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Irrigation-led Strategy for Poverty Reduction in Northern Ghana:
Large Scale Versus Small Scale Irrigation, Gauging the Evidence

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List of Acronyms and Abbreviations

CIDA	Canadian International Development Agency
DISCAP	District Capacity Project
FAO	Food and Agriculture Organisation
G'corn	Guinea Corn/Sorghum
G'dnut	Groundnuts
GCB	Ghana Commercial Bank
GDP	Gross Domestic Product
GIA NABIO	Local Non Governmental Organisation
GIDA	Ghana Irrigation Development Authority
GPRS	Ghana Poverty Reduction Strategies
GSS	Ghana Statistical Service
HA	Hectare
ICOUR	Irrigation Company of Upper Regions
ILO	International Labour Organisation
IFAD	International Fund for Agricultural Development
IMF	International Monetary Fund
KND	Kassena Nankanni District
LACOSREP	Land Conservation and Smallholder Rehabilitation Project
LSI	Large Scale Irrigation
MoFA	Ministry of Food and Agriculture
MT	Metric Tonnes
NGO	Non Governmental Organisation
ODI	Overseas Development Institute
SLF	Sustainable Livelihood Framework
SSA	sub- Saharan Africa
SSI	Small Scale Irrigation
UER	Upper East Region
US\$	United States Dollar
VCs	Village Committees

Keywords

Irrigation, Agricultural Productivity, Growth, Poverty, Food Security, Marketed Surplus, Livelihoods, Livelihood Strategies, Investment Resources, Rural Development, Ghana

CHAPTER ONE

1.0 Research Context and Setting

1.1 General Introduction

The research explores the issue of irrigation-led strategy for rural poverty reduction. It touches on the different forms of irrigation and the impacts on rural poverty reduction. It analyses farmers' perceptions, views and experiences of large and small scale Irrigation systems as well as those on rain fed in the Upper East Region (UER) of Ghana. It also analyzes views of key informants as well as reports and earlier studies on irrigation-led strategies for poverty reduction. The Research intends to provide a theoretical and empirical contribution to the on going debate on Large Scale Irrigation (LSI) schemes as against Small Scale Irrigation (SSI) systems for poverty reduction in the study region.

Ellis and Ade (2005:277) argued that, increasing overall importance for water productivity for poor people remain the main pathway to reduce poverty but how better to match the water management package (technology, policies, institutions, infrastructure) to the needs of the rural poor remains unclear. They maintained that, understanding which form of irrigation-led strategy, can reduce poverty and enable the necessary changes is most important.

There are two main reasons that served as stimulus for this research. The first reason is, the UER is considered the poorest region in Ghana for more than a decade and the poverty levels of the region continue to rise every year despite several interventions to address this issue. What remains unclear is that the various reasons given to explain this precarious situation are contradictory and needs further investigations. Secondly, the region has two large state-managed irrigation schemes: Veia and Tono. The Tono irrigation scheme is the largest in the country and has the largest agriculture dam in West Africa. However, the region can only produce 44% of its food requirement and the remaining 56% has to be imported (MoFA 2007:57). Given this scenario the research seeks to assess whether the introduction of LSI to the region has had any impacts on poverty alleviation and food security, and if not, what is the justification for

concentrating resources and leaving the larger population out of the development process.

The emphasis on agriculture led growth is considered crucial because, it is the highest contributor to the country's GDP and provides employment for over 60% of the population (GSS 2007:35). However, a number of factors limit optimal production in agriculture especially production of crops. Agriculture depends on natural conditions. Rainfall is unreliable with regards to its onset, duration, intensity and amount and can disrupt food production, especially in the Northern regions of Ghana which are semi-arid. These regions (Upper East, Upper West and Northern Region) are characterized by food deficit and precarious dependence on rain fed agriculture and outmigration. In connection with this, the notion of an irrigation led strategy became paramount for these regions where rainfall shortage is the most severe in the country. As an interventional tool for increasing agricultural productivity and reducing rural poverty in the north, the government of Ghana has used irrigation development strategies (ICOUR 2007:24).

The study will therefore focus on the Kassena Nankani District (KND) of the UER, which is one of the poorest and drought prone regions of the country and where different forms of irrigation are practiced. In this context the study seeks to find out to what extent and what form can irrigation constitute an effective instrument for poverty reduction and a broad-based income generation in the study region.

A wealth of literature is created in examining irrigation as poverty reduction strategy and its impacts on rural livelihoods in developing countries (for example: Hussain et al. 2002; Kalunde 2008; Ravnborg et al. 2007). However, few studies have been done in this area in Ghana. The few studies carried out include Analysing growth options and poverty reduction in Northern Ghana (Diao 2005), Economic growth in Northern Ghana, UER agriculture intensification (FAO/IFAD 1989) and Analysis of Governance Structures for Water Resources Management (Birner 2005). This study is not to argue about irrigation as a tool for poverty reduction but will seek to contribute to the debate about which strategy is feasible in Northern Ghana regarding formal (LSI) and informal¹ (SSI) forms of irrigation and their consequential impacts on rural poverty reduction.

¹ Formal irrigation as described by Carter (1993:3) refers to "state-managed systems" or "top down approach" or "large scale systems" and informal refers to decentralized systems managed by rural

As Bolding et al. (2003) asserted, ‘irrigation is a social construction technology: Social and normative relationship among human actors shape irrigation works and its organisation’. They go on to say, that, irrigation technology will reflect the norms and practices among production relations in the designer’s social setting. In line with this view, the choice of irrigation technique is not limited to only technical issue, but also the social and economic conditions prevailing in a particular context.

In an attempt to find solution to the poverty problem in the study region government focussed on the LSI schemes. This strategy could not provide for everyone, it covered only small percentage of the population with the assumption that the LSI will produce multiplier effects to cover the rest of the population. Few SSI systems are also practiced, and these are scattered in the rest of the region. These are farmer-managed with less resource demand as compared with the LSI and can also cover larger population but with lesser productivity and multiplier effects. The analysis therefore will basically consider the specific conditions of the UER of Ghana and the Kasena Nankanni District in particular.

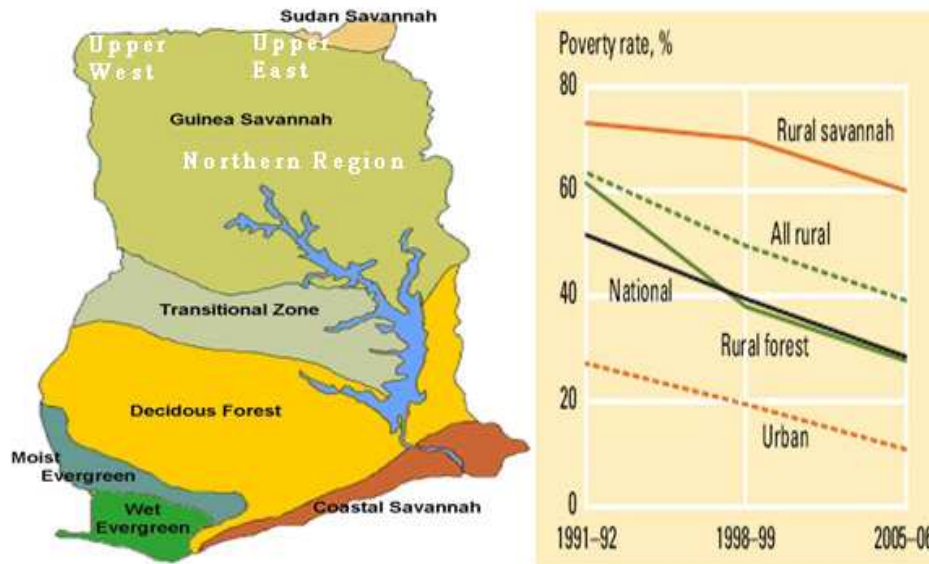
1.2 Statement of the Research Problem

1.2.1 The Physical Environment of Ghana

The physical environment of Ghana is very diverse. In general, the southern regions are more fertile than the northern regions (Upper East, Upper West and Northern Region). Due to rainfall shortage, the northern regions which are very dry, do not only suffer from drought but also experience high chronic poverty rate (figure1). The country is divided into six major agro- ecological zones. Located in them are the northern regions in the guinea and Sudan savannah (Figure 1) which have different climatic zones from the southern regions. As a consequence, the southern regions have two growing seasons whereas the northern regions have only one (see table 1 below). The drought in the northern regions is the major problem that the irrigation strategy intends to address.

small scale farmers which he described as “bottom up approach” or “small scale systems” or “farmer managed” systems.

Figure 1: Ecological zones of Ghana and the rate of Poverty



Source: Adopted from FAO 2005; World Bank 2008

Table 1: Agro-ecological zones of Ghana

Ecological Zone	Area ('000 Ha)	% Total Area	Mean Annual Rain (mm)	Crop Growing Period (Days)	
				Major Season	Minor Season
Rainforest	750	3	2200	150-160	100
Deciduous Forest	740	3	1500	150-160	90
Transition	6630	28	1300	200-220	60
Guinea Savannah	14790	63	1100	180-200	Dry Period
Sudan Savannah	190	1	1000	110-160	Dry Period
Coastal Savannah	580	2	800	100-110	60

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

The northern regions have a very short rainy season of three to five months and a long dry season characterized by low and erratic rainfall patterns. The average annual rainfall received in the region is approximately 1000 mm (table 1) characterized by a single growing season. The uni-modal rainfall regime has its peak around August and is often associated with floods and droughts that may occur in the same season. Rainfalls in these regions are often very short in duration, but rather intense, leading to high run-off rates.

1.2.2 Poverty and Environmental Linkage in Ghana

Reardon (1995: 1495) argued that, poverty and environmental links are shown to differ based on environmental problems people face. Based on this assertion, it can be argued that the trends of rural poverty in Ghana are a reflection of the environmental problems of the country. Analysis of the Ghana population and housing census (GSS 2000) reveals that rural urban dimensions of poverty reflect relative differences in numbers, severity and depth. The distribution based on ecological zones revealed that rural savannah has the highest percentage of people considered poor ²(figure 1 & table 2). As reported by the Overseas Development Institute (ODI 2005) the northern regions remain dependent on low return food crop farming, low economic growth and the share of household income from nonfarm activities remain significantly lower than in the rest of the country, the UER is the most food insecure (ODI 2005: 13) .

Table 2: Agro-ecological zones and percentage of population considered poor

Agro-Ecological zones	Accra	Urban Coastal	Urban Forest	Urban Savannah	Rural Coastal	Rural Forest	Rural Savannah	Ghana
1991/92	23	38	26	38	53	62	73	52
1998/1999	4	24	18	43	45	38	70	40

Source: Extracted from (GSS 2000)

² Ghana Statistical Service (GSS 2000) used different approaches to measure poverty. The approach adopted was based on the level of individual annual income and consumption. The uni-modal approach measure of poverty thus considered the poorest population as those obtaining less than \$100 per annum (in Ghana cedi 900,000).

1.3 Research Methodology

1.3.1 Study Approach

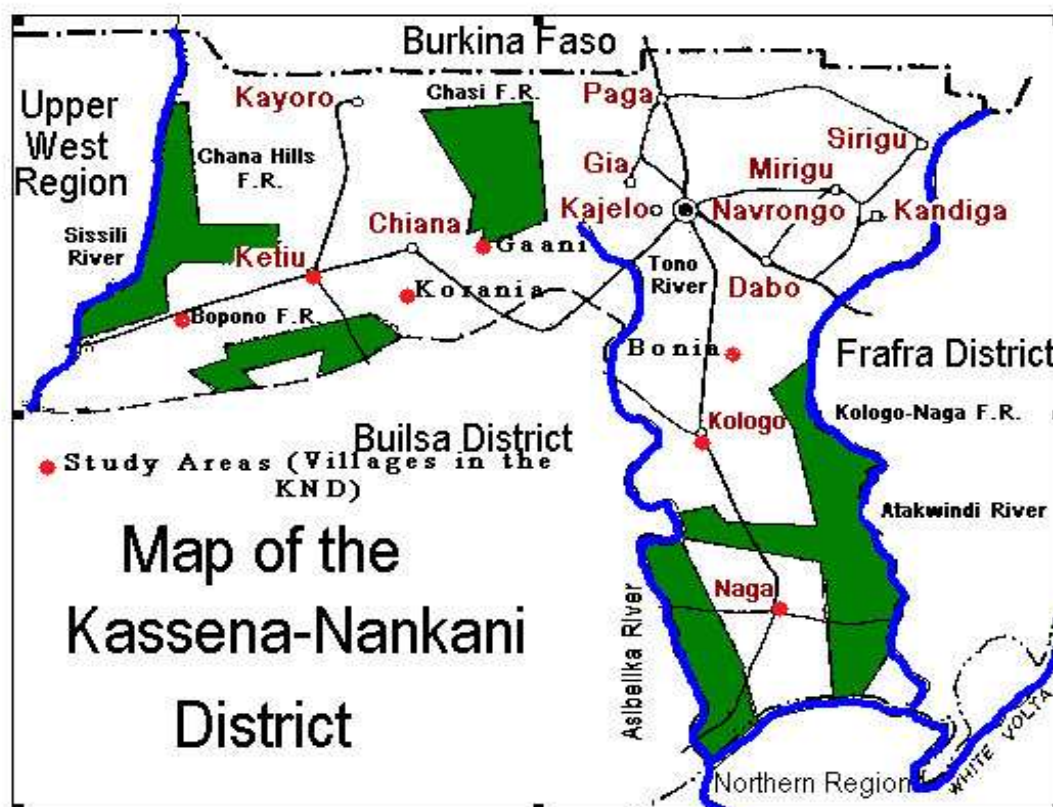
To bring out the realities, history, everyday activities and actors' relationships within the Kasenna Nankanni District (KND) in the UER of Ghana, samples of case studies covering three different areas in the KND were carried out, these were:

- (1) Areas of well developed/improved irrigation infrastructure (LSI schemes):
Farmers of this group depend on public resources and are given preferential treatment
- (2) Areas of dugouts/dams for small scale irrigation but less developed infrastructures (SSI): Farmers are provided with the basic irrigated infrastructure (dams, reservoirs to harvest water during the rainy season) but are agency of their own destiny
- (3) Areas of no dugouts/dams, and no irrigation infrastructure at all (rain fed dependent areas). Farmers have no access to irrigation facility and largely depend on diversification and migration to survive

The reason for covering these three areas was to capture information on the livelihoods of the people living in the area, their differences and similarities. Sample of beneficiary farmers and farmer groups of LSI and SSI as well as rain fed farmers from selected farming villages in the KND of the UER were carried out³. Both individual and group discussions to find out farmers' views, experiences and motivations with regards to their livelihood strategies, opportunities and constraints were held. Villages selected were: Korania, Gaani, Bonia (LSI areas), Kologo, Naga (SSI areas) and Kituu, Bopono (Rain fed areas) indicated on the map below.

³ Field study by the researcher was carried out in July, 2008 in the KND.

Figure 2: Map of the KND showing Study Areas (Villages)



Source: Modified from GSS (2005)

43 individual interviews were conducted⁴ (see guided interview questions in Annex 3); these include farmers from the areas indicated on the map above and key informants (some officials of the Irrigation Company of Upper Regions (ICOUR), Ministry of Food and Agriculture (MoFA), GIA NABIO (a local NGO), Commercial and rural bank officials) in the area. In addition group discussions (see guided group discussions questions in annex 3) with farmers were held in 4 farming villages in the area (Korania, Gaani, Bepono and Kologo). As argued by Laws et al. (2003:368) that selection of sites or people for study obviously need to be done in the light of the aims of the research. In line with this idea, purposive sampling⁵ method was used to select both the villages and farmers taking account of the difference circumstances in these areas as well as the selected officials from the various organisations indicated above.

⁴ These were 12 key informants, 17 male farmers and 14 female farmers during the months of June and July 2008 in the UER of Ghana.

⁵ Purposive sampling is a technique in which the researcher chooses respondents, trying to obtain as wide a representation as possible, taking account of likely sources of differences between individuals (Laws et al. 2003:366)

1.3.2 Research Methods and Sources of Information

Data collection methods include field observations, in-depth informal guided interviews with farmers and key informants in the KND and the region, supported by focus group discussions with farmers from the area, secondary data of documents, reports of the region and the district and general literature review on irrigation technology and rural livelihoods.

The individual interviews conducted, each interview schedule taking half an hour (30minutes) to 2 hours (120 minutes). In order to get better understanding of the data collected, focus group discussions with male and female farmers from the study areas were held. Separating the male from the female farmers was done to ensure that the females were fully integrated in the discussions. Participatory observation to complement the data was also carried out.

The analysis of interviews and discussions is focussed not only on what people do but also the motivations, reasons and social identities and how these are constructed within the social setting in which people live and work. As Laws et al (2003:286) put it, you need to know about people's experience or views in some depth and be able to rely on information from fairly small number of respondents. They say further that, both individual and group interviews complement each other.

In comparison with the original proposal⁶, the research question was reformulated during the research period and subsequent analysis and interpretation of the data. It was expected during the proposal writing that farmers practicing irrigation will have higher agricultural productivity outcomes and will participate lesser in nonfarm activities compared to farmers under rain fed, but this was not the case on the field. From the data it was realised that, both rain fed and irrigated farmers virtually carried out the same livelihood activities (farm and nonfarm) but with different motivations. This suggests that the qualitative methods adopted were very useful in this study. The interesting issue that arose was, irrigation was more than one form of strategy in the area, and has more or less similar impacts compared to rain fed agriculture. Though, they seem to have

⁶ The original question: What are the linkages between livelihood diversification and poverty in the study region, comparing households with or without access to irrigation? The reformulated question is to what extent and what form can irrigation constitute an effective instrument for poverty reduction and broad based income generation in the study region?

similar impacts, one strategy (LSI systems) concentrates resources to smaller percentage of the population while the other strategy (SSI system) spread resources to a larger population. The study made an argument out of the data gathered and with secondary data from reports, documents and early studies on the study area as well as with literature review on irrigation-led strategy for poverty reduction. The arguments in the study based on the data are; LSI systems in the study region only concentrate investible resources to small percentage of the population, and it is a limited option in poverty reduction as compared with the SSI systems that spread resources and therefore benefit more people.

1.4 Significance and Limitations of the Study

In view of the strategic role of agricultural development in bringing about economic growth and reducing poverty in the rural economy, attempts to address problems facing the sector are of policy significance. By doing so, the arguments and empirical evidence presented in this research will enormously contribute to the current debate on the SSI systems and the LSI schemes and deciding on which is most effective in poverty reduction. The arguments based on the empirical evidence in this research could provide insights to policy-makers on the appropriate choice of techniques of irrigation-led strategy for poverty reduction and livelihood improvement for the UER in particular and Ghana in general. Another important contribution of this research is the first hand information from farmers living in the study region who are the beneficiaries, their experiences, views, motivations and aspirations could be a useful guide for future research in the area.

However, the study is limited by several factors. The first is unavailability of crucial data such as the past livelihood situations of the study region before the introduction of LSI. This could have helped to evaluate the impacts of the projects before and after its inception. Second, the micro level study is based on few farmers within the study district. While it could be argued out that the picture painted is similar to other districts in the UER of Ghana, it is worth mentioning that ‘representativeness’ in its statistical sense is not the main concern or objective of the study, but rather more of reconnaissance study to identify key variables that presumably could be found everywhere and analyse how they could determine growth possibilities as well as impacts on different groups. Third, the study is largely based on qualitative information, thus on views, perceptions and

experiences collected from farmers and key informants from the study area through interviews and group discussions.

1.5 Organisation of the Paper

The paper has six chapters. Following the introductory chapter that situates the study into literature and statement of the research problem, is the chapter two that discusses the conceptual framework of irrigation-led strategy. It looks at how the strategy works within the context of the wider economy, through growth linkages and multiplier effects. It draws on some themes from some debates on the different approaches in terms of concentrating and spreading investment resources. This sets the stage for the third chapter which provides a general analysis of poverty and agriculture production in the UER, in the light of agrarian structure and agricultural performance in the region and the development of irrigation. The fourth chapter makes a critical assessment of LSI and SSI strategies in the light of agricultural growth and rural development in the study region. The fifth chapter discusses the livelihood strategies that emanate from these approaches and interventions, the outcomes of these strategies, their sustainability and vulnerability. The chapter six is the conclusion based on the main premises of the paper.

CHAPTER TWO

2.0 Theoretical Framework

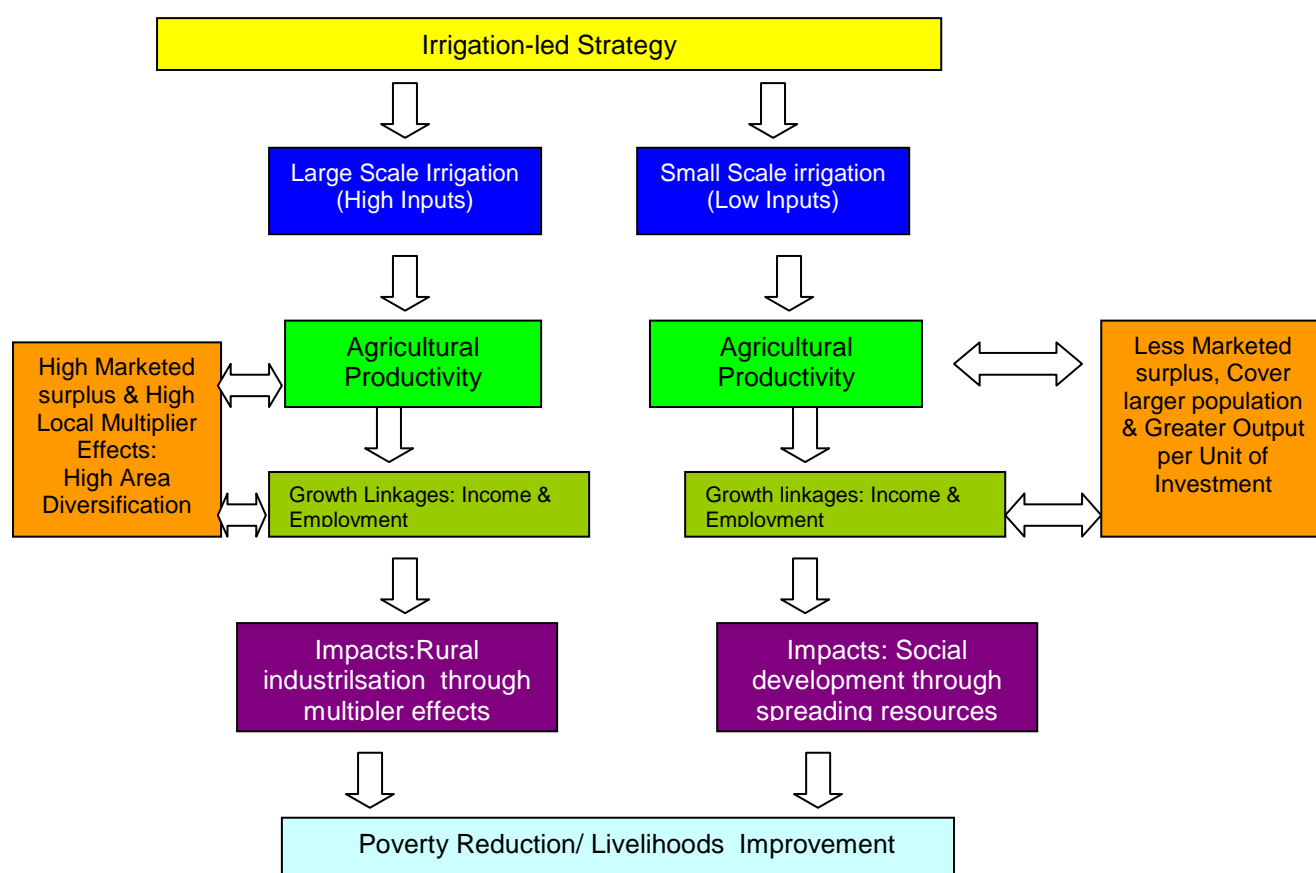
2.1 Analytical Framework Explaining How the Strategy Works

Irrigation is a socio-technical phenomenon because it is socially constructed, has social conditions of use and has social effects (Bolding et al. 2003:43). Therefore, to be able to analyse irrigation as a strategy, it is not sufficient to examine only the technical and material elements but also a technique that contains social contents. The conceptual framework below (figure 3) allows us to analyse irrigation-led strategy as a socio-technical phenomenon. It draws a distinction between Large Scale Irrigation (LSI) and Small Scale Irrigation (SSI) systems as two different livelihood strategies for poverty reduction and livelihood improvements. As seen from the framework, both the LSI and SSI systems stimulate growth in agricultural productivity. When there is high productivity as expected the LSI maximizes market surplus for greater multiplier effects through income generation activities in the local economy and the larger environment (area diversification). Furthermore, there will be the cultivation of high value crops that will be labour intensive, generating income and employment (through production and consumption linkages) for the local economy. The SSI systems on the other hand, means a strategy of spreading investment resources to cover wider areas but not the higher marketed surplus, but greater output per unit of investment. This means with the SSI systems, there is relatively lower productivity and yield but higher population and household coverage.

As Ramesh et al. (2003:18) put it, ‘when using irrigation technology, a vision is also produced; a vision about equitable distribution among users, about benefits and burdens and a vision about livelihood improvements. This vision plays a central role when using irrigation technology; these abstract concepts become expressed in concrete practices’. In line with this view, both LSI and SSI strategies as seen from the framework impacts on poverty reduction and livelihoods improvement: While the LSI impact through

greater multiplier effects and rural industrialisation, the SSI is by the spread of resources to the larger population for social development. Social development and rural industrialisation are concepts that need to be defined within the scope of this study. Social development refers to farmers' participation in decision making, reduced out migration, employment and food availability (for health and nutrition). On the other hand rural Industrialisation here refers to longer terms of economic growth for rural infrastructural development and local economy diversification.

Figure 3: Analytical framework of the Irrigation-led strategy



Source: Author's conceptualisation of the strategy.

2.2 Irrigation-led Strategy Works Through Linkages

With the question of how irrigation-led strategy can generate employment through multiplier effects, is through growth linkages. As stated by Haggblade et al (2005:26) the farm and nonfarm sector is either directly linked through production activities or indirectly linked through income and investment. The production linkage may be

upstream or downstream. Upstream linkage (Backward linkage) occurs when the farm sector grows and induces the supply of inputs and services: It results from farmers' increased demand for inputs from the nonfarm sector. The downstream linkage (forward linkage) takes place when activities such as agro-processing and distribution rely on farm products; it develops through the increased need for agro processing activities. They argued however, that, such growth linkages can only be achieved through the development of agriculture. In a related argument, Ravnborg et al (2007:160) indicated that access to agricultural water has second round effects on poverty through output, employment and prices. They explained that access to agricultural water encourages farmers to increase use of inputs, fertilizer, pesticides and improve seeds and other agricultural inputs and services. As farm output and income rises and food prices fall, 'well-off' farmers and workers will increase their expenditure on non-food products (consumption linkage), boosting demand and increasing employment opportunities in non farm income generating activities. The indirect linkage occurs when income earned in one sector is spent on output of another and investment linkages occur when profits from one sector are invested in the other. The implications of these linkages according to Haggblade et al (2005) are that, they stimulate rural growth; they indicate further, that, when agriculture grows, the rural economy benefits from increased incomes and employment multipliers.

2.3 Growth Linkages Leads to Multiplier Effects

Research shows that production linkages stimulate the input supply and output processing and distribution of industries associated with agriculture, while even larger multiplier effects arise from consumption linkages (Hasnip et al. 2002:9). It is argued that, rapid productivity growth in farm and nonfarm rural sectors occurs, with the latter, made up of commodity and service producers linked to agricultural households as suppliers of production inputs and consumer goods (ibid). Additionally they argued that, this is rein-enforced when the purchases made by farm households are none or semi tradables that benefit from a degree of natural trade protection and tend to be labour intensive. Thirtle et al (1998) (quoted in Hasnip et al. 2002:12, 32) argued that, the relevance and importance of production and consumption linkages are supported by a number of empirical studies. They indicated that income levels for most countries in Africa and Asia are between 1.3 and 1.9. That is 1% increase in agricultural output gives

0.3% to 0.9% increase in non agricultural output. They go on to say that, at least 75% of these effects arise through consumption linkages. They maintain that increased productivity in farming may not stimulate rural industry directly, but to investment by facilitating the creation of roads, power and communication network and more healthy and educated workforce (rural industrialisation). In a related argument Delgado et al. (1994:1166), noted that growth linkages are typically estimated as regional growth multipliers which measure the extra income generated in a region from stimulating new production of goods and services with stream of consumers and intermediate spending. They further stated that, growth multipliers arising from new spending come from new consumers and intermediate demands for nontradable⁷. It is argued that, because new demands for these items cannot be met from imports, they are expected to be met by increased local production (ibid). They added that, at current levels of rural infrastructure, more food commodities should be viewed as non-tradable in the African context as has previously been assumed. In their submission, (ibid 1994:1170) thus asserted that, increase in income as a result of technology or policy (LSI or SSI as in this study) are typically widely spread in small increments over large number of people. They justify that, the comparative absence of land owning class in Africa prevents surplus from being concentrated in the hands of few wealthy rural people. They further stressed, that, because rural Africans tend to be poor, these increments go into consumption, typically extra food, rather than being used for savings and investment. They maintained that, while helping to ensure food security, food as tradable goods implies that the extra consumption only displaces the export or increases imports in growth analysis. They concluded that, wide-spread increments to the incomes of rural households can potentially play major role in mobilising under used resources, through the encouragement of employment in the non-tradable sectors.

Criticism of the importance of linkages and models used to quantify these do exist. Hasnip et al (2002:9) argued that, while it is insufficient to dismiss the 'model' of agriculture as the engine of growth for rural economy, stimulating agricultural productivity may be necessary, but not sufficient to achieve economic growth and

7 The term "nontradable" is used for goods that at prevailing relative prices are rarely, if ever, traded across the borders of the chosen zone of analysis. By convention, services are always non-tradable, since the service is completely performed locally, and it can neither be imported nor exported. Staple foods are generally nontradable and perishable foods are also nontradables because of the risk of loss in transit. Tradable, on the other hand, can in theory always be imported or exported at a constant price determined by a reference market outside the region in question (Delgado et al. 1998).

poverty reduction in rural areas. They go on to say, that, complementary intervention such as investment in physical and human capital may also be needed to achieve growth and poverty reduction in agricultural and non farm rural economies. In a related argument Hasnip et al. (2002:37) stated that areas with more infrastructure and well developed rural-urban links, in most cases tend to show higher multipliers as compared with low infrastructural areas.

2.4 Questionable Assumptions

According to a GPRS report (IMF 2006:35-43), stimulating high productivity⁸ and market surplus⁹ to generate income that will lead to greater multiplier effects for economic growth and poverty reduction was the reason for introducing LSI scheme to the UER.. The implicit notion was that, high agricultural productivity leads to economic growth, hence rural poverty reduction. The question of whether or not growth alone could reduce poverty remains difficult and controversial. While those in favour of growth based their argument on the trickle-down effect, in which growth is considered necessary and sufficient condition for addressing the problems of inequality and poverty (IMF 2006), those on the other side of the debate argue that, growth have adverse distributional consequences and mostly favour the rich. They added that poverty would be alleviated if the appropriate measures are taken to ensure that the basic needs of the poor are satisfied, especially food and clothing rather than productivity and capacity to generate a surplus (ILO 1976 quoted in Abebe 2000:45). The question is how can poverty reduction goals be achieved without addressing the crucial issue of distribution and equity in economic growth?

The second assumption from the original preposition of introducing LSI schemes in the 1960s-1980s as stated in the report was; the project will supply food to the internal market that will develop the local economy. The notion here was the local market will develop automatically for the development of the local economy. The question to ask is how will the local market develop without the basic infrastructure in the area? Secondly

⁸ It is important to make a distinction between productivity and efficiency; Productivity as defined in Ramesh et al. (2003) is the amount of output produced relative to the amount of resources (time, money, inputs) that go into the production while efficiency is the value of output relative to the cost of input used.

⁹ It is important to define the concept market surplus as meant in this study; which according to the neoclassical definition in Saith (1985:17) is the difference between aggregate output and consumption.

can supply (increased productivity) create its own demand in a region that is considered poor? And lastly as indicated in the assumption, that, the multiplier effects will occur in the long run, raise the question as for how long after 30 years of introducing LSI to the region? These questions are some of the issues been argued in the light of concentration as against dispersal of investment resources and, its consequences in terms of total output (crop output¹⁰), marketed output (market surplus) and agricultural productivity.

2.5 Concentration versus Dispersal of Investment Resources

The question of which strategy should governments of developing countries employ to effectively address poverty for efficiency and equity is an issue of debate.

Concentrating investment within, in this case, the LSI scheme, if successful, as argued by Saith (1985:4, 31) go hand in hand with high yield and high labour productivity with high input coefficient (strong backward production linkages). He argues further, that, this might lead to high marketed output (requiring strong forward production linkages), both of which require good market integration (value-chains). This suggests that market (product and input markets) is a crucial precondition for agricultural-led growth strategies; hence poverty reduction as most poverty analyst argues is mainly associated with market integration. That is, both the existence and access to market matters; especially where production is unlikely to be for the local market, but instead for export and/or the wider domestic economy. Income derived from such production, may be spent on local food or non-food items, which if, produced locally; will generate further consumption linkages (the multiplier proper). However, if the demand thus generated is mainly met from regional imports (and not local production) the multiplier effects will be limited. In a related argument, Wuyts (1981:9) pointed out that, concentrating investment, while hopefully boosting productivity and marketable surplus, does not necessarily maximise total output. On the other hand the author goes on to say, that, spreading investment resources thinly (as in the case of the SSI systems) might lead to greater output per unit of investment, but lower productivity, yield and marketed surplus.

10 Crop output or total output is the total physical quantity in metric tonnes (MT) of crops produced by the farm based on the harvesting year (MoFA 2007)

2.6 Summary of the Theoretical Framework

Several points emerged from issues touched upon in this chapter. The issue of irrigation-led strategy for poverty reduction and how it operates triggers a set of debates in several respects. Firstly are the growth linkages and how such growths can be achieved by development of agriculture. It also discusses the relevant factors that determine such growth linkages. The second concerns the multiplier effects debate. It discusses how an increased productivity and marketed surplus can bring about consumption and production growth and poverty reduction. The third is about the assumptions made about LSI schemes based on high productivity, growth and poverty reduction that raise questions and answers that are debatable. The final issue is the debate on the two strategies: concentrating as against dispersing investible resources, which could effectively be a poverty reduction instrument? The arguments are based on high productivity and marketed surplus as against dispersing resources approach that has greater output per investment but low productivity and marketed surplus. These two diametrically opposing views is the subject of debate and they need to be analysed in concrete conditions of Northern Ghana today in the light of irrigation-led strategy as a tool for poverty reduction. It is important to gauge the evidence of these two policy strategies and how the choice impact livelihood and economic performance. The subsequent chapters attempt to analyse these.

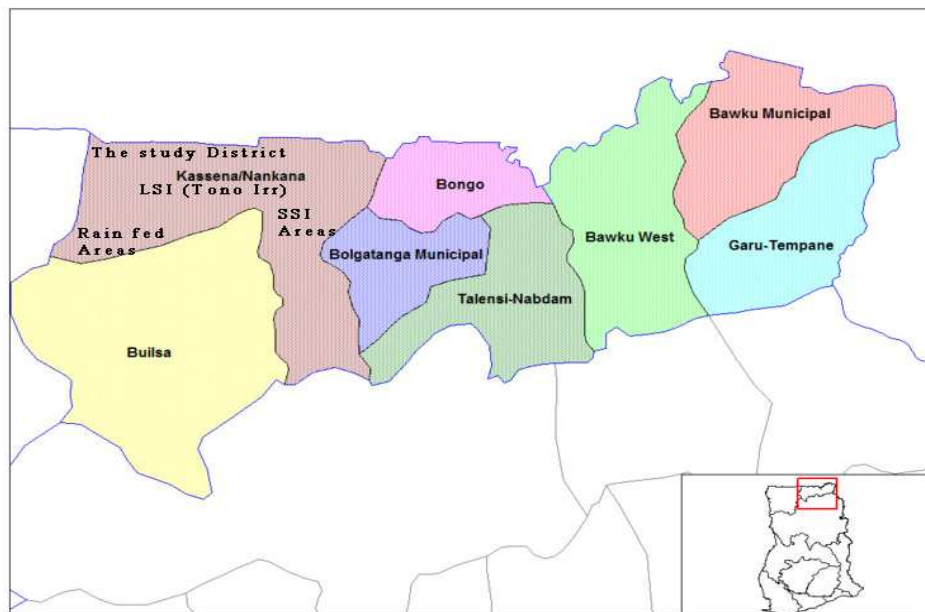
CHAPTER THREE

Poverty and Agriculture Production in the Study Region

3.1 Agrarian Structure and Economic Activities in the Region

Agriculture is the main stay of the population in the Upper East Region (see figure 4 below). It contributes about 65% of household income (GSS 2005). The prolonged dry season and lack of nonfarm activities in general, due to low infrastructural development, renders most of the people in the region seasonally unemployed (GSS 2007).

Figure 4: Map of the UER showing the Districts and the Study Area.



Source: Adopted from GSS (2005:7)

3.1.1 Access to Resources and Livelihoods

In northern savannah zone cattle serve as economic guarantee for households. Other livestock commonly kept are sheep, goats, guinea fowls and chicken. The number of livestock determines the wealth of a person (Diao 2005: 18). It is asserted that the well to do (rich farmers) own cattle sheep and maybe goats, but the less well to do, own few

goats and sheep (ibid). From the group discussions with farmers, those who own many animals get animal manure to apply to their crop fields and by this, they tend to get better yield than those who do not. Secondly, it was also revealed that those who own cattle in the area render bullock services and get extra income, or they negotiate for exchange of farm labour.

With regards to agricultural land for farming, on the average, own land is small and fragmented in the region (GSS 2005:22). There is significant variation across districts. Average land holdings in the study area are less than 2 hectares. Given the average family size of 8 persons per household the average land size of 1.3 ha implies per capita land size is 0.16 (MoFA 2007:78). According to MoFA report (2007), more than 90% of the population in the region has land holdings less than 2.1 ha. This clearly shows the level of land scarcity in the region. The scale of land fragmentation and declining soil fertility has also contributed to low agricultural productivity in the region (ibid).

3.1.2 Major Crops Grown in the Region

Common crops grown in the region are millet, sorghum (guinea corn), rice, maize and vegetables such as onion, tomato, okra, pepper and other traditional leafy vegetables are also cultivated.

Table 3: Ranking of major crops according to importance & Function

Crop	Importance ¹¹ and motivation for cropping	
	Food/consumption	Cash/Market
Millet	1	4
Maize	2	3
Sorghum/ Guinea corn	3	2
Rice	4	1
Groundnuts	3	2
Tomato and Onion	4	1

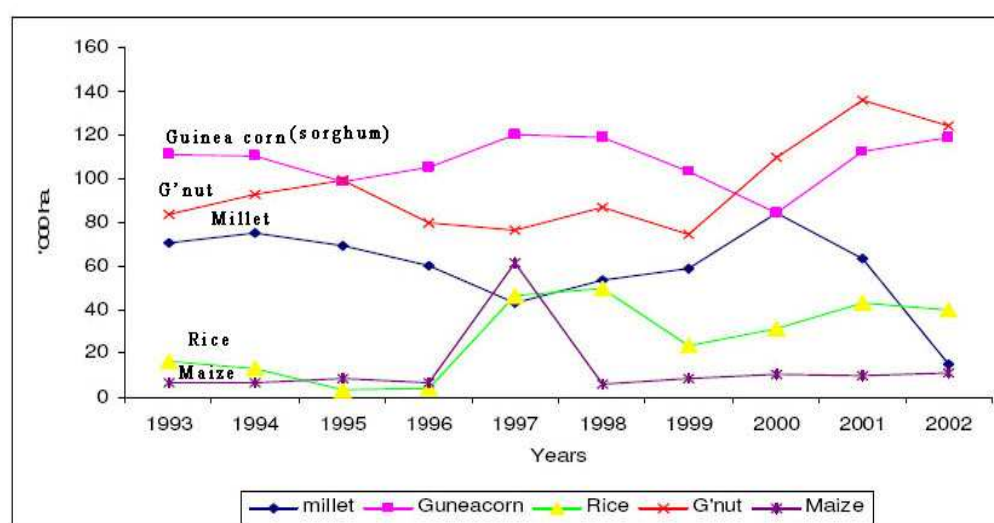
Source: Summary of Focus group discussions with farmers in the KND, 2008.

As seen from table 3, millet is ranked first in importance for food but is least important for cash or marketing. It is considered a traditional crop grown for food by every household and only sold as the last resort in times of dire need for cash (From group discussions). According to the farmers, sorghum would have been ranked second, but

¹¹ The groups were from three farming villages (Korannia, Ganni, and Bio). The ranking ranges from 1-4, that is very important to least important for a function (food or cash).

the introduction of maize to the area about 20 years ago changed this considerably. However, the cultivation of maize is constrained by the high cost of fertilizer. Rice and vegetables (tomato and onion) are grown as cash crops as seen in table 3, but in small acreages and cultivated mostly at the irrigated areas (MoFA 2007: 29). However, in term of area coverage; sorghum, groundnuts and millet in that order are widely grown compared to maize and rice as seen from figure 5 below:

Figure 5: Area Coverage (in thousand hectares) of Major Crops in the UER from 1997-2002

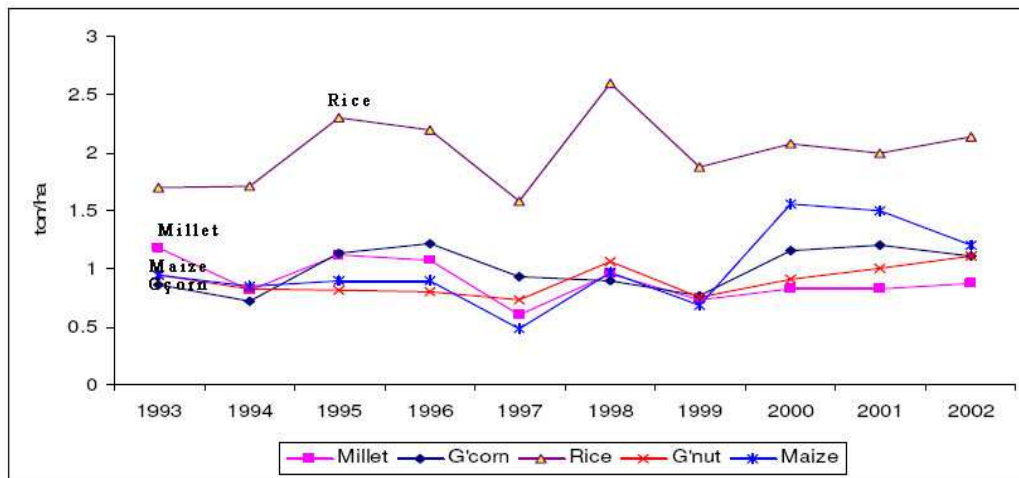


Source: Adopted from MoFA (2007)

Generally, land productivity is low in the region and fluctuates with the rainfall pattern (MoFA 2007:56) as seen from the figure 6 below. The comparatively high yields of rice than other crops is attributed to the use of inputs, and irrigated water used by farmers who have access to irrigation in the area.¹²

¹² Personal communication with MoFA staff in the KND 2008.

Figure 6: Trends of Yield per Hectare (MT/ha) of Major Crops from 1993-2002 of the UER



Source: Adopted from MoFA (2007)

3.2 The Debate on the Causes of Poverty in the Region

Two main lines of argument have been developed to explain the precarious conditions in the North in comparison with Southern Ghana: Resource endowment and socioeconomic. Firstly, the resource endowment fraction holds mainly the lack and short supply of natural resources, shift in geographic and hydrological conditions and climate change in the regions are responsible for it. The argument is old and is based on early travellers' reports (Eguavoen 2007:45), but studies also built such resource endowment ideas because its data collection stresses differences between the north and south in relation to climate change, hydrological and geographical constraints as well as the inappropriate water and resource management.

The second set of argument suggests that the north's historical experience differ from that of the south. Historical circumstances have led to exploitation and delayed political integration of the north with the rest of the country. Compared with the south, the north was systematically under-developed due to political decision making. The two lines of thought originate from the dichotomy between the resource endowment and socioeconomic arguments. Today, however, there is some consensus, that both natural and political conditions caused the present day poverty gap in the north (Codjoe 2004:124). The study area is a typical example of marginalised areas in sub-Saharan Africa

(SSA) where a combination of ecological factors and the legacy of development neglect by both colonial and post-colonial governments accentuate the poverty gap. As Whitehead (2002:578) puts it, the north has never been of great economic interest. As a consequence, less effort was made to develop the infrastructure and nonfarm income opportunities in the area.

3.3 Trends of Poverty in the Study Region

Compared to other regions of the country, the UER of Ghana shows higher levels of poverty. In 1999, 80% of the population of the UER fell into the nationally defined category of extreme poverty. This does not belie the national trend which clearly indicates (see table 2 above) positive changes, for the national population below the poverty line decreased from 52% to 40% in 1999 (Codjoe 2004:128). A study carried out in the KND of the UER in 2004, indicated that the average annual household income from farm to nonfarm activities was equivalent to 78 Euros (Codjoe 2007:1690).

The study area does not only face chronic poverty and environmental degradation but also failure in poverty alleviation efforts (ADB 2002:24). According to data from the Ghana Living Standard Survey (GSS 2002), the UER has the highest poverty rate¹³ of all administrative Regions in Ghana. The rate has increased from 67 % to 88 % from 1991/92 to 1998/99 (table 4 below). Recent studies on poverty in Ghana (Diao 2005); preliminary results of economy-wide multi-market simulation model constructed indicates that, the poverty rates in northern Ghana are very high and likely to remain high, if the past growth rates are projected into the future. As shown in table 4 below most of the regions registered a decline in poverty rate (during the period), however, the poverty rates in the UER are not only among the highest poverty rates in the country but also continue to rise and have been projected to remain at approximately 70 %, even if Ghana reaches middle income status by 2015.

13 See footnote 2.

Table 4: The Trend of Poverty Decline in Ghana; 1991/1992 and 1998/1999.

Region	1991/92	1998/99	% Change in 1998/99 From 1991/92	2015 (Projected)	% Change by 2015 From 1999
ACCRA	23	4	-83	2	-68
ASHANTI	41	28	-33	14	-49
BRONG-AHAFO	65	36	-45	12	-67
CENTRAL	44	48	9	20	-58
EASTERN	48	44	-9	33	-26
NORTHERN	63	69	9	57	-18
UPPER EAST	67	88	32	70	-20
UPPER WEST	88	84	-5	71	-16
VOLTA	57	38	-34	16	-58
WESTERN	60	27	-54	10	-62
NATIONAL, RURAL	64	50	-22	31	-38
NATIONAL, URBAN	28	30	-7	9	-53
NATIOANL, TOTAL	52	40	-24	24	-40

Source: Diao (2005:12)

3.4 Irrigation Development in Ghana and the UER

3.4.1 Large Scale Formal Irrigation Schemes

The development of LSI schemes¹⁴ is comparatively recent in Ghana and is described ‘transferred technology’¹⁵. The first scheme was initiated in the early 1960s (ICOUR 1995:26). The constructions of most of the schemes were supply-driven, regardless of whether interested smallholder farmers and with irrigation experience were available and willing to cultivate them. The notion of provision of irrigation services to ensure agricultural water supply and to increase agricultural productivity is taken as a major strategy by the Ghana government. The major justification for introducing LSI schemes to the region was to improve water productivity, to increase food production, so as to improve food security, reduce rural poverty and improve rural livelihoods in general. The plan for modernisation of irrigation systems was triggered by food shortages in the

14 Use of large reservoirs and large network of canals, laterals and sub-laterals

15 Bolding et al (2003) described transferred technology as one which social requirements for usage are external and users face social requirements and norms define by others.

region as a result of serious droughts in the region (GSS 2000: 6). In view of this, the construction of large scale state-managed irrigation systems was identified and implemented between 1965 and the 1980s. The implicit view was that the peasantry food production in the region would be complemented by these LSI project food productions (Liebie 2002:28).

There are 22 large scale formal irrigation systems in Ghana; of these only two are in the UER, the Tono and the Veia irrigation schemes. Most of these formal irrigation schemes as indicated in an IMF report (2006:35) are not performing as expected. Reasons given include operational and management difficulties as well as financial and economic problems which have not been addressed.

Tono is situated in the Kasena-Nankani district, while Veia is located in the Bongo District in the UER of Ghana (see figure 4 above). The projects are designed to assist small-scale farmers. Before the schemes were developed, much of the area was cropped once annually during the rainy seasons. The farmers living in the area were displaced so that the dam, canals and infrastructure could be constructed. Farmers within the scheme areas are able to grow two crops each year. Apart from the irrigation of crops and livestock watering, the two systems are the main sources of drinking water for the nearby urban and rural communities. The two irrigation projects, Tono and Veia cover areas of 2490 and 850 hectares respectively (ICOIR 1995:32). The project is being managed by Irrigation Company of Upper Region Ltd. (ICOIR). ICOIR is a Ghana Government organization established to promote the production of food crops by small scale farmers within organized and managed irrigation scheme.

3.4.2 Small Scale Informal Irrigation Systems

The hypothesis was that, the LSI schemes will stimulate agricultural productivity and remedy the food shortage, as well as induced the effect of poverty reduction in the region. This view placed more emphasis on the development of large scale irrigation schemes to the neglect of the SSI systems¹⁶. The focus of government policy under the Ghana Poverty Reduction Strategy 2 (GPRS phase 2) aims to reduce poverty by increasing agricultural productivity in the north. The question now is whether to

¹⁶ Use of small reservoirs consisting of small irrigable areas served by canals for the reservoirs and dugouts.

concentrate resources to the LSI schemes or expand dugouts, dams, and existing reservoirs to promote the development of SSI systems. In the Northern part of Ghana where long dry seasons and single unreliable rainy seasons prevail, a programme of construction of dugouts and small reservoirs (dams) has been implemented over the past few years to provide reliable water supplies to the local rural communities (IMF 2006:23). The SSI systems are considered ‘reproduced technology’¹⁷ as compared with ‘transferred technology’ for the LSI systems (MoFA staff interviewed)¹⁸. However, it is worth mentioning that apart from the LSI and SSI which are dominant and prominent in the region, there are also few small scale pumps systems (using motorised pumps) owned by individuals. The study seeks to focus on case studies of LSI, SSI and rain fed agriculture in the KND. The next chapter attempt to critically assess how the LSI scheme (Tono) and SSI systems impact agriculture growth and rural development in general in the study region.

17 ‘Reproduced technology’ described by Bolding et al. (2003) as one that has been consolidated as a result of a lengthy experiments and modification to adapt to both social relations and physical needs. This reproduction may occur locally from peasant to peasant or from society or interest group to another.

18 Personal communication with MoFA staff at KND, July 2008

CHAPTER FOUR

4.0 Agriculture-led Growth and Rural Development

Agricultural development led strategy is perceived as a process encompassing the attainment of several objectives simultaneously: A growth objective, an employment objective, a food security objective, a risk reducing objective and industrialisation objective (Abebe 2000:34). These objectives are only achievable based on agricultural performance in which irrigation led strategy is inevitable in a semi-arid regions like the UER of Ghana. This chapter discusses the differences between LSI and SSI strategies in the region in the light of these objectives. The arguments pursued in this chapter takes a critical assessment of the empirical studies: of crop production and productivity, management arrangement in the various schemes, investment and infrastructure, opportunities and constraints with regards to market conditions, credit and finance and the issue of land holdings and tenure arrangements, their implications for the KND in particular and the UER in more generally.

4.1 Crop Production and Productivity

4.1.1 Differences in Cropping Patterns, Implications for Marketing Arrangement

Cropping patterns for SSI and LSI farmers in the study area are almost the same during the wet season, for they all cultivate the same crops with regards to cereals but differ in the cultivation of dry season vegetables. They both (SSI and LSI farmers) cultivate rice, millet, sorghum and maize. Access to irrigation enables them to have two cropping seasons in a year (wet and dry), compared with rain fed farmers. Rain fed farmers on the other hand also cultivates millet, sorghum with few cultivating maize and rice. During the dry season, SSI farmers cultivate more of onion, pepper and okra and less of tomato compared with the LSI farmers. The reason given was that these crops require less fertilizer input and labour than tomato. It was revealed during the farmers 'group

discussions that most of the crop varieties grown by the SSI are local varieties that have local market but with very low yields¹⁹ when compared with the improved varieties cultivated by the LSI scheme farmers (Field interview with farmers, 2008).

The two systems (LSI and SSI) are almost similar in the types of crops grown. The differences lies in the cropping systems, cultural practices, input used and the support farmers receive from government and NGOs in the area as seen from the table below.

Table 5: Cropping patterns at the various schemes

Cropping system/practice	LSI scheme	SSI systems
Equipment for land preparation	Most of them use tractor service and other modern equipment provided by the scheme on credit	Most of them use the hoe and few use bullock plough
Application of chemical fertilizer and pesticides	Almost all of them	Very few could afford chemical fertilizer, but most use compost and animal manure
Planting material used	All use improved seed	Only few
Cultural practices	As prescribed by Management: Prominently, crop rotation, soils water conservation, specific cash crops	Farmer own decision: Intercropping, compost, also practice soil water conservation.

Source: Field interview with farmers (2008)

As indicated in the annual report of the region (MoFA 2007:34), it has been established that agriculture is the main source of income and entry point for development in the study region. However, LSI activities in the region as revealed in the group discussions are not yet fully integrated with rain fed cropping and other income-generating activities. In connection with this, beneficiaries farmers interviewed complained of cultivating crops that do not have readily market. They attributed part of the problem to decisions made by managers of the LSI scheme. Management ‘dictate’ particular crops to be grown by the farmer, normally called ‘cash crops’ (exotic crops presumed to have higher yields) and invariably most of these ‘cash crops’ do not attract local market (in the region) and depends on outside markets which are almost always not reliable and as such do not meet the expectations of the farmer. On one hand, as Booth and Mosley (2003:149) put it, modern varieties of food crops tends to require the employment of more labour than traditional varieties and to the extent that the labour thus absorbed is thereby moved from below poverty line. They go on to say, that, this may be an important channel of

¹⁹ Crop yields are calculated as total production divided by crop area.

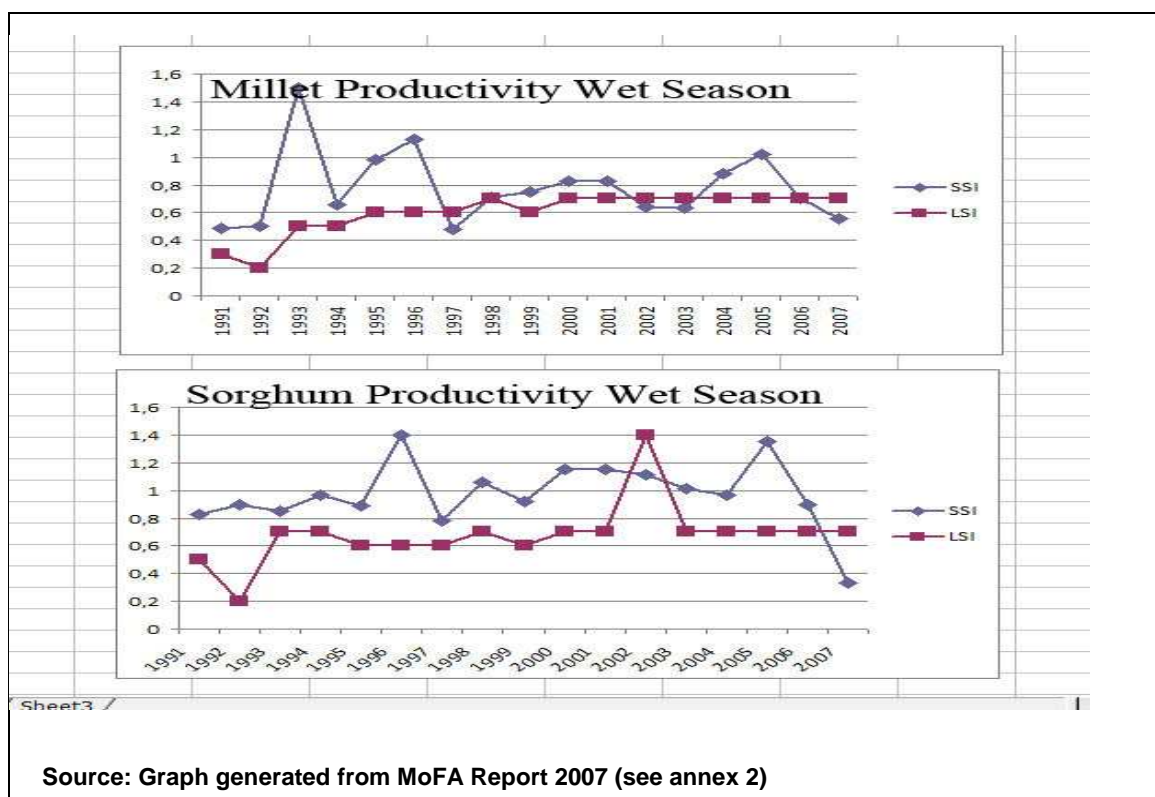
poverty reduction. On the other hand, Buchanan (1985:6) indicated that continuous expansion of production through high yielding varieties depends upon the proportion of income devoted to investment. He stated that, unless enough of the income which is generated is ploughed back into production, enough expansion will not occur to overcome the problem of unemployment. In a related argument Delgado et al. (1994:1170) indicated that, increments from high yields go for consumption in rural Africa rather than devoted for investment. In line with these views, do we continue to produce modern varieties (by LSI farmers) that have no market but have high yields or produce traditional varieties (by SSI farmers) that have comparatively low yields but have local market? As Acemoglu (2004:710) puts it, it is more appropriate to adopt a strategy that may be less productive but relatively safe in investment with opportunities like local market. With the SSI systems where the farmer makes most of the decisions, they tend to grow crops that they consume. From the interviews with farmers in the area, such crops (staple foods) do not have market problems. The reasons given for growing these so called 'cash crops' are the qualities of high yielding which will lead to the ultimate goal of multiplier effects but where the market is non-existent the expected multiplier effects as argued (income and employment) would not be achieved.

Finally, as asserted by Delgado et al. (1998) that many items consumed in rural areas are in fact nontradables. They indicated that, many of the nontradables are staple foods. They argued for example, that, policies that would encourage the production responses of producers of nontradables are important for two main reasons. First, an increase in nontradables would help capture the opportunity for additional income growth from the demand effects. Second, as income rise, supply of nontradables that people wish to spend additional income on would help prevent price increases that would put pressure on nominal wages. In line with these views, one could argue that, since SSI systems are faring well in staples like sorghum and millet, investing in them (SSI) could promote additional income to farmers in the study region. Furthermore, this might not only lead to increase in supply of staple foods in the area but might also reduce the level of poverty in the region.

4.1.2 Tradeoffs between Agricultural Productivity and Equity

Rural growth as asserted by Hasnip et al. (2002: 29) reduces poverty. They indicated that, rural growth depends on agricultural productivity. Agricultural productivity growth, they argued benefit rural people directly and indirectly. Direct benefits include increase production and marketable surplus and indirect benefits such as food security, health and nutrition and reduced outmigration. Evidence of improved levels of productivity resulting from irrigation in the study region, indicates that both LSI and SSI produce greater output and higher yields when compared with rain fed agriculture. From the records and interviews, it was revealed that average productivity (output/ha) for rain fed agriculture²⁰ is less than 0.5MT/ha. Considering the staple food crops in the area, SSI farmers on the average, comparatively do better than the LSI in millet and sorghum production as seen from figure 7 below.

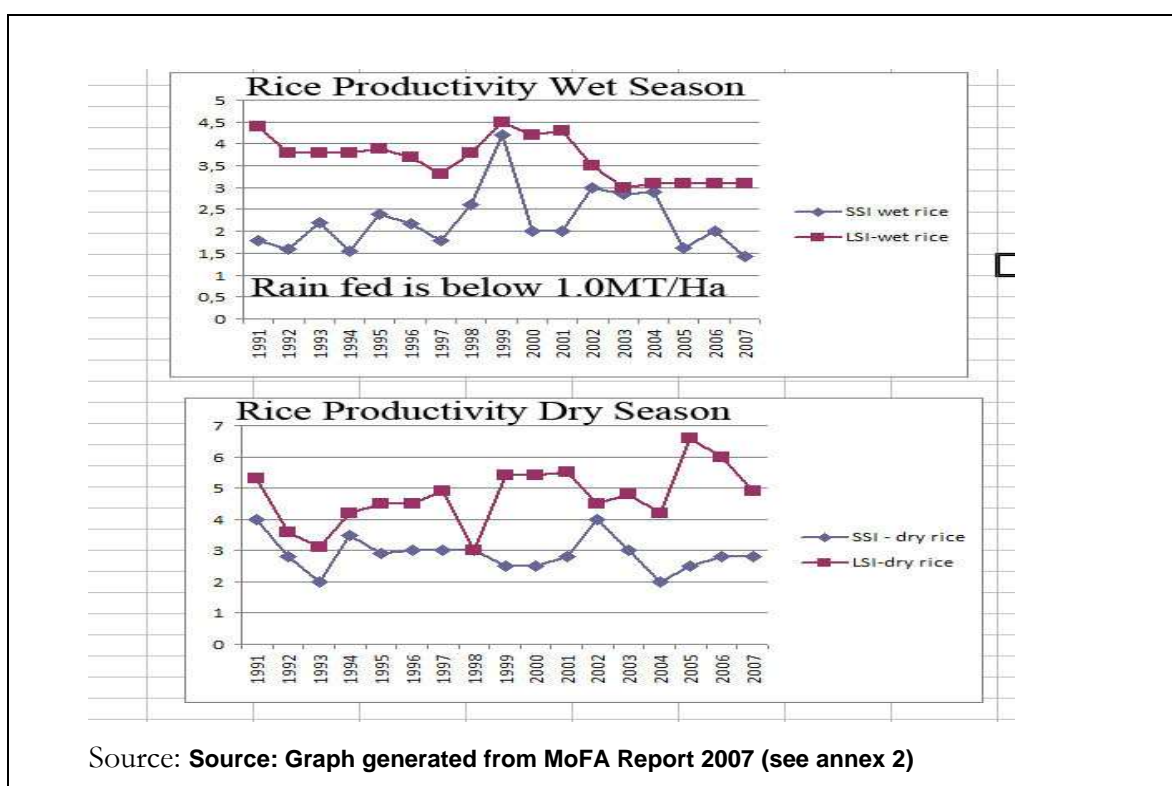
Figure 7: Productivity Trend of Millet and Sorghum for LSI and SSI in the study region (1991-2007)



²⁰ No available data for rain fed agricultural productivity during field visit.

However, when it comes to rice and maize, the LSI farmers also do better as seen from figures 8 below:

Figure 8: Productivity Trend of rice for LSI and SSI in the study region (1991-2007)

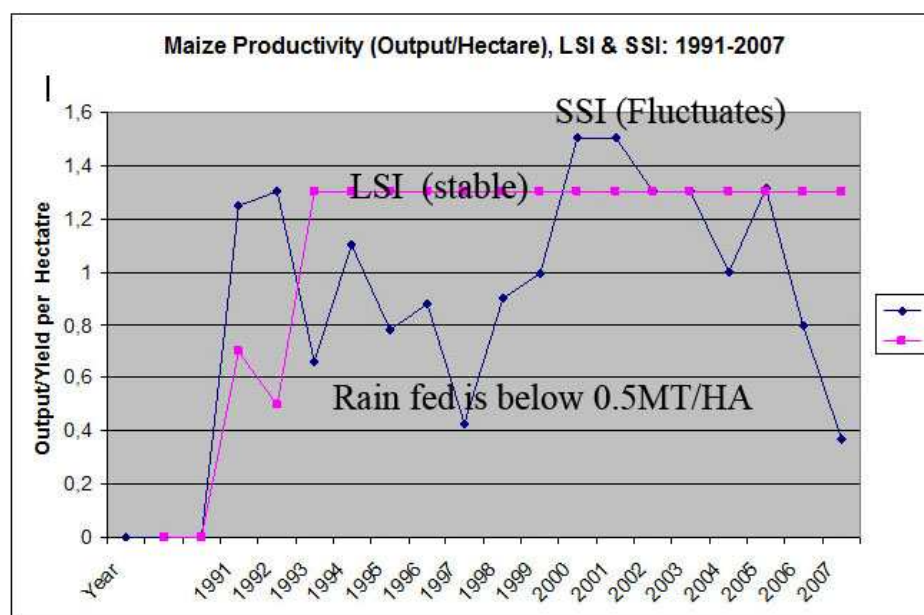


In addition to the high productivity both systems have two cropping seasons (wet and dry) in a year especially rice. In the case of maize production the LSI does better as seen from figure 9 below. A careful look at the productivity figures one will realise that even though LSI are given preferential treatment over the SSI in the area, the productivity of both systems (including livelihood outcomes) are the same²¹ with the SSI doing better in millet and sorghum (main staple foods in the area) while the LSI does well in rice and maize (high input demand crops). However, productivity trends as seen from the figures are more stable with the LSI schemes compared with SSI, especially in maize production. Though, the LSI farmers produce higher productivity as compared with the SSI, both systems does better than rain fed. This suggests that irrigation in general fare well in the region. Could one therefore not argue that, if low productivity of agriculture is seen as a major source of poverty in a region where there is a considerable deficit in food production within a context of widespread poverty, and LSI schemes for over 30 years

²¹ See Annex 1 in Appendices for outcomes of livelihoods features of LSI, SSI and Rain fed

have failed (both equity and efficiency²²) to address these problems, the SSI system might be a useful strategy.

Figure 9: Trend of Maize productivity for LSI and SSI in the Study region (1991-2007)



Source: Graph generated from MoFA Report 2007 (see annex 2)

4.1.3 Productivity not Necessarily Efficiency

The LSI produce greater output and high productivity compared with the SSI, however, as argued by Buchanan (1985:14), productivity is not enough for overall efficiency²³ assessment, neither the growth rate nor the rate of capital accumulation is by itself a satisfactory measure of investment efficiency. In line with this idea, one could argue that productivity should not be the only criteria to always give preference to the LSI schemes at the expense of the SSI systems. Production figure collected from 1987-2007 (MoFA 2007) indicated that, the SSI systems contribute about 25% of the KND food production and about 6% of the region's (UER). The LSI on the other hand contributes just less

²² Equity here refers to distribution of investible resources to larger population and efficiency means cost effectiveness

²³ The most widely accepted concept of efficiency is that developed by Vilfredo Pareto: A state of a given system is pareto optimal if and only if there is no feasible alternative state of that system in which at least one person is better off and no one is worse off (Buchanan 1985:4).

than 3% of the total food production of the KND and less than 1% of the region's (UER) as seen in table 6 below.

Table 6: Total Food Production per Main Food Crop during the periods 1987-2007 (Average MT/year/crop)

Crop	Region (UER)	District (KND)	SSI (Form 13% of Households)	LSI (form 1% of Households)	Rain fed (Form 86% of Households)
Millet	52997	12722	3220	300	9202
Sorghum	84670	11734	3034	200	8500
Rice	99156	10290	4800	2500	2990
Maize	7705	595	147	48	400
Groundnuts	78044	13226	3426	800	8000

Source: Author's own calculations based on figures of MoFA (2007)

From table 6 above, both LSI and SSI contribute about 28% of the district's (KND) food production and 7% of the region's food production. However, as seen from the table, only 14% of households have access to irrigation service (both LSI and SSI). This suggests that a vast portion of the region's food production is dependent on rain fed agriculture which is unreliable. Analysing based on the table; one can deduce that SSI and LSI contribute more than twice their representation (proportionally) in the area, probably due to high productivity discussed earlier. This suggests irrigation potential in the region is yet to be exploited to the fullest. Based on this, one could argue that investing in SSI systems might increase the access of households to irrigation in the region. This will promote equity (distributional justice) that might bring greater agricultural production, which in turn means more abundant, less expensive food for some segment of the poor.

4.2 Strategy for Rural Industrialisation or Equity

Agriculture remains the mainstay of the Ghanaian economy. Yet the fragility of this sector couple with high poverty incidence and low rural infrastructure pose several questions. The option of whether to invest in LSI schemes to have higher productivity and marketable surplus that might lead to multiplier effects for rural industrialisation; or invest in SSI systems to cover a larger population but lesser marketable surplus, is the issue of debate. The first option is perhaps as asserted by Saith (1985:3) more dynamic dimension pertains to the formulation of an appropriate strategy for affecting institutional transformation for 'rural industrialisation', while the second option is more of what Abebe (2000:14) described as 'social development', thus allowing the

participation of the people in developing their own lives. The question is which comes first? Rural industrialisation through economic growth, or a strategy of social development for equity, though they are all important?

The argument for embarking on rural industrialisation can be seen from two general, but not entirely unrelated, view points. Social development sometimes called 'autonomous' drive arise from the need to provide for people's basic needs, including health, education, sanitary facilities and housing. Fulfilling such requirements it is argued, are seen as inconceivable without the development of industrial base. Furthermore, when agricultural growth is projected some industrialisation is seen as needed to support a successful agricultural transformation (Abebe 2000:15). A second argument for embarking on large scale projects for rural industrialisation has a lot to do with colonial legacy. In this context, some level of industrialisation is required for nation building, for diversification of the local economy, especially northern Ghana, where there have been very low infrastructural development (Codjoe 2007: 127).

The two fundamental strategies are obviously not independent. However, in the context of a developing country where resources are constrained, investing in LSI schemes with the notion of 'trickle-down' (or multiplier effects), may be a limited option and unfortunately incompatible in a region where more than 80% of the people are poor (GSS 2005: 100) and cannot provide the basic human needs for themselves.

As Wuyts argued (1985:192), 'planning is not only a matter of technique, but rather a question of organisation of production and its dynamic process of change'. Indeed, based on this view, the implicit notion of agricultural modernisation through the allocation of investment resources within the rural economy has multiplier effects for the larger economy. Nonetheless, when this multiplier effects idea is not working as planned, the investment only benefits the few at the expense of the majority. This suggests that the peasantry as agents of rural development are left out, as in the case of the LSI systems in the UER where only the few (less than 1%) benefit. Meanwhile, these investments could effectively propel the process of local economic transformation if these social forces within the society are mobilised through a strategy that will encourage their participation. In a related argument, Hussain et al. (2002:60) explained with reference to case studies in Sri Lanka and Pakistan that household deprivation of agricultural water leads to other

socioeconomic deprivation whilst improved access can reduce the vulnerability of the poor. In the same vein, as Wuyts (2001:435) puts it, ‘food production for own consumption is an important factor to safe guard minimal economic security’. In line with these views and assertions one could argue that, investing in SSI systems as a first step to ensuring that at least the basic food needs of the people in the region are met might be a choice in the right direction. Beyond this, efforts can then be made towards putting up LSI for rural industrialisation; that is first things first priority. This idea seems feasible for the UER of Ghana where it is revealed that farming is not possible without irrigation as a senior officer (MoFA) remarked:

.....irrigation holds the key to survival of poor resource farmers in the district and the region as a whole, because rain fall in the region is not reliable and the trend has been erratic over the years. Because of the importance attached to irrigation agriculture in the district and the region it has been nick named ‘red cocaine’. –Mr Solomon Adda, District Officer, MoFA. KND, July, 2008

Indeed, LSI system is a vital tool for rural development and introducing the technology has more advantages than disadvantages. But where resources are limited and are not possible to get it across to all communities, a need for a technique/strategy that can reach many people is imperative. Ravnborg et al. (2007:175) asserted that, there are many instances in Africa where poorer people have lost vital livelihood systems because government planning concentrated resources to LSI schemes that cover smaller percentage of the population, denying the majority of the people access to agricultural water to live dignified lives. This assertion is in line with the current situation in the UER of Ghana. For instance, it was revealed during the field interview that, only 13% of their communities in the UER have access to SSI apart from the two LSI schemes (Tono and Veaa). In many cases, several communities (three or more) have access to the same reservoir. This means that, 87% of the communities in the region do not have access to irrigation facility and rely on rain fed which is unreliable. At the district level most of the districts have less than 13% of their communities that have access to irrigation facility, with the exception of the KND which has 20% of their communities having access to reservoir as seen from the table 7 below:

Table 7: Availability of Small Reservoirs (dams/dugouts) in the Upper East Region

District	Bongo	Bawku-West	Garu-Tampane	Bawku-Municipal	Kassena-Nankana	Builsa
Total population	118,871	176,214	161,851	238,495	228,113	94,605
No. of communities	199	173	212	286	326	158
Population/community	597	1,019	763	834	700	599
No. of comm. with reservoirs	20	20	20	28	65	19
% comm. with reservoirs	10.1%	11.6%	9.4%	9.8%	19.9%	12.0%
No. of dams	21	20	21	36	66	20
Population/reservoir ratio	5,661	8,811	7,707	6,625	3,456	4,73

Source: Birner et al. (2005:11)

4.3 Management Arrangements in the Various Schemes

Management arrangements are based on the decisions that are made of who does what. Decisions on management arrangements of irrigation projects are of two types (Carter 1993:7):

- (1) Decisions on investment and maintenance of infrastructure
- (2) Regulatory decisions regarding water use, type of crop to grow and cultural practices.

State-managed schemes are generally associated with top-down approach where management or government officials make most of the key decisions, whereas farmer-managed schemes involve the farmers themselves. The debate on which is the best have their own arguments, and generally depend on the situation in question.

The debate, as identified here is between formal or state-managed schemes (LSI) on one hand and the informal or farmer-managed schemes (SSI) on the other. As asserted by Bolding et al. (2003:110), government officials of state-managed schemes tend to prescribe certain crop production practices (see table 8 & 9 below) towards the attainment of the goal of maximising government investments. On the farmer-managed schemes, they argued that farmers approach is more of their livelihood strategies in which their experiences play an important part (ibid). They stated further, that, farmers are less inclined to involve scientific validity in their activities. In view of these lines of argument the Tono irrigation project in the study region revealed that government agronomist's design cropping pattern based on what they described as 'economic and

technical imperatives'. It is true that some decisions such as repair works, infrastructural maintenance may require technical know how (see table 8 & 9 below) and needs active role of management, but decisions such as type of crop to grow and cultural practices should require farmer participation since they are the beneficiaries.

Table 8: Decisions on investment and maintenance of infrastructure in the study area

Decisions made/Actors	LSI scheme	SSI scheme
Decisions on levy charges	ICOUR management	Farmers
Cleaning sub laterals, field drains and field bunds	VCs (Village committees) ²⁴	farmers
Maintenance of infrastructure	ICOUR management	farmers
Repair works	ICOUR management	farmers

Source: Field interviews (2008)

Table 9: Regulatory decisions of the various schemes in the study area

Decisions/Actors	LSI scheme	SSI scheme
Irrigated land and water allocation	VCs (Village committees)	Farmers
Crop to grow	ICOUR management	Farmers
Cultural practices	ICOUR management	Farmers

Source: Field interviews (2008)

As seen from tables 8 and 9 above most of the decisions are carried out by management thus a top-down approach. One argument for justifying the top-down approach in state-managed projects is to encourage mechanised farming with the 'modern technology' which is perceived to have higher output (IMF 2006). In a similar argument by Carter (1993:5), SSI systems are 'low technology' and hence low output, and that cannot produce enough surplus for multiplier effects. It is true that spreading resources does not always yield marketed surplus and may not be the best alternative since it does not guarantee the higher growth potential. Nonetheless, is also true as Wuyts (1981:12) argued, that, concentrating resources does not always provide higher output market surplus for a given investment, though it is more likely to maximize productive resources for a given investment. Notwithstanding that, investing resources on a project of higher returns which cannot alleviate the crises of the peasantry as in the UER of Ghana, but a deteriorating situation, requires a change of focus. The type of management arrangements in place has its own implications and these can cause problems or create opportunities for agricultural production and productivity, cropping patterns, marketing

²⁴ Village committees composed of small scale farmers formed in all villages belonging to the LSI scheme.

conditions, credit and finance as well as investment and recurrent cost. We shall discuss these issues based on the analysis of the current conditions in the UER of Ghana.

4.4 Investment and Infrastructure

From the previous discussions, it is not in doubt that, irrigation is vital resource for agricultural growth in the study region. One could argue that, if LSI could contribute more if extended to other parts of the region, and then why not construct more of such schemes? Such an argument is only feasible when we have abundant resources, but this is not the case in Ghana when government experiences chronic budget constraints. For instance, it will cost about 27 million US dollars to construct a modern LSI²⁵, and it will also cost about 1.6 million US dollars for the maintenance of a 1km canal (Interviews and data of past records). Operational cost for the LSI scheme is about 1.1 million US dollars per year (ICOUR, 2007: 6). With SSI systems, it will cost about 1.3million US dollars to construct a small reservoir with a recurrent cost of 88,500 US dollars for maintenance every year (Birner et al. 2005: 35). This suggests that, with the limited resource and the comparatively cheaper cost, extending SSI to rain fed areas could increase irrigated agriculture at a much lesser cost than LSI. For instance the management of ICOUR complained that, most of the canals of the LSI (Tono irrigation scheme) have deteriorated and needs rehabilitation, but due to the budget constraints, government have over the years have not done anything about it.. However, with the farmer-managed (SSI) systems in the region, it was revealed that the maintenance and rehabilitation of the reservoirs for SSI are absolutely carried out by the local communities. This suggests that the SSI systems are more sustainable with regards to the infrastructural and water resource management compared with the LSI systems in the area. This means with the informal-managed systems some responsibilities such as maintenance are taken away from government which makes SSI systems farmer owned and sustainable.

According to Ravnborg et al. (2007:168), raising productivity and market surplus will require investment in transportation, communication, capacity building and education, but budget of government in developing countries in most cases do not prioritise these

25 Figures are estimates based on interviews of ICOUR management at KND, 2008.

issues, as they are externally financed and not sustainable in the long run. They indicated that, partnership with community based groups, civil society, NGOs and service providers, could help make farmers this transition come to reality. SSI systems they added are generally favoured by these agencies and organisations in the rural areas in most developing countries. In connection with this argument, it suggests that introducing SSI systems to rural areas will most probably get the needed support to promote rural development projects and programmes as compared with the LSI systems which does not win such support and depends solely on government funding which is not sustainable. One could therefore argue that, promoting SSI systems do not only spread resources to the larger population, but could also attract the needed support for its sustainability for rural development. As revealed in the study region with regards to water resources management, the Ministry of Food and Agriculture (MoFA) has played a major role by implementing the IFAD-funded LACOSREP²⁶ projects which supports the construction and rehabilitation of small dams for SSI and promote irrigated vegetable cultivation in the region. The District Capacity Building Project (DISCAP) is funded by the Canadian International Development Agency CIDA, are examples of private sector involvement at the level of donor-funded projects for promotion of SSI systems in the region.

The point is that, Ghana being a developing country with ‘weak economy’²⁷ it might not be feasible with regard to the high cost involved in LSI operation to make it sustainable.

4.5 Differences in Marketing Conditions and Lack of Access

Food crop marketing constraints according to Ellis and Ade (2005: 65) is of two types; namely, those factors that constrain food crop marketing and those that constrain households from producing surplus for the market. They further stated that, factors that constrain food crop marketing include low fluctuating price, high transport cost, untimely payment of farmers for their produce, high input cost, and unavailability of input and lack of credit. These views tend to support the marketing conditions and lack of access to market in the study region during the field interviews and farmers’ group discussions as seen from table 10 below.

26 The Land Conservation and Smallholder Rehabilitation Project (LACOSREP)

27 Ghana per capita income as at 2005 is US\$380 (IMF 2006).

Table 10: Farmers Responses to Marketing constrains in the KND of the UER of Ghana

Marketing constrain encountered by farmers in the study area	LSI famers: Frequency of responses in percentage		SSI farmers: Frequency of responses in percentages	
	Major problem?	Minor problem?	Major problem?	Minor problem?
Low and fluctuating prices	90	10	90	10
High transport cost	80	20	20	80
Unreliable outlets	80	20	10	90
High input cost	100	-	100	-
Lack of credit and finance	20	80	90	10

Source: Field interviews and group discussions with farmers (2008)

As seen from the responses of the farmers from table 10 above, it is shown that low prices of farm produce and high input cost to be a common major problem facing all farmers in the area. Secondly, as seen from the table, though both LSI and SSI face marketing constraints, LSI farmers responded to almost all the constraints as major problems with the exception of credit and finance. This suggests that, the impact of marketing constraints on farmers in the area is greater on LSI farmers as compared with SSI farmers. The implication of these as reported (ICOUR 2007:55) is that there have been reduced crop area cultivated in the scheme covered areas from 102ha in 1996 to 38ha in 2004 and there had also been reduced productivity (land productivity) from an average of 1.2MT/ha in 1997 to 0.7MT/ha in 2007. This indicates how serious the impacts of these problems affect LSI schemes as compared with the SSI systems. These empirical findings tend to support the earlier argument that market is a crucial precondition for agricultural led growth strategy, hence for growth linkages to lead to multiplier effects require the existence of internal market. Again, this goes to support the earlier argument that, productivity should not be the only criteria for investing in a strategy but other factors such as market should also be considered. As argued by Acemoglu (2004:38-39), development goes hand in hand with the expansion of markets and better diversification opportunities. However, given the poor infrastructural development and weak market integration in the study region, capturing the peasant surplus may be difficult. In connection with these views, it means producing for an assumed internal market (see questionable assumptions argument) that is very small or non-existent, does not only retard development but also serves a disincentive for farmers. As Delgado et al. (1998) put it, resources are assumed to be underemployed if

there is insufficient demand to purchase what the resources produce because of remoteness or poverty. This assertion seems to apply to the study region where for instance tomato cultivation is the main cash crop produced during the dry season by most LSI farmers at the project site. Production usually exceed demand (see table 11 below) and the perishable nature of the crop and lack of storage facilities causes huge losses to farmers.

Table 11: Total Yield and Marketed Yield of Tomato Production in the Kasena Nankani District of the Upper East Region

Year	Marketed Yield	Total Yield
1999/00	10.6MT/ha	15.0MT/ha
2000/2001	10.5MT/ha	15.0MT/ha
2001/2002	11.9MT/ha	15.0MT/ha
2002/2003	1.3MT/ha	15.0MT/ha
2003/2004	5.7MT/ha	15.0MT/ha
2004/2005	10.7MT/ha	15.0MT/ha

Source: (ICOUR 2007:43)

From the above analysis, it is shown that, these factors do not only constrain food marketing but also constrain households in the area from producing surplus for the market. Furthermore, a strategy of investing in LSI schemes vis-à-vis the unwarranted neglect of the larger population, could have a delimited effects on overall potential growth where there is no access to market.

4.6 Finance and Credit and Lack of Access

The study area (KND) is part of the wider regional scheme that include credit component to farmers. The only commercial bank (Ghana commercial Bank=GCB) and a rural bank in the district capital give credit to agricultural producers, on conditions that need to be met. Farmers must have collateral security for the loan and must also be in groups. Most farmers find it difficult to meet these conditions. Besides, the interest rates according to the farmers are very high (25%-35%²⁸) and makes repayment difficult. As revealed during the group discussions and interviews, most of the LSI farmers in the study area apply fertilizer and herbicides. According to the farmers, ICOUR insists on their use and play active role in securing these inputs for them. These they say, are sold on credit to them which is paid back in cash or in kind (with the produce when

²⁸ Personal communication with some bank officials from the area gave out these figures.

harvested). However, this is becoming a problem because, according to ICOUR report (2007:64), credit recovery rates have declined from 94% in 2001 to 59% in 2006 due to high input cost and low price for farm produce.

The implication of lack of access to credits coupled with high input cost discussed earlier has negatively affected agricultural productivity (land and labour productivity) in the area. This is because farmers cannot either purchase inputs for their farms or will have to buy on credit. Availability of credit and finance often unlock a constraint on the ability of households to hire labour and buy inputs (Booth and Mosley 2003: 154). However, the lack of access to credit in the study area compelled farmers to buy inputs on credit. To pay back, they are also compelled to sell their produce immediately after harvest at the risk of low price. This makes farming less lucrative²⁹, as some of the farmers complained that they sometimes cannot recoup what they have invested. This suggests that, the aim of increasing productivity through the LSI is a problem in the area. What this means is that, the lack of access to credit and finance compel farmers to produce without applying the needed inputs for high productivity and market surplus. The question is, how can farmers produce beyond the subsistence level if they cannot access credit that will enable them buy inputs? On these bases, one could argue that, producing at subsistence level might not yield the market surplus at the prevailing conditions at the study region. Therefore the ultimate goal of reducing poverty through multiplier effects by LSI schemes is an 'uphill task' to say the least.

4.7 Land Tenure Arrangements

Land is such a crucial factor in agricultural production and particularly in food crop intensification. Issues pertaining to land under cultivation: land acquisition, current status of land, land control and prospects for expansion of cultivable land are pertinent to the prospects for food crop intensification. This was discovered in the KND during interview and group discussions with farmers from the area as seen from table 12 below:

29 Focus group discussions with farmers at Korania, July 2008.

Table 12: Farmers responses to land tenure arrangements in the KND of the UER

Land tenure arrangements	LSI farmer responses	SSI farmers responses
Land acquisition	Rented land	Family land, inherited land
Current status of land	Rented land	Individual owned, use right community
Land control	Need permission	Full control

Source: Field interviews and group discussions with farmers (2008)

In the study region, communal ownership is the norm, indeed throughout the northern parts of Ghana. Once land has been cultivated by a family, it is recognised as the property of the family which can then be inherited in future. New lands can be acquired from the village chief or Tindana (traditional land lord) (Birner et al 2005:36). During the field visit most of the SSI and rain fed farmers in the area acquired land through inheritance. Thus family land was the major source of acquisition. The land tenure situation in the LSI (Tono scheme) is quite different. According to ICOUR (interview), the land was formally state property, but it is now rented³⁰ out to scheme famers on 5 years basis with priority given to farmers who were displaced during the construction of the infrastructure.

Ellis and Ade (2005:188) asserted that many LSI projects have poor performance because of land scarcity and inputs constraints. They further stated, that, the presence of LSI projects in most developing countries have increased the pressure for agricultural land. They indicated that, this has adverse effects on the poor especially women. They added that, in Africa where customary tenure predominates as the means for gaining access to land, LSI schemes have displaced original custodians of the land and making such lands available to others, this have resulted in conflicts that indeed affected the performance of such projects. A study carried out in the region (Diao 2005) indicated that, land is a limiting factor for the LSI schemes compared with the SSI systems. In connection with these arguments, and the recent interviews and group discussions with farmers in the KND there is an indication that land conflicts are threatening the sustainability of the project (Tono irrigation project). Based on these revelations and arguments, suggests that extending irrigation to other parts of the region could be more appropriate with the SSI strategy, where these inherent land problems in the area are

³⁰ Rent here refers to service fee for use of the land

easily addressed when compared with the LSI schemes. Secondly, as indicated in the interviews, most of the SSI farmers have full control of land they cultivate since they are inherited (see table 12 above) and can therefore implement any policy changes on the farm without any hindrances.

CHAPTER FIVE

5.0 Livelihood Strategies and Peasant Differentiation

5.1 Introduction

This chapter aims to demonstrate how rain fed agriculture and forms of irrigation generate different livelihood strategies and their impacts on peasant differentiation in the study region. The previous chapter showed that irrigation is crucial for agricultural growth and rural development, but demonstrated that, a broad based approach or strategy is more appropriate to address the current problems in the study region. This chapter looks at the different livelihood strategies and their implications for the socioeconomic and physical environment in the study area. The chapter also uses the concepts of livelihood strategies and peasant³¹ differentiation to posit that, agriculture with or without irrigation, and the nature of irrigation do not only affect rural livelihoods but, can generate some degree of differentiation within the peasantry.

To analyse the different rural livelihood strategies carried out by households in the region, this chapter uses a livelihood approach to demonstrate how access to irrigation and forms of irrigation fits into farmer livelihoods, is important in irrigation studies. The chapter attempts to come to terms with the diverse livelihood strategies based on the differential access to resources, inputs, market and differential treatment of farmers.

5.1.1 The Sustainable Livelihood Framework

The Sustainable Livelihood Framework (SLF) approach as used in this study (this chapter) is to analyse and assess the impacts of irrigation technology. It helps to understand the opportunities and constraints that farmers are facing which may influence dynamic in assets and livelihood strategies. The goal of agricultural led growth strategy is

31 A peasant as defined by Momba (1985:281) "A peasant is a person whose subsistence depends on having some rights to land and the labour power of his family members' resident on his land. He produces primarily for consumption although he may produce some surplus to meet his rent, ceremonial and other obligations".

to increase food production with broader aims of improving livelihoods and reducing poverty. The SLF used in this study describe a more accurate picture of stakeholder assets and activities and intervention in the context of blocking or enabling pursuit of more secure livelihood over time. A livelihood is defined by Chambers and Conway (1992) as ‘the means of gaining a living, including livelihood capabilities, tangible assets and intangible assets’. One important characteristics of this definition is that it looks at the connection between assets and activities which result in options people have and their strategies for survival.

A livelihood strategy as defined by Ellis (2000:40) refers to household activities (either farm or nonfarm or combination of both) that generate the means of household survival. So livelihood strategies are set of life sustaining productive activities undertaken by rural households. These set of activities as identified by Kalunde (2008:103) can be broadly classified into three main categories: agriculture intensification (increasing farm yields) and agriculture extensification (increasing farm size), income diversification (through engaging in a range of off farm activities) and migration (temporary or permanent, partial or whole household). Even though it is possible to classify households’ strategies into three main groups, household livelihoods strategies are complex and as a result, household members may be engaged in more than one strategy at any one time.

Livelihood strategies as Ellis (2000:17) puts it are a process that leads to outcomes that encompass many types of impacts and for the interest of this study is that of poverty alleviation. Outcome can include vulnerability and improvements in other aspects of wellbeing such as feed back effects on vulnerability status and assets base. According to Devereux et al. (2003), sustainable and vulnerable livelihoods are both adequate in food stocks and income, but while a sustainable livelihood is resilient to shocks and trends, a vulnerable livelihood is not. On the other hand, a household with unsustainable livelihood, lacking adequate food supplies, has little or no income and hence is highly susceptible to shocks and trends.

5.1.2 Peasant Differentiation

Peasant differentiation in this context is defined by Momba (1985:281) as ‘a process in which as a result of the intensification of commodity production a peasantry experiences internal contradictions in the form, for example of economics stratification, gradual

concentration of wealth in fewer hands and a struggle for survival by the larger segment of the population'. As asserted by Abebe (2000:181), differentiation is a complex process involving social, economic and political relations. He further stated, that, differentiation may be symptomatized by a number of diverse indicators that basically involves the profile of household relative positions in the distribution pattern of assets and exchange process. In his assertion, he added that, a number of mechanisms (in this study a strategy of concentration or spreading investment resources) make it possible for some groups to capture new opportunities while others miss or are negatively affected by them.

5.2 Differences in Livelihood Strategies in the Study Region

Farm households in the study area are engaged in farm or/and nonfarm activities, or eventual out-migration. The farm sector as discussed in previous chapters comprises crop cultivation, animal rearing and vegetable cultivation in gardens and irrigated plots during the dry season. The nonfarm sector comprises all non-agricultural activities, such as self employment in trading, artisan works and extraction of natural resources such as fishery and mining as seen from table 13 below.

During the field visit it was revealed from the group discussions and interviews that livelihood activities (based on the livelihoods framework³²) are grouped into four categories in the study area with majority of the households in crop production as seen on table 13 below. Firstly, agriculture farm based is the largest livelihood activity in the area suggesting that irrigation is inevitable in a region that is drought prone. Secondly, it also suggests that the rural economy in the region is highly undiversified³³. This means diversification opportunities in the area are limited, and having alternatives for income generation are also limited. As Acemoglu (2004:275) puts it, heavy reliance on agriculture is a symptom of undiversified economy. He goes on to say that, such economy, non agricultural activities are subject to large uncertainty and limited growth. It is also argued that, where diversification opportunities are limited, exiting activities will bear more of the diversifiable risks (ibid). In line with this view, it could be argued that

³² Bebbington (1999), Scones (1998), Carney (1998), Ellis (2000).

³³ There is a critical difference between household level diversification and area diversification. Household can have diverse activity portfolio (within undiversified economy) with individual household members either specialising in a single occupation or taking on multiple occupations (Ellis 2000:232)

investing in a strategy that will have a broad based risk-reducing effect on existing activities may be appropriate.

Table 13 Livelihoods Diversification of the Upper East Region of Ghana

Livelihood Category	Main Economic Sub-Sector of Livelihood	Livelihood Groups with Main Sources of Income	Percentage (%) of Households Adopting this Livelihood
Agriculture Farm-Based Production Livelihood	Crop Production	Cereals Producers Vegetable Producers Legumes Producers	62.0%
Agriculture Nonfarm Production Livelihood	Agro-Processing Agro-Input Agro-Trade	Small Millers Donkey/Bullocks Service Agriculture Input Dealers Livestock and Poultry Traders	6.0%
Nonfarm Based Livelihood	Diverse	Salary Workers Artisans Traders Petty Traders	26.0%
Natural Resource Based Livelihood	Fishery Forest Products Mining	Fresh Water Fishing Fish Mongers Charcoal Producers Illegal Mining Operators Firewood Traders Honey Collectors	6.0%

Source: Extracted from (MoFA 2007:58-60) Annual Report of the Upper East Region of Ghana.

However, there are different adaptation strategies among the LSI, SSI and rain fed agriculture in the area. From the group discussions and interviews, SSI and rain fed farmers prefer local variety to the improved varieties. Respondents indicated that, local varieties are drought resistant and do better in poor soils as compared with the improved varieties. SSI and rain fed farmers do intercropping (different crops on a plot), unlike their LSI counterparts who engage in crop rotation and monocropping instead. One could therefore argue that, introducing the most appropriate form of irrigation strategy that can cover the larger population could be an effective means of alleviating poverty in the region.

Livelihoods in the study area are regulated by the dry and wet season, with the wet season being the domain of farm activities while the dry season abound with both farm and nonfarm activities as seen from the table 14 below.

Table 14: Livelihood Strategies of Farmers in the KND during the off-season

	SSI livelihood strategies	LSI livelihood strategies	Rain fed livelihood strategies
Farmers' responses to livelihood strategies	<ul style="list-style-type: none"> • Land use intensification & intercropping • Rearing more goats than sheep and cattle • Onion, pepper, water melon are commonly cultivated • Fish farming • Petty trading 	<ul style="list-style-type: none"> • Land use intensification & crop rotation • Rearing more sheep and cattle than goats • Tomato, onion commonly cultivated • Fish farming • Petty trading 	<ul style="list-style-type: none"> • Out-migration • Illegal gold mining (commonly called 'galamsey') • Rearing more goats than sheep and cattle • Sale of firewood and charcoal • Petty trading • Change of diet

Source: Focus Group discussions with farmers in the KND, (2008)

Irrigated farmers tend to carry out almost the same livelihood strategies but differ in terms of tomato for LSI farmers and water melon for SSI as well as intercropping for SSI and crop rotation for LSI farmers. Rain fed farmers on the other hand are engaged in out-migration, illegal mining, firewood and charcoal business (see table 14). The results indicate that households with access to irrigation are more into crop farming and agricultural related activities. However, Rain fed farmers on the other hand is more into natural resource based livelihoods and out migration.

5.3 Implications of Livelihood Strategies for the Environment

Data from empirical studies (Ravnborg et al. 2007:156) show that major sources of growth in crop production for all developing countries during 1961-1999 indicate that: yield increases (71%), area expansion (23%) and cropping intensity (6%). From the data it indicates that area expansion is largely carried out as compared with cropping intensity. The report reveals that the expansion of cropping land is encroaching into marginal lands as a result of agricultural land scarcity. To help arrest this problem it was suggested in the report that cropping intensity should be encouraged, which is only possible by introducing irrigated agriculture to rural areas in developing countries. In connection with this idea is the revelation during the field interviews with 15 rain fed famers in the KND, of which 13 (88%) of them responded that they increase production output by area expansion compared with 3 (25%) of 15 irrigated farmers interviewed, while 12 (75%) of the irrigated farmers increase production output by cropping intensity. It is also reported (MoFA 2007:61) that more than 26% of agricultural production growth is

attributable to expansion of crop land in the region. As indicated in the report, farmers give priority to the expansion of their farm size instead of intensification. One can therefore argue based on these facts that, extending irrigation to other parts of the region can increase cropping intensity and reduce area expansion and as well as reduce degrading of marginal lands as reported. Extending irrigation to other parts of the region therefore means widening people's options and reducing reliance on natural resources as earlier indicated. SSI systems could be more feasible, considering the high investment cost of LSI schemes compared with the SSI systems, and the resource constraints of government budgets discussed in the previous chapter. Furthermore, the study region as reported (MoFA 2007) experience torrential rainfalls for very brief periods (2-3 months) with a long dry periods (7-8 months). As a result, calls for new approach for water management to make use of rainfalls of these short periods that normally causes flooding cannot be overemphasised. Employing SSI strategy will mean harvesting run off water (during the rainy season) that for a vast area go waste rather than the LSI that is only limited to few places. Such a strategy will implicitly not only increase household access to agricultural water but, will also contribute to poverty reduction in the study area.

5.4 Differential Access and Peasant differentiations

5.4.1 Differential Access to Production Resources

According to Hussian and Hanjra (2004:6), where there is equity in resource distribution, the impacts of irrigation on agricultural productivity and growth have been more towards poverty reduction. The distribution of water and land sometimes tend to create inequality in LSI systems (canals water supplies are inequitably distributed) compared with SSI systems. Differential access to land and water lies at the basis of the social and economic differentiations among farmers (Kalunde 2008: 104). In connection with these views in the study area as discussed in the previous chapter (see table 12), the acquisition of land at the LSI scheme area is by paying service fee for use of the land, the capacity to cultivate more land will depend on your ability to pay for the service fee³⁴ for using the land for particular season. In this case the rich farmers³⁵ afford to pay for the service fee

³⁴ This service fees is not rent, but only for maintenance of the scheme project infrastructure.

³⁵ Farmers who have access to assets and opportunities

for large acreages and hence benefit relatively more than those who cannot. This however, may continue to widen the inequality between the rich and the poor in the area. However, the SSI areas in the region, farmers do inherit lands or can negotiate with neighbours for farm lands unlike the LSI scheme area where there is no such negotiation but purely on the ability to pay, which favours the rich.

From the interviews and group discussions, all the farmers in the area rely more on family labour, however, it was disclosed that during the peak season extra labour is required. It was revealed during the discussions that SSI and rain fed farmers largely fall on communal labour (mobilise labour from relatives and friends), while LSI farmers mostly fall on hired labour for specific activities such as weeding and harvesting. In the communal labour, those who can provide food and drink for participants get the services as well as those who can pay for the hired labour. The rising cost of providing food and drink and wages makes it difficult for the poor to afford as was disclosed during the group discussions, and therefore rely heavily on family labour. The results as revealed from the group discussions suggest that the poorest (the most vulnerable) are largely the rain fed farmers in the area (MoFA 2007), and they are the most disadvantaged. It can be argued from the above illustrations that, the SSI systems can be more pro-equity and poverty reducing instrument than the LSI systems, especially in the UER of Ghana.

5.4.2 Differential Access to Inputs and Market

Differential access to inputs such as fertilizer and tractor service during the group discussion clearly show these differences. The commercial farmers among the LSI farmers cultivate an average plot size of 10ha per famer while the small scale farmers have an average plot size of 0.5ha. With regards to yield (land productivity), the commercial farmers as reported have average yield of 5MT/ha (rice) as compared with the small scale farmers who have an average yield of 2MT/ha (Group discussions with farmers at Gaani). These differences in yields are translated into income. The reason for the differences in yields is because the poor farmers apply less inputs than required hence lesser yields compared with the rich farmers³⁶. This revelation tends to support Kalunde (2008:117) claim, that LSI schemes often encourages the use of expensive inputs, and this creates difficulties for households without access to capital or credit. This assertion

36 Personal communication with MoFA staff in the KND, July 2008

tend to support the earlier discussion in the previous chapter that LSI schemes cropping pattern is mostly decided by management where farmers are compelled to use fertilizer but with the SSI, it is optional and farmers who cannot, tend to use animal manure instead. It is arguable, that, increasing land productivity is only by use of chemical fertilizer. As Bolding et al. (2003:53) puts it, animal manure could meet the problem of soil fertility and avoid the difficulty of buying chemical fertilizer by the poor. Secondly, the burden of high cost of fertilizer in which the poor cannot afford makes it difficult for them to participate in the LSI scheme and therefore widen the inequality between the rich and the poor.

The LSI management do provide input credit to scheme farmers which they pay back immediately after harvest either with cash or produce equivalent to the credit. The poor SSI and rain fed farmers on the other hand who obtain seeds and inputs on credit also do sell their produce immediately after harvest in order to pay back debts and become eligible for future credit next season. Being compelled to sell immediately after harvest where there is abundant supply risks the attraction of low prices and depressed incomes. Rain fed farmers harvest less (low yields) compared with SSI and LSI farmers (MoFA 2007:22). By selling greater part of their produce, they tend to re-purchase the same produce at higher prices during the rainy season. These trends tend to impoverish them the more. The result is that the rain fed farmers in particular, as was revealed, tend to exercise less and less control over their livelihood. On the other hand new opportunities help the well off to exercise more control over not only resources but also the livelihood of others. For instance in the study area, absence of viable employment opportunities has led to some farmers who need money, to work for the well to do, others in extreme cases give away their children and wives as labourers in return for food³⁷.

Indeed, there is general lack of market in the study region, during the group discussions it was revealed that, some of these well to do farmers sometimes buy from fellow farmers at very low prices and go to sell elsewhere for profit. What this means is that the differential access to inputs, market and services widens the inequality within the peasantry.

37 Focus group discussions with rain fed farmers in the KND, July 2008.

5.5 Differential Treatment of Farmers

As revealed in the study region, the LSI farmers used to enjoy³⁸ inputs subsidies while their counterparts did not. For instance the production cost³⁹ for one hectare of rice is about 877.00 Ghana cedi (\$US 860.00), but with subsidies (50% of the cost) it will cost about 438.50 Ghana cedi (\$US 430.00). This indicates that LSI farmers were producing one hectare of rice at \$US 430.00 while non scheme farmers were producing the same acreage but at twice the cost. Though, when there is an increase in input cost they are all affected, non scheme farmers suffer the most. What this implies is that, there is a decrease in farmer income and an increase in cost of production, which affects the non scheme farmers in the area more than the schemes farmers, since they were not benefitting from the subsidies. This is reflected in the livelihood situations of scheme and non scheme farmers: LSI farmers as was revealed have enough food throughout the year, are able to send their children to school, pay hospital bills while the larger portion (rain fed farmers) of the population are in abject poverty. The underprivileged sections of the excluded peasantry also attempt to enter the economy of commoditised sector, especially through migration to the urban areas. Migration is a key livelihood strategy for the non scheme farmers (especially rain fed) in the region. Migration to the urban areas for non existing jobs has its own major problems in Ghana. For instance it was discovered⁴⁰ that while the men are free to go wherever they want to, women are often subjected to strict control by their husbands or other male household's members. What this means is that, vulnerable groups like women and children become the most affected when drought hit the area. From the group discussions, women are responsible for generating food security for their families in the study area. In the irrigated areas (LSI and SSI), most of the agricultural activities as revealed depend on women labour. These include transplanting, harvesting and winnowing. Irrigation therefore created demand for women labour which increases women bargaining power and labour market both in terms of wage rate and forms of payment. The story is quite different in the rain fed areas: women

38 Government have re-introduced input subsidies this year to all rural poor farmers by the use of coupon issued by the agricultural extension agents (AEAs) in the district: Personal communication with district MoFA staff at KND, July 2008.

39 Wet season budget for rice (ICOUR 2007:11)

40 Women Focus group discussion in the KND in July 2008

in these areas complained of lack of income generating activities. This suggests that spreading water resources is crucial not only for poverty reduction but also reducing inequality. This implies that with a SSI strategy, more rain fed farmers in the area will get access to agriculture water that may lead to increased productivity vis-à-vis greater poverty reduction.

CHAPTER SIX

6.0 Conclusions

It is argued in this paper that, irrigation is a reliable strategy to fight poverty in the UER of Ghana because of its climatic conditions. However, because of limited resources, government have to make a choice between LSI and SSI as a strategy. LSI, the paper argues, covers a relatively small percentage of the population and is therefore a fairly limited option to address the problems of poverty and food deficit production of the region.

The argument put forward in this research paper should by no means be assumed to be as absolute argument for SSI systems or against LSI systems. But whether SSI systems are better than LSI systems is the biggest issue. The most important thing is to have enabling condition such as infrastructure, marketing, technological and demographic factors to support agricultural productivity and production in the region.

Given the current poor conditions of the region, the small scale irrigation (SSI) systems seems to better address farmers needs than that of the large scale irrigation (LSI) schemes. The study therefore argues that, intervention or poverty reduction strategy needs to be broad based and inclusive as much as possible for effectiveness, efficiency and sustainability. As such, there is the need to develop an approach that will not only aim to achieve the maximum level of inclusion, but also provide some protection that will ensure a basic minimum quality of life in places and for people where inclusion in growth remains a distant hope. An approach introduced should be appropriate, manageable and beneficial to the larger population if not all.

The study identifies infrastructure and well developed market to be necessary pre-conditions for LSI strategy to effectively address poverty reduction. It also identifies growth and multiplier effects to be very limited in addressing the problems of poverty in a region which is largely dependent on rain fed agriculture and associated with food shortages and overall stagnating yields. It is therefore argued in this paper that productivity alone as a justification for a strategy is not sufficient. Thus, the necessary conditions for multiplier effects need to be put in place.

Furthermore, the paper argues that, concentrating investment in large scale irrigation (LSI) schemes may boost productivity and marketable surplus but will not necessarily maximize total output. It maintains that, spreading investment resources thinly might lead to greater output per unit of investment but lower productivity, yield and marketed surplus. Yet, this might be a useful strategy in a region where there is considerable deficit in food production and widespread poverty. It is also argued that employing broad based strategy such as the SSI systems will not only promote modest economic growth but will also contribute to environmental sustainability. This will go a long way to reduce inequality within the peasantry in the study region.

Lastly, there is no absolute rule to determine the choice of irrigation-led strategy that is aimed at reducing poverty or livelihoods improvement. However, the prevailing conditions of a given situation should be the guiding principle. It has therefore been argued in this paper that given the nature of the social, economic and environmental problems facing the UER of Ghana, it is better to spread the limited investment resources to cover the larger population that are in need. In this regard, the arguments conclude that SSI systems are a preferred strategy for poverty reduction and livelihood improvement in the region.

6.0 References

- Abebe, H.G. (2000) 'Development Strategies and the Ethiopian Peasantry '. PhD thesis, Institute of Social Studies, The Hague.
- Acemoglu, D. (ed.) (2004) *Recent Development in Growth Theory* (Vol. 2). London: Edward Elgar Publishing Limited, Glensanda House, Montpellier Parade Cheltenham, Glos GL50, 1UA, UK.
- ADB: African Development Bank (2002) Achieving the Millennium Development Goals In Africa; Progress, Prospects and Policy Implications, Global Poverty Report 2002.
- Bebbington, A. (1999) 'Capitals and Capabilities: A framework for analysing peasant viability, rural livelihoods and poverty,' *World Development* 27(12): 2021-2044.
- Birner, R. and E. Schiffer, Asante, F., Gyasi, O., McCarthy, N., (2005) Report on Analysis of Governance Structures for Water Resources Management in the White Volta Basin Ghana.
- Bolding, A., P. Mutimba and P. van der Zaag (eds) (2003) *Intervention in Smallholder Agriculture. Implications for Extension in Zimbabwe*. Harare: University of Zimbabwe Publications.
- Booth, A., Mosley, P., (ed.) (2003) *The New Poverty Strategies, What Have They Achieved, What Have They Learnt*. New York: PALGRAVE MACMILLAN, Hound mills, Basingstoke, Hampshire, RG21 GXS and 175 Fifth Avenue, New York, N.Y. 10010.
- Buchanan, A. (1985) 'Ethics, Efficiency and the Market' [electronic version].
- Carney, D. (ed.) (1998) *Sustainable rural livelihood: what contribution can we make?* London: Department for International Development.
- Carter, R. (1993) 'Paper 11 Small -scale irrigation in sub-Saharan Africa: a balanced view' [electronic version], *Priorities for Water Resource Allocation (NRI, 1993)*: <http://nzdl.sadl.uleth.ca/cgi-bin/library>: 1-17 pages (accessed 08/08/2008).
- Chambers R. and G. Conway (1992) 'Sustainable rural livelihoods: Practical concepts for 21st Century. IDS Discussion paper 296. Brighton: IDS' [electronic version].
- Codjoe, S.N.A. (2004) Population and Land Use/Cover Dynamics in the Volta River Basin of Ghana, '1960-1910'. Cuivillier Gottingen.
- Codjoe, S.N.A. (2007) 'Supply and Utilisation of Food Crops in Ghana, 1960-2000', *African Journal Food Agriculture Nutrition and Development* 7(2): ISSN 1684-5374.
- Delgado, C. and P. Hazel, Hopkins, J., Kelly, V., (1994) 'Promoting Intersectoral Growth Linkages in Rural Africa through Agricultural Technology and Policy Reforms', *American Journal of Agricultural Economics* Vol. 76: 1166-1171.
- Delgado, C., Hopkins, J., Valarie, A., (1998) 'Agricultural Growth Linkages in sub-Saharan Africa' [electronic version], *International Food Policy Research Institute*: 152. <http://nzdl.sadl.uleth.ca/cgi> (accessed 30/09/2008).
- Devereux, S., Sharp, K., Amare, Y., (2003) *Destitution in Wolo, Ethiopia*. Brighton: IDS.

- Diao, X. (2005) Analyzing Growth Options and Poverty Reduction in Ghana-- Preliminary Results of an Economy-Wide, Multi-Market Model of Ghana 1999-2005. Presentation at a Workshop organized by IFPRI. Accra.
- Eguavoen, I. (2007) "'Now you have a new pump, you have to manage it". Water Rights and Institutional Change in Northern Ghana'. PhD thesis, University Cologne, Bonn.
- Ellis, F. (ed.) (2000) *Rural livelihoods and Diversity in Developing Countries*. New York: Oxford University Press.
- Ellis, F. and F.H. Ade (2005) *Rural Livelihood and Poverty Reduction Policies*. New York: Routledge, 2 Park Square, Milton Park, Abingdon, Oxon OX14 4RN.
- FAO/IFAD (1989) 'Upper East Region Agricultural Intensification Project. Preparation Mission'. Rome: FAO.
- FAO: Food and Agriculture Organisation (2005) 'Helping to Build a World without Hunger' [electronic version]. [Http: apps.fao.org](http://apps.fao.org) (accessed 20/08/2008).
- GSS (2000) 'Ghana Living Standard Survey. Report of the Fourth Round (GLSS 4)'. Accra: Ghana Statistical Service.
- GSS (2002) 'Ghana living Standard Survey Report (GLSS)'. Accra: Ghana Statistical Service.
- GSS (2005) 'Upper East Region: Analysis of District Data and Implication for Planning'. Accra, Ghana: Ghana Statistical Service.
- GSS (2007) 'Ghana Living Standard Survey Report'. Accra, Ghana: Ghana Statistical Service.
- Haggblade, S. and P. Hazel, Reardon, T., (2005) Strategies for Stimulating Poverty-Alleviation Growth in Rural Nonfarm Economy in developing Countries. Paper prepared for the World Bank March 25, 2002. International Food Policy Research.
- Hasnip, N. and S. Mandal, Morrison, J., Pradhan, P., Smith, L., (2002) 'Contribution of Irrigation to Sustaining Rural Livelihoods'. Howberry Park, England: HR Wallingford Ltd.
- Hussain Intizar, Waqar Jahangir and M. Ashfaq (2002) 'Agriculture Water and Poverty Linkages: Case Studies on Large and Small Systems' [electronic version]: 1-73 (accessed 5-6-2008).
- Hussian, I., and M.A. Hanjra (2004) 'Irrigation and Poverty Alleviation Review of the Empirical Evidence', *Irrigation and Drainage* 53: 1-15.
- I.M.F. International Monetary Fund (2006) 'Growth and Poverty Reduction Strategy (GPRS 2): 2006-2009'. Accra, Ghana: Bank of Ghana.
- ICOUR: Irrigation Company of Upper Region (1995) ICOUR information Handbook. Ghana.
- ICOUR: Irrigation Company of Upper Region (2007) Cooperate Plan: 2006-2010. Tono Irrigation Scheme.
- Kalunde, K. (2008) 'Irrigation Based Livelihood Challenges and Opportunities. A gendered technography of the lower Moshi irrigation scheme in Tanzania'. PhD thesis, Wageningen Universiteit, Wageningen.
- Laws, S. and C. Harper, Marcus, R., (eds) (2003) *Research for Development, A Practical Guide*. London: SAGE Publications.
- Liebie, J. (2002) Estimation of Water Storage Capacity and Evaporation Losses of Small Reservoirs In the Upper East Region of Ghana (pp. 133). Bonn: University of Bonn.
- MoFA (2007) 'Annual Report of Agriculture Performance of the Upper East Region of Ghana'. Bolgatanga: Ministry of Food and Agriculture.

- Momba, J.C. (1985) 'Peasant Differentiation and Rural Party Politics in Colonial Zambia', *Southern African Studies* 11(2): 281-294.
- Overseas Development Institute (ODI) (2005) 'Economic Growth in Northern Ghana: Revised Report for DFID Ghana.' Accra: Overseas Development Institute.
- Ramesh, B., M. Scatasta and R. Cestti (2003) 'Study on the Multiplier Effects of Dams: Methodology Issues and Preliminary Results' Paper prepared for the THIRD WORLD WATER FORUM. Kyoto, Japan.
- Ravnborg, H.M., M.A. Hanjra, L. Smith and M.H. Hussein (2007) Water for Farming to Fight Poverty, *International Water Management Institute (IWMI), Report 102*. Cambodia.
- Reardon, T. (1995) 'Links Between Rural Poverty and the Environment in Developing Countries: Assets Categories and Investment Poverty', *World Development* 23(9): 1495-1506.
- Saith, A. (1985) 'Primitive Accumulation, Agrarian Reform and Socialist Transitions: An Argument', *Journal of Development Studies* 22(1): 1-47.
- Scoones, I. (1998) 'Sustainable rural livelihoods: A framework for analysis', IDS working paper, No. 72, [electronic version] 2008.
<http://www.ids.ac.uk/ids/bookshop/wp/wp72.pdf> (accessed 10/02/2008).
- Whitehead, A. (2002) 'Tracking Livelihood Change: Theoretical Methodological and Empirical Perspectives from North East Ghana', *Journal of Southern African Studies* 28: 575-598.
- World Bank (2008) 'World Development Report. Agriculture for Development'. Washington DC: World Bank.
- Wuyts, M. (1981) 'The Mechanization of Present-Day Mozambican Agriculture', *Development and Change* 12: 1-27.
- Wuyts, M. (1985) 'Money, Planning and Rural Transformation in Mozambique', *Journal of Development Studies* 22(1): 178-207.
- Wuyts, M. (2001) 'Informal economy, wage goods and accumulation under structural adjustment theoretical reflections based on the Tanzania experience', *Cambridge Journal of Economics* 25: 417-438.

7.0 Appendices

Annex 1

Identified Livelihood Features in the Kassena Nankanni District of the Upper East Region of Ghana

Key Dimensions /Handles	Impacts on the Different Farmer Groups in the District		
	Tono Irrigation Project Farmers (LSI)	Dug-Out/ Dam Irrigation Farmers (SSI)	Rain fed Agriculture Farmers
Production	All Farmers Increased crop yield, crop area, crop intensity, crop diversity Opportunity for high value crops Multiple crop and year round crop production	Some of the farmers Increased crop yield, crop intensity, crop diversity Opportunity for high value crops Multiple crop and year round crop production	All farmers Decreased crop yield, crop area, crop intensity, crop diversity Fewer Opportunities for high value crops One crop in a year.
Income/Consumption	All farmers Increased income from crop production Increased family consumption of food Increased stabilisation of farm family income Reduced food prices	Some of the farmers Increased income from crop production Increased family consumption of food Increased stabilisation of farm family income Reduced food prices	All the farmers Decreased income from crop production Decreased family consumption of food during lean season Fluctuation of farm family income Increased food prices in lean season
Employment	All farmers Increased on-farm and employment opportunities Increased off-farm employment opportunities Stabilisation of employment activities Increased rural wage rate	Some of the farmers Increased on-farm and employment opportunities Increased off-farm employment opportunities Stabilisation of employment activities Increased rural wage rate	All the farmers Increased on-farm activities during the rainy season Fewer off-farm activities Unstable wage rate
Vulnerability/Food Security	All Farmers Enhanced food availability Increased opportunities to produce and retain food for home consumption Reduced level of consumption shortfalls Reduced risk of crop failure Reduced seasonality effect of production	Some of the Farmers Enhanced food availability Increased opportunities to produce and retain food for home consumption Reduced level of consumption shortfalls Reduced risk of crop failure Reduced seasonality effect of production	All farmers Decreased food availability Decreased opportunities to produce and retain food for home consumption Consumption shortfalls continue to rise Increased risk of crop failure Increased seasonality effect on crop production
Other Impacts	All Farmers Reduced out migration Increased resources for health and education Improved overall resources base	Some of the farmers Reduced out migration Increased resources for health and education Improved overall resources base	All Farmers Increased out migration Decreased resources for health and education Decreased overall resources base

Source: Focus Group Discussions with Rain fed and Irrigated Farmers in the Kassena Nankanni District of the Upper East Region of Ghana, July, 2008.

Annex 2

Productivity of main cereal crops cultivated in the study Area 1991-2007

Year	Millet		Sorghum		Rice		Rice		Maize	
	SSI (Wet)	LSI (Wet)	SSI (Wet)	LSI (Wet)	SSI (Wet)	LSI (Wet)	SSI (Dry)	LSI (Dry)	SSI (Wet)	LSI (Wet)
1991	0.49	0.30	0.83	0.50	1.78	4.40	4.00	5.30	1.25	0.70
1992	0.50	0.20	0.90	0.20	1.60	3.80	2.80	3.60	1.30	0.50
1993	1.50	0.50	0.85	0.70	2.20	3.80	2.00	3.10	0.66	1.30
1994	0.66	0.50	0.97	0.70	1.55	3.80	3.50	4.20	1.10	1.30
1995	0.98	0.60	0.89	0.60	2.40	3.90	2.90	4.50	0.78	1.30
1996	1.13	0.60	1.40	0.60	2.17	3.70	3.00	4.50	0.88	1.30
1997	0.48	0.60	0.78	0.60	1.78	3.30	3.00	4.90	0.43	1.30
1998	0.71	0.70	1.06	0.70	2.60	3.80	3.00	3.00	0.90	1.30
1999	0.75	0.60	0.92	0.60	4.20	4.50	2.50	5.40	0.99	1.30
2000	0.83	0.70	1.15	0.70	2.00	4.20	2.50	5.40	1.50	1.30
2001	0.83	0.70	1.15	0.70	2.00	4.30	2.80	5.50	1.50	1.30
2002	0.64	0.70	1.11	1.40	3.00	3.50	4.00	4.50	1.30	1.30
2003	0.63	0.70	1.01	0.70	2.86	3.00	3.00	4.80	1.30	1.30
2004	0.88	0.70	0.97	0.70	2.90	3.10	2.00	4.20	1.00	1.30
2005	1.02	0.70	1.35	0.70	1.63	3.10	2.50	6.60	1.31	1.30
2006	0.70	0.70	0.90	0.70	2.00	3.10	2.80	6.00	0.80	1.30
2007	0.56	0.70	0.33	0.70	1.43	3.10	2.80	4.90	0.37	1.30

Source: Figures compiled from MoFA report (2007) and ICOUR (2007)

Annex 3

Guided Interview Questions to key Informants in the Study Region (selected Staff of: MoFA, ICOUR, Local NGO, District Assembly)

- (1) Why was irrigation introduced to the region?
- (2) How much of the problems could irrigation address?
- (3) Is irrigation a viable option for poverty reduction in the region and why?
- (4) Why is the region still among the poorest regions in Ghana and experiences food deficit production despite it has the largest irrigation (Tono scheme) in the country?
- (5) Do you experience any problems in your organisations? If yes, can you tell me what these problems are?
- (6) What are the problems farmers in the area face?
- (7) What are the measures been taken by your outfit to address these?
- (8) What support do you give to farmers in the area?
- (9) What group of farmers do you give your support and why that target group?
- (10) Do you think your support have helped improved the livelihood situation of your target group? If yes, in which way?

- (11) Do you have any plan of change of strategy of your support to farmers? If yes which strategy and why? If No, any reason?

Group Interview Question Guide for Focus Group Discussions

- (1) Livelihood strategies and why such strategies
- (2) Livelihood situations for the past 5 years, any improvement or worsen situation and why do you think have caused these changes
- (3) Institutions/Organisation you receive support, or give you problems?
- (4) Livelihood challenges you face and how you deal with it over the years
- (5) Land tenure systems in the area
- (6) Inputs, credit and market conditions
- (7) Labour availability, migration
- (8) History of farming systems in relation to irrigation and rain fed in the area, any changes and why?
- (9) Irrigation schemes and it management, how do you run it? Any problems?

Semi structured individual interview Guide for Irrigation farmers

- (1) What livelihood strategies do you depend on and why?
- (2) Do you practice irrigation? If yes, which type? LSI or SSI?
- (3) Do you practice irrigation all dry season? If no why?
- (4) What are the main crops you cultivate? List them in order of importance
- (5) Why these particular crops?
- (6) Is it on your own discretion that you plant these crops that you grow? If no, by whose directions and why?
- (7) What livestock do you rear? List them and what are your reasons?
- (8) Do you care for improving the fertility of your cropping land?
- (9) If no what are your reasons
- (10) If yes what techniques? 1=fallow 2=Crop rotation 3= Animal manure 4= chemical fertilizer 5= combinations of these
- (11) Any reasons for your answer in Q 10
- (12) Do you own the land you farm on?

- (13) If yes, under what ownership? 1= family/inheritance 2=Community usage right
3=Purchased/leased land 4= rented land
- (14) If no, under what terms of conditions do you use the land?
- (15) Do experience land conflict? If yes with whom and reasons
- (16) In what way do you market your farm produce? Any problems? If yes what these problems?
- (17) In what form do you market your farm produce? 1= As individual 2= As member of informal group 3= As member of a cooperative 4= combinations
- (18) Apart from farming, do you participate in any nonfarm activities?
- (19) If yes, list them and what are your reasons for participating in these activities? If no, what are your reasons?
- (20) Are there credit services in your area?
- (21) If yes, sources
- (22) Have you ever taken credit for your irrigation purpose?
- (23) If no, why? If yes, what source
- (24) Is there any change in your livelihood situation because of irrigation? If yes, which way?
- (25) Do you get any support service from any organisation in the area? If yes which organisation and which type of support? If no what do you think are the reasons?
- (26) Are there any organisations/institutions that cause you problems? If yes, which ones and what are the problems?
- (27) How do you manage your irrigation scheme/dams?
- (28) How do you improve/increase your farm output/yield? 1=Intensification
2=Land expansion Why?

Guided Semi structured Individual interview for Rain fed farmers

- (1) What livelihood strategies do you depend on and why?
- (2) Have you ever owned irrigated land? If yes, why don't you have it anymore?
- (3) What do you do during the off season?
- (4) What are the main crops you cultivate? List them in order of importance
- (5) Why these particular crops?
- (6) Is it on your own discretion that you plant these crops that you grow? If no, by whose directions and why?
- (7) What livestock do you rear? List them and what are your reasons?

- (8) Do you care for improving the fertility of your cropping land?
- (9) If no what are your reasons
- (10) If yes what techniques? 1=fallow 2=Crop rotation 3= Animal manure 4= chemical fertilizer 5= combinations of these
- (11) Any reasons for your answer in Q 10
- (12) Do you own the land you farm on?
- (13) If yes, under what ownership? 1= family/inheritance 2=Community usage right 3=Purchased/leased land 4= rented land
- (14) If no, under what terms of conditions do you use the land?
- (15) Do experience land conflict? If yes with whom and reasons
- (16) In what way do you market your farm produce? Any problems? If yes what these problems?
- (17) In what form do you market your farm produce? 1= As individual 2= As member of informal group 3= As member of a cooperative 4= combinations
- (18) Apart from farming, do you participate in any nonfarm activities?
- (19) If yes, list them and what are your reasons for participating in these activities? If no, what are your reasons?
- (20) Are there credit services in your area?
- (21) If yes, sources
- (22) Have you ever taken credit for your farming activities?
- (23) If no, why? If yes, what source
- (24) Any changes in your livelihood situation over the years? If yes, which way? If no, what do you think are the reasons?
- (25) Do you get any support service from any organisation in the area? If yes which organisation and which type of support? If no what do you think are the reasons?
- (26) Are there any organisations/institutions that cause you problems? If yes, which ones and what are the problems?
- (27) How do you improve/increase your farm output/yield? 1=Intensification 2=Land expansion Why?