

## SMALL SCALE IRRIGATION AND RURAL POVERTY REDUCTION IN THE UPPER EAST REGION OF GHANA.

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### Abstract

Poverty reduction in developing countries is an indispensable requirement for sustainable development. In line with this, the Government of Ghana since independence has undertaken the construction of a considerable number of small scale dams and dugouts to increase water accessibility for small-scale irrigation. The objective of this study was to examine the impact of small-scale irrigation schemes on poverty reduction in the Upper East Region of Ghana. Data was obtained from 235 irrigators and non-irrigators. The findings show that small scale irrigation schemes have made strides in poverty reduction through the creation of employment, improve household income sources, improve household nutritional status and reduce out-migration. However, lack of storage and processing facilities hamper the production of perishable products. It is recommended that government should set up storage facilities in irrigation communities as well as revamp the tomato processing factory to minimize post-harvest losses.

**Keywords:** Ghana, Irrigation, Poverty, Upper East Region.

### INTRODUCTION

Ghana's medium and long term agricultural policy is geared towards modernizing the sector as a necessary condition for ensuring food security and rural poverty reduction (MoFA, 2010; National Development Planning Commission [NDPC], 2010). Even though Ghana is endowed with vast agricultural land and water resources, the sector is dominated by smallholder farmers (90%) who are subsistence food crop producers who rely so much on rainfall (Ministry of Food and Agriculture [MoFA], 2010). Agriculture contributes about 30% of the total Gross Domestic Product and employs about 65% of the labour force (Diao, 2010; MoFA, 2010). The dependence on rainfall implies that farmers in the Upper East Region of Ghana cannot engage in all year round farming. In connection with this, irrigation agriculture has become paramount for regions where rainfall shortage is most severe in order to help increase global food supply (Yakubu, 2008; World Bank, 2008).

Irrigation agriculture is not a new phenomenon since it has been carried out for centuries around the globe (Punnet, 1982). Egyptians for instance, built canal system that carried water from River Nile to farms around 3000BC (Troeh & Miller, 1980). According to Troeh and Miller (1980) irrigation fastened the cultivation of crops in the flood plains of the Nile valley so that supplementary food becomes more available and cheaper to access. Irrigation agriculture is one of the most important rural development investments that have both direct and indirect impact on poverty reduction and food security in developing countries (Bhattarai et al., 2002; World Bank, 2008). According to Smith (2004), irrigation agriculture increases the reliability and consistency of production leading to crop yields because of a second and sometimes a third cropping season. Irrigation agriculture also increases crop diversification options for farmers and improve smallholder farmers' livelihoods through sustained food availability (Hussain & Hanjra, 2004; International Fund for Agricultural Development [IFAD], 2006).

Although, irrigation holds the key to boosting agricultural productivity for enhanced livelihood and food security, many inhabitants in irrigation communities in the Upper East Region of Ghana still depend on food handouts supplied by non-governmental

organizations and philanthropists (Namara et al., 2011). It is against this backdrop that this present study assesses the impact of small scale irrigation schemes on poverty reduction. This paper is divided into three sections. The first section looks at the introduction and problem statement. The second section is on materials and methods while the third section is on findings of the study and conclusion.

### Statement of the problem

Since the 1950s, Governments have embarked on various agricultural programmes and projects including the construction and rehabilitation of small reservoirs, dams and dugouts to provide reliable water supplies for domestic use, livestock watering, fishing and crop irrigation in the Upper East Region of Ghana (Coche, 1998). The Government of Ghana with support from multilateral, bilateral and non-governmental organizations constructed about 276 dams and dugouts in the Upper East Region with 154 of these dams and dugouts having land sizes ranging from 1ha to 35ha (Liebe, 2002; MoFA, 2013). The Government's policy on small scale irrigation is aimed at increasing smallholders' food crop production by providing improved technology, infrastructure and institutional support (MoFA, 2013). The reasons for providing these small scale irrigation is to reduce the adverse impacts of the single unreliable rainy season on agricultural productivity (Blench, 2006; Coche, 1998; MoFA, 2013, World Bank, 2008) and out-migration of the youth to the south of Ghana in search of non-existing white colour jobs (IFAD, 2006).

However, poverty levels and out migration among the youth in small scale irrigation communities in the Upper East Region of Ghana have been in the increase due to ineffective utilization of these irrigation facilities for dry season farming (Asare, 2002; Inkoom, 2011; Nanedo, 2014). The extent to which the provision of small scale irrigation schemes in the Upper East Region of Ghana has helped to reduce out-migration and to a large extent poverty cannot be conjectured unless an impact assessment is undertaken. One of the studies that attempt to deal with irrigation and poverty linkages comprehensively is a study that covered six countries including Bangladesh, China, India, Indonesia, Pakistan and Vietnam (Hussain & Wijerathna, 2004). Hussain and Hanjra (2004) for instance used primary data to make a comparative analysis of irrigation impact on

household income in the marginal areas of Pakistan and conclude that small-scale irrigation is positively correlated with household income, which helps them to reduce poverty. Bhattarai and Narayanamoorthy (2004) used both cross-section and time series data to compare investment in irrigation with investment in rural literacy in India and found that investment in irrigation reduces poverty more effectively as compared to investment in rural literacy. Gebregziabher and Namara (2008) found in Ethiopia that irrigators had more diversified income sources than non-irrigators and that the proportion of poor households among irrigators in the study was significantly lower than non-irrigators. Also, Dillon (2008) established in northern Mali that small-scale irrigation projects have significant positive impacts on household consumption, agricultural production, nutrition and by extension household level poverty reduction. According to Lipton, Litchfield and Faurès (2003) areas where irrigation is widely used, agricultural yields and household income are higher, less poverty and undernourishment are also observed. In Zimbabwe, Chazovachii (2012) indicates that irrigation scheme has created employment, generated income, and enabled farmers to acquire assets such as scotch carts and livestock by farmers as well as pay their children's school fees.

Fan, Zhang and Zhang (2002); Fan, Hazell and Thorat (1999); Rosegrant and Evenson (1993) argue that there is no impact on household income and poverty reduction at large when irrigation schemes are provided to communities. According to Rosegrant and Evenson (1993) for instance, the effect of irrigation on agricultural productivity in India was found to be negative. The little empirical evidence on this important subject serves as a hindrance for any meaningful policy intervention on small scale irrigation.

### Objectives of the study

The priority of this paper was to assess the impact of small-scale irrigation schemes on poverty reduction in the Upper East Region of Ghana.

### Specific objectives

The specific objectives of the study were to

- examine the effects of improved agricultural water access and use of small scale irrigation schemes on poverty reduction for smallholder farmers in the Upper East Region of Ghana, and
- identify the constraints smallholder farmers face in irrigation farming.

### Significance of the study

This paper is relevant to the government, multilateral, bilateral and non-governmental organizations as it will provide insights to whether the provision of small scale irrigation is contributing to efforts aimed at eradicating poverty and reducing out-migration. The paper will also inform stakeholders of the challenges that irrigation farmers face so as to design strategies and mechanisms to address them in order to prevent irrigation project failure and collapse.

## MATERIALS AND METHODS

### Description of the study area

The study was carried out in the Bolgatanga Municipality of the Upper East Region of Ghana (Figure 1). Bolgatanga Municipality lies between latitude 10°30' and 10°50' N and longitude 0°30' and 1°00' W. The Municipality is bordered to the North by the Bongo District, South by Talensi District, to the East by Nabdam Districts and to the West by the Kassena-Nankana East District. The Municipality covers about 729 km<sup>2</sup> with a population of about 131,550 (Ghana Statistical Service [GSS], 2012). The topography is made up of gentle slopes

with some isolated rocks and uplands. The climatic regime is semi-arid with two distinct seasons - a wet season that lasts from May to October and a long dry season that stretches from October to April. The mean annual rainfall is about 950mm while maximum temperature reaches 45°C in March/April. The natural vegetation is that of guinea savannah woodland consisting of short deciduous trees widely spaced, which gets scorched by sun during the long dry season. Seventy percent of the total land area of the Municipality is cultivated. There are about 14,145 agricultural households using most of the small scale irrigation schemes (MoFA 2010). Figure 1 is the map of the study area.



Fig(1) Map showing Bolgatanga Municipality

### Study design and sampling technique

The study used a mixed method design to collect both qualitative and quantitative data. Quantitative data collection targeted irrigation and non-irrigation farmers, while qualitative data targeted executives of water users' committee. The study used purposive sampling technique to select three irrigation schemes - Dorongo, Sumbungu and Winkogo in the Bolgatanga Municipality on the basis of their accessibility, functionality, scale, management type, similarity of crops cultivated and market access. During the 2012/2013 cropping season, a total of 289 farmers registered to undertake dry season farming at the three irrigation schemes. This comprised of 150 farmers in Dorongo, 41 farmers in Sumbungu and 98 farmers in Winkogo. The list of registered irrigators was obtained from the secretaries of the community water users' associations. Convenience sampling procedure was used to sample 120 farmers from these three irrigation scheme communities. The irrigators sample for each community was chosen with a probability proportionate to its sample frame size. Irrigation farmers were considered as those who regularly engage in dry season farming using water from the community irrigation scheme. Also, a convenience sampling procedure was used to sample 115 non-irrigators in the communities from which the irrigation schemes are located. Non-irrigators are those who predominantly depend solely on rain-fed subsistence agriculture. Therefore, the sample size arrived at for the study was 235 farmers.

### Data collection and data analysis

The main data collection instrument was a semi-structured interview guide that collected data through face-to-face interview.

Data collection covered socio-demographic characteristics of respondents (e.g. sex, age, marital status, highest educational level, years of experience in irrigation farming and livelihood sources). Data on farm features included land holding size, types of crops grown, crop yields, use of agro-chemicals and farm challenges were collected. Finally, data was collected on types of assets acquired, consumption patterns, migration, employment status and nutrition status of households. Data collected was coded according to a pre-coded legend. Respondents' perceptions on statements regarding the impact of irrigation used a 5 point Likert-scale to collect the data where 1 was strongly disagree and 5 was strongly agree. By using the Statistical Package for Social Science, descriptive statistics and charts enabled accurate presentation and interpretation of the findings.

## RESULTS AND DISCUSSION

Table 1 shows the socio-demographic characteristics of respondents. The results of the study show that farming in the sampled communities is dominated by male farmers (72%). Fifty-six percent (56%) of respondents in the age group of 36-51 years are actively engaged in farming. The findings indicate that nearly all the respondents (94%) are married. The results also indicate that about 70% of the respondents have no formal education.

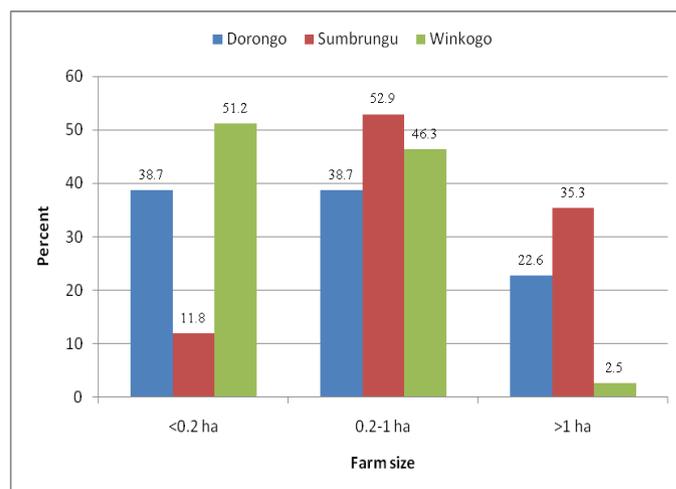
Characteristic	Irrigators		Non-irrigators		Total	
	Freq	%	Freq.	%	Freq.	%
Sex:						
Male	78	65.0	90	78.3	168	71.5
Female	42	35.0	25	21.7	67	28.5
Total	120	100.0	115	100.0	235	100.0
Age:						
Less than 20 years	3	2.5	0	0.0	3	1.3
20-35 years	29	24.2	29	25.3	58	24.7
36-51 years	58	48.3	74	64.3	132	56.1
52+ years	30	25.0	12	10.4	42	17.9
Total	120	100.0	115	100.0	235	100.0
Marital status:						
Single	9	7.5	5	4.3	14	6.0
Married	95	79.2	93	80.9	188	80.0
Widow/widower	16	13.3	17	14.8	33	14.0
Total	120	100.0	115	100.0	235	100.0
Highest educational level:						
No formal education	83	69.2	82	71.3	165	70.2
Basic (Primary/JHS/Middle)	25	20.8	26	22.7	51	21.7
SHS	8	6.7	2	1.7	10	4.3
Tertiary	4	3.3	5	4.3	9	3.8
Total	120	100.0	115	100.0	235	100.0

(Source: Computed)

### Land holdings of farmers and types of crops grown

Figure 2 shows the land holding of farmers in the study area. Land holding of farmers undertaking irrigation in all the communities is relatively small with 46% of irrigators in Winkogo cultivating 0.2-1 hectares. In Dorongo, about 39% of the farmers have 0.2-1 hectares. The results also indicate that 53% of farmers have 0.2-1 hectare of land for dry season farming in Sumbrungu. One reason for small land holdings under the various community irrigation schemes is the small size of irrigable lands relative to the number of farmers engaged in dry season farming.

The main crops cultivated by farmers in these irrigation schemes include millet (39%), sorghum (46%), maize (3%), groundnuts (12%) and leafy vegetables (39%). The reasons for the cultivation of these crops are better market price for the crop as well as the importance of the crops to the socio-cultural set-up of the communities. The high percent of farmers cultivating sorghum is due to the ready market for sorghum for the preparation of "pito" (local drink prepared from sorghum), which is widely consumed by low income earning people in the Municipality.



(Source: Computed)

Fig(2) Land holdings of farmers (ha = hectares)

### Small scale irrigation and poverty reduction

Using the five Likert-scale, the respondents were asked to indicate their perception to the following statements:

- Small scale irrigation farming provides employment during the dry season
- Small scale irrigation farming helps farmers to improve their housing conditions
- Small scale irrigation helps to improve the nutritional status (diet) of family members
- Income from small scale irrigation farms help farm households to access health care
- Income from small scale irrigation farms help farmers to pay children's school fees and
- Income from small scale irrigation farms help farmers to acquire household assets

The findings show that small scale irrigation schemes are helping countries to fight poverty through employment provision (94%), improve housing conditions (83%) and improve nutritional status of family members (61%). The results also indicate that income from small scale irrigation farms help farmers to access health care (69%), pay children's school fees (97%) and acquire household assets (89%). This finding is consistent with Dillon (2008) that small scale irrigation schemes are provided to tackle poverty among rural folk.

### Assets acquisition from irrigation farming

The assets base of individuals and households are often used as indicators to measure the level of poverty. Table 2 shows the types of assets acquired from irrigation farming. The results show that farmers use income from sale of irrigation farm produce to purchase livestock (75%), bicycles (63%) and motorbike (18%). The acquisition of bicycles and motorbikes helps farmers to reduce travelling time to farm and social gathering. The reason and

importance for the purchase of livestock in the form of cattle especially bullocks and donkeys is for animal traction while the purpose for purchasing sheep, goats, pigs and poultry is for farm diversification. The acquisition of livestock is also a form of investment for most farmers. Small ruminants and poultry are relied on if there is urgent need for cash income to meet family responsibilities. The findings suggest that irrigation schemes do not only help farmers to acquire assets but in turn are crucial for socio-economic empowerment and poverty reduction.

**Table(2) Types of assets acquired from irrigation farming**

Assets	Dorongo (N = 62)		Sumbungu (N = 17)		Winkogo (N = 41)		Total (N=120)	
	Freq.	%	Freq.	%	Freq.	%	Freq.	%
Roofing sheets	29	47	14	82	15	37	58	48
Television set	50	81	12	71	24	59	86	72
Bicycle	33	53	16	94	26	63	75	63
Motorbike	8	13	5	29	9	22	22	18
Household furniture	23	37	10	59	17	41	50	42
Livestock	46	74	16	94	28	68	90	75

(Source: Computed)

**Impact of irrigation on migration**

In this sub-section, with a Likert-scale of 5 points, farmers were asked to indicate their perception on the following two statements:

- a) Small scale irrigation schemes help to reduce out-migration of the youth from their community, and
- b) Small scale irrigation schemes have made significant impact on improving the wellbeing of individual farmers and households.

The results show that 78% of the respondents in all the study communities agree that small scale irrigation has helped in curbing out-migration of the youth from their communities to elsewhere in search of employment. The results also indicate that Dorongo irrigation scheme has made a greater impact in the prevention of out-migration (90%) compared with the other irrigation scheme communities. This finding corroborates Kpieta, Owusu-Sekyere and Bonye (2013) that youth out-migration from communities with small scale irrigation dams is very minimal as compared to non-dam communities in Wa West District of the Upper West Region. The study also found that about 96% of all the respondents agree that community irrigation schemes have made significant impact on improving the wellbeing of individual farmers and households in all the study communities. Improvement in the general wellbeing of households practicing irrigation farming reduces poverty and inequality.

**Small scale irrigation and household income**

The study gathered data on the main sources of income for both irrigators and non-irrigators. The results indicate that irrigators' main sources of income is from the sale of farm produce (94%) while non-irrigators' (49%) main source of income is from artisanal activities. The mean income of irrigation farmers was US\$4,164.42 compared to US\$1,314.17 for non-irrigation farmers. For irrigators, US\$3,695.71 representing 89% of total earnings came from the sale of irrigated crops. The results confirm previous work on irrigation highlighting improvements in income among irrigators (Hussain & Wijerathna, 2004). Cash income from irrigation is used for paying health bills, payment of children's school fees, among others. Awan, Malik, Sarwar and Waqas (2011) observe that investment in education is the most important factor regarding poverty reduction

arguing that income from irrigation that is used to educate children enhances the future earning potential of household members. The World Bank (2008) also notes that investment in health care is a critical pathway of enhancing human capital.

**Constraints facing small-scale irrigation farmers**

Table 3 shows the constraints facing farmers in the study communities. Access to extension services was reported by 60% of irrigators and 97% of rain-fed farmers as a problem facing them. The lack of access to extension service affects the management skills of farmers in dealing with their daily farm business. The results indicate that inadequate access to credit to buy inputs such as seeds, fertilizer and agro-chemicals was reported by 93% of irrigators and 97% of non-irrigators. The respondents indicate that credit institutions delay in giving out credit to farmers. Also, 98% of irrigators and 86% of non-irrigators said that the high prevalence of crop pest and disease (e.g., nematodes) is a problem that affects crop yield in terms of quality and quantity.

Furthermore, 81% of irrigators and 90% of non-irrigators said that lack of storage and processing facilities affect the production of perishable products such as vegetables leading to post-harvest losses especially when there is glut. Finally, 89% of irrigators indicate that poor water management and lack of regular maintenance of irrigation facilities results in cracks of the main canals and laterals of all the three schemes leading to massive water leakages and wastage, which has negative implications for water productivity.

**Table(3) Constraints faced by farmers**

Constraints	Irrigators (N = 120)		Non-irrigators (N = 115)	
	Freq.	%	Freq.	%
Inadequate access to extension services	72	60	112	97
Inadequate access to credit	112	93	112	97
Poor market price for farm produce	97	81	104	90
High cost of farm inputs	114	95	103	90
Lack of transport	59	49	49	43
High prevalence of crop pest and disease	118	98	99	86
Poor maintenance of irrigation facility	107	89	--	--
High water use levy	29	24	--	--

(Source: Computed)

**CONCLUSION AND RECOMMENDATIONS**

The study shows that small scale irrigation has made significant contribution towards increased incomes, employment generation, enhance food security and improve nutritional status of households. These variables are indicators of poverty and any intervention that seeks to positively improve on them in a sustainable manner is highly commendable. Majority of respondents in all the study communities agree that dry season irrigation has helped in curbing out-migration of the youth from their communities to elsewhere in search of employment. Farmers who engage in irrigation farming are able to supplement their household food requirements, generate income to pay their children school fees, and acquire physical assets. However, land holding under irrigation in all the communities was relatively small, which does not allow many farm households to benefit from the community-based irrigation schemes. The main constraints faced by irrigation farmers include poor management of irrigation facility, lack of storage and processing facilities and lack of extension services, which are seriously hampering the business potentials of farmers in the study areas.

Considering that this study found that irrigation is poverty reducing, it is recommended that the Central government should develop appropriate policies and mechanisms to facilitate prompt release of funds by credit institutions to enable smallholder farmers to get funds at the right time for crop production. The Ministry of Food and Agriculture should be empowered to regularly embark on field monitoring and supervision to ensure that there is regular maintenance of irrigation facilities in order to sustain the life span of the facilities. Furthermore, the Central government should provide storage facilities in irrigation communities as well as revamp the tomatoes processing factory in the region to ensure purchase of tomatoes in order to minimize post-harvest losses.

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