FACTORS INFLUENCING ACCEPTANCE OF FARMER EDUCATION AND IRRIGATION TECHNOLOGY FOR SUSTAINABLE FOOD PRODUCTION IN KWANAR ARE DAM – KATSINA STATE

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ABSTRACT

This study was aimed at analysing factors influencing acceptance and adoption of farmer education and irrigation technology for sustainable food production as a means of ensuring food security in rural settlement of Katsina State – Nigeria. It provided insight on the underlying socio-economic factors influencing farmer's decision to adopt education and irrigation technologies in the study area. A structured questionnaire was administered for selected farmers. Results obtained revealed that 94% of farmers were small holders with low level of education indicating that farming in the study area is highly dominated by traditional farming system that results in lower yields. It also indicates 87% of farmers were within the economic active age of 20 – 50 years. Farming experience, fragmented land holdings and poor extension services were directly related to the acceptance farmer education and adoption of irrigation technologies. The study concluded that training and educating small-scale small scale farmers that form the bulk of farming community in Nigeria are viable solutions to securing household food security, diversification of source of income and reducing rural poverty.

Keywords: Farmer Education, Irrigation Technology, Food Security, Rural Poverty

INTRODUCTION

Agriculture is the most important economic activity providing food, employment, foreign exchange and raw material for industries in many developing countries. It is the source of income for around 2.5 billion people in the developing world, FAO (2014). It is also the mainstay of Nigerian economy as it provides employment for about 70% of Nigerian's population, contributes 38% of the National Gross Domestic Product (GDP) and accounts about 90% of the activities in the rural environment (FMARD, 2006). Agriculture, therefore, occupies a central place in the overall development of most countries that is aimed at rural employment, enhancing food security and poverty alleviation.

Agricultural production in Nigeria is predominantly dependent on smallholders, who rely on unpredictable and sporadic seasonal rainfall. The onset of climate change, insufficient rainfall and occasional uncontrollable floods results in frequent crop failures having serious effects on the livelihood. As a result, production is poor and food insecurity threatens every year. Similarly, competition of precious resources due to rapid increase in population, climatic change, agricultural and industrial sector activities possesses threat to sustainable agricultural production that require excessive water leading to inefficient production and water scarcity (FAO, 2014).This has made the country's agricultural-based economy fragile and vulnerable to the impacts of climatic variability which often results in crop failure and subsequent food shortages and famines (Awotide *et al.,* (2012).

To alleviate food insecurity at household level, government at various levels have over years introduced policies to minimize risk food shortage through supplementary irrigation mainly during the dry season. Irrigation and water management practices are taken to greatly reduce the problem caused by rainfall variability, enhance productivity per unit of land, and increase the volume of annual production significantly. Lipton *et al* (2004) cited in Haile, (2008) states that irrigated agriculture reduce poverty through increased production and income to helps poor households meet their basic needs by improving their economic welfare, protection against risks of crop loss due to insufficient rain water supplies and promote use of yield enhancing farm inputs to move out of the poverty trap.

Over the years, governments focused on construction of large scale irrigation dams especially in Northern Nigeria. The performance of these dams have not however been optimal in terms of anticipated benefits (Korrtenhorst *et al*., 1989). It has thus been advocated that the promotion of small scale and affordable irrigation schemes to boost food production is the only solution to address the current challenges of agricultural sustainability and food security in the country. This study, therefore, examine the factors that influence acceptance of farmer training and education for sustainable food production in order to secure household food security, diversify source of income and reduce rural poverty in Kwanar Are Dam, Katsina State.

MATERIALS AND METHOD

Study Area

Kwanar-Are Dam is located in Rimi Local Government Area (LGA) of Katsina State. Established in 1991 in Katsina Central District, Rimi LGA covers an area of 452 km². It is bordered to the north by Kaita LGA, to the east by Mani and Bidawa LGAs, to the south by Charanchi and to the west by Batagarawa LGA. There are ten (10) wards in the LGA, KTSG (2013). Kwanar-Are Dam is located at the heart of Rimi LGA and lies between km 24 – 28 km along Katsina–Kano highway (Figure 1). Its location is strategic in that it serves the domestic and agricultural needs of several villages within the local government and beyond.
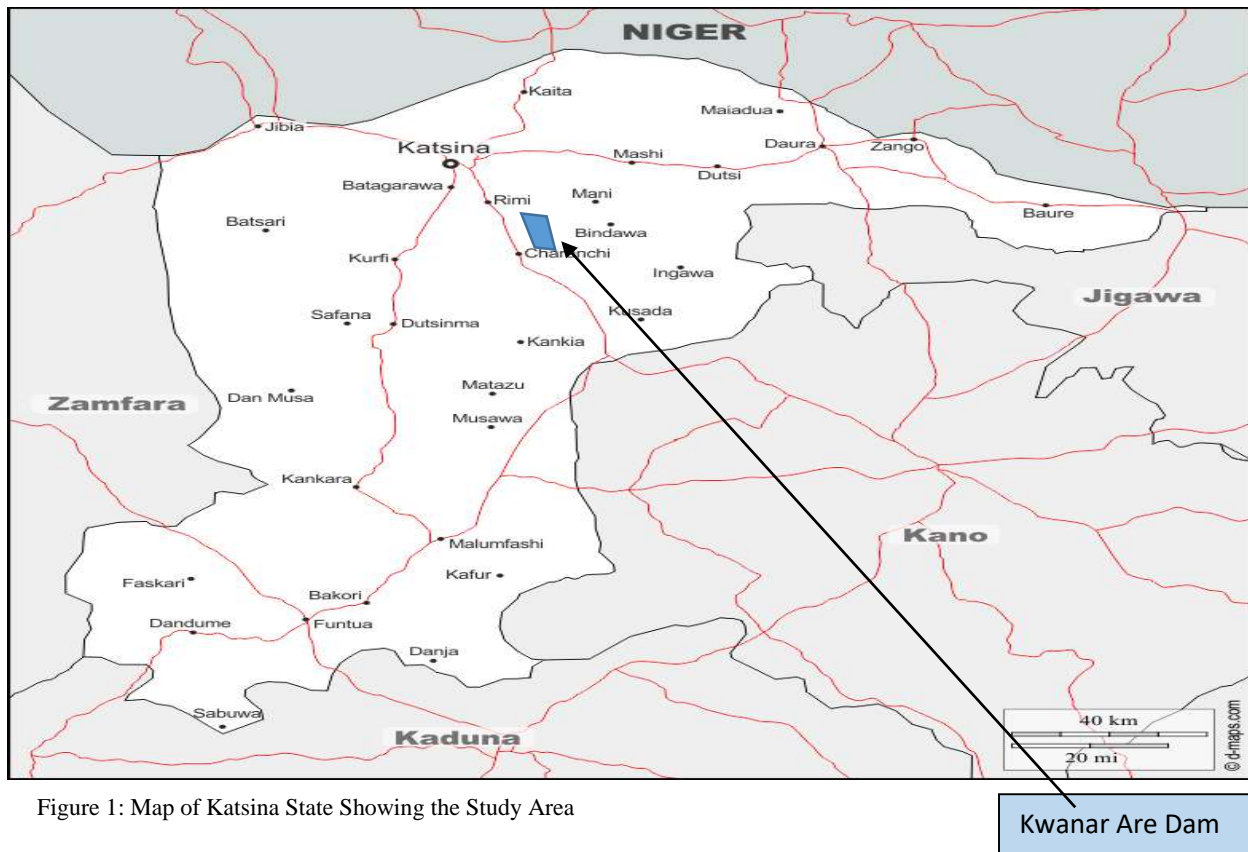
Figure 1: Map of Katsina State Showing the Study Area

Geography, Climate and Vegetation

Rimi Local Government is located 12°51′0″N and 7°42′56″E. It has a tropical climate with a clear wet and a dry season. The coolest month is experienced between December/January with temperature of less than 18°C. The study area is also composed of undulating plains of up to 450m (KTSG, 2013).

The rainfall figures of the study area ranges from 600 – 700mm annually. Climate varies considerably according to months and seasons. The cool dry (harmattan) season from December to February; hot dry season from March to May; warm wet season from June to September; less marked season after rains during the months of October to November characterized by decreasing rainfall and a gradual lowering of temperature. Mean monthly values ranges between 21°C in the coolest month and 31°C in the hottest month. Evapotranspiration is very high and relative humidity is highest in August (up to 80%) and low in January through March when moderated harmattan sets in. Soil of the area is generally loose and sandy (and hence highly erodible).They are well drained with low water retention and do not expand when in contact with water (KTSG, 2013).

Vegetation in the study area consist of stunted scattered trees that grow long tap roots and thick barks that make it possible for them to withstand long dry season and bush fires. The grass cover has durable roots which remain underground after stalks are burnt or wilted in the dry season germinates with the first rains. The study area suffers from the perennial ecological problems of drought, desertification and the menace of pest invasion. Marked fall in the level of underground water has compounded the problem of sustaining ecological balance in the study area (KTSG, 2013).

Population and Socio-Economic Characteristics

The 2006 national population census put the population of Rimi LGA at 154, 092. Ethnic profile of the study area is a predominantly Hausa-Fulani who are largely Muslim faithful's. The working population of the people in the study area are farmers and cattle rearers with rich cultural values. There are a considerable number of nomadic cattle Fulani, who's male's rear livestock, while the females hawk locally prepared fermented milk. Agriculture remains the dominant economic activity employing 80% of the population. Three is a large and youthful labour force, which, can become a great economic asset. About 56 % of the labour force is below 35 years and 38 % aged between 35 – 64 years (KTSG, 2013).

Agricultural Practices

Agriculture is predominantly on a smallholder basis in the study area, and indeed the entire Rimi LGA. About 90 % of farm holdings are less than 2 hectares. Main system of farming is traditional where hoe and cutlass are the main farming tools. There is little mechanized farming that involve tractor and machinery usage. However, in most land preparation, bullock farming is extensively practiced in the study area. There is no variation in the agricultural production system since the rainfall amount, distribution pattern and nature of soil is similar through the study area except for those involved in dry season farming.

Most food crop farms are intercropped. Mono cropping is mostly associated with few larger-scale commercial farms. Sorghum, Millet, Groundnut, Pepper, Mango, Livestock, Water Melon, Cotton, Tomato, Pepper, Amaranths, Onions and Garlic and Hides are the major agricultural products produced in the study area. Recently, few farmers are into sesame, maize and wheat production (FAO, 1997; Cosmas et al. (2010) and KTSG (2013).

Sampling, Data Collection and Analysis

The data for this study was obtained from a sample survey conducted between April and May 2019 amongst 150 farmers who practice irrigated farming at Kwanar Are Dam in Rimi LGA, Katsina State. Multistage random sampling procedure was employed in selecting the sample from where the data was collected, Babbie (1994). In the first stage, purposive sampling technique was used to select 5 from 10 villages that are located around the irrigation scheme. The selected villages are: Faduma, Cikakoshi/Are, Kadandani, Remawa/Iyatawa and Rimi. In the second stage, random sampling technique was used in selecting 30 respondents in each of the villages to give a total of 150 respondents for the study.

Data was obtained through a well-structured questionnaire schedule with both open and close ended questions. The questions directed at the farmers were meant to obtain information on demographic characteristics, farmers' level of participation in irrigation activities, impact of various levels of farmer education on productivity and other issues that are pertinent to the focus of the study. Respondents were contacted personally explaining the objectives of the project, encouraging them to participate.

Descriptive statistics such as frequency distribution, charts, mean and percentages were employed to analyze the quantitative data to determine the factors influencing acceptance of farmer education and irrigation technology for sustainable food production among farmers in the study area.

RESULTS AND DISCUSSION

Demographic Socio-Characteristics of the Farmers

In an attempt to gauge how farmers' socio-economic characteristics affected irrigation technology adoption, a number of variables were considered. These include gender, age, marital status, farm size, access to credit, levels of formal education, land ownership, cooperative affiliation, etc.

Farm and Family Characteristics

The results of the study shows that over 90% of farm households own private land in the study area. The average family size was 6 – 7 persons while mean of labour size in the households was three persons and average age of household heads was about 45 years old. Some 25% of farmers have market access, and nearly 75% of them participates in both rain fed and irrigated farming activities in the study area.

Majority of the respondents (80%) participated in dry season irrigation farming at the Kwanar-Are Dam on full-time bases while 19% were practicing irrigation on part-time basis probably to argument their income. Farm practices in the study area are predominantly subsistence; mainly family-based labour; equitable small land distribution; low levels of agriculture extensions; and very limited access to credit.

Gender

Results obtained reveals that only male farmers were participating in irrigated farming in the study area. This infers that agricultural production in the study area is male dominated.

Female were not involved in irrigation practices suggesting that women are not given opportunity to own farm and contribute to household food security. This may possibly be as a result of the religious belief of the respondents who are largely Muslim faithful's and do not allow women to participate in jobs that are mainly reserved for men. Females were merely hawking locally prepared fermented milk, poultry enterprise, pottery, mat making and commercial food-related enterprises thus agreeing with earlier report of KTSG (2013).

Marital Status

Results obtained indicated that majority of the farmers (92%) in the study areas were married while remaining 8% of the farmers were either divorced or widowed. None of the respondents was single. The study also revealed that 56 % of irrigation farmers within the age bracket of 41 – 50 years have more than one wife. Married couples were observed to be more focus and serious minded than those who were divorced, or widowed. This may be attributed to the fact married farmers have responsibility for up keep of their immediate families unlike the unmarried who has less responsibility of family up keep.

Age

Data obtained indicates that majority of the irrigation farmers (87%) were within the ages of 20 – 50 years, 56% of which was between 41 – 50 years. This corroborates reports of FAO (1997) which placed the active age of farmers between 40 – 50 years thereby reflecting the active nature of irrigation farmers in the area. It was also discovered that youth were being attracted into irrigation farming possibly because of the tight economic situation where white collar job is not easy to come by. It was further observed that younger farmers who were between the ages of 20 – 31 years make up about 15 % of the respondents. Closely followed by this group of irrigation farmers were respondents whose age bracket ranged between 31 – 40 years that constitutes 16%. These sets of farmers were observed to be flexible, more likely to be dynamic and willing to take risks associated with farming with hope of improving their income levels. Individuals within this age group in the study area were however constrained by lack of access to land for farming and collateral security for access to credit facilities. Only a few of them could afford to own land due to customary laws concerned with property inheritance. These observations were in agreement with the studies conducted by Mishra et al., (2002) and Onwubuya (2005) that young farmers were innovative, more flexible and ready to accept and adopt new technologies that reduce time spent on farming. The study also reveals that (13%) of the respondents' age was above 50 years. Older farmers in the study area were unlikely to adopt sustainable technologies introduced to them. Caswell et al., (2001) discovered old age to diminish farmer's interest in the new technology because of farmer's advanced age, and the possibly due to less interest in amercing wealth.

Farm Size

The study also revealed that majority of the farmers (56%) in the study area had farm sizes ranging between 3 – 5 acres. About 38 % of the respondents had > 2 acres, implying that the farm size was quite small for the use of modern farming technologies (Figure 2). By virtue of their limited educational background, these set of irrigation farmers may not be able to produce maximally since their rate of adoption was low. The study agreed with Polson and Spencer (1991 who rightly found that only farmers with larger farms or higher yields were more likely

to pay close attention towards accepting and adopting farming technologies.

The study further showed that 4% of the respondents farm sizes between 5 – 10 acres while 2% of the farmers in the study area had more than 10 acres farm land. This implies that majority of the respondents were peasant farmers producing on a small scale to feed their families and a small quantity for sale. The result could infer that the farmers have small capital base, poor access to farm input and lack of extension education as an aid to increase productivity. This buttresses Polson and Spencer (1991) assertion that the agricultural sector has been left largely in the hands of poor and subsistence farmers.
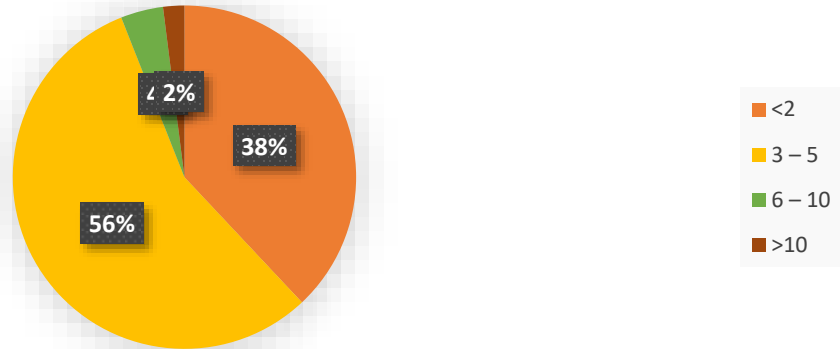

Figure 2: Farm Land Distribution among the Respondents

Farming Experience and Educational Background

Figure 3 describes the knowledge base of irrigation farmers in Kwanar-Are Dam irrigation site showing education levels in the categories of no education, adult, primary, secondary, college, and university educational levels. As shown, primary education is the predominant category among smallholder farmers in the study area where about two-thirds (64%) have only a primary school education, while 20 % of the respondents had no formal education. The study also observed that those who attained secondary and university education were 6% each. Similarly, 2 % each of the respondents were either having Diploma or Advanced Degree. This also implies that the study area was not dominated by literate farmers.
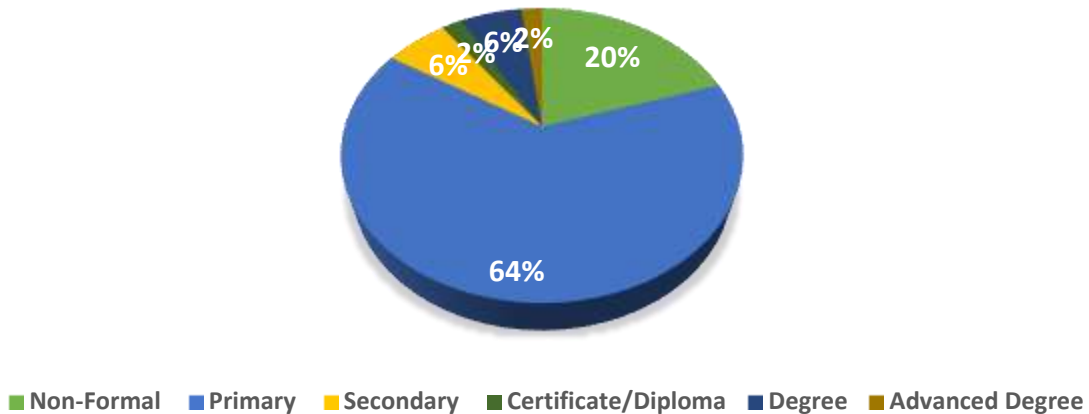

Figure 3: Educational Background of the Respondents

Irrigation farmers in the study area who have accepted and adopted improved technologies were in most cases observed to have a certain level of education. This observations were in agreement with an earlier study conducted by Caswell *et al.*, (2001) that education creates a psychologically favourable mental attitude for effective and efficient acceptance and adoption of new technologies. With regards to irrigation farming experience, the study revealed that 30% of the farmers in Kwanar-Are Dam have been practicing irrigated agriculture between 5 – 10 years while 60% have experience of more than 10 years indicating the 90 % of irrigation farmers have been in the business for more than 5 years (Figure 4). The long years of farming experience could possibly be the reason why these farmers have high adoption rate and the capacity to overcome production constraints despite the fact that farmer education and extension services was at its minimal web. These findings does not contradict earlier observations of DiGennaro (2010) who found experience to be a positive and significant in acceptance and adoption of micro irrigation technologies.
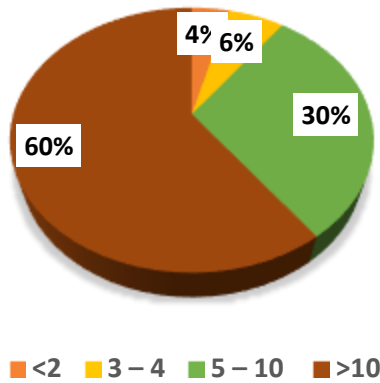
Figure 4: Irrigation Farming Experience

From the results obtained, it was also observed that 87 of the 150 farmers representing 58% of the respondents sought and attended one form of farmer education of the other in the last 5 years. Topics discussed include management of farm inputs, marketing strategies, irrigation techniques and water management, product preservation and storage, agricultural credit, financial planning and budgeting. Benefits derived from these form of farmer education in the study area include increased production, improved access to agricultural information, improved management of inputs, and improved marketing strategies. Along this line, Onwubuya (2005) noted that increased agricultural production depends primarily on the educating farmers to accept changes which are difficult for the illiterate farmer. Hamisu *et al,* (2017) also observed that vital information provided to farmers by extension agents helps in identifying their problems and possible solutions.

Societal leadership

On community and other social leadership, result obtained revealed that traditional, religious and political leadership in the study area accounts for 11, 8 and 3 % of farmers engaged in irrigation farming, respectively. This indicates that a total of 22 % of the farmers are in leadership positions which gave them the ability to influence famers one way or the other. The implication of this means that an innovation could easily be transmitted to the farmers once these group of leaders were convinced with effectiveness and workability of the introduced technology. This result was in agreement with Haile (2008) who found that for any organization or group to survive, there must be an effective leadership to give direction to the efforts of accomplishing the goals of the organization. Similarly, the results of this study does not contradicts the findings of Polson and Spencer (1991) who noted that traditional leader has authority by virtue of the community's tradition; enjoins unlimited loyalty and undisputed obedience as a mark of respect for the stool or office, irrespective of the qualities of the incumbent. In rural communities they are influential because people look unto them for their knowledge and skills for direction and assistance on various matters both within and outside the scope of their expertise.

Access to information and social network

Findings regarding the information sources utilized by these farmers revealed that 62% of the respondents obtained information concerning improved irrigation technologies from radio and television programs in Kwanar-Are Dam (Figure 5). These programmes inspired the farmers to accept and adopt new innovations of irrigation practices in order to reap the benefits projected. Radio and television appears to be the most reliable source of information by the irrigation farmers in the study area. In an earlier study, Polson and Spencer (1991) have discovered radio and television contacts as most stimulating methods of adoption among farmers.
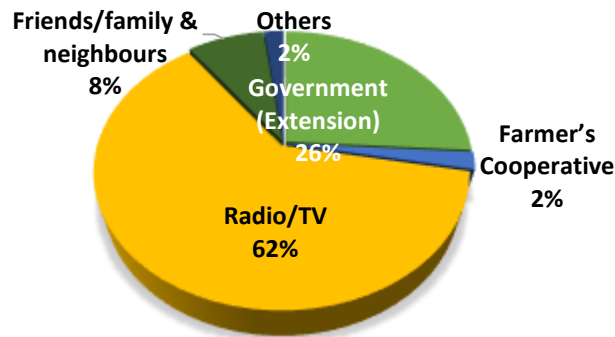

Figure 5: Respondent's Access to Information and Social Network

The study also revealed that 26% of the respondents obtained information concerning improved irrigation technologies from the extension workers that occasionally visits to provide them with advisory services. This discovery also agreed with Polson and Spencer (1991) that contact with extension agents have positive and significant influence on their technology adoption. Caswell *et al*. (2001) also agreed that information reduces uncertainty about a technology's performance hence may change individual's assessment from purely subjective to objective.

Results obtained shows that only 2% of the respondent's resorted to obtaining information about irrigation technologies from Farmer's Cooperative. The limited number of irrigation farmers that sought and obtained information from the Farmer's Cooperative (2%) indicated the absence and weakness of the Cooperatives in terms of assisting the farmers to improve and increase production.

Credit Systems and Economic Factors

Results obtained shows that majority of the respondents (80%) of the irrigation farmers in the study area had no access to credit while only 14% of the respondents had access to credit facilities. Those who were able to secured loan were educated and/or in one position of authority or the other. Lack of credit facilities may also be the major reason of the minimal progress generally observed among the irrigation farmers in the study area. Awotide *et al.,* (2012) found access to credit as being among the key elements that were prerequisite for improving agricultural production and poverty reduction. This could enable them acquire relevant tools required for the acceptance and adoption of improved irrigation technologies.

Government Policies

External factors such as policies were observed to have influenced farmers' adoption decision. There is continuous policy instability in providing the adequate environment needed by governments at various levels. Subsidy removal on fertilizer, irrigation pumps and other inputs was observed to be the greatest policies that negatively affect the performance of farmers in the study area. Irrigation farmers had to pay more for inputs thereby increasing their cost of production and limiting their purchasing power. Similarly, government's inability to enforce price control does not favour irrigation farmers in the study area, especially when there is glut. This does not encourage technology adoption. Results of this study, therefore, confirms the observations of Norman *et al.*(1997) that negative domestic policies are great obstacles for advancement of sustainable agriculture systems.

Land Tenure

The system of land ownership among the respondents in the study area was captured in Table 1. Farmers themselves own a majority of the cultivated area within the scheme. This was attributed to the prevailing land tenure systems which culturally favour men in inter-generational property transfer and gender roles. Very few respondents (2%) have been managing irrigation plots for their aged mothers. Leasing of plots is observed only in few cases. Results obtained does not therefore contradicts the findings of Polson and Spencer (1991) that subsistence producers have traditional ownership rights to farmland either through inheritance or as part of communal village holdings.

Table 1: Respondent's Land Tenure System

Land Ownership	Frequency	Percentage	Cumulative Percentage
Inheritance	114	76	76
Lease/Rented	15	10	80
Purchased land	21	14	100
Total	**150**	**100**	**100**

Landlord/tenant relationships was also seen to have negative effect on adoption. Lessors were afraid of using much inputs on the plots for fear that the land owner may not allow them to cultivate the same plot in the coming year. Land owner may also decide to change how land is currently utilized, which will surely affect the farmer. This findings agrees with Polson and Spencer (1991) that an insecure land rights inhibits innovation. Land ownership was thus a key factor for farmers since it enables them to make decisions about its development as well as accepting and adopting irrigation technology.

CONCLUSION

This study provides insight about the underlying socio-economic factors influencing the decision to adopt farmer education and irrigation technologies in the study area. Gender, age, marital status, farm size, availability of inputs, access to information and credit, land ownership, support services, membership in farmer's cooperative, farmer education, etc. were observed to have positive effects on adoption. Farmer education were seen to broaden farmers' understanding of irrigation farming to accept and actively participate in irrigation farming to achieve sustainable food self-sufficiency. The study also identified the constraints and possible solutions associated with the non-acceptance of farmer education include low level of formal education, poor extension service and poor loan facilities in the irrigation scheme. Extension education programmes significantly increase yields, create employment and to improve food security and secure livelihoods in the study area. Results of this study would also provide realistic information on irrigation development and for formulating future strategies on irrigation investment in the study area and the country at large.

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