Journal of Economics and Sustainable Development
ISSN 2222-1700 (Paper) ISSN 2222-2855 (Online)
Vol.6, No.2, 2015


# Determinants of Small-holder Farmers Extent of Market Participation; Case of Rice Marketing in Ahero Irrigation Scheme, Kenya

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**Abstract**

The extent of market participation among smallholder farmers indicates the level of commercialization of rural production since 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 National Irrigation Schemes were compelled to deliver all their output to the National Irrigation Board (NIB) 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 this paper was to determine the extent of market participation by small-holder rice farmers and the factors that influences the extent of participation. The study was conducted in Ahero irrigation Scheme (AIS), in Kisumu County Kenya. Random sampling procedure was employed to contact 182 respondents and a semi-structured questionnaire used to collect data from smallholder rice farmers in the scheme. The data was analyzed using descriptive statistics and Multiple Regression model. The result indicated that about 89% of rice produced in the scheme was marketed and seven factors; household size, off farm income, grading, group marketing, source of market information, extension services offered and access to credit significantly influenced the extent of rice marketing among the farmers. Based on the results of this study, policy implications was drawn towards improving commercialization of smallholder farming and household income in the study area.

**Key words**: Extent of market participation, small-holder rice farmers, multiple regression

## 1.0 Introduction

Rice (O*ryza 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).

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 channels of their choice. The main channels are NIB mills, private sector mills, brokers and consumers' (Omondi and Shikuku, 2013; Short *et al*., 2013). 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 (Kirimi *et al*., 2013). Such a transformation can help address the poverty and income challenges that confront many smallholder producers (Alene *et al*., 2008).

## 2.0 Methodology

### 2.1 Study Area and Sampling Technique

Ahero Irrigation Scheme is located in Muhoroni sub-county, Kisumu County, Kenya. 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 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.

### 2.2 Methods of Data Analysis

STATA computer program was used to process the data. Descriptive statistics together with multiple regressions model were used to analyze the data. In examining market participation, Heckman two-stage models, Double-hurdle model, multiple regression model and Tobit model have been employed. Heckman two-stage model and Double-hurdle model procedures are two stage estimators that utilizes a simple regression method to estimate behavioral functions by least squares methods. Given that the two selection models have the two parts, the choice of participation and the extent of participation, they are not suitable for the study since it is presumed that all the farmers in AIS scheme participate in rice marketing. 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. 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.

This study therefore adopted multiple regression models to determine the factors that influence the extent of participation while the extent of participation was generated from STATA computer program. 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 (utility maximization framework). 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.

The model was thus estimated as follows: 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 multiple regression model was given by:

$$Y = \beta_0 X_0 + \beta_1 X_1 + \beta_2 X_2 + \ldots \beta_n X_n + e \quad \ldots\ldots (1)$$

Where Y denotes the proportion of rice sales, $\beta_0$ is a constant, $\beta_{1\ldots\ldots n}$ are parameters to be estimated $X_{is}$ are vector of explanatory variables.

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

$$Y_i = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \ldots\ldots\ldots + \beta_n X_n + \varepsilon \quad \ldots\ldots (2)$$

$$(Y_i) = \beta_0 + \beta_1 Age + \beta_2 Gend + \beta_3 EducLvl + \beta_4 HHSize + \beta_5 FrmSiz + \beta_6 OfFmInc + \beta_7 MnsTrns + \beta_8 MktDist + \beta_9 CrdtAcs + \beta_{10} IMktInf + \beta_{11} PrOpt + \beta_{12} ContArr + \beta_{13} OutptLvl + \varepsilon \quad \ldots\ldots (3)$$

 

**Table 3: Description of Variables used in the Multiple Regression Model**

| Variable Code | Full identity | Measurement | Expected sign |
|---|---|---|---|
| Age | Age in years | Years | +/- |
| Gend | sex of household head | 1= Male, 0= Female | +/- |
| FrmSz | Household farm size | Acres | + |
| HHSiz | Household Size | Numbers | - |
| EducLvl | Level of education | Years | +/- |
| LandTen | Land Tenure | 1=Owned, 2=Family, 3=Rented | +/- |
| OfFarmInc | Off farm income | 1 = Yes, 0 = No | +/- |
| CrdtAcs | Credit access | 1 = Yes, 0 = No | + |
| ExtnS | Extension services | Accessibility to agricultural extension services | + |
| MrktDst | Distance to the market | Kilometers | - |
| MrktInfo | Market information | formal or informal access to market information | + |
| OutptLev. | Output Level | Kilograms | + |
| PrOutpt | Price of output | Kenya shillings | + |
| OutptGrd | Output grading | 1 = Yes, 0 = No | - |

## 3 Results and Discussions

### 3.2 Households Socio-economic Characteristics

In terms of gender distribution, 80% of the farming households were male headed and 20% female headed. 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. The results in Table 2 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% 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 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 4: 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 | 182 | 1.00 | 4.00 | 2.15 | 0.864 |
| 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 |

### 3.3 Institutional Factors in Relation to the Farming Households

The results in Table 3 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. Credit is necessary for acquisition of inputs and payment of casual labour that assist in the farm work. 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). 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 5: Institutional Characteristics in Relation to the Farmers**

| Variable | | Frequency | Percent |
|---|---|---|---|
| Member of Farmer Group | YES | 181 | 99.50 |
| | NO | 1 | 0.50 |
| Access to Extension Services | YES | 149 | 81.90 |
| | NO | 33 | 18.10 |
| Access to Credit | YES | 169 | 92.90 |
| | NO | 13 | 7.10 |
| Off-farm Income | YES | 75 | 41.20 |
| | NO | 107 | 58.80 |
| Contract Marketing | YES | 39 | 21.43 |
| | NO | 143 | 78.57 |

### 3.4 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 4 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 6: 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 | 62.50 | 100 |

### 3.4. 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, multiple regression estimation was used. The results as presented in Table 5 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.

**Table 7: Multiple Regression Coefficient Results**

| Variable | Coef. | Std. Err. | Z | P>/Z/ |
|---|---|---|---|---|
| Gender | 0.038 | 0.014 | 0.53 | 0.601 |
| Age | -0.002 | 0.001 | -0.09 | 0.931 |
| Household size | -0.005** | 0.003 | -1.03 | 0.032 |
| Years of education | 0.002 | 0.005 | 0.31 | 0.760 |
| Off farm income | 0.099*** | 0.023 | 4.26 | 0.001 |
| Land tenure | -0.009 | 0.012 | -0.75 | 0.464 |
| Land size | 0.007 | 0.001 | 0.46 | 0.653 |
| Quantity of rice produce | -9.061 | 0.000 | -0.51 | 0.614 |
| Grading | -0.051* | 0.032 | -1.83 | 0.085 |
| Contract marketing | 0.006 | 0.047 | 0.13 | 0.896 |
| Group marketing | -0.098*** | 0.029 | -3.35 | 0.004 |
| Market information source | 0.026** | 0.010 | 2.48 | 0.024 |
| Extension services offered | 0.030* | 0.015 | 1.96 | 0.066 |
| Price of rice | 0.009 | 0.007 | 0.12 | 0.966 |
| Credit Access | 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 coefficient of house hold size was negative and significantly influenced the extent of market participation among the rice farmers. The result showed that the smallholder 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 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 is considered a social capital that increases the farmers bargaining power. Jagwe (2011), found that belonging to a farmer's group, significantly influenced extent of farmers' participation in banana markets. However, the result of this study indicates that those farmers who sold their rice together had lower chances of selling more by -0.098 than those who sold alone and it is statistically significant at 1% confidence level. 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. Grading of farm produce before sale had a negative influence 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. Market information empowers farmers on the prevailing market prices, market opportunities and market demand. Since almost all the farmers accessed market information, market information sources were examined to determine their influence on extent of market participation. The result found out 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. Farmer education through extension services is one of the major sources of information to farmers. The coefficient of extension services is positive 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. Access to credit improves the productive capacity of the farmers. The study found out that access to credit positively influenced the extent of market participation and was significant. The coefficient of credit was 0.093 implying 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.

## 4 Conclusion and Recommendations

There were variations in the socio-economic and institutional factors among the farmers. The extent of market 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, extension services offered and access to credit while negatively influenced by household size, grading and group marketing.

From the key findings, the study recommends that market information and extension services should be timely delivered to farmers to empower them with market opportunities and market demand. 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.

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