

**DETERMINANTS OF SMALLHOLDER FARMERS MARKET PARTICIPATION; A  
CASE STUDY OF RICE MARKETING IN AHERO IRRIGATION SCHEME**

**BENARD OWINO APIND**

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of the Award of Master of Science Degree in Agricultural and Applied Economics of  
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**DECLARATION AND APPROVAL**

**DECLARATION**

I declare that this thesis is wholly my original work and to the best of my knowledge has not been presented for the award of any degree in this or any other university.

Signature: -----

Date: -----

**Benard Owino Apind**

Reg. No.: KM17/3258/12

**APPROVAL**

This work has been submitted to graduate school under our approval as university supervisors.

Signature: -----

Date: -----

**Prof. Job K. Lagat, (PhD)**

Department of Agricultural Economics and Agribusiness Management,

Egerton University, Njoro (Kenya).

Signature: -----

Date: -----

**Dr. Hillary K. Bett, (PhD)**

Department of Agricultural Economics and Agribusiness Management,

Egerton University, Njoro (Kenya).

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## **DEDICATION**

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## ABSTRACT

The extent of market participation among smallholder farmers indicates the level of commercialization of rural production. The marketed surplus reaches the urban consumers and other rural non-producers through market participation by the producing households. During the government management, rice farmers within the Kenya National Irrigation Schemes were compelled to deliver all their output to the National Irrigation Board mills for milling and marketing. Currently farmers market their own rice and make any use decisions with their output, a case that attracted many private traders. The entry of the private sector traders is often regarded as a motivation to a wide number of participants. The objective of the study was to characterize smallholder rice farmers in Ahero Irrigation Scheme, determine the rice marketing outlets and their price differential, determine the factors that influence smallholder farmers' choice of marketing outlets and the extent of market participation. The study was conducted in Ahero irrigation Scheme, in Kisumu County Kenya. Multistage sampling procedure was employed to contact 182 respondents and a semi-structured and pre-tested questionnaire used to collect data from smallholder rice farmers in the scheme through face to face interview. The data was analyzed using descriptive statistics, Multinomial Logit Model and Multiple Regression model. SPSS and STATA computer programs were used to process the data. Among the five marketing outlets, Private Millers handled 39% of rice produce, followed by NIB Millers 30.8%, Brokers 20.9%, Others outlets 7.1% and last was Consumers with 2.2%. It emerged that there was statistically significant price differentials among the various participating marketing outlets. Choice of marketing outlet was significantly influenced by age, gender, years of education, land tenure, contract marketing, regular buyer, market distance, group marketing and market information source. The result indicated that about 89% of rice produced in the scheme was marketed. Eight factors; household size, off farm income, grading, group marketing, source of market information, level of output, extension services accessed and access to credit significantly influenced the extent of rice marketing among the farmers. Based on the results of this study, there is need to harmonize rice prices to benefit all the farmers. Market information and extension services should be timely delivered to farmers to empower them with market opportunities and market demand and more farmer friendly credit institutions be made accessible to farmers to ensure greater depth of outreach in provision of credit.

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## **LIST OF ACRONYMS AND ABBREVIATIONS**

<b>AFC</b>	Agricultural Finance Corporation
<b>AIRF</b>	Ahero Irrigation Revolving Fund
<b>AIS</b>	Ahero Irrigation Scheme
<b>ANOVA</b>	Analysis of Variance
<b>EUCORD</b>	European Corporation for Rural Development
<b>FAO</b>	Food and Agriculture Organization
<b>GoK</b>	Government of Kenya
<b>ME</b>	Marginal Effects
<b>ML</b>	Multinomial Logit
<b>MoA</b>	Ministry of Agriculture
<b>NIB</b>	National Irrigation Board
<b>OLS</b>	Ordinary Least Square
<b>SPSS</b>	Statistical Package for Social Scientists

## **CHAPTER ONE INTRODUCTION**

### **1.1 Background of the study**

Rice (*Oryza sativa*) is the third most important staple food crop in Kenya after maize and wheat. It is majorly produced as a cash crop amongst the rural producers in the country. The production of rice in Kenya is done under three major categories including National Irrigation Board (NIB) Schemes, Non-NIB irrigation and Rain fed production. There are four major rice irrigation schemes under the NIB which include Mwea in Central region, Bunyala in Western, Ahero and West Kano in Nyanza region. In Ahero irrigation scheme, rice is mainly produced by smallholder farmers (GoK, 2008).

As Kenya aspires to produce enough rice to supply its over 40 million people over the next years, the Government reverted to policies that would increase rice productivity especially in the NIB schemes. Improving productivity would ensure increase in food security and increased income among smallholder farmers (Omondi and Shikuku, 2013). The marketed surplus reaches the urban consumers and other rural non-producers through market participation by the producing households. The marketed output can be greatly influenced by the current changing eating habit in Kenya, where majority of people are now using rice as one of the major food items.

In NIB schemes, before the year 1999, the Government agencies took the responsibility for purchasing inputs, selling outputs and organizing production and marketing processes. This approach took on the character of ‘command-and-control’ operations, with smallholder farmers largely treated as laborers (Ruigi, 1988; Swallow *et al.*, 2007; Omondi and Shikuku, 2013). In this respect, farmers were required to deliver their produce to the NIB mills, which marketed and determined the price and dues for farmers. Farmers had to bear the cost of delay in land preparation and seeding and also inefficiencies in milling and marketing (Kabutha and Mutero, 2002). These conditions resulted in low output, low incentives to deliver the produce to the NIB mills, and consequently low revenue for the farming households. In contrast to the failure of state-sponsored smallholder irrigation, commercial irrigation operations, in which commercial farms pay for efficient irrigation and market services, have generally remained profitable (Shah *et al.*, 2002; Cheserek *et al.*, 2012).

In its thrust for commercially oriented and modern agriculture, the Government of Kenya divested from state handling production, processing and marketing of rice that could be better done by the private sector. Such a move has promoted increased productivity, commercialization and competitiveness of agricultural commodities and enterprises. Farmers in the NIB irrigation schemes therefore market their own rice. In its Agricultural Sector Development Strategy (2010-2020), the Government noted that subsectors that are liberalized perform better generally than those that are not. In line with vision 2030, it emerged that to achieve the transformation of smallholder agriculture from subsistence to commercial business, there is need to improve market access for smallholders through agricultural policy reforms and institutions (GoK, 2007).

Ahero irrigation scheme was commissioned in 1969 and experienced several challenges under government management. It collapsed in the year 1997, a case that Mambala (2007) attributes to the high government involvement that crowded out the private sector. Kabutha and Mutero (2002) affirm that the low produce prices, high costs of seeds, fertilizer and chemicals from the NIB management also exacerbated conflicts between the NIB and the farmers. In the National Irrigation Board Corporate Plan for 2003-2007, reforms were proposed to reduce government involvement in non-core activities. This led to the revival of Ahero Irrigation Scheme towards the end of the year 2004, with the NIB remaining as the water service provider.

The reforms that shifted the production and marketing decisions to farmers led to the emergence of large number of rice traders, small scale rice millers, and large scale private sector rice millers in addition to the jointly owned NIB mills. The rice farmers in the NIB schemes therefore produce and sell their rice through different market outlets of their choice. The main outlets are NIB mills, private sector mills, brokers and consumers' (Omondi and Shikuku, 2013; Short *et al.*, 2012). A rational producer is expected to use an outlet that maximizes their profits from the sale of their farm produce, or from a coexistence of marketing outlets, choose one that maximizes their expected utility such as convenience and relations.

## **1.2 Statement of the problem**

Under the Government management, rice farmers within the National Irrigation Schemes including AIS were compelled to deliver all their output to the NIB mills for milling and marketing. The low produce prices, high costs of seeds, fertilizer and chemicals from the NIB management led to conflicts between the NIB and the farmers, a case that led to collapse of the scheme in 1997. With the revival of the scheme in the year 2004, NIB remained as the water service provider and the farmers free to market their own rice and make any use decisions with their output, a case that attracted many private traders. The entry of the private sector traders is often regarded as a motivation to a wide number of participants. However, little was known about the extent of market participation by the smallholder rice farmers in AIS under farmer management. Consequently, it was not clear which of the available marketing outlets offered better prices for the farmers' output. It is, expected that a profit maximizing producer will use a marketing outlet that maximizes profits and subsequently improves on their welfare. The dearth of information concerning the extent of market participation by smallholder farmers in AIS, and their choice of marketing outlets was the basis of the study. This study attempted to fill these knowledge gaps.

## **1.3 Objectives of the study**

The general objective of the study was to investigate the extent of market participation of rice farmers in Ahero irrigation scheme through the various marketing outlets towards improving the welfare of the smallholder farmers.

### **1.3.1 Specific objectives**

1. To characterize smallholder rice farmers.
2. To determine the rice marketing outlets and their price differentials.
3. To determine the factors that influence smallholder farmers' choice of marketing outlets.
4. To determine the extent of market participation by smallholder rice farmers and the factors that influences the extent of participation.

## **1.4 Research questions**

1. What are the characteristics of smallholder rice farmers?
2. What are the rice marketing outlets and their price differentials?
3. What are the factors that influence smallholder farmers' choice of marketing outlets?

4. What is the extent of market participation by smallholder rice farmers and factors that influence the extent of participation?

### **1.5 Justification of the study**

The extent of farmers' market participation can be used as a measure of the level of commercialization among the farming households. Commercialization is an important aspect of smallholder farming since it acts as a form of rural employment and source of income to the farming households. The generation of income helps alleviate poverty levels and thus improved livelihood. The choice of marketing outlets by the individual farmers helps them in exploring the options from which they derive maximum satisfaction. In bid of commercial agriculture, the Government of Kenya divested from state handling production, processing and marketing of rice that can be better done by the private sector (GoK, 2007). Since the shift from government managed to farmer managed production of rice in the NIB schemes, much is not known about the market participation by the farming households.

This study aimed at determining the market participation by smallholder rice farmers in Ahero irrigation scheme under farmer management. Understanding the extent of farmers' market participation helps stakeholders to establish effective and efficient policies, extension projects and programs that would promote commercialization. Identifying price differentials between the various marketing outlets helps inform farmers on profitable outlets to market their rice. This increases the income base for the farmers and consequently improves on their welfare.

### **1.6 Scope of the study**

The study was carried out in Kisumu County, Muhoroni Sub County, Kenya. The study focused only on smallholder rice farmers in AIS.

### **1.7 Limitations of the study**

Ahero Scheme is just one of the schemes under the NIB which operate under same circumstances but were excluded from this study. Information on socio-economic, institutional and market factors was collected by use of a structured questionnaire. Therefore, the study might be limited by failure of farmers to give accurate information because of problems of recall of past information due to unavailability of records keeping.



## **1.8 Definitions of terms**

**Market participation** - refers to any market related activity which promotes sale of produce.

**Extent of market participation** – refers to the proportion of produce sold to the total quantity produced.

**Marketing outlets** – are the buyers through which the farmers sell their farm produce.

**Price differentials** – are the differences in prices among the rice marketing outlets.

**Socio-economic factors**- factors that influence both the social and economic wellbeing of an individual.

**Institutional factors** – are formal and informal rules that govern transaction activities between individuals or among groups of people.

**Market factors** – any external factors that affect the demand for or the price of a good or service.

**Smallholder farmers** – are rice farmers characterized by land holding less than 5 acres.

## **CHAPTER TWO**

### **LITERATURE REVIEW**

#### **2.1 Consumption and production of rice**

Rice in Kenya was formerly consumed more in the urban areas, with most people in the rural consuming little. Currently, the consumption of rice has been growing rapidly than for other cereals (EUCORD, 2012). Cheserek *et al.* (2012) attributes this increase to a progressive change in people's eating habits, coupled with rapid urbanization in the country. Being the third most important cereal after wheat and maize, EUCORD (2012) states that rice per capita consumption in Kenya was about 10-18 kilograms per year from the year 2005. This is observed to have increased in the years after, at a rate of 12% compared to wheat at 4% and maize at 1%. It is still expected that the demand for rice will continue to rise in the future (GoK, 2008; EUCORD, 2012). This provides an opportunity for rice farmers to increase their market participation in order to benefit from the increasing market demand of rice.

With the soaring demand of rice in Kenya, the country is only able to produce 20% of its national needs, leaving a bulk of deficit. The deficit is met through imports. Nearly all the imports come from the Far East, with Pakistan accounting for 74% of total imports during the period 2006-2010, followed by Vietnam at 7% (Short *et al.*, 2012). Of the 20% domestic production, 80% is produced under irrigation and 20% is rain fed (GoK, 2008). Short *et al.* (2012) found out that 74% of the irrigated rice was produced from the NIB schemes in the period of 2005-2010.

#### **2.2 Smallholder commercialization**

Commercialization is often viewed as an avenue to improve household food security due to its comparative advantages over subsistence production. Household commercialization as defined by household participation in input (fertilizer and seed) and crop output markets affects food security position (Kirimi *et al.*, 2013). Economic liberalization has given opportunities for smallholder farmers to diversify their products and take their surplus to nearby markets (Asfaw *et al.*, 2010). Removing trade barriers and discouraging local monopoly helped smallholder farmers to choose their markets both inputs and harvested products (Shiferaw *et al.*, 2008). Such participation is expected to have a positive impact on their incomes and thus enhance their livelihoods (Jagwe *et al.*, 2010).

### **2.3 Marketing of rice**

Most small holder operations are ordained with the family as the center of planning, decision-making and implementation. The marketing decisions are taken by the farmers in terms of whether to sell or not to sell and the quantity to be taken to the market. These decisions determine their market participation. Policies for commercial transformation of smallholder agriculture are often aimed at promoting household market participation (Gebremedhin and Jaleta, 2013). Salami *et al.* (2010) states that improved market participation is a key precondition for transformation of the agriculture sector from subsistence to commercial production. Commercialization is often viewed as an avenue to improve household food security due to its comparative advantages over subsistence production (Kirimir *et al.*, 2013). Such a transformation can help address the poverty and income challenges that confront many smallholder producers (Alene *et al.*, 2008).

In the early years, before 2004, rice from the NIB schemes used to be delivered to NIB mills that processed and marketed the rice on behalf of all farmers through the National Cereals and Produce Board (Ruigi, 1988; Swallow *et al.*, 2007; Irea, 2010). With the rice sector liberalization, farmers make the use decision, and therefore market their own rice through the various emergent outlets. According to GoK (2008), there are four major rice mills spread across the country with varying capacities. LBDA has a milling capacity of 3.5 metric tons, Mwea NIB 24 metric tons, Western Kenya Rice mills 3 metric tons and Tana Delta with 3 metric tons per hour. In addition, there are several small privately owned mills within the proximity of the schemes. There are also several rice traders in the country. The major traders include the government owned National Cereals and Produce Board (NCPB), National Irrigation Board (NIB) and Lake Basin Development Authority (LBDA) through their rice mills in Ahero, Mwea and Kibos process and supply milled rice to supermarkets and local retailers; Dominion Farms and Capwell Industries among others. In addition, there are also numerous small traders mostly women who sell rice in the local markets.

### **2.4 Factors that influence participation**

Numerous factors are believed to have an influence on farmers' market participation decision. Such factors range from social-economic factors, institutional factors, market factors and external factors. Social-economic factors include age, gender, off-farm income, level of education, years of farming, household size, farm size and output level. Institutional factors

entail membership to a group, access to extension services, access to credit, land tenure, infrastructure, contractual arrangements and, policies and law. Market factors such as access to market information, prices of output, distance to the market place, means of transport and other external factors such as natural calamities that result in crop failure also determines market participation by the crop farmers.

The analysis of socio-economic factors that influence participation in indigenous fruits trade identified household size, gender, form of employment and distance to the market as significant variables (Mwema *et al.*, 2013). In his study, Awotide *et al.* (2013) found that gender of the household, contact with extension agents' educational level, area cultivated and use of improved varieties to be positively and statistically significant in determining market participation by smallholder rice farmers in Nigeria. Mathenge *et al.* (2010) explains that the age of the household head normally acts as a proxy for experience in farming, and therefore can significantly influence participation. Gender of the household head has an influence on household decision making and therefore significantly affects market participation. The female headed households participate more in trade of indigenous fruits (Mwema *et al.*, 2013). Compared to males, females have a lower probability of selling beans to traders and cowpeas to consumers, but they have a higher probability of selling to retailers (Boadu *et al.*, 2013). On the other hand, Guiterrez (2003) stated that female headed households are more likely to be resource constrained hence affecting production of marketable surplus that limits their participation in the market.

Household size can be viewed both in terms of family labour and the number of mouths to feed. Education is a key factor in making informed decisions, and therefore can influence market participation. In his analysis of the beans market in Zambia, Boadu *et al.* (2013) found that education is not a significant factor in determining market participation. Contrary to this finding, education level of smallholder farmers has been found to be a significant determinant of market participation (Davis *et al.*, 2013). Consistent with the positive relationship between education level and market participation is the finding by Ondieki (2013) where an additional year of schooling also increased the likelihood of participating in the French beans market.

Distance from the farm to the market is noted as a major constraint to the intensity of market participation by the smallholder farmers (Bardhan *et al.*, 2012). Ownership of transport

means can significantly determine participation in relation to the distance to the market place. This can be attributed to poor access to transport facilities due to high transaction costs. This provides a need to upgrade both rural access roads and roads in peri-urban areas, strengthen delivery systems and encourage market integration (Omiti *et al.*, 2009; Jagwe, 2011; Awotide *et al.*, 2013). Boadu *et al.* (2013) found that geographic location of smallholder farmers has a larger impact on market participation than gender and education. Market integration provides a sure market for the farmers.

Belonging to a farmers group is a social capital aspect that increases farmers bargaining power. Jagwe (2011), using a two stage Heckman and Probit model found that belonging to a farmer's group, significantly influenced extent of farmers' participation in banana markets. This finding is similar with the findings of Rutto *et al.* (2013) in his analysis of livestock market among pastoralist in Kenya. As explained by Jagwe *et al.* (2010), promoting collective action among smallholder farmers can help improve their economies of scale in input and output markets and the information flow among them.

Total crop land is a proxy measures of scale of production hence an important factor in determining surplus production for the market. Mukundi *et al.* (2013) states that market participation is predominantly determined by the resource base of a household, where the size of land holding is a fundamental factor. The findings of Mathenge *et al.* (2010) and Martey *et al.* (2012) confirm that larger farms have potential for a household to increase its marketable surplus hence increasing market participation. Larger farms are also likely to benefit from scale economies which translate into lower transaction cost and increased potential of participating in the market. Non-farm income can be used by farmers to buffer household income and therefore, those with more income from the farm may opt out of the market. Those with little non-farm income have to sell more in order to generate income. A study on Fresh fruits farmers revealed that farmers with less than 25% or less of their income from farming were 21% more likely not to participate in the market (Davis *et al.*, 2013).

Access to market information determines market participation by farmers. Whether obtained directly or through formal or informal institutional arrangements, it is critical for market participation (Jagwe *et al.*, 2010). As explained by Omiti *et al.* (2009), better output price and market information are key incentives for increased output sales. Access to extension service

empowers farmers with information about the market. Inadequate access to extension services hinders market participation (Ndoro *et al.*, 2013). Bardhan *et al.* (2012) explains that extension contact is one of the most important policy variables that favourably influence intensity of market participation among dairy farmers in Uttarakhand. In South Africa, an additional visit by an extension officer was found to be increasing the probability that the farmer will sell his/her livestock (Bahta and Bauer, 2007). Jagwe *et al.* 2010 states that Policies aimed at encouraging market information access, investments in rural infrastructure and collective action by farmers may help to lower transaction costs and thus enhance market participation.

The decision by farmers on market outlet through which to sell their farm produce is greatly influenced by the price they receive from the outlet (Lupin and Rodriguez, 2012). Convenience and relationship with the producer can also play a major role in this decision. A study by Umberger *et al.* (2010) revealed that long term relationship of farmers with their buyers, price, willingness to negotiate and cash payment are important factors to farmers when choosing a market outlet. Shiimi *et al.* (2010) found that problems with transport and accessibility to market- related information are significant factors affecting choice of a marketing outlet.

## **2.5 Econometric approach to modelling market participation**

In analyzing farmers' choice of marketing outlets, Multinomial Logit model (ML) has been used. The model predicts how changes in the independent variables translate into the probability of observing a particular categorical outcome. Therefore, using data from relevant independent variables, Gujarati (1992) explained that ML regression predicts the probability (P) of occurrence and not essentially attainment of a numerical value for a dependent variable. Binary logistic regression can also be used to model choice. In the binary logistic regression, the dependent variable has only two categories unlike ML model which allows for more than two categories of the dependent variable. Since this study presumed more than two categories of rice marketing outlets, ML model outweighs the binary logistic regression which is limited to a maximum of two choices.

Compared to the log-linear regression, ML model does not estimate the changes in the predictor variables by a constant amount. In ML regression, as the value of an explanatory variable gets smaller the change in the predictor variables approaches zero at a slower rate and

therefore the explanatory variables with more likelihood of determining a given choice gets the greater weight. Binary logistic regression and the log-linear regressions are therefore not more appropriate for the study and thus ML model was used.

In examining market participation, Heckman two-stage models, Double-hurdle model, and Tobit model have been employed. Tobit model was proposed by James Tobin in 1958. This Model presumes that the participation and sales volume decisions are made simultaneously and hence factors that affect the participation decision and the sales volume decision are the same. As proved by Fernando (2011), Tobit is limited in the sense that it is observed if only it is above or below some cut off levels *i.e.* left and right censoring, hence it is called censored regression model. Fernando explains that the results in the censored observation on the left pull down the end of the regression line resulting in underestimation of the intercepts and overestimation of the slopes. Similarly, if the censored observations are excluded for which  $Y > 0$  (that is, truncating the sample), it will overestimate the intercept and underestimate the slope. These observations make the Tobit model inappropriate, since the degree of bias in both cases increase as the number of observations that take on the value of zero increases.

Empirical studies have shown that the Tobit model is inadequate thus suggesting the use of alternative approaches. The Tobit model assumption of simultaneous decision making of participation and extent of participation is relaxed by the two- stage models. The two- step models allows for the separation of the two decisions, the decision to participate and the extent of participation. As explained by Omiti *et al.* (2009), several studies have adopted either the sample selection model of Heckman (1979) or the Double Hurdle model of Craig (1971).

The Double-Hurdle model is designed to deal with survey data which has many zero observations on a continuous dependent variable. This helps to solve the simultaneous decisions taken by an individual thus correcting the assumption of joint decision as assumed in the Tobit model (Gao *et al.*, 1995). In this model, the marketing decision is taken to be a two-step process. The household is thus assumed to make two separate decisions; first is the decision to participate or not to participate in marketing and the second being the decision on the extent of participation. It uses the Probit model to identify factors that affect decision to participate in the marketing and a truncated regression model to analyze the extent of participation by the participating households in the second stage. This model is not appropriate in this study because of the case of

incidental truncation, some part of the dependent variable is not observed because of the outcome of another variable.

Heckman two-stage model procedure is also a two stage estimator that utilizes a simple regression method to estimate behavioral functions by least squares methods. It uses the Probit model to identify the factors that influence decision to participate in the market and in the second step, uses the Ordinary Least Squares (OLS) regression estimate to determine the household extent of participation. The inverse mills ratio computed from the Probit regression, is used with other explanatory variables to help explain variable in the continuous, non-zero dependent. As discussed by Heckman (1979), the bias that results from omitted variables bias is eliminated, for the case of censored samples. The model also caters for the problem of selectivity bias that arises from purposive sampling procedure in the Double-Hurdle model and to relax the assumptions in the Tobit model.

Given that the two selection models have the two parts, the choice of participation and the extent of participation, they were not suitable for the study since it was presumed that all the farmers in the scheme participate in rice marketing. This study therefore adopted multiple regression models to determine the factors that influence the extent of market participation.

## **2.6 Theoretical framework**

This study was based on a framework of the theories of utility; the utility maximization theory and random utility theory (Norris and Batie, 1987; Pryanishnikov and Katarina, 2003).

### **2.6.1 Utility maximization theory**

The decision on the proportion of output to sell and the proportion to retain depends on the expected level of satisfaction derived from selling the output. This decision can be influenced by the socio-economic characteristics of the producer. In the case of rice, it is also influenced by the rapid changes in the eating habit, where the majority of Kenyans are turning to rice as a major staple. Those who use rice as a staple crop and have large household size may opt to sell less in the market and retain more for home consumption. Those who borrowed credit for the purpose of farming may be forced to participate more in order to pay back. Those who participate in the market have to utilize marketing outlets that maximize their profits or expected utility such as convenience and relations.



### 2.6.2 Random utility theory

Whenever an individual is to choose amongst a group of options, they are rational if they choose the option that gives the greatest utility, or else equal utility. If, when everything is taken into account, the decision that provides the greatest utility is equivalent to that which is the most preferred, and then we would expect the individual to take that most preferred option. This implies that a rational individual will always select that option that they prefer the most. It is important to emphasize how rationality relates to a farmer's individual preferences. Farmers prioritize different marketing outlets. For example one farmer may prioritize government outlets while another farmer may value private sector outlets, based on convenience, prices or relation. Given their preferences, both make the economically rational choice.

Therefore, assuming that farmer  $i$  chooses from a set of mutually exclusive marketing outlets,  $j = 1, 2, \dots, N$ , from which the farmer obtains a certain level of utility  $U_{ij}$  from the alternative outlet chosen. Assuming further that the intention of the farmer is to maximize utility from the choice made. The producer therefore makes a decision based on the utility achieved by selling to a given market outlet or to an alternative. In essence, producer  $i$  assign each alternative  $j$  in his choice set of supposed utility  $U_j$  and selects the marketing outlet that maximizes his/her utility. A number of measurable attributes of the alternative outlets and the farmer's characteristics who is the decision maker determine the utility assigned to each choice.

$$U_j^i = U^i X_j^i \dots\dots\dots (1)$$

In equation (1),  $U^i$  is the supposed utility and  $X_j^i$  is a vector of attributes relative to alternative  $j$  and to decision maker  $i$ , utility is still unknown with certainty and must be represented in general by a random variable. It follows that the probability that the farmer selects alternative  $j$  conditional on his choice set  $I^i$  will be:

$$P^i(j/I^i) = P^i(U_j^i > U_k^i) \quad \forall k \neq j \quad k \in I^i \dots\dots\dots (2)$$

Hence, the utility is decomposed into deterministic ( $v_{ij}$ ) and random  $\varepsilon_{ij}$  part:

$$U_{ij} = v_{ij} + \varepsilon_{ij} \quad \forall_{ij} \in N = v_{ij} \dots\dots\dots (3)$$

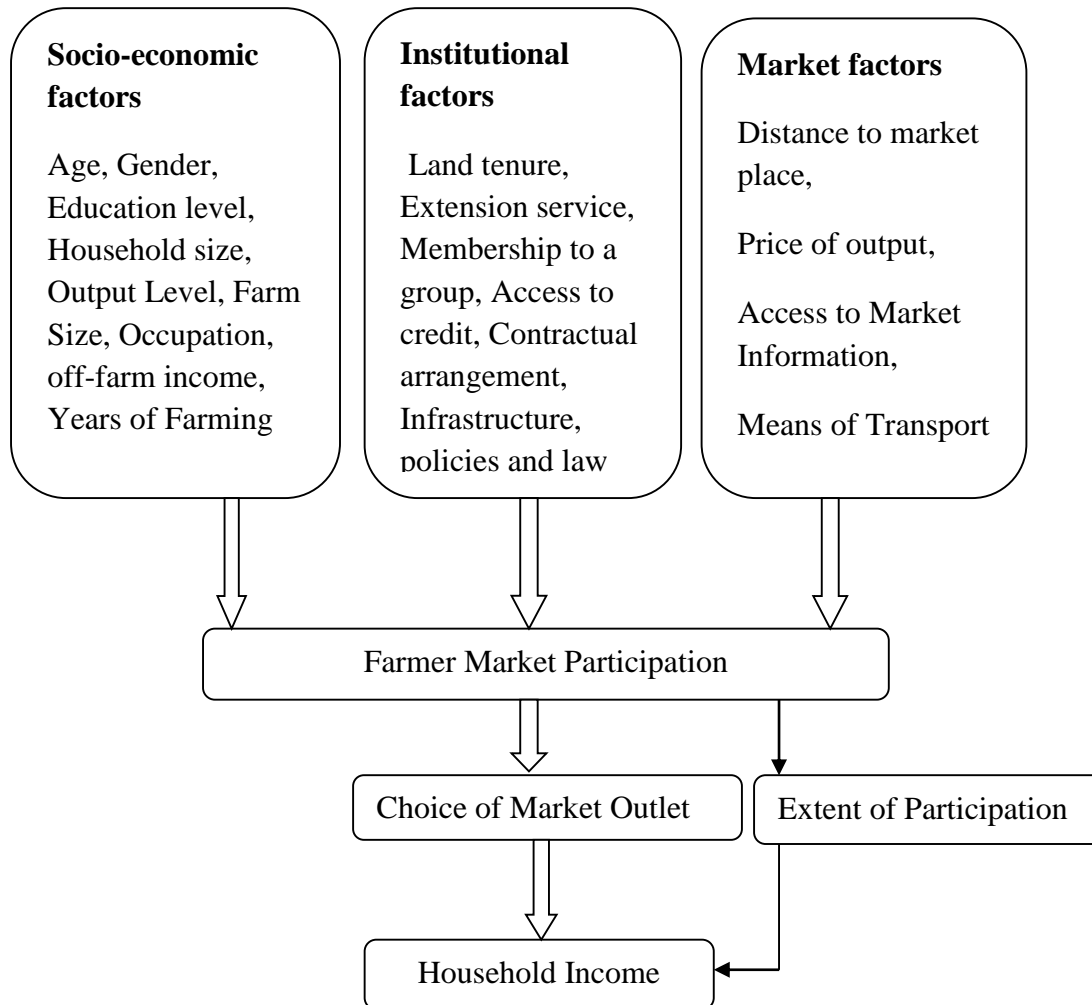
With  $V_j = E(U_j)$ , then  $E(V_j) = V_j$ ,  $\text{var}(V_j) = 0$  and  $E(\varepsilon_j) = 0$ ,  $\text{var}(U_j) = \sigma^2_{ij}$  these yields,

$$P^i(j/I^i) = \text{Prob}(V_j^i - V_k^i > \varepsilon_k^i - \varepsilon_j^i) \quad \forall k \neq j \quad k \in I^i \dots\dots\dots (4)$$

Where  $P^i$  is the choice probability of the outlets. Equation 4 gives the likelihood of farmers selecting alternative  $j$  and further suggests that the choice of a given alternative depends on the systematic utilities of all competing alternatives and on the law of joint probability of random residuals  $\varepsilon_j$ . From equation (3),  $\varepsilon_{ij}$  denotes a random error which is specific to a producer's utility preference (McFadden, 1976). A farmer is thus expected to choose an alternative that gives higher utility among the alternatives.

### 2.7 Conceptual framework

Farmers' market participation is accustomed by a number of variables which may consequently depend on the nature of the individual farmer's characteristics. The conceptualization of this study is given in figure 1. It identifies factors that influence farmer's decision to participate, extent of participation and choice of marketing outlets. The study conceptualizes that farmer's participation is influenced by socio-economic and institutional factors. Socio-economic factors include; household size, land size, age and gender of the household head, education level, household's wealth and occupation. Institutional factors include; extension services, access to credit from institutions, group membership. These factors also influence household's extent of participation. The choice of marketing outlet is mainly influenced by the market factors which include; infrastructure, distance to the market, prices of output, Information availability, customer search cost and cost of contracts. The extent of market participation and the choice of marketing outlets consequently determine the household income that impacts on household's welfare.



—————> Direction of influence

**Figure 1: Conceptual framework of the determinants of market participation among smallholder rice farmers.**

Source: *Authors conceptualization.*

## **CHAPTER THREE METHODOLOGY**

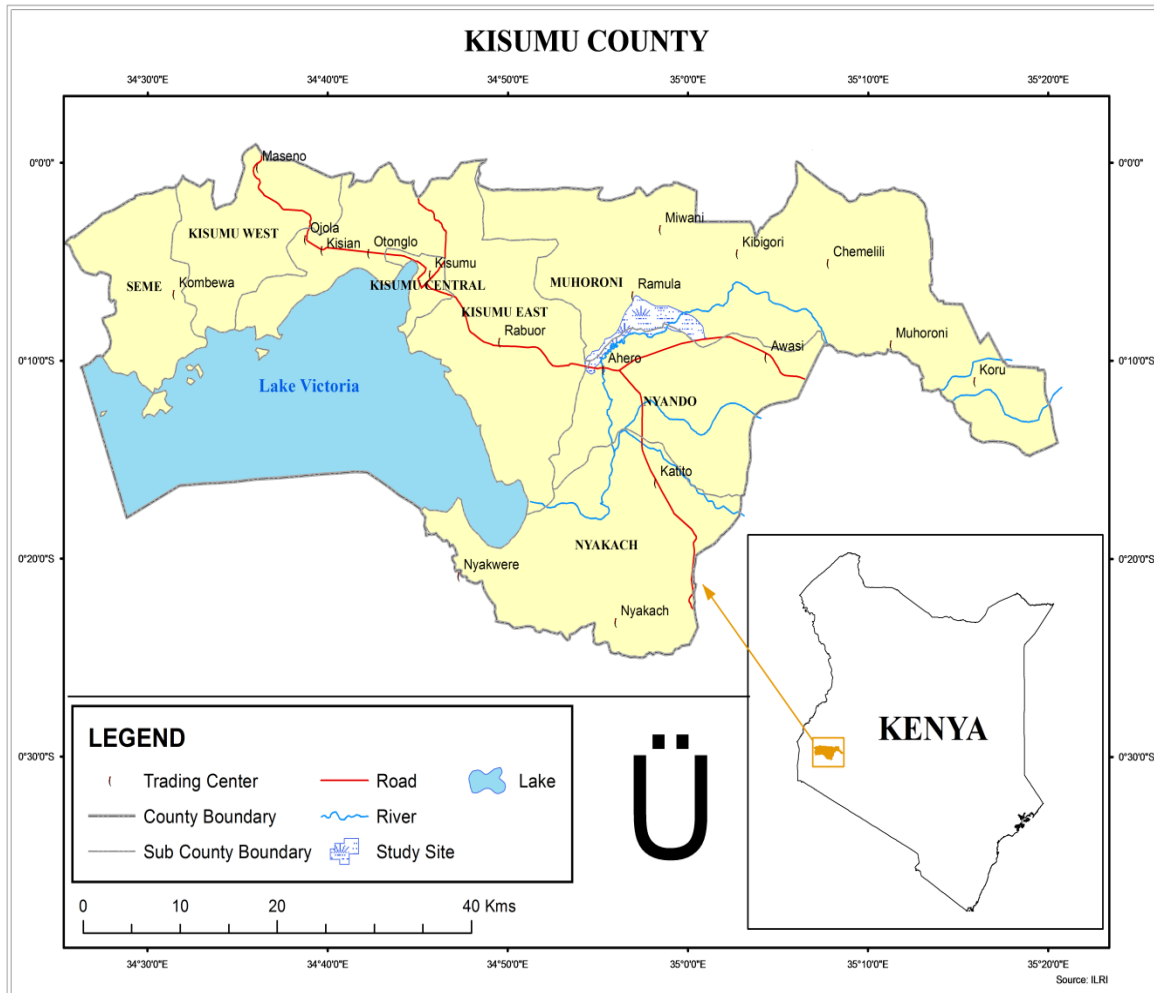
### **3.1 The study area**

Ahero Irrigation Scheme is located in Muhoroni sub-county, Kisumu County, Kenya. The scheme is located 24 km south east of Kisumu city. It lies in the Kano plains between Nandi Escarpment and Nyabondo Plateau at an altitude of 1,150 m above sea level. The climate of the area is relatively dry with high temperatures, annual mean temperatures vary between 17°C and 32°C. The area is relatively humid due to its proximity to Lake Victoria. It experiences three peaks of rains with an average annual rainfall of 1,000 – 1,800 mm. The first peak of rains occurs between March and July, with an average monthly rainfall of 150 – 260 mm. The other rainy season occurs in August. Short rains occur between September and October and have an average monthly rainfall of at least 125 mm.

The scheme covers an area of about 4,300 acres and is managed by the National Irrigation Board in partnership with the farmers who are charged Kshs. 2,559 per acre per year for scheme Operation and Maintenance (O&M). The area under cultivation is 2,624 acres which is divided into 12 Blocks with a total of 1,650 farmers and farm size of 1-4 acres. The scheme has population dependents' of about 30,000 people. Nearly all irrigated farmland is used for paddy cultivation as the main crop of four main varieties; Basmati 370, IR 2793, ITA 310 and BW 196. The average yield is about 1416 – 1821 kilograms per acre with an approximate net income of between Kshs. 25,000 and 35,000. (Omondi and Shikuku, 2013; NIB, 2014)

### **3.2 Sampling procedure**

The target population of the study was rice farmers in Ahero Irrigation Scheme, since all of them are smallholder. Purposive sampling was used to select 8 of the 12 blocks which included blocks P, L, M, N, O, C, K and B. Proportionate to size method was used to determine the sample size per block, after which random sampling method was employed in each of the blocks to give the total sample size of 182 farmers. The required sample size was determined by Yamane (1967) theorem as given in equation 5.



**Figure 2: Map of Kisumu County showing the study area.**

Source: ILRI (2014).

The general formula for sample size is given as:

$$n = \frac{N}{1 + N(e)^2} \dots \dots \dots (5)$$

Where  $n$  is the desired sample size,  $N$  is the population size and  $e$  is the acceptable error (0.07) to obtain a representative sample. Therefore:

$$n = \frac{1650}{1 + 1650(0.07)^2} = 182$$

**Table 1: Household population and sample size per block.**

<b>Block</b>	<b>Acres</b>	<b>Number of Farmers</b>	<b>Sample Size</b>
P	301	90	16
L	148	79	14
M	158	119	22
N	287	139	25
O	206	180	33
C	194	165	30
K	180	58	11
B	252	168	31
<b>Total</b>	<b>1726</b>	<b>998</b>	<b>182</b>

### **3.3 Data collection method**

A cross sectional data set was used. The methods for data collection included interviews, using formal questionnaires. Properly trained and carefully selected enumerators pre-tested the questionnaire. Primary data on socioeconomic characteristics, extent of participation and market outlets was collected through the administration of semi- structured questionnaire to the 182 respondents.

### **3.4 Data analysis**

Data obtained was edited, coded, cleaned to ensure consistency, uniformity, and accuracy, and then entered into computer software for analysis. Both SPSS and STATA computer programs were used to process the data.

### **3.5 Analytical framework**

Data regarding objectives outlined were analyzed as follows:

#### **Objective one and two**

The two objectives were analyzed using descriptive statistics such as graphs, means and percentages. This captured the socio-economic variables that indicate the characteristics of the farming households. The marketing outlets preferred by the farmers and their price differentials were also determined.

**Objective three**

To determine the factors that influence the choice of rice marketing outlets, multinomial logit model was used. A marketing outlet is chosen among other alternative outlets and is therefore discrete. The probability of choosing any given outlet can be represented by  $P_{ij}$  and is given by the equation below as,

$$P_{ij} = \beta_0 + \beta_i X_i + e \dots\dots\dots (6)$$

$i$  takes values (0, 1, 2, 3, 4) each representing choice of marketing outlet (NIB Millers =0, Private Millers=1, Brokers = 2, Consumers =3, Others outlets (Wholesalers and LBDA) =4).  $X$  are factors affecting choice of a marketing outlet,  $\beta$  are parameters to be estimated and  $e$  is randomized error. With  $j$  as the alternative choices, probability of choosing outlet  $j$  is given by,

$$Prob (Y_i = j) = \frac{e^{z_j}}{\sum_{k=0}^j e^{z_k}} \dots\dots\dots (7)$$

Where  $Z_j$  is choice and  $Z_k$  is alternative choice that could be chosen (Greene, 2000). The model estimates are used to determine the probability of choice of a market outlet  $j$  given the factors that affect the choice  $X_i$ . With a number of alternative choices log odds ratio is computed as,

$$\ln\left(\frac{P_{ij}}{P_{ik}}\right) = \alpha + \sum X_i (\beta_j - \beta_k) + e \dots\dots\dots (8)$$

$P_{ij}$  and  $P_{ik}$  are probabilities that a farmer will choose a given outlet and alternative outlet respectively.  $\ln\left(\frac{P_{ij}}{P_{ik}}\right)$  is a natural log of probability of choice  $j$  relative to probability choice  $k$ ,  $\alpha$  is a constant,  $\beta$  is a matrix of parameters that reflect the impact of changes in  $X$  on probability of choosing a given outlet,  $e$  is the error term that is independent and normally distributed with a mean zero. Marginal effects of the attributes on choice are determined by getting the differential of probability of a choice and it is given by,

$$(\delta) = \frac{\partial P_i}{\partial X_i} = p_i(\beta_j - \sum_{k=0}^j P_k \beta_k) = P_i(\beta_j - \beta) \dots\dots\dots (9)$$

Every sub-vector of  $\beta$  enters every marginal effect both through probabilities and through weighted average. Table 2 shows the variables to be used in multinomial logit model and multiple regression models.

**Multinomial logit model**

Choice of a marketing outlet is specified as shown below in equation 10 and 11.

$$P_{ij} = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \dots\dots\dots + \beta_n X_n + \varepsilon \dots\dots\dots (10)$$

$$(P_{ij}) = \beta_0 + \beta_1 AgeHH + \beta_2 GendHH + \beta_3 EducLvl + \beta_4 LandTen + \beta_5 Grading + \beta_7 MeansTrns + \beta_8 MrktDist + \beta_9 RegBuy + \beta_{10} MktInfoS + \beta_{11} GrpMrkt + \beta_{12} ContArr + \varepsilon \dots\dots\dots (11)$$

**Objective four**

To determine the factors that influence the extent of participation in rice marketing, a multiple regression model was used. These factors include socioeconomic, market factors and institutional factors. The regression allowed for estimation by OLS procedure where the extent of rice marketing (Y) is a linear function of repressors X. The extent of participation (Y) was generated from STATA computer program, achieved through dividing the quantity of rice sold by the quantity of rice produced.

The OLS model is given by:

$$Y = \beta_0 X_0 + \beta_1 X_1 + \beta_2 X_2 + \dots\dots\dots + \beta_n X_n + e \dots\dots\dots (12)$$

Where Y denotes the proportion of rice sales,  $\beta_0$  is a constant,  $\beta_1, \dots, \beta_n$  are parameters to be estimated  $X_{is}$  are vector of explanatory variables.

**Extent equation (OLS)**

Factors that influence the proportion of rice sales is specified as shown below,

$$Y_i = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \dots\dots\dots + \beta_n X_n + \varepsilon \dots\dots\dots (13)$$

$$(Y_i) = \beta_0 + \beta_1 AgeHH + \beta_2 GendHH + \beta_3 EducLvl + \beta_4 HHSiz + \beta_5 FrmSiz + \beta_6 OfFmInc + \beta_7 LandTen + \beta_8 ExtnS + \beta_9 CrdtAcs + \beta_{10} IMktInfS + \beta_{11} PrOutpt + \beta_{12} ContArr + \beta_{13} OutptLvl + \beta_{14} GrpMrkt + \beta_{15} Graging + \varepsilon \dots\dots\dots (14)$$



**Table 2: Description of variables used in the multinomial logit model and multiple regression model**

<b>Variable Code</b>	<b>Full identity</b>	<b>Description of the variables</b>	<b>Expected sign</b>
AgeHH	Age of household head	Age of the household head in years	+/-
GendHH	Gender of household head	Sex of the household head	+/-
HFrmSiz	Household farm size	Size of the household farm land in acres	+
HHSiz	Household Size	Size of the household	-
EducLvl	Level of education	Education level of the household head in years	+/-
LandTen	Land Tenure	Land tenure system of the farmers	+/-
OfFarmInc	Off farm income	Income earned from employment or other non-farm activities	+/-
CrdtAcs	Credit access	Access to credit from any institution	+
ExtnS	Extension services	At least accessed agricultural extension services	+
MrktDst	Distance to the market	Distance to the near markets in kilometers	-
MrktInfoS	Market information source	formal or informal sources of market information	+
OutptLev.	Output Level	The amount of output produced by the household	+
PrOutpt	Price of output	Per unit price of rice purchased from the rice farmers	+
GrpMrk	Group marketing	Market rice produced as a group	+
ContArr	Contractual	Any contract between the farmer	+

	Arrangement	and the buyer	
MeanTras	Means of Transport	Mode of transport used in marketing	+/-
RegBuy	Regular buyer	Sell produce to a particular buyer	+
Grading	Grading	Grade produce before sale	+/-

## CHAPTER FOUR

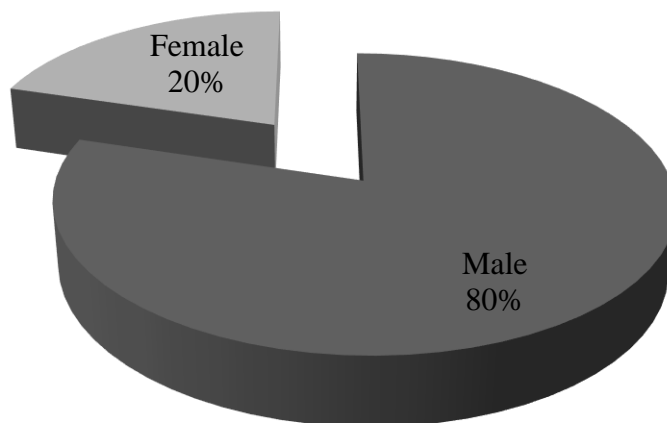
### RESULTS AND DISCUSSIONS

This chapter presents findings of the study and includes results and discussions.

#### 4.1 Characterization of smallholder farmers

##### 4.1.1 Socio-economic characterization of the farmers

In terms of gender distribution, as shown in Figure 3, majority of the farming households, (80%), were male headed. Female headed households comprised only 20%. A female as household head is majorly attributed to being widowed hence inherit land. Single females rent land for growing rice. The low possession of land by females is due to cultural marginalization that limits them the rights of accessing land.



**Figure 3: Gender of the household heads**

The results in Table 3 show the mean age of farmers was 48.33 years. The average household size for the scheme was approximately 6 people and this is slightly above the Kenya's national mean figure of 5 members per household (KNBS, 2010). It has been found that large household size negatively influences the extent of farmers market participation (Mwema *et al.*, 2013) as more of the farm produce will be held for home consumption. In terms of education level of the households, the average number of years taken in school by the household head was 8.33 which is approximately primary level. About 48.4%, had primary education level, 12.6% no formal education, 28% secondary level and tertiary education 11%.

Land holdings per household was an average of 2.15 acres implying that the farmers are smallholder. Rice output varied depending on the plot size majorly in addition to production techniques such as the use of inputs and other production management practices but the average yield was about 2391 kilograms per household. All the producers had a surplus for the market. The quantity of unprocessed rice sold was from 700 kilograms to a maximum of 5670 kilograms. This gives an average of 2137 kilograms of unprocessed rice sold per household. Of all the farmers in the scheme, 58.8% had no off farm income while 41.2% had at least a source of off farm income from either full time or part-time employment, business or pension.

**Table 3: Household socio-economic characteristics**

Characteristics	N	Minimum	Maximum	Mean	Std. Deviation
Age of the household head	182	26.00	73.00	48.33	11.62
Household size	182	2.00	13.00	5.61	2.64
Years of formal education of the household head	182	0.00	16.00	8.33	4.29
Size of land under rice in acres	182	1.00	4.00	2.15	0.86
Quantity of rice produced in kilograms	182	800.00	5850.00	2390.60	829.08
Quantity of rice sold in kilograms	182	700.00	5670.00	2137.03	832.79
Off-farm Employment	Frequency	Percent			

YES	75	41.20
NO	107	58.80
Total	182	100

Table 4 indicates the occupation of the household heads in the scheme. Majority of the farmers, (59.9%), depended on rice production as their source of income. Among them, 19.2% had either a formal or part-time employment while 16.5% engaged both in farming and business as a source of livelihood. Minority of the farmers, (4.4%), received pension as a source of income. These results show the importance of rice as a cash crop in the scheme.

**Table 4: Occupation of the household head**

Occupation	Frequency	Percent	Cumulative Percent
Farmer	109	59.9	59.9
Farming and Business	30	16.5	76.4
Farming and Employed	35	19.2	95.6
Farmer and Pensioner	8	4.4	100.0
Total	182	100.0	

Income category of the farmers with other source of off-farm income is as shown in Table 5. It was observed that 62.67% of those with off farm income earned an average of Ksh. 5000 per month and about 1% earned the highest off farm income of about Ksh. 45000. With such income levels and an average of six persons per household, it implies that the households may not sustain all the needs without supplementing. Therefore, rice has to play a major role as a source of income for both those depending on farming as a major activity as well as those with off farm income.

**Table 5: Off-farm income category of the household head**

Category in “000”	Mean in “000”	Frequency	Percent	Cumulative Percent
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1-9.99	5	47	62.67	62.67
10-19.99	15	20	26.67	89.33
20-29.99	25	7	9.33	98.67
30-39.99	45	1	1.30	100.0
Total		75	100	

#### 4.1.2 Institutional factors in relation to the farming households

The results in Table 6 elaborate that almost all the farmers (99.5%) in the scheme belonged to a farmer group. Belonging to a farmer group is important to farmers as it adds bargaining power and a major source of information sharing. While extension service is an important source of information to farmers, it can more effectively be done in groups. Indeed, 81.9% of the farmers at least had an access to information from an extension officer or from the NIB officers while a small number (18.1%) did not have access to extension services.

The results indicate that 92.9% of the farmers accessed credit. This high access to credit could be attributed to the existence of Ahero Irrigation Revolving Fund (AIRF) which was an initiative of FAO aimed at promoting agricultural production in the scheme (NIB, 2014). Credit is necessary for acquisition of inputs and payment of casual labour that assist in the farm work. Contract marketing is perceived to be a source of ready market for the farmers and therefore provides increased incentive for a higher extent of market participation. However, only 21% of the farmers embraced this modern marketing strategy while the majority (79%) did not. This could be due to the unpleasant effect of past experiences of institutional marketing through national irrigation board.

**Table 6: Institutional characteristics in relation to the farmers**

Variable		Frequency	Percent
Member of Farmer Group	YES	181	99.50
	NO	1	0.50
	Total	182	100
Access to Extension Services	YES	149	81.90
	NO	33	18.10
	Total	182	100

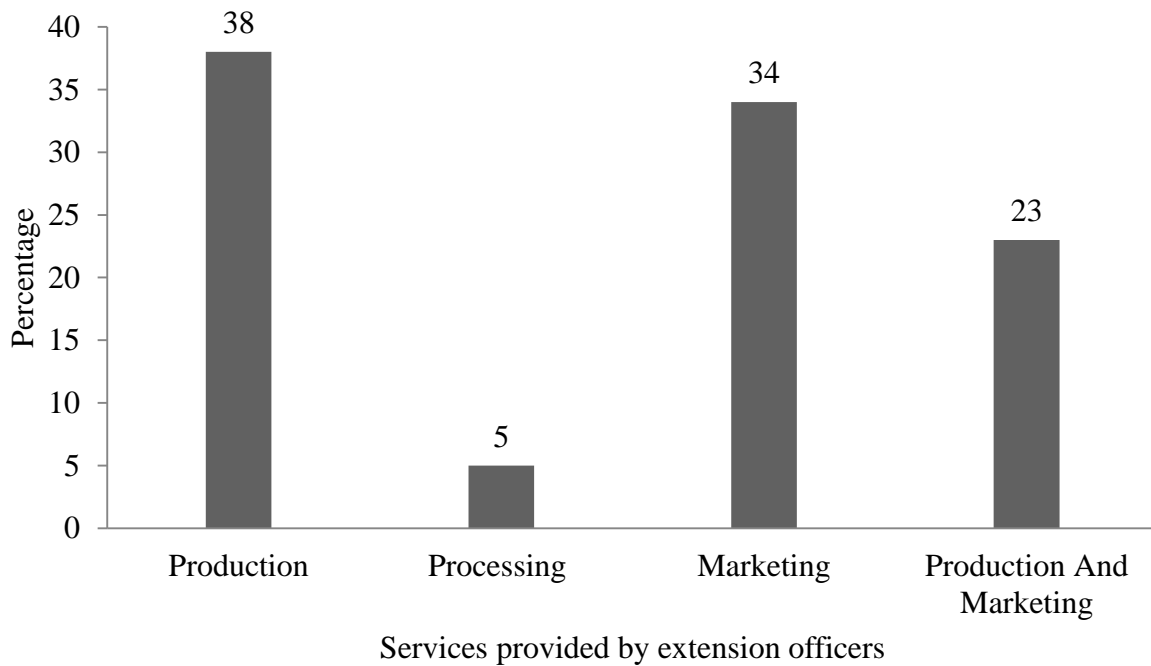
Access to Credit	YES	169	92.90
	NO	13	7.10
	Total	182	100
Contract Marketing	YES	39	21.43
	NO	143	78.57
	Total	182	100

The results in table 7 show that of the farmers who belonged to a farmer group, 51.93% obtained multiple benefits through the group by acquiring inputs, accessing information and access to credit from sources such as AIRF and women groups. Those who benefited by marketing together, acquiring inputs, credit and information access were 33.7% while the minority (0.5%) benefited through group marketing. In total, only 34% of the farmers marketed their produce through the farmer groups. Marketing together increases bargaining power and reduces transaction cost incurred by the farmers but it seems this has not been exploited fully. Group membership in this case has majorly been used as a tool to acquire inputs and access credit. About 93% acquired both inputs and credit through the farmer groups.

**Table 7: Benefits derived from group membership**

Benefit from the Group	Frequency	Percent	Cumulative
Market together	1	0.55	0.55
Acquire inputs	8	4.42	4.97
Credit access	1	5.52	5.52
Information access	4	2.21	7.73
Acquire inputs and credit access	12	6.63	59.67
Acquire inputs, credit and information access	94	51.93	93.37
Market together, Acquire inputs, credit and information access.	61	33.70	100
Total	181	100	

With respect to extension services, 38% of the farmers who accessed extension services were only advised on production practices while 34% were advised on marketing and the market opportunities that had emerged (Figure 4). Only 5% were advised on value addition through processing. This indicates that progress is being made towards having market oriented since production information used to be the core of agricultural extension in the defunct NIB. The balance of extension services between production and marketing is a necessary tool towards enhancing smallholder commercialization.



**Figure 4: Extension services provided to farmers**

Table 8 indicates that 86.39% of the farmers acquired credit specifically for purchase of inputs while 10.65% acquired credit for school fee payment. Only 0.59% acquired credit for output marketing while 1.78% acquired for output processing which added value to the produce for better prices. In total, only 2.37% of the farmers acquired credit for the purpose of post-harvest practices that is processing and marketing while 97.04% acquired credit for input

purchase. From this result, it is clear that farmers have not understood the aspect of value addition which would improve the marketability of their products and fetch higher prices.

**Table 8: Purpose of the acquired credit and the credit institutions**

Credit Purpose	Frequency	Percent	Cumulative
Input purchase	146	86.39	86.39
Output processing	3	1.78	88.17
Output marketing	1	0.59	88.76
School fee	18	10.65	99.41
Renting farm	1	0.59	100
Total	169	100	

Despite the majority of the farmers acquiring credit, the institutions from which credit was obtained were limited. The results in table 9 showed that 76.33% of the farmers acquired credit from AIRF and 11.24% borrowed multiple loans from both AIRF and women groups. Only 10.06% borrowed from Agricultural Finance Corporation and only about 2% acquired credit from the two local savings and credit organizations, which are Saint SACCO and Mwangaza Trust. The large number of farmers obtaining credit from AIRF could be attributed to accessibility and less stringent terms of borrowing from the institution. This shows the need for more of these friendly institutions in the rural areas for greater depth of outreach to the farmers.

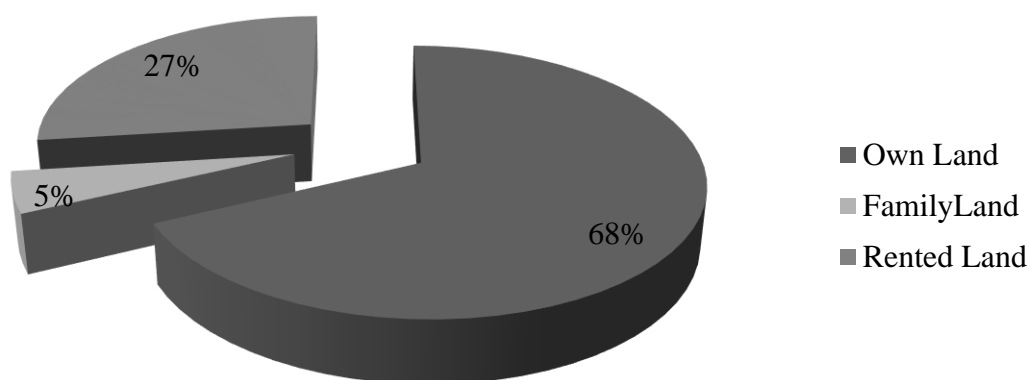
**Table 9: Institutions from which credit was acquired**

Credit Institution	Frequency	Percent	Cumulative
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Ahero Irrigation Revolving Fund (AIRF)	129	76.33	76.33
Agricultural Finance Corporation (AFC)	17	10.06	86.39
Saint SACCO	3	1.78	88.17
Mwangaza trust	1	0.59	88.76
Women group and AIRF	19	11.24	100.00
Total	169	100.00	

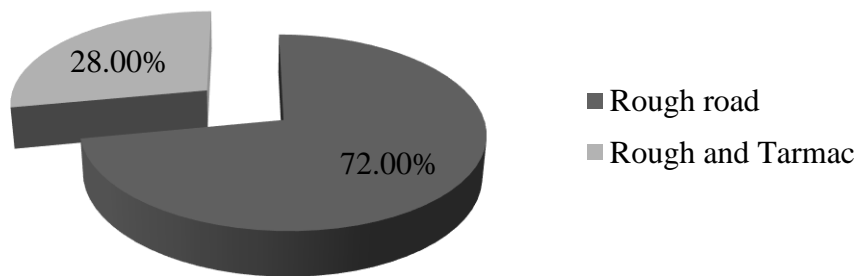
As illustrated in Figure 5, majority of the farmers (68%) owned the land under which they produced. 5% used their family land while 27% rented the land for production. Land tenure is an institutional factor that greatly affects agricultural production and consequently market participation.



**Figure 5: Land tenure in the scheme**

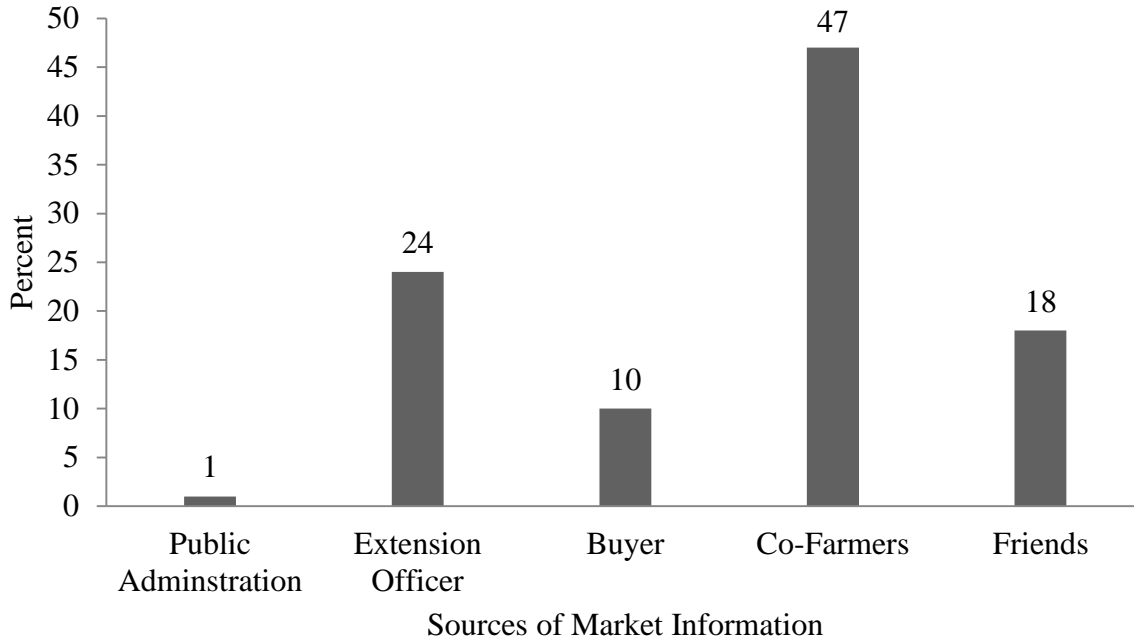
#### **4.1.3 Market factors in relation to market participation**

Figure 6 indicates the available road infrastructure. It emerged that 72% of the farmers' accessed road made of earth surface. Only 28% had access to road surface made of both earth surface and tarmac. The earth surface roads were in poor condition typically indicative of poor road infrastructure. Such roads offer a disincentive towards market participation as it leads to high transportation cost and a decreased bargaining power by the farmers.



**Figure 6: Type of road infrastructure used in rice marketing**

Market information irrespective of the source empowers farmers with the knowledge of emerging marketing opportunities and market prices. All the rice farmers in the scheme had access of market information from various sources prior to marketing their produce. As shown in figure 7, the major source of market information (47%) was the co-farmers followed by extension officers at 24%. Friends and buyers followed at 18% and 10% consecutively. Public administration played a minimal role as a source of market information to the farmers' at 1%. This provides a need of strengthening the farmer groups in order to improve access to information among the farmers.



**Figure 7: Sources of farmers’ market information**

#### **4.2 Rice marketing outlets and their price differential**

Emergence of a large number of private traders provided the farmers with an opportunity to choose from a mix of outlets. Consequently, a rational producer was expected to choose an outlet that maximized their expected utility. Such outlets included NIB mills, private millers, brokers, consumers and other outlets (Wholesalers and LBDA).

Table 10 provides the results of market outlets through which the farmers sold their rice. It emerged that 39% of the farmers sold their rice to private millers. This was followed by 30.8% selling to the NIB mills and brokers commanding 20.9% of the rice produce sold. The three outlets combined controlled a market share of 90.7%. Other outlets came fourth at 7.1% and lastly the consumers handling the least at 2.2%.

The private millers handling a larger portion of rice from the farmers could be attributed to the better prices offered compared to all the identified outlets. This could also be attributed to convenience of buying from the farm gate which saved the farmers the cost of transport and consequently maximized farmers’ returns. In line with this, Zanello *et al.* (2012) observed that farmers’ preferred buyers who come to farm gate because selling at farm gate reduce proportional transaction costs for farmers.

It was noted that rice sold to the five outlets were unprocessed except one, the consumers. Farmers who sold their rice directly to the consumers had added value through processing. The farmers were contracted through tender, supplying nearby schools and hospitals with the processed rice. This indicated a lower level of integration between production and processing of rice among the farmers.

**Table 10: Rice marketing outlets used by farmers**

Market Outlet	Frequency	Percent	Cumulative Percent
NIB Millers	56	30.80	30.80
Private Millers	71	39.00	69.80
Brokers	38	20.90	90.70
Consumers	4	2.20	92.90
Other Outlets	13	7.10	100
Total	182	100.00	

Table 11 shows the five marketing outlets identified and their mean prices offered to the rice farmers. A rational producer would always prefer better prices for their farm produce. Rice sold to the final consumers were processed hence farmers who sold to this market fetched higher prices with an average of Ksh. 98.00 per kilogram for which is approximately equal to the retail price of rice in the Kenyan market.

For the unprocessed rice, the private millers offered better prices to the farmers compared to all the outlets which received unprocessed rice. On average, it offered Ksh. 38.60 per kilogram. The large quantity of produce sold to this outlet by the farmers could be thus attributed to the better prices offered. Other outlets (LBDA and Wholesaler) was second after the private millers with an average price of Ksh. 36.00 per kilogram. Brokers offered the third better prices with an average of Ksh. 35.23 per kilogram with NIB offering the lowest average price for the farmers at Ksh. 34.65 per kilogram.

**Table 11: Marketing outlets and their price differentials**

Marketing Outlet	N	Minimum	Maximum	Mean	Std. Dev	F-Value
Price per kilogram of processed rice sold to consumers	4	95.00	100.00	98.00	2.45	
Price per kilogram of unprocessed rice sold to NIB millers	56	34.00	36.00	34.65	0.56	62.25*** (0.000)
Price per kilogram of unprocessed rice sold to private millers	71	35.00	43.00	38.60	2.33	
Price per kilogram of unprocessed rice sold to brokers	38	34.00	40.00	35.23	1.98	
Price per kilogram of unprocessed rice sold to Other Outlets	13	35.00	38.00	36.00	0.80	
TOTAL for Unprocessed	178	34	43	36.42	2.53	

**Note:** Figures in parenthesis are the probability values associated with the test statistic.

\*\*\*: significant at 1% level.

The results of One-way Analysis of Variance (ANOVA) showed that the mean difference between the group of marketing outlets that sold unprocessed rice was statistically significant at one percent significance level, that is  $F = 62.25$  and  $P = 0.000$  (Consumer outlet was excluded from this comparison since it offered a different product; processed rice). Therefore, there are significant differences between the unprocessed rice prices offered by the four marketing outlets. To further determine how the prices of the marketing outlets differed from each other, a Tukey post-hoc test was conducted and the results presented in table 12. This multiple comparison showed which marketing outlets differed from each other in terms of rice prices offered to the farmers. The Tukey post-hoc test revealed that the Private millers' prices (Kshs.  $38.60 \pm 2.33$ ) was significantly higher than the prices offered by NIB mills (Kshs.  $34.65 \pm 0.56$ ), Brokers

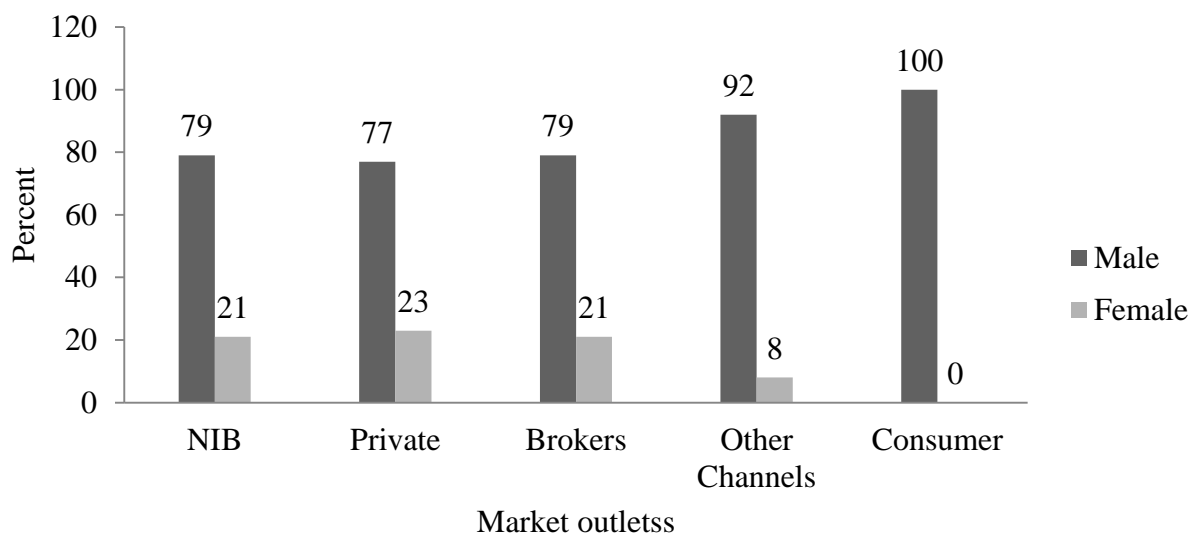
(Kshs.  $35.23 \pm 1.98$ ) and other outlets (Kshs.  $36.00 \pm 0.80$ ). There were no statistically significant differences between the prices offered by the NIB mill, Brokers and Other outlets.

**Table 12: Multiple comparison of price differentials**

(I) Base Marketing Outlet	(J) Marketing Outlets Used	Mean Difference (I-J)	Std. Error	Sig.
NIB Millers	Private Millers	-3.99***	0.32	0.000
	Brokers	-0.53	0.37	0.484
	Other Outlets	-1.22	0.55	0.118
Private Millers	NIB Millers	3.99***	0.32	0.000
	Brokers	3.46***	0.36	0.000
	Other Outlets	2.77***	0.54	0.000
Brokers	NIB Millers	0.53	0.37	0.484
	Private Millers	-3.46***	0.36	0.000
	Other Outlets	-0.69	0.57	0.624
Other Outlets	NIB Millers	1.22	0.55	0.118
	Private Millers	-2.77***	0.54	0.000
	Brokers	0.69	0.57	0.624

**Note:** \*\*\*. The mean difference is significant at the 1% level.

Figure 8 shows the results of marketing outlets in relation to gender of the household head. In terms of gender distribution, those who sold to the consumers were all male. Selling directly to the consumers required value addition through processing and male farmers could be having more time than the female farmers for the activity.



**Figure 8: Gender of the household head in relation to the marketing outlets**

The results in table 13 indicate that farmers who sold rice to the NIB and Other outlets were elderly with a mean age of about 53 and 51 years respectively. Those who sold to private millers, brokers and consumer were in their mid-age with a mean of 46, 45 and 41 years respectively. Those who sold to the consumers were the youngest (41 years). Young farmers are more aggressive and informed hence make use of modern marketing. The difference in the mean ages was statistically significant ( $F = 4.326$  and  $P = 0.002$ ).

**Table 13: Age of the household in relation to the marketing outlets**

Marketing Outlet	N	Mean	Std. Deviation	Std. Error	F-Value
NIB Millers	56	52.93	11.00	1.47	4.326***
Private Millers	71	46.31	10.96	1.30	(0.002)
Brokers	38	45.05	11.05	1.79	
Consumers	4	41.50	1.29	0.65	
Other Outlets	13	51.23	14.99	4.16	
Total	182	48.33	11.62	0.86	

**Note:** Figures in parenthesis are the probability values associated with the test statistic.

\*\*\*. The mean difference is significant at the 1% level.

Given the significant differences in the mean ages of household head among the marketing outlets, a Tukey post-hoc test was conducted to determine how the ages of the marketing outlets differed as presented in table 14. The mean age for farmers who sold rice to

NIB mill ( $53 \pm 11.00$  years) was significantly higher than the mean ages for those sold to the private millers ( $46 \pm 10.96$  years), brokers ( $45 \pm 11.05$  years ) and consumers ( $42 \pm 1.29$  years). There was no significant difference in the mean age for farmers who sold to NIB mills and to the other outlets. Farmers who sold rice to the private millers, brokers, consumers and the other outlets had no statistically significant differences in their mean ages.

**Table 14: Multiple comparison of age of household head among the marketing outlets**

(I) Base Marketing Outlet	(J) Marketing Outlets used	Mean Difference (I-J)	Std. Error	Sig.
NIB Millers	Private Millers	6.62**	2.01	0.010
	Brokers	7.88***	2.36	0.009
	Consumers	11.43***	5.81	0.006
	Other Outlets	1.70	3.45	0.988
Private Millers	NIB Millers	-6.62**	2.01	0.010
	Brokers	1.26	2.26	0.981
	Consumers	4.81	5.77	0.920
	Other Outlets	-4.92	3.38	0.594
Brokers	NIB Millers	-7.88***	2.36	0.009
	Private Millers	-1.26	2.26	0.981
	Consumers	3.55	5.90	0.975
	Other Outlets	-6.18	3.60	0.428
Consumers	NIB Millers	-11.43***	5.81	0.006
	Private Millers	-4.801	5.77	0.920
	Brokers	-3.55	5.90	0.975
	Other Outlets	-9.73	6.41	0.553
Other Outlets	NIB Millers	-1.70	3.45	0.988
	Private Millers	4.92	3.38	0.594
	Brokers	6.18	3.60	0.428
	Consumers	9.73	6.41	0.553

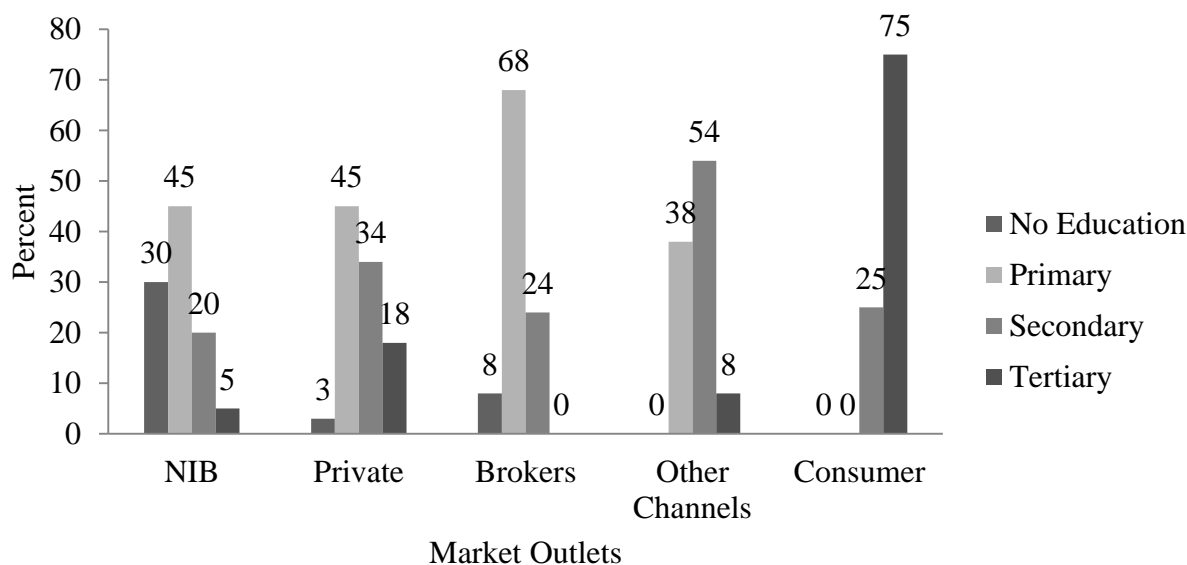
**Note:** \*\*\*: significant at 1% level; \*\*: significant at 5% level

Figure 9 shows education level distribution in relation to the marketing outlets. NIB and Private Millers received produce from all the levels of education. Those with tertiary level of education did not sell their rice to the brokers. Given that those with tertiary are well informed



they know the exploitative nature of the middlemen in any marketing system and would prefer to sell directly to millers.

Farmers who added value sold rice directly to the consumers. As in figure 9, about 75% of those who sold to the consumers had tertiary level of education while 25% had secondary education. Those with primary education dominated all the other outlets because they formed the majority of the farmers.



**Figure 9: Marketing outlets in relation to the farmers’ education level**

Table 15 shows the means of transport used in relation to the marketing outlets. Majority of the farmers who sold their rice to Private millers (86%) and Consumers (75%) used the buyers’ means of transport. These two outlets favoured the farmers as they reduced the cost of marketing since they provided the means of transport for the farmers produce. Apart from the other means of transport used, 54% of those who sold to the other outlets and 50% of those who sold to NIB used the buyers’ means of transport. On average, 17% of the farmers hired a vehicle individually while 15% hired a vehicle as a group. This indicated that the level of group marketing is low among the rice farmers in the scheme and hence no cost reduction through groups.

**Table 15: Means of transport used in relation to the marketing outlets in percentage**

Means of Transport	NIB	Private Mil	Broker	Others	Consumers	Pooled
Own Transport	4	7	8	23	25	8
Hired Individual	20	7	37	8	0	17
Hired in Group	27	0	26	15	0	15
Buyer Transport	50	86	29	54	75	60
TOTAL	100	100	100	100	100	100

#### 4.3 Factors that influence smallholder farmers' choice of marketing outlets

This objective was measured using Multinomial Logit model, and the marginal effects of the variables estimated. Given that a small number of farmers (4) sold to the consumers, it was excluded from this analysis due to lack of variation in the independent variables. Appendix 1 presented the coefficient estimates of independent variables that influenced the choice of market outlets among the smallholder rice farmers. The variables included in the estimation were: age, gender, years of education, land tenure, grading, contract marketing, regular buyer, means of transport, market distance, group marketing and market information source. The Chi-square value of 0.000 showed that likelihood ratio statistics of -124.856 are highly significant ( $P < 0.000$ ) suggesting that the model had strong explanatory power. The pseudo-R square was 0.4272 signifying that the explanatory variable explained about 42.72% of the variables in the choice of market outlets. The coefficient estimates indicated the direction of the effect of the independent variables on the dependent variable but not the actual magnitude of the change of probabilities. To determine the magnitude of change on choice of market outlets with respect to a unit change in an independent variable, the marginal effects were estimated.

Table 16 presents the results of the marginal effects of the Multinomial Logit model. Thus, the marginal effects from the ML model, which measure the expected change in probability of a particular choice being made with respect to unit change in an independent variable, are reported and discussed. The referent group was the NIB Mills and the impact of a unit change in the variables of the remaining outlets are relative to the NIB Mills. The variables that were significant from the marginal effects included age, gender, years of education, land tenure, contract marketing, regular buyer, market distance, group marketing and market information source.

Gender of the household head significantly influenced the sale of rice to the private millers negatively with Marginal Effects (ME) = -0.244. This implies that a household headed by female were less likely to sell rice to private millers by 24.4% than the male farmers with respect to the NIB mills. A possible explanation to this is due to the fact that men are more mobile and aggressive in terms of search for better market prices while women are more confined with family chores. In line with this finding, Boadu *et al.* (2013) stated that compared to males, females have a lower probability of selling beans to traders and cowpeas to consumers, but they have a higher probability of selling to retailers due to their availability. Female would therefore use more time saving outlets such as the NIB and brokers since they could be convenient in terms of availability.

Age of the household head significantly influenced the sale of rice to the private millers and brokers (i.e. ME = 0.012 and ME = -0.013 for private and brokers respectively). Therefore, a one year increase in age positively influenced the use of private millers by 1.20% and negatively influenced the use of brokers by 1.30%. The elderly people are more conservative and would therefore prefer a direct participation rather than participating through an intermediary. Brokers play the role of an intermediary and therefore avoided by the old farmers to avoid exploitation.

Years spent in formal education by the household head had a positive and significant influence on participating in the private millers' market outlet (ME = 0.040). This implied that a one year increase in education increased the probability of participating in the private outlet by 4% than to sell to the NIB mills (base outcome). The result is in agreement with the statement of Agbola *et al.* (2010) that farmers with higher level of education are more exposed and are better at marketing, especially when using formal marketing systems like the private sector. Therefore, as the level of education increases, one becomes more profit oriented and works towards lowering the transaction costs incurred in marketing. This was observed where the majority of the farmers who sold to the private millers (86%) used the buyers transport and therefore did not incur any cost of transport but still received better prices for their produce than from all the other outlets.

Land tenure plays a very important role in agricultural production. In the study, land tenure had a significant influence on the choice of private, NIB and brokers as the marketing channels (ME = 0.216, ME = -0.134 and ME = -0.090 for private, NIB and brokers respectively). It positively influenced participation in private millers while negatively influenced participation

in both NIB and brokers. Farmers who used rented land for production of rice with respect to own or family land were 21.64% more likely to participate in private millers as the marketing outlet rather than using NIB mills. Farmers who rented land rather than own or family land were 13.40% less likely to sell to the NIB but sell to either of the other outlets, while 9.02% were less likely to sell to brokers relative to NIB mill. This can be attributed to the two outlets (NIB and Brokers) offering the lowest market prices for rice as compared to all the outlets observed in the scheme.

Contract marketing significantly influenced participation in NIB, private millers and other outlets as the rice marketing outlets. Contract marketing negatively influenced the sale of rice to the private millers (ME = -0.368). This implied that it was 36.80% less likely that those farmers who sold to the private millers were under contract with the millers. On the other hand, contract marketing positively influenced the participation in both NIB and other outlets as the marketing outlets with ME = 0.40 and ME = 0.167 respectively. It was 40% more likely that those who sold to the NIB were under contract and 16.70% that those who sold to the other outlets were contracted. In agreement with this finding, Jari and Frase (2009) observed a positive relation between formal marketing outlets and contractual arrangements. In this case, NIB and LBDA in the other outlets are more formal since they are government institutions.

Regular buyer positively influenced the choice of NIB as the outlet and negatively influenced the choice of brokers as the outlet (ME = 0.461 and ME = -0.282 for NIB and brokers respectively). Farmers who sold their rice to the NIB were 40% more likely to have been trading with NIB for a period of time. In contrast, there was 28.20% chance that farmers who sold rice to brokers had not been trading with the buyer than those who sold to the NIB. Years of trading with a particular buyer leads to positive relation and trust. The result is in line with the findings of Zanello *et al.* (2012) that a strong relationship possibly joins a farm gate buyer and the farmers and therefore farmers have significantly higher trust to trade with such a buyer.

**Table 16: Marginal effects from multinomial logit on the choice of marketing outlets**

Variable	NIB mills		Private Mills		Brokers		Others	
	$\delta y/\delta x$	P	$\delta y/\delta x$	P	$\delta y/\delta x$	P	$\delta y/\delta x$	P
Constant	-	-	-	-	-	-	-	-
GendHH	0.161	0.185	-0.244*	0.088	0.047	0.607	0.036	0.177
AgeHH	0.001	0.982	0.012*	0.083	-0.013***	0.005	0.001	0.466
EducLvl	-0.025	0.156	0.040**	0.026	-0.020	0.122	0.005	0.905
LandTen	-0.134*	0.099	0.216***	0.008	-0.090*	0.095	0.008	0.583
Grading	0.052	0.648	0.099	0.316	-0.104	0.227	-0.095	0.165
ContArr	0.400***	0.005	-0.368***	0.005	-0.084	0.364	0.167*	0.093
RegBuy	0.461***	0.000	-0.163	0.140	-0.282***	0.001	-0.017	0.483
MeansTrns	0.050	0.569	0.001	0.995	-0.043	0.421	-0.008	0.507
MrktDist	0.278***	0.006	-0.386***	0.002	0.081	0.233	0.027	0.181
GrpMarkt	0.370***	0.000	-0.546***	0.000	0.135*	0.054	0.041	0.172
MrktInfoS	-0.148**	0.012	0.172***	0.002	0.059	0.158	-0.035	0.135
Log likelihood							-124.856	
LR $\chi^2$ (33)							186.260	
Prob> $\chi^2$							0.000	
Pseudo $R^2$							0.4272	

**Note:** \*\*\*: significant at 1% level; \*\*: significant at 5% level; \*: significant at 10% level. **Source:** Survey data 2014.

The distance to the rice marketing outlet significantly determined the probability of farmers participation in the private and NIB as the outlet where it had a negative effect on private millers and a positive effect on NIB (ME = -0.386 and ME= 0.278 for private millers and NIB respectively). The implication is that as the distance to the private miller increases, the likelihood of selling to that private miller decreased by 38.60%. With the increase in distance to the private millers, the probability that a farmer would sell rice to the NIB increased by 27.80% than to sell to all the other participating outlets. This observation can be attributed to the fact that farmers would try to lower transaction cost incurred in moving their produce and would rather sell to NIB which is within the scheme. This finding concurs with the findings of Wanjiru *et al.* (2012) who stated that an increase in distance to the market increases the probability of selling to the local traders and brokers in the case of banana marketing in Muranga County, Kenya.

Group marketing negatively influenced participation in private millers (ME = -0.546) despite the fact that group marketing empowers farmers with bargaining power as well as lowering the cost of marketing. On the hand, it positively influenced participation both in NIB and brokers as the marketing outlets (ME = 0.370 and ME = 0.135 for NIB and brokers respectively). For farmers who sold rice to the private millers, there was 54.60% probability that they sold individually and did not engage in group marketing. The probability that farmers who marketed their rice as a group sold to NIB was 36.70% and that they sold through brokers was 13.50%. In agreement with this, Njuki *et al.* (2009) found that besides reducing transaction costs, collective marketing empowers farmers to negotiate for better trade terms and prices. Anderson *et al.* (2013) also stated that the ability to negotiate with the buyer prompts the farmers to sell to a particular outlet. Given that majority of the farmers who sold to NIB and brokers used hired transport (47% and 63% respectively) as indicated earlier in table 17 justify the use of group marketing for these outlets in order to reduce transaction costs and increase bargaining power.

The results indicated that the source of market information significantly influenced participation in both private and NIB as the marketing outlet. The source of market information positively influenced participation in the private mills (ME = 0.172) and negatively influenced participation in NIB as the market outlet (ME = -0.148). The source of market information increased the chance that a farmer would sell rice to the private millers by 17.20% relative to the NIB while the probability of selling to the NIB decreased by 14.80%. Majority of the farmers obtained market information from their co-farmers and it is more likely that they shared

information on emergent market opportunities which are mainly the private millers. Buyer as the source of market information would also influence the outlet of sale and given that the private sector is more aggressive in information delivery could possibly cause the influence on participating in the private outlet. As stated by Zanello *et al.* (2012), broader information pushes the farmer to sell at the market.

#### **4.4 The extent of market participation by smallholder rice farmers and factors that influence the extent of participation**

##### **4.4.1 The extent of market participation**

The extent of market participation is a proportion between the quantity of output sold and the total quantity produced (Proportion Sold = Quantity of Rice Sold/Quantity of Rice Produced). This proportion is a proxy measure of the level of commercialization among the smallholder farmers. The result in Table 17 indicates the extent of market participation among the smallholder rice farmers in Ahero Irrigation Scheme. On average, farmers sold 88.57% of their rice output. The minimum extent of participation among the farmers was 62.5% while some of the farmers sold all their rice giving a maximum extent of participation of 100%. Consequently, approximately 11% of rice produced in the scheme was used for home consumption or shared with relatives and friends to the farmers.

The extent of participation of about 89% exhibited a high level of commercialization among the smallholder rice farmers in the scheme. This also showed that rice is grown majorly as a cash crop in the region even though it is still used as a staple crop among the producing households, which can be attributed to the crop being the third major staple crop in Kenya today. Rice therefore play a significant role to the farmers as the major source of income in Ahero and also a source of food and therefore significantly contributes to their livelihoods.

**Table 17: Extent of market participation among smallholder rice farmers in AIS**

Variable	Observations	Mean	Std. Dev.	Minimum	Maximum
Proportion Sold	182	0.886	0.077	0.625	1.00
Percentages	100	88.57	7.71	62.5	100

#### **4.4.2 Factors that influence the extent of market participation**

The extent of market participation among smallholder farmers is often influenced by various factors. To determine the factors that influence the extent of market participation among smallholder rice farmers, OLS regression estimation was used. The results as presented in Table 18 indicate that seven factors, household size, off farm income, grading, group marketing, source of market information, extension services offered and access to credit were significantly influencing the extent of rice marketing among the farmers.

The coefficient of house hold size was negative (-0.005) and significantly influenced the extent of market participation among the rice farmers. This implied that the smallholder rice farmers who had large household size had a higher probability of reducing the proportion of rice sold by 0.005. As the number of family members' increases, the number of mouths to feed also increases hence the responsibility of providing food. This gives the necessity to withhold more farm produce for home consumption. This result concurs with the findings of Onoja *et al.* (2012) household size significantly influenced participation in fish marketing in Niger delta region.

Off farm income had a positive coefficient (0.099) and significantly influenced the extent of market participation. As the level of household off farm income increases, the extent of participation also increases by 0.099. This finding contradicts the results of Davis *et al.*, (2013) which revealed that fresh fruits farmers with high off farm income were more likely not to participate in the market. This change could be attributed to diverse feeding habit and shift in priorities for those with higher income and therefore would sell more of their rice in order to acquire other food substances or invest in real assets.

Group marketing had a significant and negative coefficient (-0.098). This indicates that those farmers who sold their rice together would sell less of their output by 0.098 than those who sold individually. This is in spite the consideration of group marketing a social capital that increases the farmers bargaining power. Jagwe (2011), found that belonging to a farmer group significantly influenced extent of farmers' participation positively in banana markets. This contradiction could be attributed to lack of appropriate transport facilities such as low capacity of means of transport and high transport cost. Again, the end market for those who sell as a group my demand less quantity than the total production and since all the group members must sell,



they have to reduce the proportion sold resulting into a lower extent of participation among the group members.

**Table 18: Multiple regression (OLS) coefficient results**

Variable	Coef.	Std. Err.	Z	P> Z
GendHH	0.015	0.016	0.91	0.362
AgeHH	-0.002	0.010	-0.44	0.660
HHsize	-0.005**	0.003	-1.03	0.032
EducLvl	0.006	0.059	0.31	0.760
OfFarmInc	0.099***	0.023	4.26	0.001
LandTen	-0.009	0.012	-0.75	0.464
FrmSize	0.007	0.012	0.57	0.653
OutptLvl	0.052***	0.000	4.76	0.000
Grading	-0.051*	0.032	-1.83	0.085
ContArr	0.006	0.047	0.13	0.896
Grpmarket	-0.098***	0.029	-3.35	0.004
MrktInfoS	0.026**	0.010	2.48	0.024
ExtnSAcc	0.030*	0.015	1.96	0.066
PrOutpt	0.009	0.007	0.12	0.966
CrdtAcs	0.093*	0.052	1.80	0.090
Constant	0.547	0.276	1.98	0.064

R-Squared=0.8122

Adjusted R-Squared=0.6354

\*: significant at 10% level; \*\*: significant at 5% level; \*\*\*: significant at 1% level.

Source: Survey Data (2014)

The level of output significantly increased the extent of market participation by 0.052. Therefore, an increase in level of rice output produced by the household implied an increase in marketable surplus thus increasing the extent of market participation. Grading of farm produce before sale had a negative influence (-0.051) on extent of market participation and was significant. Farmers who graded their rice had a lower chance of selling more of their produce by 0.051 than those who did not grade. Grading enhances value and therefore fetches better prices

for the farm produce. As poor grades of the produce are sorted out, less quantity remains for the market and thus negatively influencing the extent of market participation. Poor grades are often left for home consumption, shared with relatives and friends or later sold at lower price.

Since almost all the farmers accessed market information, market information sources were examined to determine their influence on extent of market participation. The result indicated that the source of market information had a positive and significant influence on the extent of market participation by 0.026. This result conforms to the finding of Jagwe *et al.*, (2010) which revealed that irrespective of the source of information, it remains critical for market participation. Market information empowers farmers on the prevailing market prices, market opportunities and market demand. Farmer education through extension services is one of the major sources of information to farmers. The coefficient of extension services is positive (0.030) and significantly influenced the extent of market participation among the rice farmers. It indicates that access to extension services increased the extent of market participation by 0.030 among the rice farmers.

The study found out that access to credit positively influenced the extent of market participation (0.093) and was significant. Access to credit improves the productive capacity of the farmers. The coefficient of 0.093 implied that a farmer who acquired credit was more likely to sell 9.32% of their produce than those who did not. Despite of improving the productive capacity, credit adds on to the farmer's liabilities that have to be covered. Such farmers will therefore have to sell more of their produce in order to pay back their debts and still generate income for their households.

## **CHAPTER FIVE**

### **CONCLUSION AND RECOMMENDATION**

#### **5.1 Conclusion**

From the study, five marketing outlets were identified; NIB mills, private millers, brokers, consumers and other outlets (wholesalers and LBDA). Private millers formed the dominant outlet among the rice farmers followed by NIB of Kenya. Brokers was third, other outlets fourth while the last was consumers. Farmers who sold directly to consumers' added value to their rice through processing. For the unprocessed rice, private millers offered the highest prices per kilogram while NIB mills offered the lowest price. There was significant differences in the prices of unprocessed rice.

With respect the marketing outlets, age, years of formal education, land tenure and market information source positively influenced participation in private mills as the marketing outlet and negatively influenced by gender, contract, regular buyer, market distance and group marketing. Contract marketing, market distance, group marketing and regular buyer positively influenced participation in NIB mills as the marketing outlet and negatively influenced by land tenure and source of market information. Sale to brokers was positively influenced by group marketing while negatively influenced by age, land tenure and regular buyer. Participation in other outlets was positively influenced by contract marketing. The extent of participation indicated a high level of commercialization among the rice farmers in the study area. The extent of market participation was positively influenced by off-farm income, market information source, level of output, extension services offered and access to credit while negatively influenced by household size, grading and group marketing.

#### **5.2 Recommendations from the study**

From the key findings, the study recommends that there is need to harmonize rice prices in the scheme so that stable prices are witnessed in the market to benefit all the farmers. This can be achieved by pooling the farmers produce through farmer cooperative in the scheme which is currently dormant. Market information and extension services should be timely delivered to farmers to empower them with market opportunities and market demand. More farmer friendly credit institutions should be made accessible to farmers to ensure greater depth of outreach in provision of credit. Farmers should also be encouraged to engage in more off-farm income

activities for greater extent of market participation. There is need to sensitize farmers to invest more in formal education for their children and eradicate school drop outs. This will ensure that more wise production and marketing decisions are made by the farmers and to develop more skills on off-farm income activities towards improving their productivity, generating more income from the crop and diversify their income sources.

### **5.3 Suggestions for further research**

This study mainly focused on extent of market participation and choice of marketing outlets in Ahero Irrigation Scheme which is just one of the schemes under the NIB schemes that operate under similar circumstances. Therefore, a similar study can be carried out in two of the schemes to allow for comparison and validation of these results. Secondly, this study only focused on the marketing outlets and therefore another study can be carried out to determine the rice marketing channels in the scheme.

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APPENDICES

**Appendix 1: Multinomial Logit Regression Coefficient Estimates Results**

Marketing Outlet	Coeff	Std. Err	Z	P> Z
<b>NIB Mills</b>	(Base Outcome)			
<b>Private Millers</b>				
Constant	4.1522	1.8631	1.45	0.147
GendHH	-1.0288	0.1237	-1.54	0.123
AgeHH	0.0314	0.0301	0.96	0.335
EducLvl	0.1676	0.0849	1.97	0.043**
LandTen	0.9086	0.3918	2.32	0.020**
Grading	0.1313	0.0522	0.25	0.802
ContArr	-2.3486	1.214	-1.93	0.053*
RegBuy	-1.6624	0.5864	-2.83	0.005***
MeansTrns	-0.1240	0.4427	-0.28	0.780
MrktDist	-1.7213	0.5865	-2.94	0.003***
GrpMarkt	-2.5488	0.6635	-3.84	0.000***
MrktInfoS	-0.8261	0.2754	-3.00	0.003***
<b>Brokers</b>				
Constant	2.4334	2.1793	0.82	0.414
GendHH	0.8121	0.7351	1.10	0.296
AgeHH	-0.0952	0.0337	-2.83	0.005***
EducLvl	-0.2031	0.0933	-2.18	0.029**
LandTen	-1.0299	0.3959	-2.60	0.009***
Grading	-0.7891	0.5937	-1.33	0.184
ContArr	0.9718	0.4041	0.69	0.489
RegBuy	-1.7451	0.7620	-1.54	0.123
MeansTrns	-0.2180	0.4363	-0.50	0.617
MrktDist	1.4281	0.6127	2.33	0.020**
GrpMarkt	2.2096	0.6800	3.25	0.001***
MrktInfoS	0.7516	0.2940	2.56	0.011**

Marketing Outlet	Coef.	Std. Err	Z	P>/Z/
<b>Other Outlets</b>				
Constant	-4.3082	2.1630	0.96	0.339
GendHH	2.5600	2.1525	1.19	0.234
AgeHH	0.0023	0.0451	0.05	0.959
EducLvl	0.0758	0.1682	0.45	0.652
LandTen	-0.2990	0.5353	-0.56	0.577
Grading	-1.9154	1.2499	-1.53	0.125
ContArr	2.7887	1.4423	1.93	0.053*
RegBuy	-0.1790	1.0595	-0.17	0.866
MeansTrns	-0.2718	0.5188	-0.52	0.600
MrktDist	1.9660	0.6236	3.15	0.002***
GrpMarkt	3.2300	1.2477	2.59	0.010**
MrktInfoS	-0.7641	0.4500	-1.70	0.089*
Log likelihood				-124.856
LR $\chi^2$ (33)				186.26
Prob> $\chi^2$				0.000
Pseudo $R^2$				0.4272

**Note:** \*\*\*: significant at 1% level; \*\*: significant at 5% level; \*: significant at 10% level.

**Source:** Survey data 2014.

**Appendix 2: QUESTIONNAIRE**

This study is conducted to find out the factors that determine the extent of market participation among smallholder rice farmers in Ahero Irrigation Scheme, Kenya. Your participation in the study is voluntary and the information you give will be treated as confidential and will be combined together with responses from other 181 households for analysis.

**QUESTIONNAIRE IDENTIFICATION**

Name of Enumerator: ..... Questionnaire Number

Name of Respondent: .....

**A. DEMOGRAPHIC DETAILS**

A.1. Gender:  Male  Female (*Tick where appropriate*)

A.2. Relation to household head (*Tick where appropriate*)

Head	Wife	Sibling	Others ( specify)

A.3. Occupation of the household head (*Tick where appropriate*)

Farmer	Businessman	Employed	Others ( specify)

A.4. Age of the household head ..... years

A.5. Marital status of the head

Single	Married	Widowed	Divorced

A.6. Household size (*number of people living and eating together*) .....

A.7. What is the highest educational level the head of household has completed?

No formal education	Primary level	Secondary level	Tertiary level	Others ( specify)

A.8. Indicate the number of employees who assist with farm work

Type of employee	Full-time employees	Part-time employees	Family member	TOTAL
Number				

A.9. Do you have any off-farm employment?

1. Yes.                       2. No.

A.10. If Yes in A.9 above, what is your employment status and under which income class do you fall in?

Employment status		Income class(Ksh)					
	Tick	< 1000	1000-10,000	10,000-20,000	20,000-30,000	40,000-50,000	>50,000
Full-time worker							
Part-time worker							
Formally employed							
Pensioner							
Other (specify)							

**B. LAND TENURE AND USE**

B.1. What is the tenure system of your farm?

<b>Tenure</b>	<i>Tick where appropriate</i>	<b>Size in Acres</b>
Own Land		
Family Land		
Rented Land		

B.2.a) List other crops that you grow apart from rice. ....  
 .....  
 .....

B.2.b) On which land do you grow Rice?

1) Own Land       2) Family Land       3) Rented Land

B.2.c). On which Land do you grow these other crops?

1) Own Land       2) Family Land       3) Rented Land

B.3. How have you apportioned your farm to the first three major crops grown?

<b>Crop</b>	<b>Size of farm in Acres</b>
1. Rice	
2.	
3.	

B.4. What is the major reason for growing Rice? (*tick where Appropriate*)

1) Sale	
2) Home Consumption	
3) Both	



**C. RICE MARKETING**

C. 1. What quantity of rice do you produce per acre every Year? ..... Kgs.

C.2. What quantity do you sell and consume per year?

Use	Quantity in Kilograms
Sale	
Household Consumption	
Give out to Relatives and Friends	

C.4. Where do you sell most of your Rice produced?

Place	<i>Tick where appropriate</i>	Reason
Farm gate		
Around the village		
Road side		
Nearest town		

C.4. What marketing arrangement do you use for selling your rice?

Market	Reason
Formal market	
Informal market	
Contractual	

C.5. Which market outlet do you use to sell your rice?

Outlet	Quantity (Kgs.)	Price per Kilogram (Ksh.)	
		Processed	Unprocessed
Wholesalers			
NIB Millers			
Private Millers			
Rural Assemblers			
Brokers			
Farmer Cooperative			
Consumers			
Others (Specify)			

C.6. Do you always find ready market for rice produced? 1. Yes  2.No

C.7. If No, what happen to unsold rice produced? (*tick where appropriate*)

lost to spoilage	Consume (family & friends)	Sell at low price	Store and sold later

C.8. How difficult is it to find the buyer? (*tick where appropriate*)

Easy	Fair	Difficult

C.9. Is your rice graded before marketing? 1. Yes  2. No

C.10. Do you have problems meeting the required grades? 1. Yes  2. No

C.11. What happens with the poor grades of rice?

lost to spoilage	Consume (family & friends)	Sell at low price	Dispose off

C.12. In terms of the market outlet you use regularly, what are the main benefits

Receive High Price	Under Contract	Provided Inputs	Related	Convenience (Nearer)	Others (Specify)

C.14. Do you have regular customer, who always buy from you? 1. Yes  2. No

C.15. If yes, how long have you been trading with these customers? Years  Months

C.16. How is your produce moved to the market point? (*tick where appropriate*)

	Type of transport				
	Bicycle	Motorbike	Truck	Nissan	Other (specify)
Own transport					
Hired vehicle ( individual)					
Hired vehicle ( group)					
Public transport					
Buyer transport					
Provided by Cooperative					

C.18. How far is marketing point from your farm? ..... Kms.

C.19. How much do you pay for single trip to the market? Ksh ..... per.....kgs

C.20. What general problem do you experience in moving your produce?

Lack of transport	Small size of transport	High transport cost	Others ( specify)

C.21. Complete the below for payments and how long it take to receive the payments

List the marketing outlet	How are you paid			Time taken for payment
	Cash	Cheque	Other (specify)	

C.22. When selling do you combine, with other farmers?

Yes	Reason		No	You don't sell at the same time	
		It is lower cost			
	Increase bargaining power			You conflict	
	Share market knowledge			They will degrade your produce	
	Specify (others)			Specify ( others)	

## D. INFRASTRUCTURE

D.1. What type of road do you use to the market?

Tarmac	Rough	Both

D.2. In your own opinion, how do you rate your road?

Fine	Good	Bad

D3. Are you satisfied with the number of road that links you to the market? 1. Yes { } 2 No { }

### E. MARKETING INFORMATION

E.1. Do you have access to market information? 1. Yes { } 2.No { }.

E.2. Do you receive market information prior to sale? 1. Yes { } 2. No { }

E.3. What are your sources of information?

Sources	Type of information ( provided)						
	Rank	Prices	Date for sale	Buyer	Market demand	Market opportunies	Others ( specify)
Public administration							
Buyer							
Extension officers							
Friends							
Co- farmers							
Media							
Others ( specify)							

E.4. How often do you receive the information?

Daily	Weekly	Monthly	Annually	Others ( specify)

E.5. How would you prefer the information to be delivered?

Through media	Through cell phone	Through extension officer	Through farmers group	Specify (others)

E.6. In which language is the information delivered? .....

E.6. Is the language used to deliver information favorable? Yes.  Or No.

E.7. Do you consult other farmer, before making decision? Yes  or No

E.8. What do you normally consult others farmers about?

.....  
 .....

**F. EXTENSION SERVICE**

F.1. Do you have contact with extension officers during marketing period? Yes { } or No { }

F.2. what service are provided by extension officers

Advice on Production	Advice on processing	Advice on marketing	Specify ( other)

F.3. Are the extension officers always available when you need help?

Never available	Sometime available	Always available

F.4. List the problem you encounter when you are contacting extension officers

.....  
 .....

.....

.....

**G. PRICING**

G.1. At what price do your rice? .....KShs per..... Kgs

G.2. Do you perform price surveys, before selling? Yes { } or No { }

G.3. How is price set during sales?

I set the price	We negotiate	It is market driven	It is dictated by the buyer	Contract Price	Specify (others)

G.4. How do you decide the sale price of your produce? Tick where appropriate

Reason	Very important	Important	Not important
a) It depends on the price of other local farmers			
b) It depends on the price of international farmers			
c) It depends on the market we sell to			
d) It depends on the production costs			
e) It depends on the concentration of the market			
f) It depends on the transaction costs			
g) Others:			

G.5. How do the price that the buyer is willing to pay differ from your expectation

Lower than expected	Equal	Higher than expected

G.6. When selling who negotiate on your behalf?

.....  
.....

G.7. When negotiating, which language is used?

Own language ( Name it)	English	Kiswahili

G.8. If not own language, are you able to negotiate as well as you would do if you were to use your own language? .....

G.9. List what you consider to be the major problems you face in marketing your Rice.

.....  
.....  
.....  
.....  
.....

G.10. Suggest ways in which such problems can be addressed

.....  
.....  
.....

**H. ACCESS TO CREDIT**

H.1. Have you ever had access to credit? Yes  or No

H.2. If yes in H.1 above, what was the purpose of the credit? (*tick where appropriate*)



Input Purchase	Output Processing	Output Marketing	School Fee	Home consumption	Renting Farm	Others (specify)

H.3. List the institutions from which you obtain your credit.

- a) .....
- b) .....
- c) .....

H.4. Where did you get the money to repay your loan? (*tick where appropriate*)

Sale of rice	Non-farm income	Others (Specify)

**I. MEMBERSHIP TO FARMER GROUP**

I.1. Are you a member of any farmers group in the scheme? 1. Yes  2. No

I.2. What benefits do you get from the group?

Market together	Acquire Inputs	Credit Access	Information Access

*THANK YOU FOR YOUR PRECIOUS TIME AND PARTICIPATION*