local non-tradables from increasing too much from any agricultural stimulus, by essentially making such products more tradable. The above points are not easily generalized, and the presence of only a subset of the above conditions implies that agricultural development policy in such circumstances must be judged on an individual country basis.

Historical lessons from country experience show that Agricultural development played different roles in growth and poverty reduction in the now developed countries. The development paths of developed countries like the United Kingdom and the United States relied primarily on capital intensive industrial development in the early phases that induced slow growth in labor demand. As at the same time the labor supply was increasing, the real wages of unskilled workers, the primary factor determining incomes of the poor, grew slowly and hence there was little impact on poverty. During the early phases of industrialization of these countries, namely from the late eighteenth to the midnineteenth centuries, agricultural productivity increased only a little. In the United Kingdom, the early agricultural technological improvement of the eighteenth century, consisted of the development of an integrated crop-livestock system of husbandry, which was more labor intensive than the traditional one, but increased the productivity of land, while the increases in net returns to labor were small. However, the total employment increased, and this gave work to many underemployed workers.

The English agricultural revolution did not supply surplus labor for industry, but rather food for the rapidly rising population from which both agricultural and industrial labor was recruited. Hence real wages did not rise. It is only since 1840 that the incidence of poverty in the United Kingdom started declining, and this was because of a decline in the overall labor force growth that led to real wage increases. The expansion of the land frontier in the United States induced labor saving technological change, and increased overall production. The increase in agricultural productivity and consequent expansion of production, led to slow secular declines in the prices of food, and it is this, along with the slowdown of the growth rate of labor supply that induced real wage increases and consequent declines in poverty. It is also only since the mid-nineteenth century that in the

US agricultural technology and labor productivity in agriculture started improving, thus inducing a more balanced pattern of growth, and favoring more labor intensive techniques.

By contrast in countries like Japan, development in the nineteenth century occurred through a broad based strategy to improve subsistence-oriented agriculture, a strategy that led to both reduced poverty as well as improved growth. The Japanese model was transplanted in Taiwan, which under the Japanese colonial administration, by the 1920s had a well established agricultural research system, irrigation infrastructure, availability of chemical fertilizers, and a well developed transportation and marketing system, so as to facilitate the provision of marketed surplus to Japan. The introduction of new rice varieties in the 1920s induced large increases in fertilizer use, and increased yields considerably. In contrast to the English agricultural revolution, in Taiwan, labor productivity and the labor earnings of individual cultivators rose concurrently with the rise in land productivity, which resulted from the introduction of modern biological technology. The increased incomes of farmers permitted the transfer of resources to nonagriculture, primarily small rural based industries, as well as to government through taxation. However, the government helped the agricultural transformation by improving rural infrastructure, and heavily investing in rural education and rural public health. The consequence was not only fast agricultural and non-agricultural growth, but also a decline in poverty.

The success of the green revolution in India and other Asian countries has been well documented and needs no further discussion.

In India, for instance, in the twenty-year period since the introduction of irrigation and the new varieties, poverty levels dropped nearly to half. This occurred partly due to increased employment of the poor in agriculture, but mostly because higher farm incomes led to increments of expenditures in local employment intensive goods and services, which in turn spurred the creation of many rural small scale enterprises to provide these goods with labor intensive techniques, in a setting with abundant and underemployed labor (Chambers, 1993).

The story of China has already been mentioned. The Chinese success story relied heavily on agricultural development, spurred by broad based agricultural technological improvements, as well as local infrastructure investments and rural education. The increase in rural incomes led to increases in demand for other products that were also provided largely by rural based small-scale labor-intensive industries. The number of absolutely poor as a consequence declined substantially from 250 million in 1978 to 125 million in 1985 and to less than 100 million in the mid-1990s.

The experience of Bangladesh is similar. Rapid broad based agricultural technological change, in conjunction with improvements in rural infrastructure, and coupled with the provision of a food security system for the poor, has made Bangladesh much less vulnerable to floods, and has reduced poverty.

Mellor, (2001) cites the example of Malaysia, a country with physical agricultural resources similar to those of Western Africa, as a success story of agricultural development and poverty reduction. The agricultural growth of Malaysia came from exportable cash crops like rubber and palm oil, rather than food crops. However, Malaysia adopted a policy of support for irrigation, research and rural infrastructure that led to considerable yield increases that induced large income increases from the many small producers of these products. The intensification of rice production, through heavy investment in irrigation, also led to increases in rural incomes that were translated to increased non-farm employment. The multiplier effects of such agricultural development strategy have been documented, Hazell and Roell (1983).

Vietnam presents another success story in agricultural transformation through the introduction of technology like irrigation and others to small holders. Indeed, the country is now a significant exporter of some commodities such as rice and coffee. (Bage, 2008)

Mellor, (2001) provides other examples of successful agriculture led growth and poverty reduction stories. These include Kenya, Costa Rica, and Indonesia. In all cases the major impetus to success has been agricultural broad-based growth, with spillovers to non-agricultural sectors. Also in all cases the agricultural transformation has been aided by infrastructure investments and rural education. These are examples that reinforce the

points made earlier about the conditions that are conducive for the harnessing of irrigation towards agriculture led growth and poverty reduction.

CONCEPTUAL FRAMEWORK

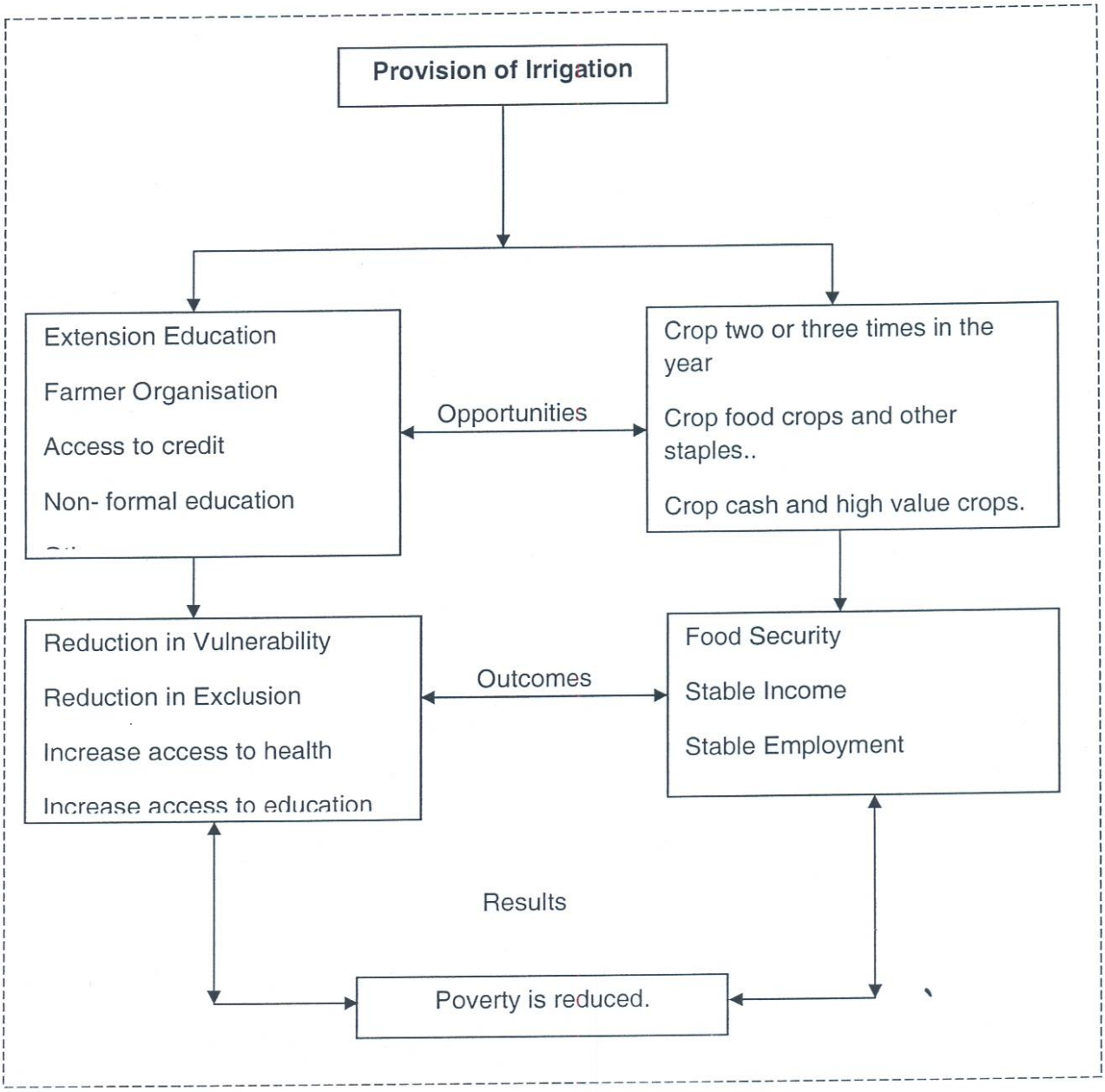


Figure 2.8 **Conceptual Framework.**

The above framework which is the main domain of the study seeks to elaborate how the provision of irrigation can open opportunities for people to crop twice or thrice in a year, engage in fish farming to improve nutritional levels of the people, availability of water

throughout the year for a sustainable livestock and ruminant production, and the capacity to produce high value cash crops to improve on income levels.

Since irrigation farming is a specialized area, farmer organisation and extension are paramount. Thus, extension education would provide pathways for other crosscutting issues like access to credits, functional literacy, gender mainstreaming and HIV/AIDS education e.t.c. to be available to the irrigation community.

These opportunities well tailored would lead to outcomes in food security, creation of employment opportunities throughout the year, increase in income levels and reduction in out-migration to the Southern regions during the dry season.

Extension education and other opportunities in irrigation communities would also lead to reduction in vulnerability and exclusion, good nutrition, better housing and general increases in access to health and education.

The overall result would be a gradual reduction in poverty levels in the communities. Poverty reduction indicators should therefore be viewed from the perspectives of increases in income levels, reduction in vulnerability of livelihoods of the people, increase access to education and a marked improvement in the general health status of irrigation communities.

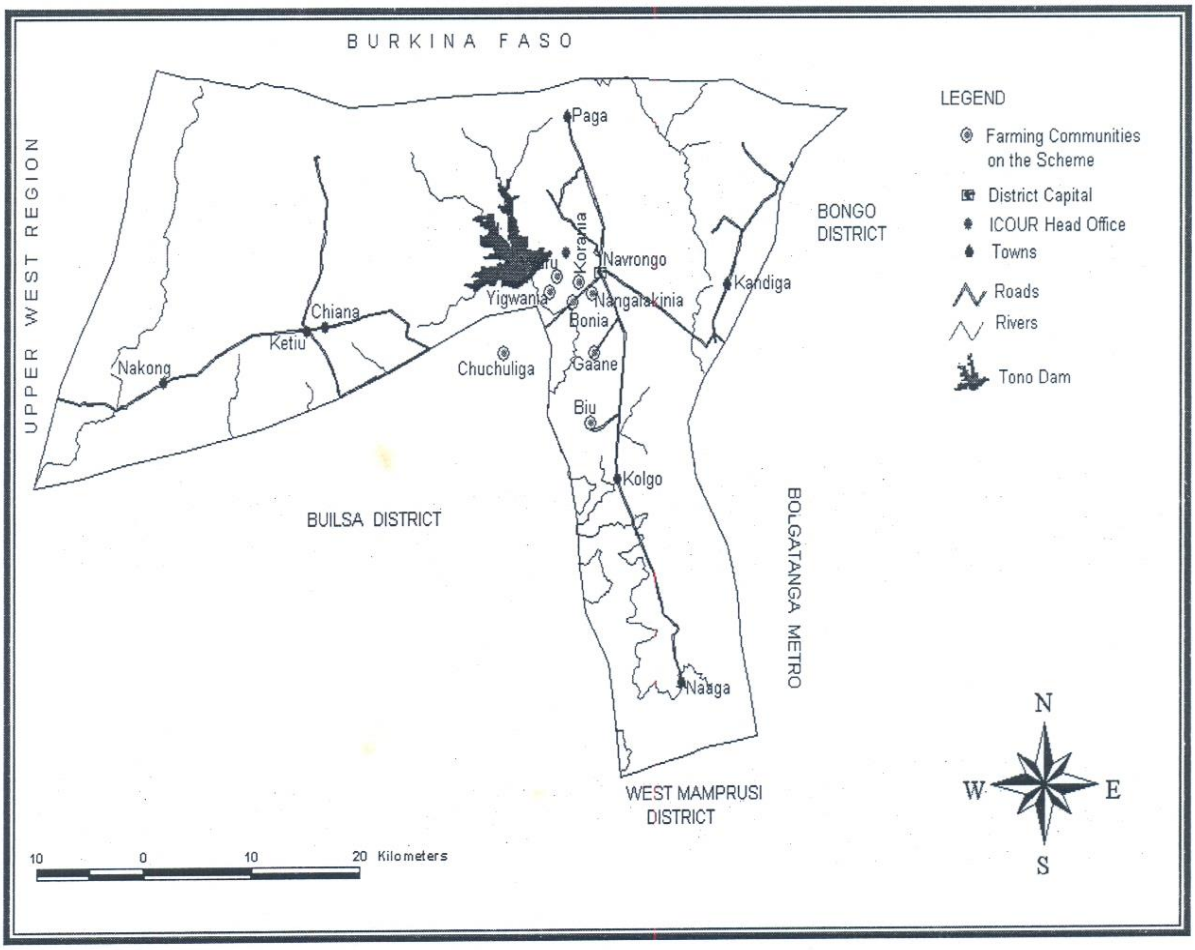
CHAPTER THREE

3.0 METHODOLOGY.

3.1 INTRODUCTION

This chapter deals with the profile of the district, the research design to be adopted, the sample design, and the tools to be used for data collection .It would also highlight how data gathered would be managed, and how the data would be analysed.

MAP OF KASSENA NANKANA DISTRICT - Tono Irrigation Scheme Inclusive



3.2 PROFILE OF THE STUDY DISTRICT

The study area is the Kassena-Nankana District in the Upper East region of the Republic of Ghana. The geographical characteristics, including demographic and socio-economic information about the District are discussed below.

3.2.1 PHYSICAL CHARACTERISTICS

3.2.11 Location and Size

The Kassena- Nankana district lies between latitudes 10°,35' and 11°,00' North and longitude 1°01' and 1°30' West. It is located in the Upper- East Region of Ghana. It has a total land area of about 1640sq km and bordered to the north by The Republic of Burkina Faso, south by Bolgatanga and Talensi- Nabdam districts, Builsa and Sissala- East district of Upper-West region to the west, and Bolgatanga and Bongo districts to the East (KNDA, 1991).

3.2.12 Climate

The Kassena- Nankana district falls under the semi-arid climatic classification. (Sarpong, 1986). Mean monthly temperatures ranges between 23°C and 35°C. Highest monthly temperatures can reach 43°C just before the onset of the rains in April, and the lowest monthly minimum can fall to 12°C in January, when the dry, cold and windy harmattan season is in session.

The most critical factor for farming in Northern Ghana is rainfall. The single rainy season starts from April to October i.e. 7 months, recording an average of 1070mm annually. Rainfall totals for the dry months i.e. November to March averages 29mm. The total number of rainy days averages between 75-80 days, with extreme annual rainfall totals ranging between 700mm and l 400mm. Rain is a critical factor in the agricultural economy of the district, and any poor distribution is likely to throw the agricultural calendar off gear. Rainfall analysis has shown that drought is endemic in the district and the Upper- East region as a whole. (Ofori-Sarpong, 1980), (Obeng, 2005).

With the annual oscillation of the Inter-tropical Convergence Zone (ITCZ), dry northeastly winds (the harmattan winds) prevail over the district from November to

February. These dust-carrying winds from the Sahara Desert are cold and dry with a low relative humidity at all levels, the situation creates ideal condition for bush fires, which have become an annual feature of the physical environment of the district.

3.2.13 Relief

The district is characterized by flat plain with gentle slopes ranging from 1 % to 5% with Isenberg outcrops and some upland at the western sections of the district. It falls within the Biriman Tarkwain and Voltarian sandstone basin of Ghana. There is evidence of the presence of minerals especially gold around the southern part of the district, notably, Kologo and Naaga area.

3.2.14 Vegetation

The natural vegetation is that of guinea savannah woodland consisting of short deciduous trees widely spaced and a ground flora, which gets burnt by fire or scorched by sun during the long dry season. The common economic trees are the shea, dawadawa, baobabs and acacias. This woodland savanna satisfies domestic requirement for house construction, cattle kraals, vegetable cultivation, fence and materials for handicrafts. The grasses and shrubs provide pasture for the livestock population; mainly goats, sheep, and cattle .In the dry season however, annual bush fires decimate the grasses and shrubs and as a result pasture for the livestock is largely destroyed.

Some of the most densely vegetated parts of the district can be found along river basins and forest reserves. Most of these trees in the forest areas shed off their leaves during the dry season.

3.2.15 Soils

Two main types of soil are present in the district, namely the Savannah ochrosols and groundwater laterite. The Northern and Eastern parts are covered by the savannah ochrosols, whiles the rest of the district has groundwater late rite.

The former soils are porous, well drained, loamy, mildly acidic and interspersed with patches of black or dark-grey clay soils. This type is suitable for cultivation and hence

account for the arable land sites including most parts of the Tono Irrigation Project where both wet and dry season farming activities are concentrated.

The groundwater late rite are developed mainly over shale and granite and covers about 60% of the district land area. Due to the underlying rock type (granite), they become waterlogged during the rainy season and dry out during the dry season, thus causing cemented layers of iron-stone (hard pan), which makes cultivation difficult.

3.2.16 Drainage

The drainage system of the district is constituted mainly around the tributaries of the Sissilli river- Asibelka, Afumbeli, Bukpeni and Beeyi. A tributary of the Asibelika (Tono) has been dammed to provide the irrigation facility. During the rainy season these rivers overflow their banks and sheet flooding results. In the dry season, however, the rivers for the most part, dry up or are reduced to intermittent pools which disrupts water supply especially for livestock. There are also some few dug-outs and ponds which are used for livestock, crop farming and domestic purposes.

3.3.1 DEMOGRAPHIC CHARACTERISTICS

3.3.11 Population

Population Size

The population of the District from the 2000 Population and Housing Census is estimated to be 149,491. The figure represents 1.0 per cent increase over the 1984 figure of 48,680. This inter censual growth rate of 1 per cent is below the national growth rate of 2.7 per cent.

3.3.12 Sex Composition

The sex composition of the District's population favors female. The female forms a little over one-half of the total population of the District. The female population is estimated to be 77,575 representing 51.9 per cent while the male recorded 71,916 representing 48.1 per cent of the population. This is indicated in table 3.3.12 below.

TABLE: 3.3.12 Population by Sex

Male	Female	Total
71,916 (48.1 %)	77,575 (51.9%)	149,491 (100%)

Source: 2000 Population & Housing Census. Ghana Statistical Service

3.3.1.3 Population Density

The District recorded a population density of 91 persons per sq. km. This is higher than the national density of 79.7 persons per sq km but below the regional density of 104.1 persons per sq. km.

TABLE: 3.313 Density of Population

Area sq. km	Population	Density
1,642	149,491	91

Source: 2000 Population & Housing Census. Ghana Statistical Service

3.3.1.4 Growth

The population growth rate between 1960 and 1970 and also between 1970 and 1984 was 2.95 per cent and 3.0 per cent respectively but fell to 1 per cent between 1984 and 2000. This shows inter-censual decline of as much as 2.9 per cent (see Table 3.3.15 for population trend in the District).

TABLE: 3.3.1.4 Population Trend for various Censual Years

YEAR	POPULATION	GROWTH RATE (%)
1960	93,397	-
1970	99,006	2.95
1984	147,996	3.0
2000	149,491	1.0

Source: 2000 Population & Housing Census. Ghana Statistical Service

3.3.1.5 Age Dependency

Dependency Ratio (DR) is defined as the ratio of the sum of the population aged below 15 years and above 65 years to the population between 14 and 65 years as expressed as a percentage.

The District recorded age dependency ratio of 87.8 as indicated in Table 3.3.15. This means that 100 economically active persons have responsibility for approximately 88 dependents.

TABLE: 3.315 Age Dependency Ratio

AGE		TOTAL	DEPENDENCY
0 - 14	65+		
40.5	6.1	46.6	87.8

Source: 2000 Population & Housing Census. Ghana Statistical Service

3.3.1.6 Geographical Distribution

The population density is 91 people per square kilometer with dispersed settlements The District consists of 216 communities - majority of which are rural, only 13 per cent of the

population live in towns. At least three out of four people living in the District reside in the rural areas. Table 3.3.16 depicts clearly the population sizes of the 10 largest settlements as follows:

TABLE: 3.316 Ten Largest Settlements

NO.	SETTLEMENT	POPULATION SIZE	RANKING
1	Navrongo	15,983	l st
2	Paga	7,819	2nd
3	Kandiga-Atibabisi	3,325	3rd
4	Chi an a	2,890	4th
5	Biu	2,748	5th
6	Nakolo	2,401	6tli
7	Nayagenia	2,253	7th
8	Upper Gaane	1,945	8th
9	Korania	1,885	9th
10	Punyoro	1,854	10th

Source: 2000 Population & Housing Census. Ghana Statistical Service

3.3.1.7 Mortality

There has been an improvement in the mortality rate especially, infant and maternal mortally rates in the District. Infant mortality has consistently been reducing from 2003 to 2005 as indicated in table 3.3.17 below. This success is as a result of improvement in access to basic health services, parental care, nutrition status and good sanitation.

TABLE: 3.317 Infant mortality from 2003-2005

Year	Number
2003	95
2004	91
2005	80

Source: DHMT, Navrongo, 2005

3.3.1.8 Migration

Out migration is seasonal and more pronounced in the dry season. The youth (10-34 years) are the majority that migrates to the southern parts of the country in search of greener pastures. Most of them, after the dry season, return home to commence farming activities whiles others continue to hustle with great ambitions. This explains why the District recorded a tremendously low population growth rate of 1 % in the year 2000 Population and Housing Census.

The trend of in-migration is very insignificant as mostly nomads from Burkina Faso and Mali, transferred workers and traders, especially during the tomato season travel into the District As indicated in Table 3.318, the net migration over the period shows the difference between people who leave the district and those who are coming in. The negatives indicate that more people left the district than those who came in, and the positives indicate the reverse situation.

TABLE: 3.318 Net Migration rates (per 1000 population/year) 1996-2000

AGE GROUP	**1996/97**	**1997/98**	**1998/99**	**1999/2000**
0- 14	-14.03	-11.76	13.17	21.3
5-9	-8.90	-4.07	7.92	10.63
10- 14	-24.07	-26.18	-3.10	-3.92

15 -19	-60.64	-80.24	-41.57	-43.01
20-24	-49.85	-56.33	-2.22	-3.55
25-29	-23.48	-30.28	6.18	22.29
30-34	-4.99	-20.66	11.34	36.47
35-39	-7.51	-14.19	12.53	15.53
40-44	-6.86	-3.34	14.76	10.27
45-49	1.80	-1.73	8.65	10.64
50-54	-1.64	-7.58	3.51	12.73
55-59	-3.97	-4.05	0.52	-0.17
60-64	0.00	-7.08	6.88	3.03
65+	-1.01	0.96	12.88	5.06
All Ages	-18.46	-22.32	1.09	4.66

SOURCE: Nyarko *et al*, 2000

3.3.2 Occupational Distribution

The mainstay of the local economy is agriculture, which accounts for about 68.7 per cent of the employable population. Public servants, traders, food processors and small-scale artisans constitute the remaining 31.3 per cent. The District has virtually no sizeable manufacturing industries

TABLE: 3.32 Main Occupation of the Economically Active Population Age 15 Years And Older By Sex in percentages (%)

Type Of Occupation (Both Sexes)	Both Sexes	Male	Female

Professional / Technical work	3.5	4.6	2.4
Administration / managerial work	0.1	0.2	0.0
Clerical and related work	1.4	2.1	0.7
Sales work	9.2	4.8	13.8
Agric/ Animal Husbandry/fishermen/Hunters	68.7	76.2	61.0
Production / Transport Operators & Labourers	10.4	6.8	14.2
All others	1.0	1.3	0.8
Service Workers	5.6	4.2	7.1
Population	57.678	29,153	28,525

Source: 2000 Population & Housing Census. Ghana Statistical Service

The major occupations in the District are Agriculture, employing about 68.7 per cent of the total labour force; production / transport operators and laborers constitute 10.4 per cent, Sales workers (9.2%), service workers (5.6%), Administration / Managerial workers (0.1 %), professional technical workers (3.5%) and others (1.0%).

3.3.3 Household Size

The average household size is seven (7). The extended family system accounts for the large household size, which is relatively higher than the national average of five (5) persons. Such large household sizes have socio-economic implications.

3.4 Structure of the Local Economy.

The economy of the district is dominated by agricultural activities, which constitute 68.6% of the GDP. The secondary sector performance is dominated by small-scale industrial enterprise activities, contributing 30% to the GDP and about 2% exclusively to labor employment. The tertiary sector whose contribution comes mainly from informal private individual activities records about 11 % to the district local economy in terms of her GDP and also accounts for about 30% to the labor employment figure.

Agriculture is the mainstay of the districts economy, employing over 60% of the economically active population .Farming activities is mainly rain fed, however irrigation facilities at the Tono Irrigation Scheme, small dams and dugouts and some water bodies serve as sources of water for dry season farming.

Although crop farming is the highest contributor to agriculture development, in practice, the people integrate the other non-cropping activities such as fishing, hunting, livestock and poultry keeping with their cropping activities. Nevertheless, non-cropping activities are less intensively practiced as compared to cropping which is relied on to satisfy the domestic needs through direct consumption and sale of others to patch up non-food requirements.

Formal manufacturing industrial activities do not exist in the district, however, small-scale entrepreneurial activities dominate the entire industrial scene. It forms about 8.5% of the economic activities of the district, these include small-scale agro-processing such as fibre, cotton, and groundnuts, shea-nuts, fruits, dawadawa, rice and small-scale construction works among others.

These activities offer value adding opportunities to the raw agricultural produce in the district, as well as offering coping mechanisms to majority of the poor, particularly during the off-season periods.

Generally, the service/tertiary sector activities contribute about 32% of total employment in the district. Apart from the sectors activities with regards to the aggregation of the economy's GDP and employment generation indices, the services complement, extends

and consequently add value to the output gotten from the primary sectors activities, for example, telecommunication. In effect, these activities do not only generate revenue, but also fill the livelihood gaps left after the agricultural activities impact.

Trade and commercial activities revolve around mainly foodstuff, semi-processed food and craft items. These items are sold in the local markets as well as outside the district, with some specialized ones meant for the international markets.

About 95% of those engaged in these activities are women. Foodstuff traded includes millet, sorghum, cowpea, groundnuts, and rice. Others includes cassava, gari, palm fruits, yam, citrus fruits are mainly from southern Ghana, with Techiman being the main point of purchase. The processed items includes baobab powder, sheabutter, dawadawa, milled products from millet, maize, rice, groundnuts, processed malt for the pito drink (locally brewed beer), woven items including smocks, hats, baskets, pottery products and locally made ceramics for domestic use are also traded in the markets.

3.5 Surface Accessibility

The district is physically accessible by road, air, and footpath. There are four trunk roads over IOOkm in length, three secondary roads and five feeder roads all totaling about 327.6km in length. The roads can be classified as first, second and third class standards, the first class road (35km) links Navrongo to Paga and Bolgatanga. The second-class roads are either tarred in patches or full, linking Navrongo to Chuchuliga, as well as institutions in and around the fringes of the district. The third class roads are mainly feeder, linking the capital to other growth points and service centers including Chiana, Naaga, Nakong, and Sirigu, Though these roads are motorable, they need periodic maintenance to keep them functional throughout the year.

Foot and bush paths are available to link settlements, farms and market centers. There is also an air strip at Paga where people visiting the region from other parts of the country via the airspace first land.

3.6 Education.

According to the 2003 Core Welfare Indicator Questionnaire (CWIQ) survey, the adult illiteracy rate in the district was 27%, which was slightly higher than the regional average of 23%, but Jess than the national average of 53%. The youth illiteracy rate was also estimated to be 55.7%, which was higher than the regional average of 45% but lower than the national average of 68.8%.

There are 98 functioning primary schools throughout the district; junior high schools are much fewer at 44, with only 6 senior high schools and 3 vocational training institutions. Forty-four pre-schools, a Teacher training college and a Faculty of Applied Science of the University for Development Studies are also located in the district.

3.6.1 Enrollment and Retention.

It is a well-known fact that girl-child education is a problem in the country, particularly the three Northern regions. The district has its fair share of this problem, however, evidence abound that there has been a remarkable improvement in girl-child school enrollment.

There is also clear evidence that more boys are enrolled in schools than girls with noticeable progression in the gap between boys and girls' enrollment as they move from primary to junior high school. However, there has been a continuous improvement between 2003 and 2005 in girls' enrollment.

The increase in girl enrollment might be due to the efforts of the Girl-child Education Programme, supported by development partners like World Food Programme and Catholic Relief Services. The dynamics of school enrollment depicts the progressive decline in the number of pupils retained as they climb upwards along the educational ladder.

Awareness creation has facilitated the formation and strengthening of School Management Committees and Parent Teacher Associations in running the schools effectively. Some PT As have contributed some logistics for pupils education, and generally are taking active part in the running of the schools to fully support the FCUBE Programme.

Table 4.2.1 Cropping Pattern at the Tono Scheme

SITE	CROPS CULTIVATED	
Upland	Dry season	Wet season
	Pepper	Soyabeans
	Tomatoes	Cowpea
	Onion	Groundnuts
	Soyabeans	Maize
	Leafy vegetables	Millet
		Sorghum
Lowland	Rice	Rice

The project has two seasons, the dry season, which is al.so the major season, begins in October and ends· in April, the wet season, also the minor season, spans from May to September each year.

The uplands· are made up of basically sandy and loamy soils, thus, suitable for the cultivation of legumes, cereals and vegetables, whiles the lowlands which have heavy clayish soils and water-logging in character are used for the cultivation ofrice .

In addition, the project investigates and test withfarmers, other cash and food crops from time to time, especially high value crops like green beans, melons, carrots e.t.c when there is ready markets, and where the returns can justify the cost of irrigation.

The project gives priority to better timing, cultivation methods,. and optimum plant population to improve productivity. These practices, together with a reliable supply of farm inputs (fertilizer, agro-chemicals), are expected to result in a crop yield increase. Farm yields on the project have improved dramatically in many of the stable food crops,. Millet and sorghum, the chief staple in the area, increased by more than 100 % between 1987 and 1992, maize and tomatoes also doubled, while rice cultivation increased by 38%. (Burayidi M.1996)

Clearly the importance of the project on agricultural production can be said to be positive. Correspondently, farmers reported an increase in yields on their farms compared to non- irrigable fields or rain fed production.

The withdrawal of Government subsidies on farm inputs, notably fertilizers has recently, impacted negatively on the general yields of almost all crops. Thus whereas N. P. K. was sold for ¢40,000 per 50kg in 1997, the same went for ¢250,000 in 2006, whiles the percentage increase in the market price of the produce is much lower, farmers recording of lower yields recently therefore is attributed to high cost of production and low organic matter as a result of continues cropping. Despite the adequate institutional organization and good agronomic practices enshrined in the participatory concept of the village committees

Table 39.2 below depicts the quantum of production of various crops on the project from 1995 to 2005 with their corresponding values in Cedis during the period.

Table 4.2.2. VOLUME OF PRODUCTION

Year	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005
Crop Production (tonnes)	10856	11743	1173.5	8955	14380	16706	19059	15713	7993	7577	4089
Value (billion Cedis)	3.76	6.64	8.75	10.74	11.79	21.76	38.13	33.95	19.89	22.16	14

Source: ICOUR CORPORATE PLAN 2007

4.2.3. VILLAGE COMMITTEES

A number of authors have suggested that the level of participation of farmers in the general operation and management of irrigation have an impact on the viability and productivity of the scheme. (Parlin and Lusk 1991), (Bryant and White 1984), (Wallach 1988). The participatory measure adopted on the Tono Irrigation Project is the concept of

Village Committees. Thus, each of the nine communities has a committee which serve as an administrative link between the farmers and the project management.

The basic unit of the Village Committee is the farmer based organization (F B Os) that is, a group of farmers in a particular village coming together purely for production on their farms and where available, to obtain assistance regarding the supply of inputs, loan facilities to buy inputs, and transfers of knowledge in best farming techniques. Farmers are motivated to form F. B. Os. based on members shared goals and aspirations and clearly articulated objectives. Some traditional social groups are transformed into farmerbased organisations for farming purposes. The project extension and development staff embarks on a massive capacity building programmes for group members. Group members and their leadership are taken through basic management skills including leadership, discipline, record keeping, conflict resolution, etc.

The importance of holding regular meeting of the group is emphasized in all training programmes, and the need for the groups to play an active role in the operation of the project stressed.

The amalgamation of the various F.B.O, s in the village constituted the Village Committee, that is representative of all F.B.Os, with a five member executives (chairman, treasurer, secretary, vice chairman, and organizing secretary)

The village committees of the nine villages came together and appointed a committee to draft a constitution and byelaws, which was ratified in 1992. Among the functions of the committees are, to serve as an administrative link between farmers operating in F. B. Os, and the project. They are also to allocate land within the boundary of the village, supervise and oversee the cleaning of bunds, laterals and sub-lateral before the beginning of a season.

They were also to see to the equitable and economic use of water for irrigation purposes, and to organize fund raising for the benefit of farmers and the entire village. The V/CS are also mandated to assist with the marketing of farmers' produce, and assist in the education of farmers not only on viable agricultural practices, but also activities that would lead to the socio-economic development of farmers.

The V/Cs in consultation with F. B. Os, also appointed reliable chief irrigators for various laterals and sub-laterals in the area of the village. This function actually marked a watershed in the participatory approach, because, hitherto, the project appointed and paid employees to open and close laterals. With the development of the Village Committees, this function was taken over by farmers themselves relieving the project of having to employ people. Currently, only two water bailiffs are in employment in this area, with the responsibility of opening and closing the main and major canals from the dam. Thus, supply of water to farmers and shutting the lateral when water is not needed has been shifted to beneficiary farmers.

Another major task of the village committee, which requires elucidating, is land allocation. Initially individuals use to form loose groups and only contact the project management for land allocation. This non- participatory measure proved futile and led to a high rate of farmer indebtedness. With the development of the committees, the project management left this function for V/CS, who not only have an up to date data of all F. B. Os operating in the village, but also allocated land using local and traditional criteria with little conflicts. In other words, ancestral and family land areas were considered during allocation, which was easily understood by all participating farmers.

In view of the importance people attach to land, disputes are quickly resolved usmg traditional parameters and principles. Reserve and controversial land that the V /Cs are not using are reverted back to project management for allocation to contract farmers.

Another important concept that assisted in the development process of the V/Cs was the construction of the V/Cs offices. Through ICOUR's assistance, every V/C mobilized communal labour and constructed an office to enable day-to-day activities to be carried out. The building has a general office, a hall, the office of the chairman and a storeroom. With time this offices became focal points for almost all village activities. Meetings and all training activities in the village takes place in the offices, it is used as mother and child health care centres for immunizations, it is also used as polling stations during national and local elections, and lastly used for church activities during Sundays. Thus, the village committee offices serve as community centres for the economic, political, social and spiritual development of the villages.

With time and currently, V/Cs have metamorphosed into a major development player in the villages. In addition to their function of ensuring an effective irrigation regime, the V/Cs are now the vehicles through which other development activities get to the villages. N. G. Os and Government development agencies have relied on the V/Cs in the initiation and sustenance of development activities in the various villages, currently, General Agricultural Workers Union of the Trade Union Congress in partnership with Food and Agricultural Organization is running a programme aimed at eliminating child labour in the project, and the V /Cs are the main players and implementing agencies at the village level, seeing to the withdrawal of child labourers on the farms and ensuring that they are enrolled in formal schools. V /Cs also initiated and mobilized communal labour to sink boreholes in Korania, Bonia, Chuchuliga and Gaani and constructed a day - care centre at Gaani.

It is also note worthy to state that, the village committee participates in all policy decision-making issues of the company. At the highest level, the V/Cs have a representative on the Board of Directors of ICOUR, where policy issues are discussed. At the beginning of every season ICOUR management and V/Cs executives of the nine villages, including the District Chief Executives of the two districts (Kassena-Nankana and Builsa) where the project is situated, and representatives of their traditional councils, meet to map out strategies and cropping programme for the season. This consultative committee meeting reviews the activities of the previous season and look at the way - forward. At the project level, monthly meetings are organized between project management and V/C executive to look at operational challenges.

In addition to the above, farm inspections are organized during the mid-season to tour village committee areas. During this tour, officials of the Ministry of Food and Agriculture assess land use, field sanitation, debt recovery and the general organizational capabilities of each village committee, at the end of the tour, marks are awarded, and the best organized V/Cs receive prizes from ICOUR.

The role of the V/Cs presently has resulted in ICOUR changing their policy to be the training and development of participation farmers to take an ever increasing role in the operation of the project, so that in the long-term, ICOUR will only need to provide major

services (eg irrigation water, and major maintenance) and minimal organizational and administrative management.(ICOUR CORPORATE PLAN 2002-2006)

4.3 The demographic characteristics of respondents.

The study was conducted using a stratified sample of hundred respondents selected from a sample frame of 498 farmers. The questionnaire, which was developed to provide primary data and information required for the study, were administered to fifty farmers from the irrigation communities and fifty from the rain-fed communities. The face to face administration of the questionnaire made it possible to achieve a high response rate. Key informants from the V/Cs, Scheme management, MOFA, and the District Administration were also interviewed using an interview guide.

The distribution of respondents in both communities was skewed towards males, 86% of respondents were males and 14% females in the irrigation communities, whiles 78% and 22% respectively was the case in the rain-fed communities as shown in Figure 4.3 This is expected since in the Northern part of the country, traditionally farming is a male dominated occupation. Culturally, it is the responsibility of male household heads to cater for the family. Giving that the mainstay of the local economy is agriculture, which accounts for about 70% of the employable population, the expectation was that, most adult males would be engaged in this activity.

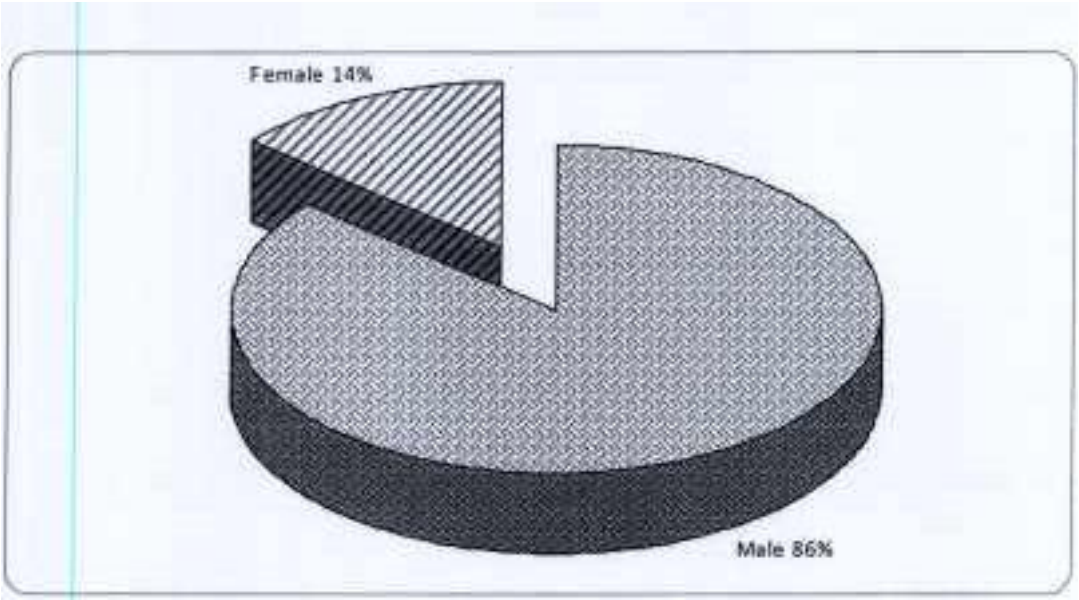


Figure4.3a Sex distribution of respondents in Tono

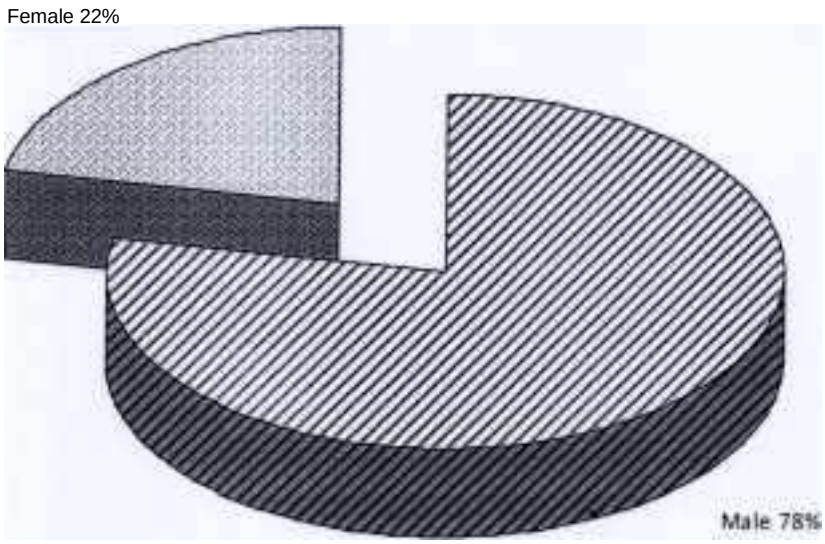


Figure4.3b Sex distribution of respondents in Chiana

The study showed that most of the respondents were in the age group of 20-49 years thus, 80% for Tono and 84% for Chiana. 50 or more than 60 years age group had 12% for

Tono and 8% for Chiana. Age group less than 20 years has 8% for Tono and 8% for Chiana The details of the age distribution of respondents is shown in Table 4.3.

Table 4.3. Age Distribution of respondents.

Tono -- Chiana -Rain-Fed Irrigated					**Total**	
Age group	**Frequency**	**Percentage**	**Frequency**	**Percentage**	**Frequency**	**%**
0-19 yrs	4	8	4	8	8	8
20-29yrs	14	28	10	20	24	24
30-39yrs	18	36	20	40	38	38
40-49yrs	8	16	12	24	20	20
50-59yrs	4	8	3	6	7	7
More than 60yrs	2	4	1	2	3	3
Total	50	100	50	100	100	100

From the Table, it was clear that the modal age is in the age group of 30-39 years which implies that the able-bodied and the youth are actively engaged in both irrigation and rain-fed agricultural activities. Being the main source of livelihoods in the area, agriculture engages a large portion of the working population in the rural communities, and therefore contributes immensely to the GDP of the area. With the availability of water at Tono, a large number of the youth who are out of school due to poverty or other reasons have taken up the opportunity to engage themselves throughout the year.

The study also showed that most of the respondents are married with a few cases of divorcees. However, majority of the widowed are women farmers in both communities. Marriage is recognized by society as a union of man and woman and their families for the purpose of procreation, mutual support and companionship.

In terms of marital status, 74% ofrespondents are married, 16% single, 6% divorced and 4% widowed in Tono, whiles that of Chiana is 76% married, 12% single, 8% divorced and 4% widowed as indicated in Figure 4.4

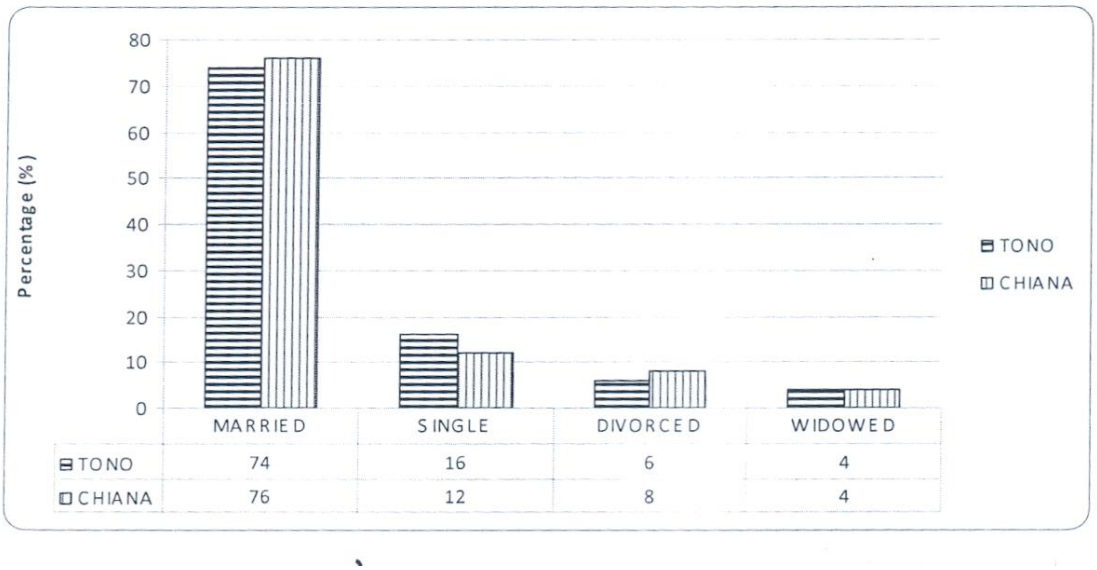


Figure 4.4 Marital status of respondents.

During focus group discussions it came out that marriage in rural settings such as the Kassena-Nankana district cannot be disregarded, as the family labor constitute an integral part of the labor force for all activities that provide food for the upkeep of the family. In addition, farming is the only family business available to most people and marriage helps to support it.

The relatively high women in the widowed bracket is quite understandable since the death of a man necessitates the widow to take up the farming activities of the husband to provide food for the upkeep of the family, this also accounted for an appreciable rate of female household heads in the area.

On religious affiliation, the study showed a high influence of Christianity in both locations. Catholics constituted 56%, Protestants 20%, Muslims 14% and Traditionalist 10% for Tono, whiles that of Chiana was Catholics 58%, Protestants 22%, Muslims 12% and Traditionalist 8%

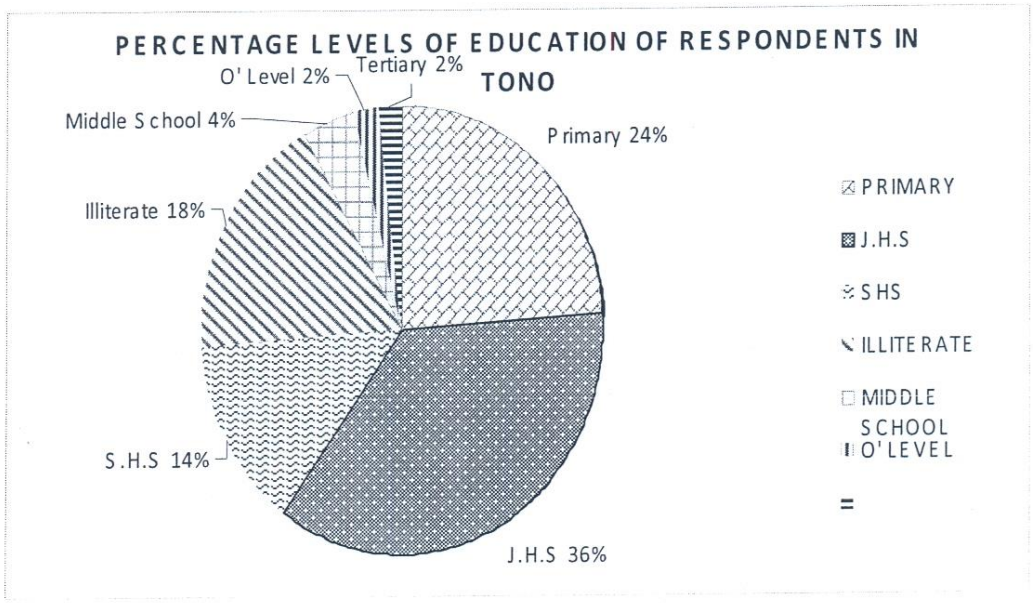
Table 4.4. Religious Denomination of respondents.

	TONO		CHIANA		TOTAL	
	Frequency	**%**	**Frequency**	**%**	**Frequency**	**%**
Catholics	28	56	29	58	57	57
Protestants	10	20	11	22	21	21
Muslims	7	14	6	12	13	13
Traditionalists	5	10	4	8	9	9
Total	**50**	**100**	**50**	**100**	**100**	**100**

As indicated in Table 4.4, Christianity has influence in the Kassejia-Nankana society. It is on record that the Roman Catholic Fathers settled in the area from Burkina Faso around 1906. The district is reputed to have been among the first point of contact by the Catholics in Northern Ghana, hence the predominance of Catholics among the population.

The level of education of respondents showed that 24% attended primary school, 36% Junior High, 14% Senior high, 18% Non-literate, 4% Middle school, 2% 0 level, and 2%

tertiary for Tono. A similar pattern was realised from respondents from Chiana, that is 32% primary, 30% Junior high, 6% Senior high, 22% Non-literate, 4% middle school, 4% **O** level, and 2% tertiary. Details are shown in Figure 4.5



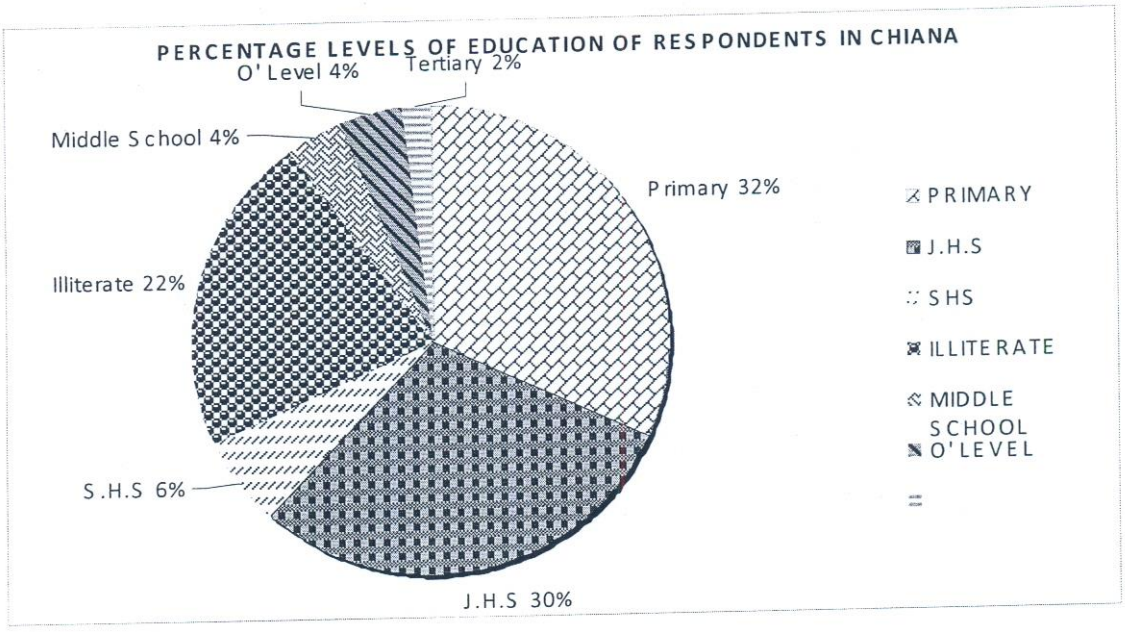


Figure 4.5 Level of Education of respondents

There is enough evidence from research that educational attainment begins to have positive impact on behavioral and attitudinal pattern only after the Junior High school level.

Figure 4.3 shows that 60% of respondents from Tono and only 42% from Chiana have Junior high level of education and beyond, and therefore are capable of benefiting from capacity building and training courses organized by the Extension services division of MOFA, and other institutions to improve on farming techniques. Only 18% and 22% are non-literate from Tono and Chiana respectively. This is explained by the fact that the presence of the early Catholic missionaries necessitated the building of educational institutions to provide basic literacy to the people before central government extended education to the North. There is enough evidence that education improves efficiency of production.

The World Bank examined the relationship between level of education and productivity in twenty low income countries, and found out that, all things being equal, farmer productivity increased on the average by 6.9% if a farmer had four years of education. (Thompson, 1981) Since primary and junior high level education is nine years, and

almost all the respondents are engaged in agriculture, it implies that farm productivity would increase. Sekhor (2008) also noted that a growth rate of 2.3% in agricultural output is likely to lead to a growth rate of rural employment of 5% or more. In view of the good level of literacy among respondents, reports from management of the Tono scheme and personnel from MOFA indicates that new skills are well adopted by most farmers in the district.

Size of the household is very important for rural productivity. More able-bodied people in a household means more cultivated area with increase in production.

The study showed as in Table 4.5, that 66% of the respondents have household size of 2- 6 persons, 7-13 persons is 30%, and 4% representing above 13 persons for Tono. That of Chiana was 58% for household size of 2-6 persons, 32% for 7-13 persons and 10% representing above 13 persons.

Giving the fact that Christianity is the dominant religion, the communities are highly monogamous hence the moderate household numbers. The district average is 6.8 persons per household, and 5 persons per household is the national average, the modal household sizeof 2-6 among respondents therefore lies within both the district and national averages It must however, be pointed out that no respondent lives alone in both communities. Perhaps, the traditional extended family system, which still finds strong expression in rural communities accounted for this.

Table 4.5. Household Size of respondents.

	TONO		CHIANA		TOTAL	
Size	Frequency	%	Frequency	%	Frequency	%
2 -6	33	66	29	58	62	62
7 - 13	15	30	17	34	32	32

Above 13	2	4	4	8	6	6
None of the above	0	0	0	0	0	0
Total	**50**	**100**	**50**	**100**	**100**	**100**

4.4 Institutional and Production Activities and their effects on Poverty Reduction

To ascertain the extent to which Irrigation affects poverty reduction, it is significant to check on the crop performance, the income levels of participants, employment generation, and the general farmer organisation.

Crop Production

At Tono, the main crops grown are rice, vegetables (tomatoes, onion, pepper etc), soyabeans, and cowpea during the irrigation season that constitute the major season. Whiles Soyabean, rice, groundnuts, sorghum, millet, and maize are cultivated during the wet season. Most of the farmers have been on the scheme for over 6 years, and have an average of 2 to 3 acres per farmer, making them basically smallholders.

As indicated in Figure 4.6, yields for the various crops have been relatively higher under irrigation than under rain-fed

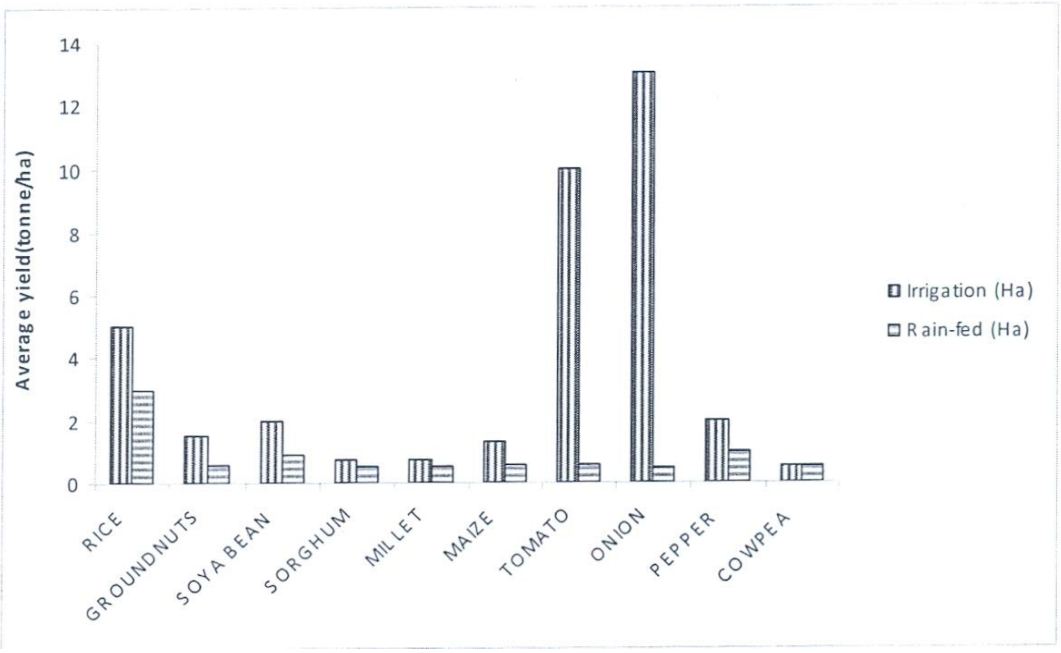


Figure 4.6 Average yields of various crops under irrigation and rain- fed.

Source; Monitoring Unit of ICOUR, 2009.

Respondents agreed that crop yields can go up many fold with irrigation because of the high intensity of agronomic practices and more importantly the availability of water all year round. Irrigation also allows for the cultivation of high-value crops for both local and export markets. Crops like green pepper, cucumber, carrots, etc have recently surfaced at the Tono scheme during the dry season. These crops are sold in markets in other parts of Northern Ghana and Southern regions.

Seasonal Earnings from Production.

Table 4.6 shows the earnings of respondents. Whereas majority of irrigation farmers, 76% earns between GH¢300-400 per season, 80% of the rain-fed farmers earns between GH¢ 100-200 annually since they have *only* one season.

Table 4.6 Earning of respondents per season.

Earnings(GH¢)	Tono		Chiana		Totals	
	Frequency	Percentage	Frequency	Percentage	Frequency	%
up to 50	5	10	6	12	11	11
100 -200	5	10	40	80	45	45
300 - 400	38	76	4	8	42	42
500 & above	2	4	0	0	2	2
Total	**50**	**100**	**50**	**100**	**100**	**100**

Apart from the fact that at Tono farmers have the advantage of cropping twice in a year, their yields are also relatively higher due to the extra intensity given to crops under irrigation. The respondents at Tono also agreed to the fact that their better earnings is as a result of the irrigation facility.

Source of Capital for Production

For any economic activity to be undertaken the source of capital is very important. A reliable source of capital would ensure a smooth operation of activities this is even more pertinent in crop production which is time bound and requires inputs at the right quantities. To the issue of their source of capital, respondents from Chiana indicated lack of institutional capital and largely depended on cultural practices and personal savings. On the other hand, Tono farmers showed that most of them get their capital from banking institutions and their farmer associations or FBOs. This is shown on Table 4.7 below:

Table 4. 7 Sources of Capital for farming

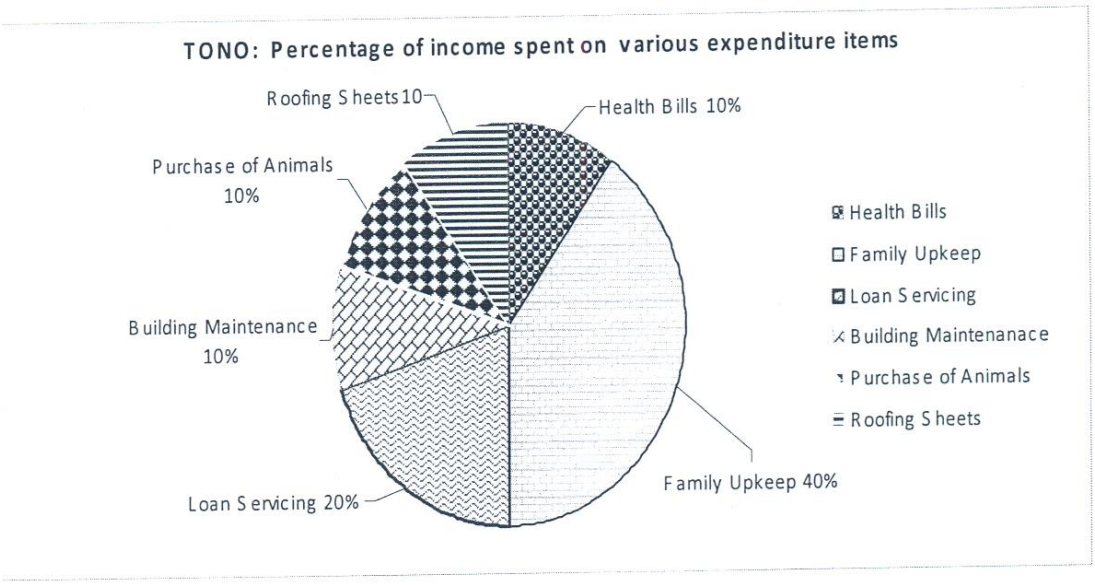
	TONO		CHIANA		TOTAL	
	Freq	%	**Freq.**	%	**Freq.**	%
Own savings	2	4	30	60	32	32
Loan from Bank	24	48	2	4	26	26
Loan from Money Lenders	6	12	2	4	8	8
Credit fromFBOs	15	30	8	16	23	23
Other	3	6	8	16	11	11
Total	**50**	**100**	**50**	**100**	**100**	**100**

It is clear from the Table that credit from associations (FBOs) comes in the form of inputs that is seed, fertilizers, herbicides and insecticides, and not cash. Thus, the associations organize for these inputs for their members, and payments are done at the end of the season with produce .This practice is a recent phenomenon at Tono, where FBOs enter into agreements with potential buyers, and get inputs on credit for their members. In Chiana, the associations are sometimes sponsored by NGOs who provide groundnut and soyabeans farmers with inputs. The associations are therefore required to collect produce from beneficiaries during harvesting to offset the credit package. On other source, respondents mentioned remittances from family members and donations as other source of capital.

From the above, there is evidence that irrigation farmers have a better and more credible sources of capital for their operations. The restricted nature of production, the availability of water for the crops, and therefore better organisation of activities may have accounted for their easy access to loans from institutions.

Expenditure Pattern

The expenditure pattern of people can as much be used to measure their poverty status. In other words, what people do with their earnings can be used to ascertain weather they are making progress or not in the fight against poverty. Figure 4.7 depicts respondents answer to six main items on which their earnings are spent



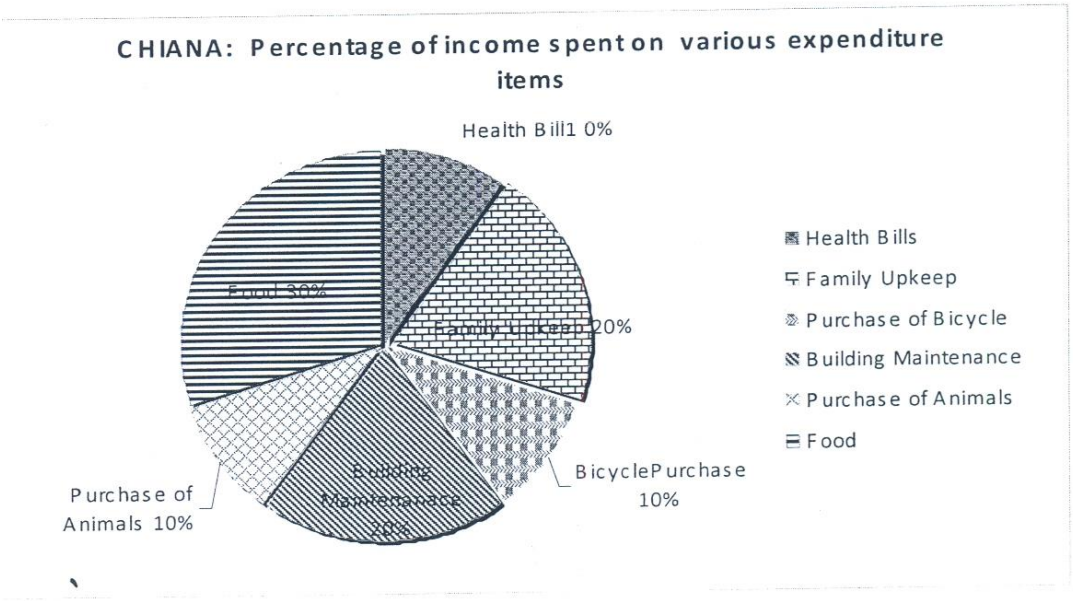


Figure 4.7 Six main items on which respondents spend their income.

An analysis of the expenditure pattern of the two communities clearly shows that food security is a serious issue in Chiana than in Tono. This is quite understandable, given that they have no access to irrigation and depended solely on rain-fed agriculture which of late has become unreliable. A large portion of their production is also subsistence, hence most households experience food shortages during the dry season. Hunter, (1967) was the

first to document this observation about the Upper regions through his hunger studies at Nangodi.

No wonder respondents at Tono mentioned food security as one of the three most important things their communities have achieved as a result of the irrigation scheme. As in Figure 4.8, 56% mentioned food security, 20% rural employment, and 24% curbing migration.

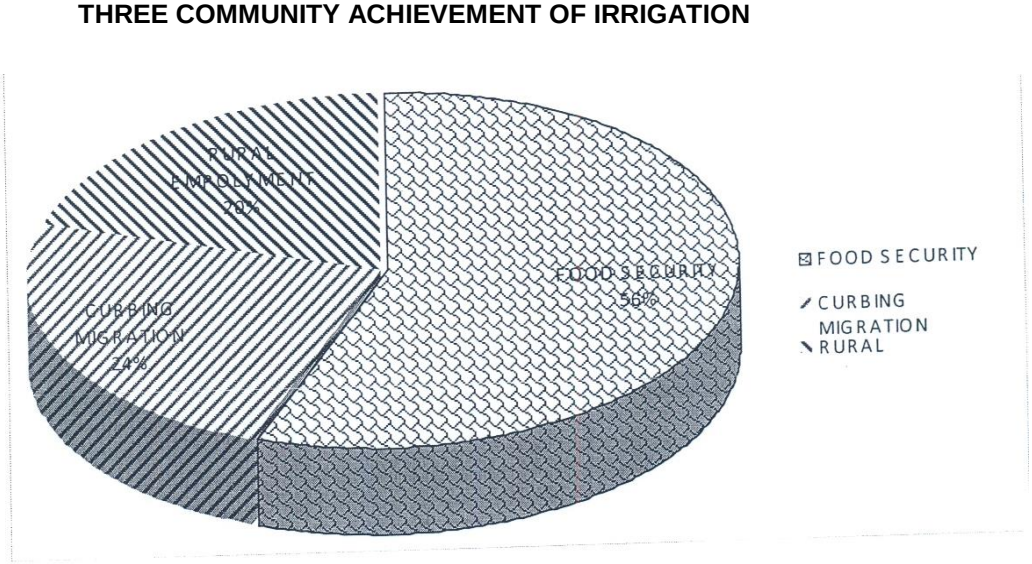


Figure 4.8 Community achievements from irrigation.

Source of Labour.

Farm labour constitutes a very important aspect of rural employment. In crop production, getting things done timely require the engagement of more people, especially where there is conspicuous absence of mechanization for all the agronomic practices. In rain-fed production family labour is the dominant practice and little paid labour is engaged. However, in irrigated agriculture family labour may not be sufficient to get things done timely, hence the need for hired Jabour. To the question weather respondents employ labor for their farming activities, almost all the Tono respondents 96%, answered "yes" with only 38% of the Chi an a respondents answering "yes". As to the number engaged per

season, 80% of the Tono respondents indicated that they engage between4-6 people, whiles 12% says between 1-3 and 8% chose between 7-9. This is depicted in Table 4.8 below

Table 4.8 Number of people employed by respondents at Tono.

No.	Frequency	Percentage (%)
1 – 3	6	12
4 – 6	40	80
7 – 9	4	8
Above 10	0	0

Clearly this goes to confirm their earlier submission that rural employment is one of the benefits of irrigation. It is a source where those who cannot be involved directly in the production of crops may make their labour available, which is needed at every stage of the production of the crop (from planting to harvesting). It is another source of rural income which goes to stabilize families

Out- Migration Pattern.

In more recent times the phenomenon of Northern youth migrating to Southern Ghana, especially to cities like Accra and Kumasi, looking for jobs have been of great concern to policy makers. Population growth coupled with non-availability of jobs, especially during the long dry season in the North, compel the youth to migrate. However, with the availability of schemes like Tono, the expectation is that people would have a reliable and stable source of employment and income, and therefore may not need to migrate. To the question weather a member ofrespondents' household have migrated to the South, an overwhelming 84% of Chiana respondents answered "yes", as against only 24% of respondents from Tono as shown in Table 4.9 below

Table 4.9. Respondents' Household member on Migration.

	TONO		CIDANA		TOTAL	
	Frequency	Percentage	Frequency	Percentage	Frequency	%
Yes	12	24	42	84	54	54
No	38	76	8	16	46	46
Total	50	**100**	50	**100**	**100**	**100**

One can deduce that the availability of the scheme has made migration unattractive to Tono farmers. On the other hand, the long dry season act as a push factor for family members in Chiana to migrate. The migrants come back during the rainy season to engage in their traditional farming.

Asset Acquisition.

As a poverty reduction measure asset acquisition is seen as a saving against future unforeseen circumstances. In this period of natural disasters as a result of climate change and other factors, people acquire asset to serve as buffers in case of contingencies. Chambers, (1986) clearly state that the poor operate within the context of vulnerability, and they normally lack assets in the form of buffers to cushion them in times of contingencies. Respondents were asked to list any three assets they have acquired through farming. Both communities showed similar trends in their acquisition as Figure 4.9 depicts, 58% of Tono farmers acquired sheep and goats, whiles 90% of Chiana respondents also had sheep and goats.

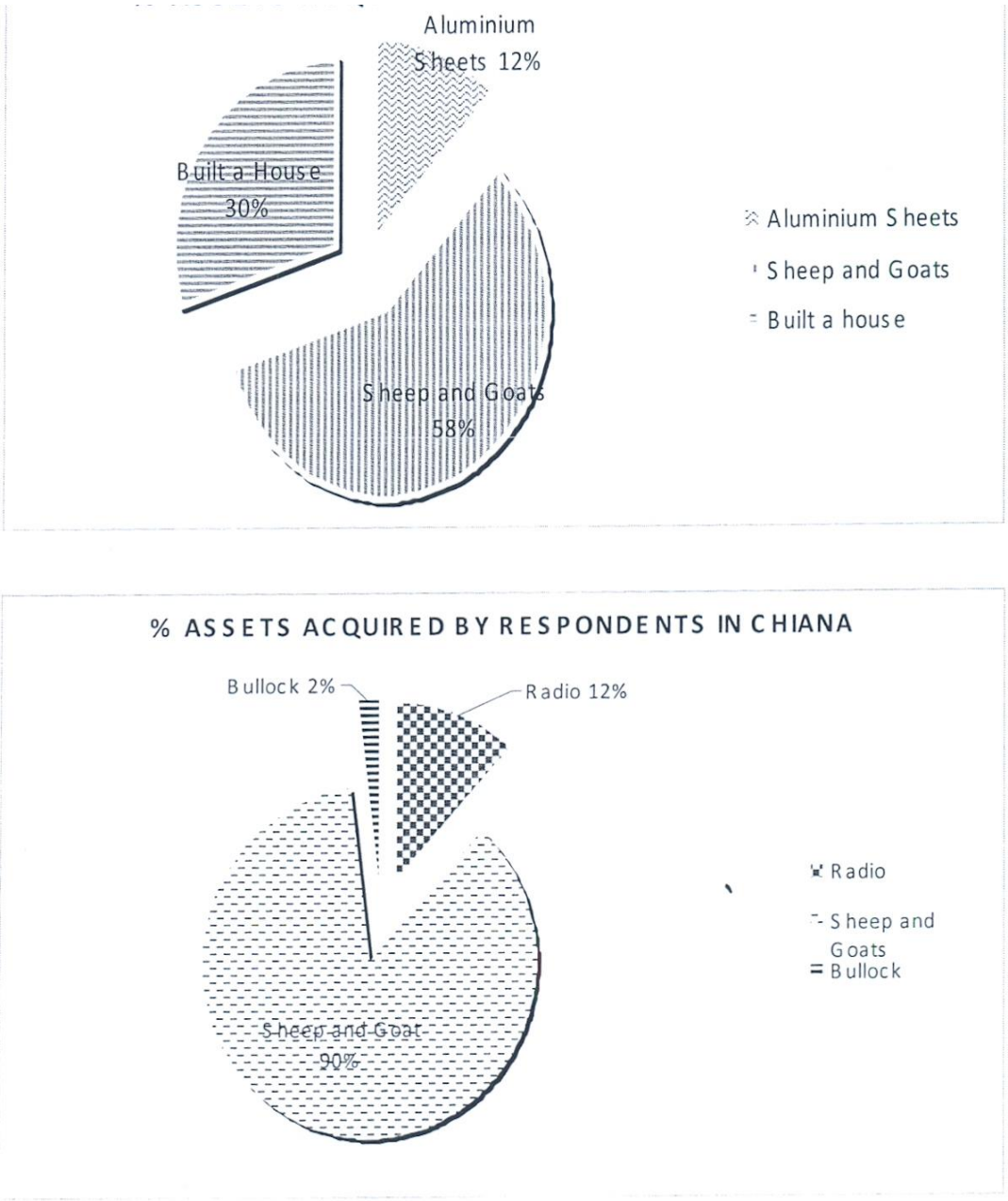


Figure 4.9 Three most important assets acquired by respondents.

It must be emphasized however, that an appreciable number of the Tono respondents also invested in real estates, whiles others changed the roofing materials of their houses from local to aluminum. On the whole, it is clear that animals are still regarded by communities in the district as the safest form of assets against future social and economic shocks. It could also be reasoned that as farmers it is better to invest in animal production. This is because they multiply faster and can be fed on farm residue during the dry season. They can also be easily sold in times of emergency.

It can also be deduced that despite the vulnerability of the poor, they also keep some form of assets. It might be marginal, but it still serves the purpose of savings against contingencies.

Production Challenges

Every enterprise has problems that militates against the achievement of its objectives. Thus, agricultural production has its share of problems, be it rain-fed or irrigation. Respondents from the two communities, according to the study, listed marketing as the major problem confronting them. 78% of Tono respondents and 68% of that of Chiana chose marketing as the major problem as indicated in Figure 4.10 below;

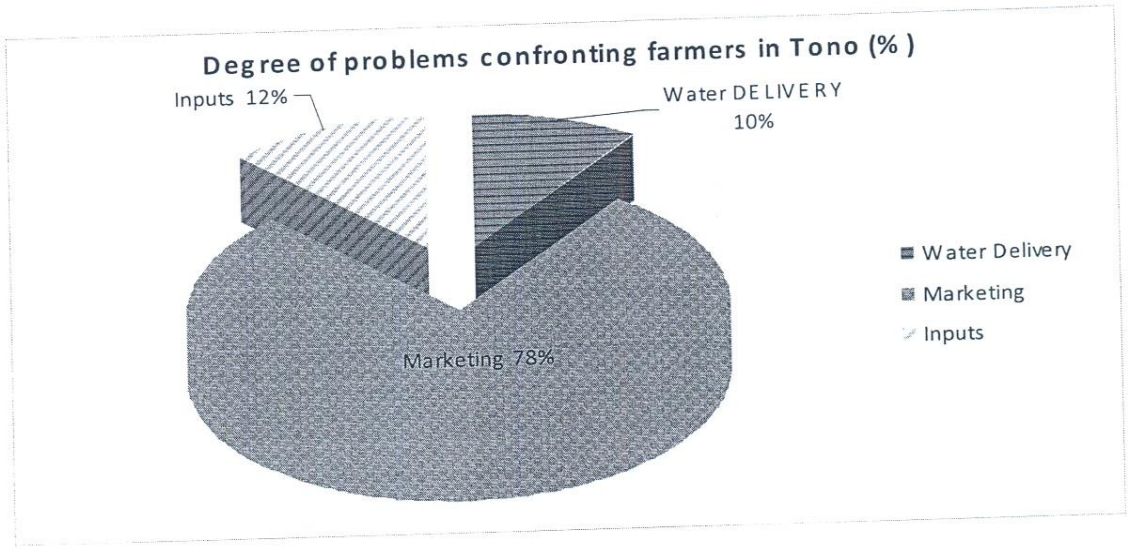


Figure4.10a. Degree(%) of major problems confrontingfarmersinTono.

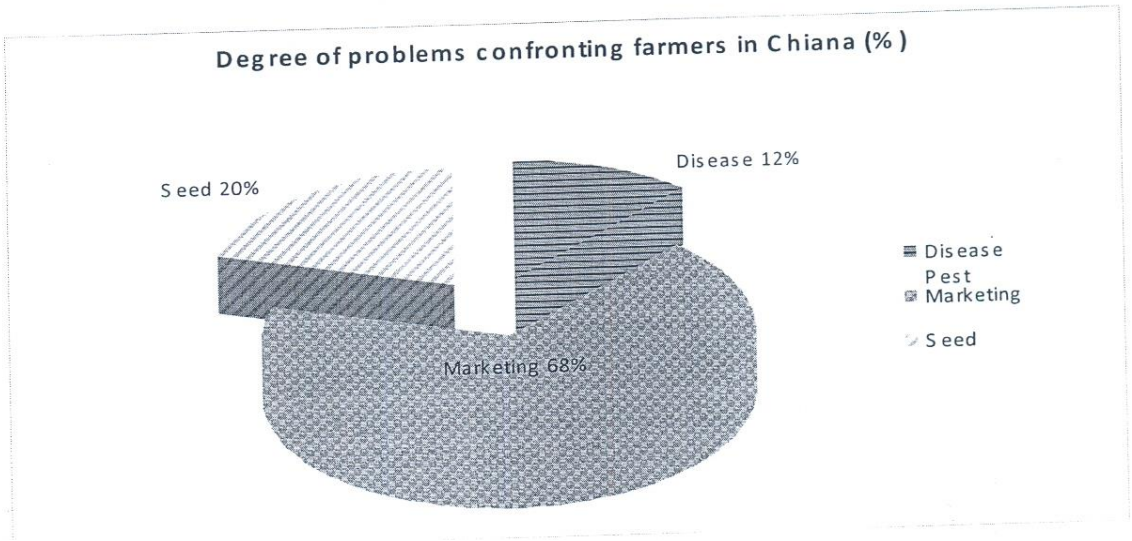


Figure 4.10b Degree (%) of Major Problems confronting farmers in Chiana.

Marketing has been observed as the major obstacle facing farmers, especially irrigation farmers. The lack of processing facilities and inadequate storage facilities expose farmers to low prizes during harvesting, especially perishable crops like vegetables. The result is that farmer's fall victim to the "cobweb syndrome" in market economics. Thus, due to poor prices, the number of farmers producing a particular crop drops during the following

season, thereby pushing the market price up as a result of decrease in production. The price increase attracts more farmers in the third season, which results in increased production with the consequent fall in prices, and the circle continues.

The current world economic dispensation has seen most developing countries removing subsidies on agriculture as condition for loans and grants by international financial institutions. This has led to escalating cost of inputs, hence increase in cost of production. This coupled with poor markets makes producers in this sector vulnerable.

This situation operating in irrigation communities would negate the ideals behind the establishment of the schemes. In rain-fed agriculture, though a substantial part of the production is for subsistence, efforts are made to reserve part of the output for the market to cater for other livelihood challenges like health and education. A lack of adequate markets structures therefore would make rural agricultural producers live in a state of vulnerability, culminating in their inability to come out of poverty

Educational Level of Dependents

Poverty reduction enables people to see to the education of their children and dependents to an appreciable level. A child from a poor home may not be able to go higher on the educational ladder. The study observed that 40% of Tono respondents have wards in the first cycle, 42% in the second cycle and 18% in tertiary. On the other hand, respondents from Chiana had 68% in first cycle 30% in second cycle and only 2% in tertiary.

Table 4.10: Educational level of respondents' dependents

	TONO		CHIANA		TOTAL	
Educational Level	Freq.	%	Freq.	%	Freq.	%
1st Cycle	20	40	32	64	52	52
2°° Cycle	21	42	15	30	36	36
Tertiary	9	18	1	2	10	10
None of the above	0	0	2	4	2	2
TOTAL	50	100	50	100	100	100

Table 4.11 Cross - tabulation of Seasonal Earning and Dependant level Education

Tono **Seasonal Earnings**

Level of Education of Dependents	GH¢0-50	GH¢ 100-200	GH¢ 300-400	GH¢ 500 and above	Total
1st cycle	3	1	16	1	21
2nd cycle	1	2	17	0	20
Tertiary	0	2	6	1	9
None	0	0	0	0	0
Total	4	5	39	2	50

Chiana **Seasonal Earnings**

Level of Education of dependents	GH¢0-50	GH¢ 100-200	GH¢ 300.-400	GH¢ 500 and above	Total
1st cycle	2	29	2	1	34
2nd cycle	3	10	1	0	14
Tertiary	1	0	0	0	1

None	0	0	1	0	1
Total	6	39	4	**1**	50

Seasonal earnings

Level of education of dependents	GH¢50.00	GH¢100-200	GH¢300-400	GH¢500 and above	Total
1st Cycle	5	30	18	1	54
2nd Cycle	4	12	18	1	35
Tertiary	**1**	2	6	1	10
None	0	0	1	0	1
Total	10	44	43	3	100

Generally school enrollment in the district is one of the highest in the region, and every household tries to ensure that children get the needed education. However, the high rate of secondary and tertiary enrollment among Tono respondents could be attributed to their' exposure to better incomes that enable them to afford to send their dependents that far.

The study went further to ascertain whether there is a relationship between the earning capacity of respondents and their dependents level of education. For it is presumed that, the higher a persons earnings, the higher the likelihood that his dependents would pursue higher education. From the Tables 4.11 above, majority of the Tono respondents are

earning higher with their dependents in all the levels of education, compared to their Chiana counterparts, where majority earns between GH¢100-200 with more than 90% of their dependents in the first and second cycles. This clearly shows that incomes are more sustainable in irrigation communities, where they have the advantage of cropping twice ma year.

On the other hand inadequate earnings, among other factors, may inhibit rain-fed farmers from seeing to their dependents going higher in the educational system, especially at the tertiary level.

On the whole, one can conveniently say that there is a positive relation between earning capacity and the level of education of dependents. From the grouped table above majority of farmers of the two communities have their dependents in the first and second cycles, however, there is equally an appreciable numbers also in tertiary, which goes to support the fact that, greater part of farmers earnings goes to support their dependents education. It is also a good indictor that there is improvement in the standard of living of farmers of the two communities.

4.5 Farmer Participation in the Organisation and Management of the Scheme.

In irrigation development there is a growing consensus that farmer participation in the organisation and management is very important for the effective operation of the scheme. Group of farmers who use the irrigation water are needed to maintain the system and allocate water to avoid conflicts. Further, the farmers' knowledge of local conditions is needed in the sustenance of the whole physical structure. The study made efforts to ascertain whether the farmers at Tono have a role in the organisation and management of the scheme, since participation would ensure the sustainability of the facility.

Construction of the Tono Irrigation Scheme started in 1975 and completed in 1985. The prime objective was to transform the subsistence farmers in the area into cash crop producers by introducing them to modern farming techniques. It is clear that beneficiaries were not involved in the planning and implementation of the scheme at the initial stages.

According to the scheme officers and the traditional authorities, this non-involvement nearly resulted in chaos and necessitated serious social re-design.

In the 1990s, the Village Committee (VC) concept was introduced, where farmers formed their own groups and associations. These groups under the VCs come together to allocate land, distribute water, and repair their canals. The VCs therefore serve as an administrative link between the scheme management and farmers thereby ensuring a level of participation.

Most of the irrigation farmers belong to associations within their communities. The study indicated that 96% of the respondents on the scheme belong to a farrner based organisation (FBO), formed by themselves with assistance from scheme management. Table 4.12 gives the details.

Table 4.12. Respondents belonging to FBO's (Tono)

	Frequency	**Percentage *(%)***
Yes	48	96
No	2	4
	50	100

Communication Channel

Perhaps the most crucial test for participation in the operation of irrigation is in the area of land allocation and water distribution. These two functions if not properly handled could lead to conflicts and inefficiency in irrigation farming. The study went further to ascertain how these two functions are handled from the perspective of respondents. An overwhelming 90% and 94% of farmers agreed that water delivery and land allocation respectively are done by the FBOs in consultation with scheme officers. They also pointed out that they hold regular meetings with the scheme management and discuss issues like levy payment, encroachment and cropping programmes for the season

Communication is very crucial when one wants to measure the level of participation, especially when it comes to important decision making issues involving the adoption of new techniques of crop production. In specialized farming like irrigation, this is even more pertinent where land aJJocation, water distribution and general conflict resolution are on-going processes. According to the study, most farmers agreed that they get their information from meetings with the extension unit of the scheme and through their FBOs. As indicated in Figure 4.11 below, 54% of respondents said they get information from the extension unit, 38% from FBOs, and 8% from other sources like radio. Apart from crop production respondents also indicated that other cross-cutting social issues like H.l.V/AIDS, Female Genital Mutilation (FGM) and other community enhancement issues are normally discussed at meetings.

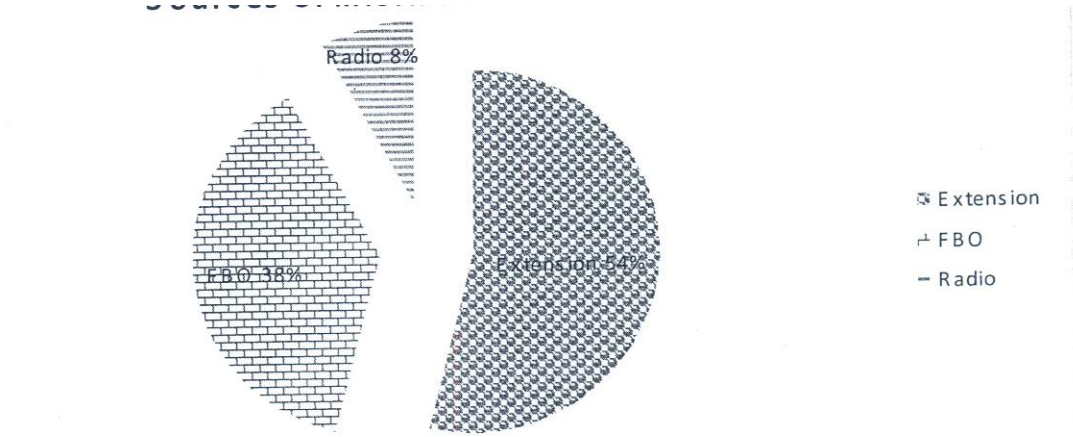


Figure 4.11 Source of Information for Farmers.

The Extension/Farmer ratio of 1:400 is quite adequate given the specialized nature of production under irrigation, and by far this is better compared to the national average of 1: 1500 farmers. Almost all respondents agreed that Extension officers visit them on their farms periodically.

Perhaps the most crucial test for participation in the operation of irrigation is in the area of land allocation and water distribution. These two functions, if not properly handled could lead to conflicts and inefficiency in irrigation farming. The study went further to ascertain how these two functions are handled from the perspective of respondents. An overwhelming 90% and 94% of farmers agreed that water delivery and land allocation respectively are done by the FBOs in consultation with scheme officers. They also pointed out that they hold regular meetings with the scheme management and discuss issues like payment, encroachment and cropping programmes for the season.

Table 4.13 shows responsibility for water distribution and land allocation

Table 4.13a. Responsibility for Water distribution

	Frequency	Percentage (%)
FBO and Scheme staff	47	94
Project	3	6
	50	**100**

Table 4.13b: Responsibility for Land Allocation

	Frequency	**Percentage** (%)
FBO and Scheme staff	45	90
Project	5	10
	50	**100**

Benefits for joining FBO

As to the benefits members derive from being in FBOs, 44% of respondents mentioned arrangement of credits, 30% indicated land allocation and water distribution, 20% indicated general information provision, and 6% mentioned marketing. This is illustrated Figure 4.12 below.

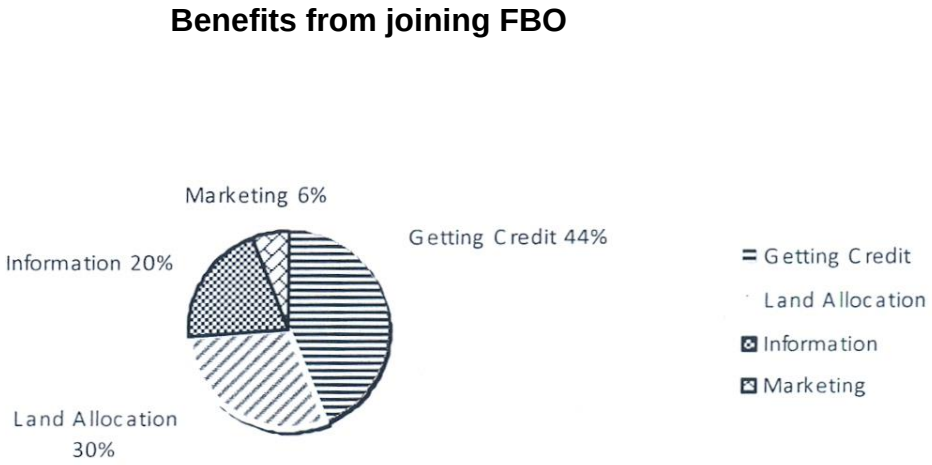


Figure 4.12. Benefits from joining FBOs

Clearly, this goes to confirm the earlier submission by respondents that marketing of their produce is their major problem. The FBOs lack the capacity of organizing markets for their members.

Relations between FBOs and Management.

As to how respondents view the relationship between their FBOs and the scheme management, 48% indicated the relationship to be co-operative, 36% indicated it to be cordial, 10% saw it as tight and only 6% claimed there is no relation at all. This is illustrated in Figure 4.13 below.

Relations between F B Os and Project Management No Relations 6%

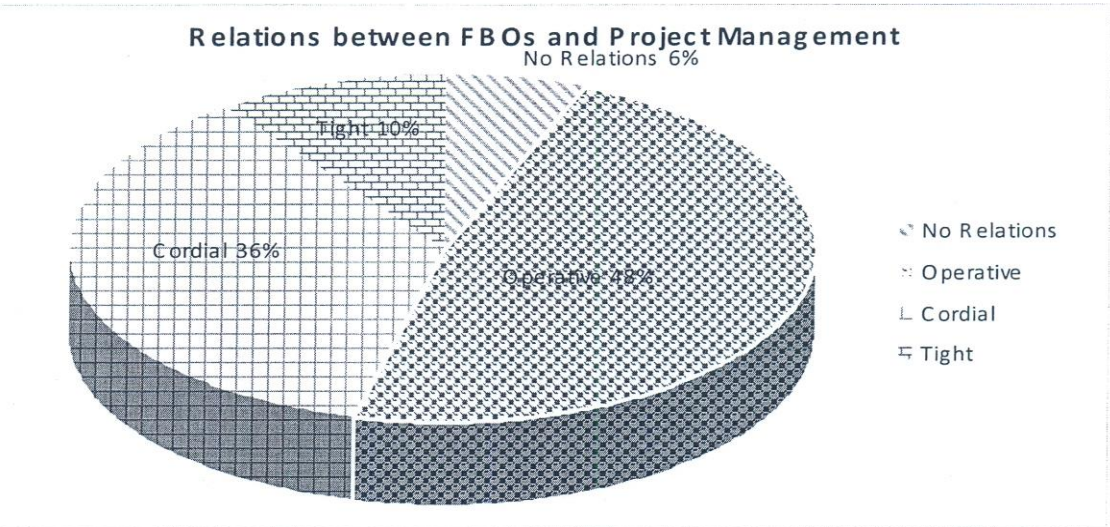


Figure 4.13 Relations between FBOs and Project Management.

In addition majority of respondents also thought that farmers take part in decision making activities at the scheme, (86%). This is indicated in Table 4.14

Table 4.14. Farmers taking part in Decision making

	Frequency	Percentage (%)
Yes	43	86
No	7	14
	50	100

From the above analysis one can adequately say that a level of participation in the management of the scheme is being practiced, especially when it comes to the issues of land allocation and water distribution.

The establishment of FBOs is very vital to poverty reduction. Such organisations provide an answer to the lack of representation and voice to the poor, and reduce their degree of social exclusion, hence their vulnerability. Secondly, such organisations take lead in providing capacity building to their members in order to enhance their productivity. However, the issue of marketing needs some particular attention since the FBOs lacks capacity in this area, despite their ability to participate in the management of the scheme.

4.6 The Unintended Consequences of Irrigation.

Most studies on irrigation have the tendency of looking at the positive impact on the livelihoods of beneficiaries. Mudima (2002), looked at the socio-economic impact of five irrigation schemes in Zimbabwe, cataloging only the positive side with little reference to the negative aspects which in most cases are very detrimental.

The study also sought the perspectives of respondents as to some of the positive and negative impacts of the scheme. As earlier on ascertained, they cited food security, rural employment, stable income, nutrition and animal production among others as the positive socio-economic benefits of the irrigation scheme

Notwithstanding the positive developments, there are equally a number of challenges which came out during an in-depth interview, focus group discussions with all stakeholders. The unintended consequences are all related to the availability of water throughout the year, pollution and erosion of traditional values as a result of the economic empowerment of the people.

- The flooded rice fields and water in the canals serve as breeding areas for mosquitoes and other water-borne vectors. Malaria and other parasitic and water-borne disease are prevalent all year round in the area, posing a serious public health threat. Reports from the District Health Administration attest to this. Malaria accounts for almost 90% of all out-patient attendance at the district hospital and clinics. Bilharzia is also identified as a serious public health concern in all the irrigation communities
- Stakeholders also mentioned the erosion of traditional values as a result of the economic empowerment as a serious social consequence of the scheme. The elders believe that the scheme has enable farmers particularly the youth, to have stable incomes thereby exposing them to the so-called "modern" lifestyle which is an anathema to traditional value systems. This has resulted in disrespect for authority, prostitution, frivolous spending, excessive drunkenness and alcoholism. Perhaps this may be related to the prevalence of H.I.V/AIDS in the district. Currently the district has the highest rate in the region.
- Another issue mentioned by stakeholders during discussions was the irresponsible use of agro-chemicals on the scheme, which they claim have resulted in pollution of the environment, and the prevalence of strange diseases which hitherto was completely absent in the area. They argued that farmers use chemicals on their crops, especially vegetables, without following instructions and advise from extension officers, thereby not only exposing themselves and others to danger, but also poisoning the food- chain and the entire environment.
- The presence of the water body also exposes children to drowning. The youth who most often goes to the canals to cool down during the hot months of March to May every year sometimes end up drowning, bringing sorrow and grieve to families
- Another major challenge that came out during group discussions was the issue of child labour. Child labour refers to the exposure of children to work under hazardous conditions which is detrimental to their mental and physical well-being. In Tono children are normally engaged during the latter stages of rice cultivation when grain-eating migratory birds invade the rice fields. The children are engaged to scare the birds away,

which is very tedious and hazardous. In more recent times however, efforts are being made to stop the practice. The ILO is collaborating with the General Agricultural Workers Union of the Ghana Trades Union Congress to sensitize all V/Cs and FBOs on the issue of child labour.

- The study also revealed that almost all respondents answered "yes" to the question whether they use the irrigation water for domestic purposes. The farmers do not only use the water for building their houses, but also use it for washing, bathing and cooking, especially families who stay closer to the canals. Domestic use of the irrigation water without the necessary treatment and purification exposes family members to forms of infections, thereby increasing the health bill of the affected families and negatively affecting their capacity to increase productivity.
- Another issue that came out clearly from interactions and discussions with stakeholders, especially the traditional authorities, was the issue of land. The original land owners or "tendanas" of the land where the irrigation scheme is situated, which occupies an area of about 20km^2, are aggrieved about their lack of authority over the land, and the nonpayment of compensation when government acquired the land for development. They argue that they still perform traditional sacrifices to appease the Gods of the land and yet they are sidelined when it comes to the usage of the irrigated lands. The result is that land related disputes and conflicts have surfaced in the scheme which is enigmatic to efficient crop and food production.

The above unintended challenges need to be addressed in order that the scheme would achieve full sustainability and realize the objectives of contributini to poverty reduction and food security in the district and the region.

4.7 Other Ways Irrigation can contribute to Poverty Reduction other than Farming

Traditionally irrigation is meant to provide adequate water to the root zone of crops to enhance plant growth and crop production. However, there is enough evidence to the fact that the constant availability of water could be used to develop other avenues to increase

income and provide employment. In India, other water-related productive activities are promoted along side crop production in most irrigation schemes. Mellor, (1988) gave account of how technological advancement in rural agriculture, including irrigation can lead to other multipliers and boosting overall rural productivity.

The study sought the views of stakeholders as to what irrigation can provide other than crop production. The following were suggestions presented by respondents.

- They contended that apart from food and cash crop production, fruit tree plantations, like cashew, mango, and pawpaw, could be established especially along the main drains and some reserved lands. With the availability of water all year round, these plantations could further boost employment and provide more jobs in the area of processing and retailing. The existence of early maturing varieties of these fruit trees would ensure faster rates of return to investment.
- Fishing activities at the scheme is not fully developed. Apart from the natural stocking of the main dam from its catchment area during the rainy season, no meaningful fishfarming is taking place on the scheme. It is the view of stakeholders that aquaculture on the scheme could be developed by artificially stocking the dam and making good use of existing fish ponds. This would not only boost the productivity of the dam in terms of the volume of fish catches, but also provide employment and improve the nutritional status of the people.
- The micro-environment exhibited at the scheme during the dry season provides huge opportunities to boast tourism. The green environment created during the dry season whiles the rest of the region is dry, can provide opportunities for the creation of beautiful sceneries where people can go for recreation and relaxation, especially during the hot months of March to May and during holidays. These recreational facilities would serve as source of entertainment to boost the tourism potential of the region.
- Bird watching has also been identified as a huge tourist potential on the scheme. Migratory birds from Europe flock to the scheme in December every year. Different species of birds could be seen all over the scheme during this period. Currently, only one

tour operator, The Rock- jumper Tours from South Africa organizes tourists from Southern Africa to Tono for bird watching. An officer from the tour operators indicated that the scheme provides one of the best bird sanctuaries in Africa. This can be developed through massive advertisement and partnership with players in the tourism industry to create jobs

- The dam is a huge investment and occupies an area of about 1860 hectares. Water sports and boating could be developed as a source of entertainment for people in the region and beyond. The serene atmosphere on the islands of the dam could serve as avenues for relaxation during holidays and weekends. This would not only boost the health status of people, but would also create down stream jobs for people.

As to who should introduce these additional innovations and initiatives to further boost the potential of the scheme, stakeholders suggested that both government and the private sector in the spirit of public-private partnership should be targeted. The District Assemblies, Ghana Tourist Board, MOFA and ICOUR could collaborate, map out strategies and come out with proposals to source for funding to finance the additional initiatives.

Finally respondents unanimously said "yes" to the view that irrigation contributes positively to poverty reduction 96% against 4%.

CHAPTER FIVE

5.0 SUMMARY, CONCLUSION AND RECOMMENDATION

5.1 Introduction

The study sought to find out the effects of Agricultural modernization, particularly the introduction of irrigation farming, on poverty reduction, using the Tono Irrigation Scheme as a case study.

This chapter presents a summary of the main findings of the study, the conclusions and related recommendations.

5.2 Summary of Findings

Effects of Irrigation on Poverty Reduction

The study approach was to look at a comparative analysis between irrigation and rain-fed communities at Tono and Chiana respectively. It revealed the active participation of men doing more farming than women in both instances, within the age range of 20-49 year range. This may be due to the fact that men are dominant in this sector because of their traditional role as bread winners of the family, and therefore have to till the land, in the absence of alternative employment opportunities in the rural areas, to provide food for their dependents.

The study also revealed that most of the men engaged in both irrigated and rain-fed agriculture are married with household size of between 2-6 people and Christianity is the dominant religion of the area with about 80% of the respondents.

To identify factors in irrigation that promote poverty reduction, the study realised that irrigation recorded better yields in almost all crops than rain-fed due not only to the intensity of cultivation, but also a better Extension/ Farmer ratio. Hence irrigation farmers have a better earning capacity, majority of irrigation farmers earns between

GH¢300-GH¢400 per season, whiles their rain-fed counterparts earns only GH¢ 100-GH¢200 or less annually. This makes irrigation farmers have a better and stable source of income.

Irrigation farmers also have a better and reliable source of capital for their production activities. They have access to institutional credits from the banks, and credit packages from their FBOs. On the other hand, rain-fed farmers depend entirely on their own savings and remittances from family members.

The analysis further revealed that most irrigation farmers spend their income on family upkeep, servicing their loans, and investing in real estates. On the other hand, rain-fed farmers spend a huge part of their income on food, making food security a serious issue in rain-fed communities.

80% of irrigation farmers engage between 4-6 people every season, whereas their rain-fed counterparts depend solely on family labour for most of their farming activities. Clearly this makes rural employment one of the development off-shoots of irrigation.

The study also revealed that more people migrated to Southern Ghana in rain-fed communities than in irrigation communities. Whereas 66% of irrigation farmers did not experience migration of family members, 84% of rain-fed farmers said their family members migrated, especially during the dry season. This could be attributed to the food security issues facing them as earlier on indicated.

Clearly it also came out from the study that marketing is the major problem confronting all farmers. The situation is though worst for irrigation farmers due to the high cost of inputs and generally high cost of production

Irrigation farmers also have a high percentage of children in secondary and tertiary institutions, 60%, as against rain-fed farmers of 32%. The implication is that irrigation farmers have a better capacity to educate their children to high levels due to their better source of income.

Almost all irrigation farmers 96%, belong to an association or an FBO which serve as an administrative link between farmers and the scheme management. The level of participation in the management of the scheme is by the FBOs taking up responsibility over land allocation, water distribution, and repairs of canals, which are major functions in any irrigation regime. Thus, 84% of the farmers' belief that they take part in decision making of the scheme through co-operative relations of the FBOs and scheme management. Therefore the level of participation of farmers in the organisation and management of the scheme can be said to be positive.

On the issue of the unintended consequences of irrigation, respondents cited pollution, health problems as a result of malaria and other water-borne diseases, child labour, and erosion of traditional values, as the negative effects of irrigation on the communities.

It also came out from the study that there are other opportunities other than crop production which the scheme could tap as a poverty reduction measure. These include fruit tree cultivation and plantation such as cashew, mango, pawpaw etc, Expansion of the fishery activities by reactivating fish-farming, Tourism development through bird watching, and creation of entertainment, amusement and relaxation centers.

These new avenues could be developed through the spirit of public-private partnership with government institutions, the private sector and farmers all coming together

5.3 Conclusions

The provision of irrigation as part of the modernization of agriculture has played and continues to play important roles in poverty reduction in Ghanaian communities in general and the Kassena-Nankana district in particular. There is enough evidence from the study to arrive at the following conclusion;

- Food security is assured in irrigation communities than their rain-fed counterparts.
- The income status of farmers under irrigation is quite sustainable.
- Rural employment creation is enhanced under irrigation than rain-fed.

- More people migrate in rain-fed communities than in irrigation communities.
- Farmers are better organized and participate in the organisation and management of the Tono scheme.
- The scheme also has negative impacts which include health hazards, pollution, land disputes and child labour among others.
- The scheme can provide other avenues for poverty reduction by developing the eco-tourism potential, in the of bird-watching and creating of entertainment centers
- Another way is by establishing fruit-tree plantations and he activation of the aqua-cultural section of the scheme.

The evidence from the findings therefore goes to confirm the hypothesis of the study that irrigation contributes towards poverty reduction, and also goes to authenticate the conceptual framework of the study.

5.4 Recommendations

The following recommendations flow from the foregoing analysis;

- Irrigation development should be promoted as a matter of government policy, especially in the Northern part of Ghana. This recommendation emanates from the fact that most parts of Northern Ghana have no other economic activity during the long dry season. This condition serves as breeding period for the resurrection of land and chieftaincy conflicts which is inimical to the development of the area. Government through agencies like the Savanna Accelerated Development Authority (SADA) should ensure that all potential irrigation facilities, where feasibility studies have been carried out, should be developed. In addition, water saving irrigation systems like drip irrigation should be introduced to make judicious and economical use of water which is becoming a scarce commodity worldwide. Communities with adequate water bodies like rivers and lakes should also be encouraged to use pump machines to lift water for irrigation during dry

spells to boast production. This would not only keep people in employment throughout the year, but would also ensure steady incomes and a general reduction in their vulnerability and poverty levels.

- To improve agricultural productivity and boast the income of farmers, the problem of marketing should be seriously addressed. The Value-Chain approach should be adopted, especially by irrigation farmers, such that, farmers only go in to crop produce that have ready and guaranteed markets. Thus, FBOs and farmer associations should source for potential buyers of their produce, sign Memorandum of Understanding (MOU) with them, and if possible such potential buyers commit themselves by making available to farmers some inputs, before farmers go into production. On the other hand, farmers would also ensure that the right standards are met during harvesting. This system has started gradually at the Tono scheme with regards to rice cultivation, this could be replicated for other crops and to other parts of the country to cover not only irrigation farmers but all other categories of farmers.
- The current crop yields on the irrigation scheme are not the best, given the fact that the conditions under irrigation are appropriate for higher yields. Despite the fact that yields are still better than under rain-fed, there is the need to re-visit local and traditional farming practices, and integrate the good ones with modem irrigation approaches, thus, composting and the use of animal droppings should be encouraged to improve on the organic matter of irrigated plots, instead of over-reliance on artificial fertilizers. Agricultural research stations should come out with high yielding crop varieties with shorter durations to improve crop yields and reduce cost of irrigation farming.

- Despite the non-involvement of the beneficiaries at the initial stages of the development of the scheme, the current participatory model of the V /Cs and the FBOs is encouraging. Efforts however, must be targeted towards building and strengthening their capacities. To ensure sustainability of irrigation and other development initiatives, it is important that local beneficiaries play a role in the operation and management through training, empowerment and capacity building. Currently, the FBOs in Tono are in charge of

water delivery and land allocation, these roles could be expanded to include fixing of levies, land preparation, marketing among others.

- The District Assembly, as the representative of central government, Traditional Authorities, ICOUR and MOFA should collaborate to address the negative consequences of the irrigation scheme in the area. Thus, the problem of pollution and uncontrolled use of agro-chemicals should be tackled through education. Radio programmes and discussions targeting dealers and farmers should be a regular feature. The use of impregnated bed nets by farmers should be encouraged to curtail malaria infestation. V /Cs and FBOs at the local irrigation communities should lead a campaign of moral rejuvenation of the youth by organizing youth related community development programmes to sensitize them on moral virtues. To curtail conflicts with landlords, they should be given a voice in the activities of the scheme to integrate them into the management structure. A committee made up of representatives of V/Cs, landlords, and scheme management should be formed to handle all land disputes. - Lastly, all forms of child labour should be banned with culprits sanctioned. V /Cs byelaws should make provisions for the elimination of child labour on the scheme, and those who contravene should be sanctioned.

- The scheme management, Tourist Board, the District Assembly, and private entrepreneurs should collaborate to develop the tourism potential of the Tono scheme. With the appropriate investment, areas could be transformed into places of relaxation, leisure and entertainment which people could patronize during weekends and public holidays. Given the right advertisement, the bird sanctuary could attract a lot of foreign tourists. Individuals and institutions should be encouraged to take up the fish ponds and the fruit tree plantations for development to improve on the nutritional requirement of the region in particular and Ghana as a whole.

- Finally, it is necessary that further studies are conducted on the effective ways irrigation systems, and for that matter, other modern agricultural initiatives, as a poverty reduction strategy, can contribute to poverty reduction, especially in the poverty endemic areas in Ghana. This particular study emphasized the relevance and the challenges of irrigation

within the context of the Tono Irrigation Scheme, in the Kassena-Nankana District of the Upper-East region. The results cannot therefore be used to generalize on all situations; it is only when further studies are conducted with similar reports at other locations can the base be set for generalization.

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Appendix 1. - QUESTIONNAIRE FOR RESPONDENTS FROM TONO AND CHIANA

QUESTIONNAIRE FOR COLLECTION OF PRIMARY DATA.

1.0 DEMOGRAPIDC BACKGROUND		RESPONSES
101	Respondent identity	
102	Sex	1 =male 2 =female
103	Age	1 = Less than 20years 2 = 20-29 years 3 = 30-39 years 4 = 40-49 years 5 = 50-59 years 6 = More than 60 years
104	Marital status	1 = single 2 =married 3 = divorced 4 =widowed 5 = separated
105	Religious Denomination	1 =catholic 2 = protestant 3 = muslim 4 = traditional
106	Level of Education	1 = Primary 2 =Junior high 3 = Senior high 4 = Middle School Cert. 5 = 0 Level Cert 6 =Tertiary 7 =Non-literate.
107	Size of household	1 = 2-6 2 = 7-13 3 =above 13 4 = None of the above
2.00	**PRODUCTION ACTIVITIES AND EFFECTS ON POVERTY REDUCTION**	**RESPONSES**
201	What crop (s) do you	1 =Rice

	cultivate	2 =Vegetables 3 = Soyabeans 4 = Groundnuts 5 -Sorghum 6 = Others	
202	How long have been cropping	1 - Less than one year 2 = 2 -3 years 3 = 4-5 years 4 = above 6 years	
203	What is the size of your farm	1 = Less than 1 acre 2 = 2 -3 acres 3 = 4 -5 acres 4 = Above 5 acres	
204	Do you farm both dry and wet seasons {irrigation farmers only)	1 =Yes 2=No	
205	What is your yield	1 = Less than 1 ton/ha 2 = 2 -3 tons/ha 3 = 4 -5 tons/ha 4 = Above 6 tons/ha	
206	What is your average earning	1 = GH¢50.00 2 = OH¢ 100 -200 3 = GH¢300 - 400 4 = GH¢500 and above	
207	What is your source of capital for your farming activities	1 = Own savings 2 = Loan from the bank 3 = Loan from money lenders 4 =Credit from association 5 = Others sources	
208	Do you think irrigation farming has increase your earnings (IFO)	1 =Yes 2=No	
209	If yes, How		
210	If no, Why		
211	List six main items on which greater part of your income is spent	1 =Food 2 = School fees 3 = Family upkeep 4 = Maintenance of bicycle or motorbike 5 = Maintenance of building 6 = Purchase of roofing sheet 7 = servicing of loans 8 = Purchase of animals 9 = Performance of funerals 10 = Entertainment 11 =Health bills	

		12 =Others (specify)
212	List any three things your community has achieved as a result of the irrigation project. (IFO)	1 =Food security 2 = Employment 3 = Increase in income 4 = Increase in nutrition 5 = Increase in child enrollment in school 6 = Availability of water 7 =Curbing migration 8 = Family stability 9 = Lack of hunger 10 =Animal production 11 = Others (specify)
213	Do you employ labour for your farming	1 = Yes 2=No
214	If yes, how many people per season	1 = 1 -3 2 =4-6 3 = 7 -9 4 =Above 10
215	If no, what is your source of labour	1 = family 2 = friends 3 =Co-operative (Nuboa) 4 = Others
216	Do you have any member of your household who have migrated to southern Ghana	1 =Yes 2=No
217	If yes, since when	
218	Have you acquired any asset through your farming activities	1 = Yes 2=No
219	If yes, list any three of them	1 =Built a house 2 = Bought a bicycle 3 = Bought a motorbike 4 = Change roofing to aluminum sheets 5 =TV SET 6 = Bought radio set 7 =Bullocks 8 = Sheep and goats 9 = Others (specify)
220	What are the major problems confronting you in your farming activities	1 =inputs 2 =water delivery 3 =marketing 4 =seed 5 = pest and diseases

		6 =others (specify)
221	At which level of the educational system are your dependants	1 = First cycle 2 = Second cycle 3 =Tertiary 4 = None of the above
300	**PARTICIPATION IN ORGANISATION AND MANAGEMENT. (IFO)**	**RESPONSES**
301	Who decides on the crop(s) to farm per season	1 =Myself 2 =Project 3 =Farmers association 4 = Others(specify)
302	Do you belong to an association or organisation in relation to your farming on the project	1 =Yes 2=No
303	If yes, how was the association formed?	1 =Project 2 =Farmers 3=NGO 4 = Others(specify)
304	How do you get information in relation to your farming activities	1 = Project extension 2 =Radio 3 = Farmer group/association 4 = Others
305	Who is responsible for water delivery to your farm	1 = Project staff 2 = Farmers group/association 3 =Others
306	Who allocated the plot/land to you to farm	1 =Project 2 = Farmers group/association 3 =Others
307	What topics do you discuss during meetings with project officers	1 = Crop agronomy 2 = Marketing 3 = Levy payment 4 = Land allocation 5 = Encroachment 6 = Others
308	Who organizes such meetings	1 = Farmers group/association 2 =Project 3 =Both 4 =Others
309	Do project extension staff visit you on your farm	1 =Yes 2=No

310	If yes, what topics do you discuss during such visits	
311	What benefits do farmers gain from being members of a group/association	1 = Arrange credit packages 2 = Land allocation 3 = Market sourcing 4 = Information provision 5 = Others
312	How in your view is the relationship between farmers group/associations and the project.	1 = No relation 2 = Cordial 3 = Co-operative 4 = very tight 5 = others
313	Do you think farmers take part in deciding the activities of the project	1 = Yes 2 = No
314	What recommendations would you make to ensure that farmers participate actively in the running of the project.	
400	**INTENDED AND UNINTENDED CONSEQUENCIES OF IRRIGATION**	**RESPONSES**
401	Why was the irrigation scheme cited at Tono	1 = Food security 2 = Employment creation 3 = Source of income 4 = source of water 5 = Others
402	What do you do during the dry season	1 = Migrate to south 2 = idling 3 = Trading 4 = Hunting 5 = Farming 6 = Others
403	What are some of the effects of citing an irrigation project in an area	1 = POSITIVES; Food security, income, employment, animal production, fish and nutrition, tourism, stop migration, friendly environment, others 2 = NEGATIVES; Water-borne disease, drowning of children, restriction of

		animals, disrespect for elders, erosion of traditional values, pollution of environment due to chemical use, prevalence of strange disease, others
404	Do you or members of household use water from the irrigation canal for domestic use (IFO)	1 = Yes 2=No
405	If yes, specify the usage?	1 =Building of houses 2 = Washing of clothing and dishes 3 =Cooking 4 = Watering of animals 5 =Bathing 6 =Drinking 7 = Others
406	What are the commonest sicknesses that affect you and your household	1 =Malaria 2 = Bilharzias 3 = Stomach aches 4 = Filariasis 5 = Others
407	Do you think the water in the canal and the fields contributes to the sicknesses	1 = Yes 2=No
408	Would you subscribe to the citing of irrigation dams in other areas	l =Yes 2=No
500	OTHER USES OF IRRIGATION	RESPONSES
501	Are you satisfied with your current yields	1 =Yes 2= No
502	If no, suggest ways of improving the yields	
503	Are there any other problems you face in your farming activities apart from what you earlier on enumerated	
504	What other topics do you think should be included in your meetings with the extension unit .	

505	What other activities do you think can be undertaken other than farming and fishing, as a result of the availability of water throughout the year	
506	Who should introduce such activities	
507	Do you agree with the statement that ' irrigation contributes positively to the reduction of poverty'	1 =Yes 2=No
508	If no, Why?	
509	What do you think could be done to maximize the benefits of irrigation	
510	What in your opinion can be done to make irrigation facilities more efficient and effective	

Appendix 2.-INTERVIEW GUIDE FOR AGRICULTURAL STAKEHOLDERS IN THEK.N.D.A

1. What is your stake on Agricultural development of the District?
2. What are the crops grown in the district?
3. What is the average yield experienced by farmers in the following crops, Rice, millet, maize, and groundnuts, both under rain-fed and under irrigation?
4. What are the yields under irrigation?
5. What is the main source of capital of farmers?
6. What are the main problems farmers faces in their production?
7. How do the DA help farmers to solve these problems?
8. What in your view is the effects of irrigation on the livelihoods of farmers?
9. Are there any other uses the dams for irrigation can be used other than farming?

   Yes, No

If Yes, What are they?

10. What problems do rain-fed agricultural farmers face?
11. What are the consequences of citing dams in poor communities? (both positive and negative)
12. How are farmers organized in their activities on the project?
13. How are farmers organized under rain-fed organized?
14. Do you agree with the notion that irrigation farming can reduce poverty in the district?

    Yes, No

If Yes, how?

15. What role does other organisations other than government play in agricultural development in the district?
16. What in your view can be done to improve agricultural productivity in the district?
17. Which area do you think irrigation has contributed in poverty reduction?

18 Would you subscribe to the notion that "irrigation is the only way of solving food insecurity in the district?

19 What are the most common diseases in the district?

20 Do you think the irrigation dam has any thing to do with the diseases in the district?

21 What can be done to curb water related diseases in the district?