AN ANALYSIS OF FACTORS INFLUENCING MARKET PARTICIPATION AMONG SMALLHOLDER RICE FARMERS IN WESTERN PROVINCE, ZAMBIA

BY

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DECLARATION

This Thesis is my original work and has not been presented for the award of a degree in any other academic institution.

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DEDICATION

This thesis is dedicated to my father, Mr. Moono Jeremiah, and mother, Beatrice Mudenda Moono, for their support financially, mentally and encouragement since my childhood up to this level. It is with this in heart that I truly appreciate their support towards attaining the Master of Science degree in Agricultural and Applied Economics.

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ABSTRACT

Increasing market participation among smallholder producers has the potential to lift them to better income levels through increased productivity and surplus production. Nowhere in the Zambian agricultural sector is increased market participation more sought after than in the rice sub-sector as the government endeavors to promote the crop's commercialization and to tap into the Southern African Development Community (SADC) regional market. It is estimated that 56 percent and 50 percent of rice producers participated (sold) in the rice market during the 2010/11 and 2011/12 marketing seasons respective. In addition region such as Western Province which has the highest number of rice producers showed that 40.9 percent sold rice during the 2011/12 marketing season.

This study used data from a survey of 390 smallholder rice producers, conducted in 2013, and a Heckman two-stage econometric model to identify the factors that affect the rice producers' participation in rice markets. The results suggest that the decision to enter the rice market is positively influenced by the household's asset endowment (such as livestock), membership in farmer organizations, access to knowledge about output prices prior to sell, output price and quantity of rice produced. The results further suggest that intensity of market participation is directly influenced by ownership of assets such as (size of land owned), access to credit and output produced. These findings provide useful insight on what factors need to be target to stimulate market participation and intensity among rice farmers. Policies that facilitate ownership of productive assets such as livestock restocking should be implemented, access to price information prior to selling should be enhanced and being a member to a farmer organization should be promoted among rice farmers for the purpose of collective marketing. Pricing and productivity enhancing policies should be implemented to stimulate production for the market and also increase output produced which will in turn increase quantities sold among farmers. In addition access to credit should be enhanced as it facilitates farmers to access inputs and other productive assets which increase output produced leading to more sales. Other stakeholders should encourage bulk marketing through farmer organization and also farmers should be encouraged to be members of farmer organization as it improves market participation. Implementation of the stated policies will increase market participation and ultimately improve the livelihood among rice farmers in Western Province of Zambia.

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ABBREVIATIONS AND ACRONYMS

CFS	Crop Forecast Survey
CFU	Conservation Farming Unit
COMACO	Community Markets for Conservation
CSO	Central Statistics Office
FAO	Food Agriculture Organization
FRA	Food Reserve Agency
FSRP	Food Security Research Project
GRZ	Government of the Republic of Zambia
IFAD	International Fund for Agriculture Development
IFRI	International Food Policy Research Institute
ILRI	International Livestock Research Institute
JICA	Japan International Corporation Agency
MACO	Ministry of Agriculture and Cooperatives
MAL	Ministry of Agriculture and Livestock
NAP	National Agriculture Policy
NAP	National Agriculture Policy
NGO	Non-Governmental Organization
PHS	Post Harvest Survey
SADC	Southern Africa Development Community

SNV	Stichting Nederlands Vrijwilligers (Netherlands Development Organization)
WCS	Wildlife Conservation society
ZCF	Zambia Cooperative Federation
ZNFU	Zambia National Farmers Union
ZNRDS	Zambia National Rice Development Strategy
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CHAPTER 1

INTRODUCTION

1.1 Background

The majority of the population in Sub-Sahara Africa (SSA) lives in rural areas where poverty and deprivation is severe. It is estimated that about 70 percent of the rural poor in SSA depend on agriculture for their livelihood directly or indirectly (IFAD, 2011). Therefore, any poverty reducing strategies that focus on agriculture are more effective than other sectors in poverty alleviation. Poverty reduction strategies focusing on agriculture directly raise farm incomes by increasing marketable output and indirectly through generating employment as agriculture is labour-intensive. The agricultural sector also has linkages with other sectors such as processing industries and factor markets (land, labour and capital). It also reduces food prices thereby benefiting also the urban poor (Pender and Alemu, 2007). According to Timmer (1997) strategies that use the agriculture sector in poverty alleviation are twice effective than other sectors. The author found that a one percent per capita growth in agriculture caused a 1.7 percent reduction in the number of people living below the poverty line.

Zambia, like other SSA countries, still faces the problem of high poverty levels and is promoting the use of the agricultural sector to alleviate it. Poverty levels in 2010 stood at 60.4 percent and almost 50 percent unemployment rates. The poverty levels are more severe in rural areas accounting for 80 percent compared to 34 percent in urban areas as of 2006 (Chapoto *et al*., 2011). The living standards seem to have further deteriorated as in 2012; Zambia dropped from being 154th poorest country to 164th poorest countries out of the 186 countries within the United

Nations countries using the Human Development Index (HDI) (UNDP, 2013). The agriculture sector has been identified as the key driver to poverty alleviation in rural areas because 61 percent of the Zambian population living in the rural areas directly dependent on agriculture. It absorbs 67 percent of the labour-force of which the majority are women who account for 60 percent of the rural population and contributed 21 percent of Gross Domestic Product (GDP) in 2010 (GRZ, 2011).

Commercialization or increased market participation of smallholder farm enterprises, who account for 70 percent of the farming community, is one strategy being promoted by the Zambian government as a means to promote poverty alleviation and wealth creation (Tripathi *et al*., 2009). Commercialization changes the focus of production from consumption to production for the market; it translates into high productivity, greater specialization and subsequently higher incomes for smallholder farmers (Jaleta *et al*., 2009). Currently three main road map documents are promoting commercialization of small holder enterprises, namely; the National Agriculture Policy (2004-2015), the Sixth National Development Plan (2008), and the Zambia National Agriculture Investment Plan (NAIP, 2014-2018). Poverty reduction and livelihood improvement among smallholder farmers through diversification and commercialization of the agricultural sector are key priorities areas in all these roadmap documents.

Rice is one of the crops being promoted for commercialization and diversification by the Zambian government (NAIP, 2013). The crop is being promoted because at the national level, it is the third most important crop from maize and wheat (MACO, 2011). At producer level, it is a major source of income in three major producing provinces namely; Northern Province which

produces about 50 percent of the national output, Western province where it is the most grown crop and Eastern Province (CSPR, 2011). Rice production is exclusively done by smallholder farmers and about 66, 600 households are estimated to be involved in rice production of which about 32 percent are women (MACO, 2011).

Rice output in Zambia increased from 9, 293 metric tons (MT) in 1988 to 24, 023 MT in 2008. Much of this increase is attributed to increased land allocation under production rather than productivity (MACO, 2011). Yields have remained low, ranging from 0.5 to 1.9 MT per hectare (*ibid*). Despite the increase in production Zambia has not yet achieved self-sufficiency in rice and has been experiencing deficits since the crop was included in the national food balance sheet in 2004. The 2013/14 food balance sheet shows that the country will need to import 15 000 MT from 9 240 MT in 2010/11 (CSO/MAL, 2013). The deficit is expected to continue to widen if appropriate policies to stimulate production are not implemented because consumption patterns are shifting upwards in urban areas. According to Mason and Jayne (2009), maize is being substituted by wheat and rice in urban areas such as Lusaka and Ndola. The middle class is also growing and this is the class which is shifting the consumption patterns from maize to other crops like wheat and rice.

Rice provides an opportunity for poverty alleviation and livelihood improvement among producers if market participation is increased because local and regional consumption is anticipated to continue growing. Regional consumption in the SADC has been increasing at 6 percent per annum since 2000 (Kahari, 2009). The GRZ is looking at ways in which it can improve incomes of producers by tapping in the local and regional markets by increasing market participation (MACO, 2011). According to the Netherlands Development Organization (SNV

2012), rice producers in the country are faced with limited access to formal markets which prevents them from increasing the quantity and quality of produce and this creates reliance on imports to fill the deficit as shown above. It is estimated that (14- 40) percent of small scale farmers have access to formal markets (MACO, 2011). It is further estimated that 56 percent and 49.97 percent of rice farmers participated (sold) in the rice market during the 2010/11 and 2011/12 marketing seasons respectively (CSO/MAL, 2013). Increased market participation among smallholder producers has the potential to increase their incomes and improve their livelihood because it stimulates production of marketable surplus (Omiti *et al*. 2009).

Further, output market participation has been identified both as a cause and consequence of development (Barrett, 2008). It has been defined as a cause and consequence of development because when markets are accessible they provide an opportunity for households to sell their surplus output which increases their incomes and in turn buy other commodities and services they need. With increased income among poor households demand for other goods and services increase thereby stimulating development (Boughton *et al*., 2007). Therefore, with most people in Zambia depending on agriculture for their livelihood, particularly those involved in rice production, increasing market participation is one way that will pull them out of poverty and facilitate development.

1.2 Problem statement

The rice marketing system in Zambia has been identified as one of the major constraints to increasing production by the smallholder farmers (MACO, 2011). According to SNV (2012), rice producers in Zambia are faced with limited access to formal markets which prevents them

from increasing the quantity and quality of rice produced. As a result, the rice deficit stood at 15, 000 MT in the 2013/14 national food balance sheet. According to Post-Harvest Surveys (PHS), 56 percent and 50 percent of rice producers participated (sold) in the rice market in the 2010/11 and 2011/12 marketing seasons respectively (CSO/MAL, 2013). The survey further shows that regions like Western Province, which has the largest number of rice producers and the second largest rice producer in the country, only had 41 percent of farmers selling during the 2011/12 marketing season. This raised the question of (i) why Zambian rice farmers were not participating in rice markets despite the country experiencing a deficit in the rice sector? (ii) What factors other than those based on markets constrain Zambian farmers from participating in the rice market?

A number of studies have been conducted on market participation and different factors that influence market participation have been outlined. Barrett (2008) indicates that market participation is heterogeneous among smallholder producers because of differences in level of infrastructure which integrates them into local and international markets, transaction costs, access to productive assets and institutional arrangements. Therefore, studies conducted in other SSA countries may not be conclusive and apply to the Zambian context due the heterogeneity in infrastructure, transaction costs, institutional arrangements and heterogeneity among farmers within SSA countries and within Zambia. Few studies focusing on market participation have been conducted in the rice sector in Zambia despite farmers having challenges in accessing the market as shown above. Therefore, this study highlights the factors that influence market participation in Zambia among rice producers.

1.3 Purpose and Objectives of the Study

The purpose of the study was to identify the factors that influence market participation among smallholder rice farmers in Western Province of Zambia. The specific objectives were:

(i) To characterize rice farmers in Western Province of Zambia

(ii) To identify the factors that influence smallholder rice farmers' decision to participate in the rice market in the Western Province of Zambia

(iii) To identify the factors that influenced the intensity of market participation among smallholder rice farmers in the Western Province of Zambia.

1.4 Hypotheses

Hypothesis 1

The study hypothesised that social-economic factors, household assets, production factors and institutional factors singly had no influence on farmers' decision to participate in the rice market in Western Province of Zambia.

The specific variables that were hypothesised are; **social-economic factors** (age of household head, education level of head, household size, gender of head), **household assets** (ownership of transportation asset, working radio, livestock for traction, size of land), **Production factor** (production technology) and **Institutional factors** (Extension, Credit Access, being a member to farmer organization, access to price information)

Hypothesis 2

The study hypothesised that social-economic factors, household assets, production factors and institutional factors singly had no influence on intensity for market participation among smallholder rice farmers in Western Province Zambia.

The specific variables that were hypothesised are; **social-economic factors** (age of household head, education level of head, household size, gender of head), **household assets** (ownership of transportation asset, working radio, livestock for traction, size of land), **Production factor** (production technology) and **Institutional factors** (Extension, Credit Access, being a member to farmer organization, access to price information)

1.5 Justification

The rice subsector has been included in Zambia's NAIP as one of the crops targeted for commercialization (GRZ, 2013). The study highlighted key policy areas that need to be targeted by policy makers and other stakeholders in an effort to increase market participation among smallholder rice producers for food security and increased incomes. The successful commercialization of the rice sub-sector will contribute in achieving the Millennium Developmental Goal (MDG) one of halving the number of extreme poor people by 2015 and also facilitate the achievement of 2030 vision of making Zambia a middle income country by 2030.

The study also provides important information to assist in revising the Marketing Act which is under review) that anchors the privatization of the rice sub-sector. Currently, government of Zambia buys rice stocks in certain districts through the Food Reserve Agency (FRA) as a way of providing markets to smallholder producers.

The study also focuses on rice as an upcoming domestic staple grain crop whose consumption is increasing in Zambia. Studies have shown that domestic staple foods have the potential to involve a much larger number of smallholder producers than other commodities both for domestic and export market in most SSA countries (Olwande and Mathenge, 2011). Thus, in the immediate term, policy makers should focus on first increasing staple food surplus among poor producers before they decide which crops are more profitable or diversification to high value crops. According to Pingali *et al.* (2005), the production of marketable staple foods is far more important than the shift to specialized high value commodities among smallholder producers. Once staple foods are commercialized over time, diversification among smallholders will come naturally first shifting to mixed staple and cash crop production, afterwards specialize in high-value crops and livestock products (Gabre-ab, 2006). Therefore, rice provides an opportunity to pull many farmers out of poverty since many can grow it once market participation is increased.

1.6 Study area

This study was conducted in Western Province of Zambia. The province was selected because it is the second largest rice producer in the country. Table 1 shows the number of producers by province during the 2011/12 marketing season.

Table 1.1: Rice Producers and Market participation by province in Zambia during 2011/12 farming Season

Province	Number of Household who grew rice	Number of Household who sold	Percentage who sold
Central	689	466	67.6
Copperbelt	57	0	-
Eastern	9,839	4,229	43.0
Luapula	5,077	2,996	59.0
Lusaka	313	53	17.0
Northern	25,692	15,786	61.4
Northwestern	379	300	79.2
Southern	117	0	-
Western	30,316	12,390	40.9
Total	72, 479	36220	49.97

Source: Post Harvest Survey Report (CSO, 2013).

As shown in Table 3.2, Western province has the largest number of rice producers in the country with 30,316 representing 41.83 percent of the total producer in the country during the 2011/12 marketing season. Market participation was also least in Western Province and the Government of Zambia also aims at alleviating poverty in the province through commercialization of the rice sector because it has a comparative advantage over other crops.

The Western Province has eight districts namely; Lukulu, Kaoma, Kalabo, Mongu, Senanga, Shangombo, Sesheke and the newly created district of Limulunga, which was part of Mongu and Kaoma. The sample was drawn from four districts Mongu, Kalabo, Senenga and Limulunga. The districts were purposively selected because of the reasons outlined below. Mongu District was selected because it is the largest rice producer in the province and also a link district for all the producers in the province to the city of Lusaka, the major rice market. Kalabo District is the second largest producer of rice in the region, Senanga is the third largest rice producer, while Limulunga District was selected because of its proximity to Mongu the link district to Lusaka.

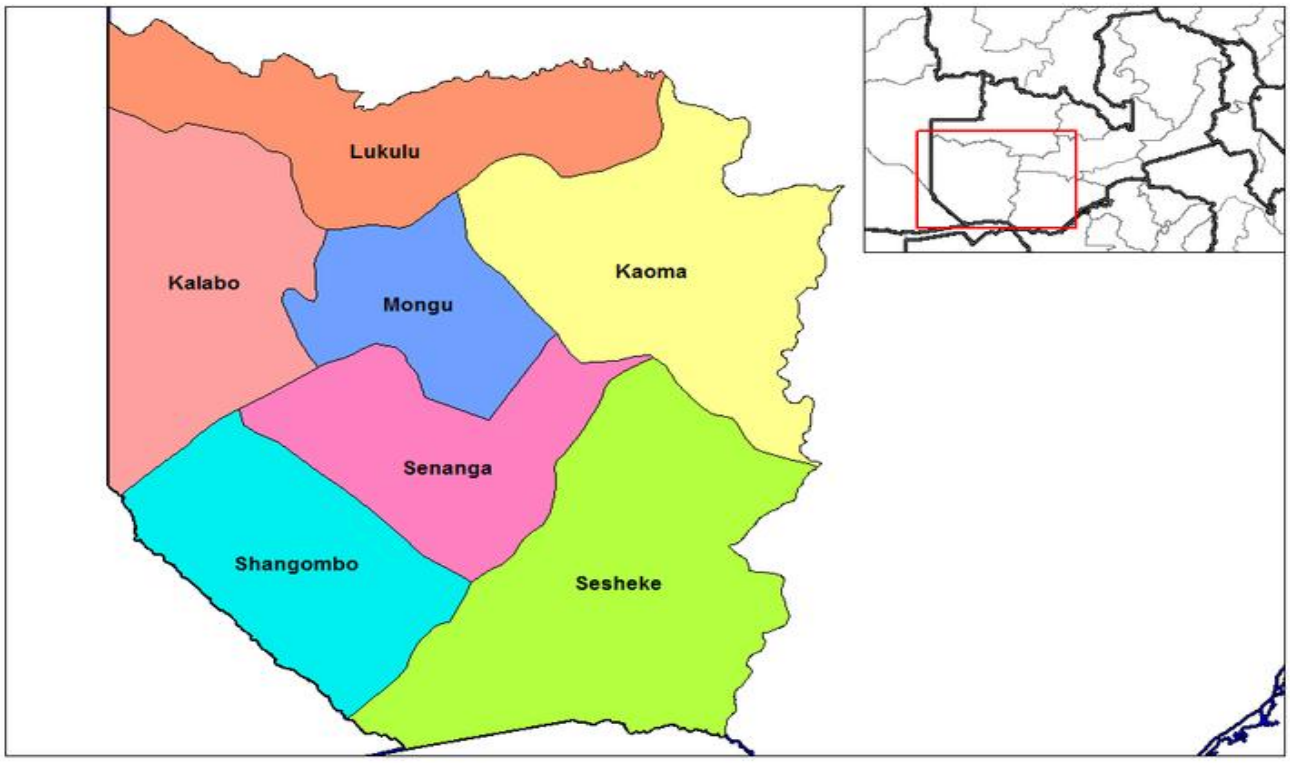

Figure 1.1: Study Sites in Western Province Zambia

1.7: Organization of thesis

This thesis is organized as follows: The first chapter presents the introduction which comprises the background information, context of rice production in Zambia; the problem statement, objectives, hypotheses and justification. Chapter Two reviews pertinent literature starting with Zambia's marketing environment, relevant theoretical and empirical literature, while Chapter Three discusses the Methodology. Chapter Four presents the results and discussions. Lastly Chapter Five presents the summary of findings, conclusions and policy recommendations.

CHAPTER 2

LITERATURE REVIEW

2.1 Definition of terminologies

Market participation entails farmers being able to buy inputs in the input market or being able to sell their output in the output market. Intensity of market participation is defined as the quantity of output sold by a farmer from total production or quantity of input a farmer is able to purchase in the input market (Jagwe, 2011). This study considers market participation from the view of farmers being able to sell their output in the output (rice) market and intensity from the view of quantity of output (rice) sold by farmers in the rice market. Therefore literature is reviewed from these perspectives.

2.2 Zambian Agriculture Sector

Zambia's crop production is mainly rain dependent. Crop production is mainly dominated by small scale farmers who comprise 70 percent of the farming community (NAP, 2004). Out of the 752, 614 Km^2 total land mass available, it is estimated that 58 percent of the total land is arable and only 14 percent of the arable land is under cultivation and 11.8 percent is under irrigation (*Ibid*). Crop production is dominated by maize accounting 60 percent of total land under cultivation followed by Wheat and Rice being the third most important crops to Zambia's National Food Balance respectively (MACO, 2011).

2.3 Agriculture marketing in Zambia

Agriculture marketing in Zambia was liberalized in the early 1990s when the Movement for Multy Party Democracy (MMD) was voted into power. The liberalization of the sector was both

in the input and output markets. Prior to the adoption of market liberalization, the National Marketing Board (NAMBOARD), a government parastatal, was in charge of agriculture marketing for inputs and outputs throughout the country (Mwanaumo, 1999). By 1999, the government had completely withdrawn from the input market but continued buying maize for strategic reserves for food security through FRA. In 2002 the government re-introduced the input subsidies and has continued providing these inputs up to date and even expanding them from maize to commodities such as rice since last farming season. The government has also included rice on the crops FRA buys in some places since 2007/8 farming season as a temporal strategy to improve market access among rice producers.

According to the Ministry of Agriculture and Cooperatives (2004) market development in Zambia is hampered by several factors such as institutional, policy and legal framework, investment, finance and infrastructure services. There is lack of capacity for small scale producers and traders to form an effective linkage and also there is lack of comprehensive agriculture legal framework to guide the function of agriculture sector.

2.4 Empirical studies on Factors that influence Market Participation and Extent of Market Participation in Agricultural Products

Increased market participation among smallholder producers has emerged to be key in agricultural transformation or commercialization because of its ability to unlock the smallholder's productivity thereby increasing their incomes and reducing poverty. As such, a number of studies have focused on market participation. For example, Key *et al*. (2000) used an agricultural household model to assess how transaction costs influence different households when they enter the market as buyers, sellers and when they are in autarky among corn producers in Mexico. The study found that the decision to produce corn among sellers was positively

influenced by production shifters such as seed variety, point of sale or buying, member to farmer organization, access to formal credit, mechanization index and price among sellers. These findings showed that interventions aimed at stimulating production for the market should ensure access to high yielding varieties and improved mechanization for increased market surplus among Mexican corn producers.

Komarek, (2010) evaluated the determinants of banana market commercialization in Western Uganda using a double hurdle approach. In the first hurdle the study determined what influenced the decision of the producer to enter the banana market (sell) using a probit model. The study found output price, yield and access to price information prior to sell to positively influence the decision to enter the banana markets, while distance to market negatively influenced the decision to enter the market. The study highlighted the importance of price level in stimulating famers to enter a market and also the importance of reducing proportional transaction costs through reducing distance to the market which increases transportation costs in entering the market. Access to price information prior to information reduces fixed transaction costs or information search costs for available markets and price levels hence its importance in increasing the chances of a farmer to enter the market. The second hurdle determined the intensity or extent of market participation using a truncated model. Output price, yield, size of household, ownership of land and access to price information were found to positively influence the extent of market participation, while off-farm income negatively influenced it. The study shows that for intensity to be increased farmers should produce substantial yields to enable them have a market surplus; in addition produces should also own production assets such as land.

Mather et al., (2011) assessed smallholder heterogeneity and maize market participation in Southern and Eastern Africa. The study used a double hurdle bivariate generalization of the Tobit model to identify factors which influenced market participation in Kenya, Mozambique and Zambia. The study reviewed stated that market participation was heterogeneous among these country and within different regions in these countries. Using the first hurdle to determine factors that influenced the decision to enter the market, the study found that in Kenya the decision to enter the market was positively influenced by; use of fertilizer, age of household head, ownership and price, while in Mozambique total area planted, total assets owned, ownership of animal traction and distance to fertilizer dealer. In Zambia it was positively influenced by; size of land owned, use of fertilizer and planting hybrid seed, but negatively influenced by education level of head, age of head, distance to road and gender of the household head.

Intensity of market participation in Kenya was positively influenced by use of hybrid seed, area planted, use of fertilizer, ownership of oxcart and radio, while in Mozambique it was positively area planted, access to information prior to selling and price. In Zambia area planted, use of fertilizer, planting hybrid seed, ownership of cell phone and radio all positively influenced intensity of participation while gender and age of the household head negatively influenced intensity. This study clearly highlighted that some factors affecting the decision to enter the market and extent of market participation differ from country to country because of differences in the level of infrastructure development, agro-ecological conditions and heterogeneity among farmers.

Olwande and Mathenge (2011) evaluated market participation among poor rural households in Kenya using a double hurdle model. The study assessed factors that influenced market

participation among four commodity producers namely; maize, vegetables, fruits and milk producers. The study reviewed that factors that influenced market participation on each commodity varied within the country. The study found that being a member to a farmer organization, ownership of transportation asset and the region positively influenced the decision to enter the market among maize producers, while dependency ratio negatively influenced the decision to enter the market. Among vegetable producers being a member to a farmer organization, ownership of cell phone, price and region positively influenced the decision to enter the market, while lack of formal education and distance to tarmac road negatively influenced the decision to enter the market. Fruit producers were positively influenced by per capita land size, ownership of cell phone and negatively influenced by lack of formal education. Further, milk producers were positively influenced by price, being a member to a farmer organization, education level of household head and region, while age of household head and distance to tarmac road negatively influenced the decision to enter the market among milk producers. Intensity of market participation also varied among maize, vegetable, fruit and maize producers. For example, distance to tarmac negatively influenced maize producers but positively influenced fruit producers. Output price was found to negatively influence fruit producers but positively influenced maize producers. In addition per capita land size only influenced fruit producers and maize producers positively. Dependency ratio only influenced vegetable producers negatively only. This study highlighted that market participation within a country was commodity specific and could not be generalized.

Chilundika (2011) determined market participation of bean smallholder farmers in Zambia. The study focused on gender, particularly if the factors that influenced female bean producers to participate in the market were different from those in the pooled data. The study found that

female producers were positively influenced by; number of hectares owned, yield and region the producer was from. Ownership of transport technology and production technology negatively influenced the decision to enter the market among female producers. Intensity of market participation was positively influenced by number of hectares owned, age squared, being a member to a farmer organization and the region the producers is from, while price, transportation asset, age of head, income and yield negatively influenced intensity. The study showed that the factors that influenced market participation among women producers were different from that of the pooled data set. For example, the decision to enter the market was further positively influenced by education level and age of household head. In the pooled data intensity of market participation was influenced by level wealth and ownership of land. Controversy also existed in the direction of influence of certain variables. Ownership of transport positively influenced intensity among female producer but in the pooled sample the influence was negative. Output price negatively influenced female producers but was not significant in the pooled sample. The study highlighted that intervention on market participation are also gender specific and could not be generalized.

Reyes *et al*., (2012) evaluated market participation and sale of potatoes by smallholder in central highland of Angola using a double hurdle. The study included the production decision to determine if the factors that influenced quantity produced, the decision to enter the market and extent of participation were different. The findings showed that the decision to produce was positively influenced by; gender of household head, quantity of seed used, used fertilizer and production cost. While the decision to enter the market was positively influenced by gender and dependency ration while number of adults in a household and access to public market negatively

influenced the decision to enter the market. Intensity of market participation was positively influenced by ownership of bicycle, presence of extension officer in the village, index of home assets and lastly index of productive assets. The findings showed that any intervention aimed at stimulating any of the three stages; increase quantity produced, increase entry into the market or increase intensity should target different variables because variables that influenced each level were different.

2.5 Review of approaches to model market participation

Various models have been used to understand determinants of market participation. These include tobit, double hurdle, triple hurdle and Heckman two-stage. The tobit model was used initially but the draw backs of the tobit model is that it results in clustering of zeroes for non-participation and treats those with zeroes as if they did not sell because they did not want to, but in contrast they may have not sold because there was no market. The other major limitation of the model is that it assumes the same set of parameters and variables determine both the probability of market participation and intensity of market participation (Reyes *et al*., 2012). The tobit model is appropriate where the decision to sell and the quantity sold were made simultaneously. According to Barrett (2007) households face a two-step decision making process with regard to market participation. The first step involves deciding whether or not to participate in the market while the second one focuses on the quantity to sell once the participation decision has been made. The models suitable under conditions where decisions are not jointly made include double-huddle and the Heckman two-step (Mather *et al*., 2011).

Both the double-hurdle and Heckman models use the probit model in the first step to determine the probability of participating in the market. The second step uses a truncated model to evaluate the factors influencing the quantity of produce sold in the market from the double-hurdle, while the Heckman two-step uses a regression model.

In an event that some participants in the sample did not sell, then the researcher is faced with the selection bias problem and the double-hurdle is inappropriate due to its failure to account for the selection bias. Sample selection bias arises when the researcher does not observe a random sample of the population of interest. In the linear regression, selection bias occurs when data on the dependent are missing non-randomly conditional on the independent variable. This yields biased and inconsistent estimators of the effect of the independent variables (Winship and Mare, 1992). If a researcher is faced with such a situation selection model is appropriate and the Heckman two-step to be specific (Green, 2003). The model uses a probit regression to assess the probability of participation and ordinary least squares (OLS) to determine the intensity of market participation. The selection bias is captured by an inverse Mills' ratio derived from the first stage model and incorporated in the second step the regression (*Ibid*). Some studies that used Heckman two-step in analyzing market participation include;

Siziba *et al*., (2011) evaluated the determinants of cereal market participation by SSA smallholder farmer using pooled data from 8 African countries namely; Nigeria, Niger, Uganda, Democratic Republic of Congo (DRC), Rwanda, Mozambique and Zimbabwe. Using the Heckman tow-step, the study found that the decision to enter the market was positively influenced by experience of household head, use of animal manure, access to price information

prior to selling, road network, ICT and area planted, while household size negatively influenced it. Intensity of market participation was positively influenced by ownership of radio, off-farm income, access to extension services, research part, access to price information prior to sell and ICT, while the amount of credit accessed and membership to farmer organization negatively influenced it. The study highlights that access to public assets such as good road network, information on prices prior to selling and access to ICT influence both the decision to enter the market and extent of market participation. Access to such public services would increase market participation among smallholder farmers, further access to extension and off-farm income which increases total household income also influence market participation. The study also highlights that the amount of credit a farmer was given and being a member to a farmer organization negatively influenced the intensity of market participation in these countries.

Jagwe (2011) evaluated the impact of transaction costs on the participation of smallholder farmers and intermediaries in the banana markets in Burundi, Democratic Republic of Congo and Rwanda. The study used a Heckman two-step and found that the decision to enter the banana market was positively influenced by land size owned by household, being a member to a farmer group. The entry decision was negatively influenced by ownership of bicycle, access to price from neighbor and some geographical region. The study further found that intensity of market participation was positively influenced price, number of children between the age of 6 and 17 years, ownership of bicycle and residing in the western part. The Inverse Mills' ration was also significant at 1%.

Sebatta et al. (2012) looked at the determinants of smallholder farmers' participation in the potato market in Kabale and Mbale using a Heckman two-step model. The study found that the

decision to enter the market was positively influenced by condition of the road to the nearest market, age of the farmer and distance to the nearest market. Intensity of market participation was positively influenced by output price, total farm land owned and the Inverse Mills' ratio was also significant at 5%.

This study also used a Heckman two-step because of the selection bias that was anticipated in the data. The PHS (2013) reviewed that 41 percent of rice producers participated (sold) in the rice market in Western Province of Zambia during 2011/12 marketing season. Since some farmers did not sell this normally results in a selection problem and the Heckman two-step model is adequate to handle this problem

2.6 Summary

The literature reviewed in the fore-going sections shows that there are many factors that influence market participation. These factors can be grouped into four categories namely; transaction costs, productive assets which increase the chances of a farmer producing a surplus for the market, productive technologies which also increase the chances of surplus, and institutional factors. Various models have been suggested in the literature to evaluate market participation. This study used the Heckman two-step model because of its ability to handle selection bias.

CHAPTER 3

METHODOLOGY

3.1: Conceptual framework

Output market participation has been identified both as a cause and consequence of development because when markets are accessible they provide an opportunity for households to sell their surplus output which increases their incomes (Boughton *et al*., 2007). Increased incomes in turn buy other commodities and services they need. With increased income among poor households demand for other goods and services increase thereby stimulating development (*Ibid*).

Figure 3.1 postulates the factors that could be influencing market participation in Western Province of Zambia among rice farmers. A number of factors have been argued in literature to be influencing market participation. According to Carter and Barrett (2006), lack of assets may cause smallholder farmers to be unable to produce a marketable surplus and this could hinder them from participating in markets despite the cost of accessing the markets being low. Low asset base could be one challenge affecting market participation in the region. According to CSPR, (2011) the region is the poorest and this could be a potential influence for low output hence low or marketable surplus.

In addition, markets in Africa are characterized by imperfections and this give rise to higher transaction costs which have been found to be among the greatest challenge faced by smallholders to market participation. In cases where they are too high, smallholders will not participate (De Janvry and Sadoulet, 2010). According to MACO, (2011) the rice market is still characterized by high transaction costs and this could also be affecting farmers in the region from participating in the rice market. Further, access to production factors such as seed and

improved also improves marketable surplus produced. Access to factor constraint is another impending factor to market participation (Barrett, 2008).

Socio-economic factors also influence market participation such as age of household, education level and age of the household head. Older households tend to be risk averse and may not take new technologies to improve marketable surplus (Chilundika, 2012). Institutional factors such as (access to market information on the prices, access to credit) are important in market participation. Access to information enables farmers to make informed decision on when to enter the market, once the price is able to cover the transaction costs to be faced (Key *et al*., 2000). Table 3.1 further shows that due to low market participation among rice farmers, this result in low incomes and subsequently poor livelihood. Low levels of incomes causes' low usage of input which results in low outputs produced, subsequently leading to deficit of rice at national level and continued low participation in the rice market. The situation mention above makes farmers to be trapped in the poverty trap but if market participation is increased it has the potential to unlock them from the poverty trap (Omiti, *et al*., 2009)

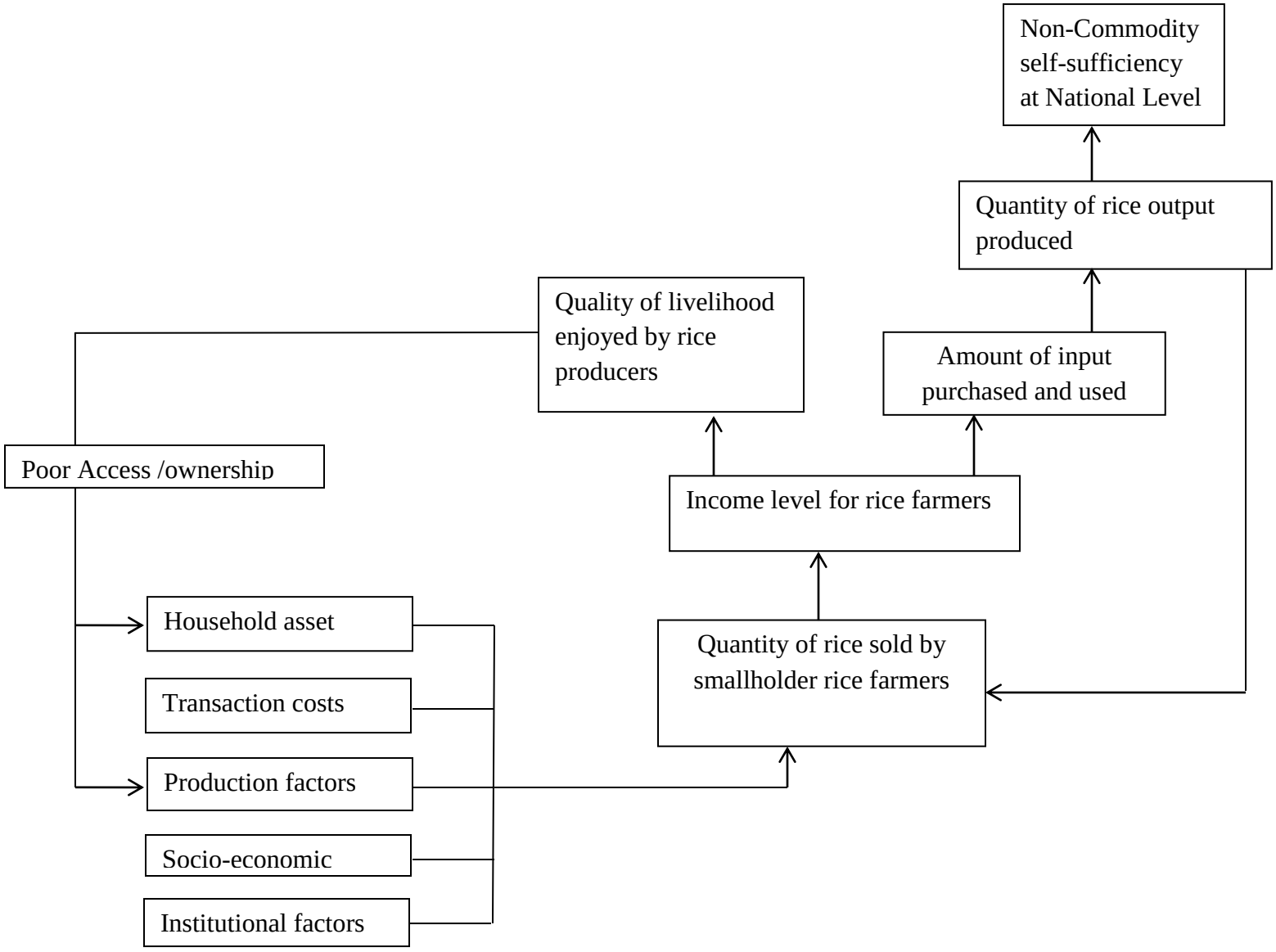

Figure 3.1: Conceptual framework

3.2: Theoretical Framework

The study uses an agricultural household model framework based on Key *et al*. (2000). The household decides how much of each good *i* to consume (*Ci*), produce (*qi*), and use as input *xi*. The household also decides how much of each good to sell (*mi*). The objective of the household is to maximize utility and if we assume there were no transaction costs. The household's problem would be to maximize the utility function (3.2.1) subject to constraint (3.2.2-3.2.5).

$U(c; \mathrm{z_u})$ utility function ……... (3.2.1)

$\sum_{i=1}^{N} p_i^m m_i + T = 0$ cash constraint ……... (3.2.2)

$q_1 - x_i + A_i - m_i - c_i = 0$ Resource balance (where i= 1,…N) ..... (3.2.3)

$G(q, x; z_q)$ Production Technology ……...…… (3.2.4)

$c_i, q_i, x_i \geq 0$ non-negativity condition ..... (3.2.5)

where p_i^m is the market price of good *i*, A_i is an endowment in good *i*, T is the exogenous and other income, Z_u and Z_q are exogenous shifters in utility and in production respectively and G represents the production technology. Constraint (3.2.2) the cash constraint states that expenditure by the household should not exceed revenue and transfers; Constraint (3.3.3) the resource balance, states that, for each of the N goods, the quantity consumed, used as input and sold is equal to what is produced and bought plus the endowment of the goods. Constraint (3.2.4) is the production technology which relates input to output.

When transaction costs are included in the model, with the inclusion of proportional transaction Costs (PTC) t_{pi}^b , which increases the price paid by the buyer and lowers the price received by the producer, the cash constraint becomes

$\sum_{i=1}^{N}[(p_i^m - t_{pi}^s(Z_t^s))\boldsymbol{\delta}_{\mathrm{i}}^{\mathrm{s}} + (p_i^m + t_{pi}^b(Z_t^b))\boldsymbol{\delta}_{\mathrm{i}}^{\mathrm{b}}] + \mathrm{T} = 0$ ……...…… (3.2.6)

where $\boldsymbol{\delta}_{\mathrm{i}}^{\mathrm{s}}$ is equal to one if $m_i \geq 0$ the if the household is a net producer and zero otherwise and $\boldsymbol{\delta}_{\mathrm{i}}^{\mathrm{b}}$ is equal to one if $m_i \leq 0$ and zero otherwise. The proportional transaction costs reduces the prices received by the seller than the market price p_i^m by unobservable amount t_{pi}^s and the price paid by the buyer is greater than the market price p_i^m by unobservable amount t_{pi}^b. The proportional transaction costs are expressed by observable characteristics $Z_t^s$for the net producers and $Z_t^b$for the net buyers. When fixed transaction costs (FTC) are also included in the model, then the cash constraint becomes;

$$\sum_{i=1}^{N}[(p_i^m \ - t_{pi}^s\,(Z_t^s))\boldsymbol{\delta}_{\mathrm{i}}^{\mathrm{s}} + \ (p_i^m \ + \ t_{pi}^b\,(Z_t^b))\boldsymbol{\delta}_{\mathrm{i}}^{\mathrm{b}}]m_i - t_{fi}^s\,(Z_t^s))\boldsymbol{\delta}_{\mathrm{i}}^{\mathrm{s}} -$$

$$t_{fi}^b\,(Z_t^b))\boldsymbol{\delta}_{\mathrm{i}}^{\mathrm{b}}] \ + \mathrm{T} = 0 \qquad \text{………………………………………….……..} \ (3.2.7)$$

Where the household pays a fixed cost of t_{fi}^s if they sell and t_{fi}^b if they buy, hence both fixed transaction Costs and Proportional Transaction Costs are taken into account. To derive the supply and demand equation for a household facing both fixed and proportional transaction Costs, a Langragian expression can be used from equation (3.2.1)-(3.2.7)

When transaction costs are incorporated the supply curve for the selling, buying and those in autarky is given as follows.

$\mathrm{q}^s = \mathrm{q}(\mathrm{p}^\mathrm{m} - \mathrm{t}_\mathrm{p}^\mathrm{s} - \mathrm{t}_\mathrm{f}^\mathrm{s}, \mathrm{z}_\mathrm{q})$ For sellers …………………………...…………. (3.2.8)

$\mathrm{q}^b = \mathrm{q}(\mathrm{p}^\mathrm{m} + \mathrm{t}_\mathrm{p}^\mathrm{b} + \mathrm{t}_\mathrm{f}^\mathrm{b}, \mathrm{z}_\mathrm{q})$ For buyers …………………………...…………. (3.2.9)

$\mathrm{q}^a = \mathrm{q}(\hat{\mathrm{p}}, \mathrm{z}_\mathrm{q})$ For autarkic households ……………………..… (3.2.10)

According to Jagwe (2011) for empirical analysis, focusing on the selling households, a linear expression is assumed for the supply functions and is given as follows:

1. $q(p, z_q) = p\beta + z_q\beta_q - t^b_{p,}$ ……..……..….(3.2.11)

   Where, $t^s_p = -z^s_t\beta^s_p$ and $t^b_p = -z^b_t\beta^b_p$.

This leads to the linear expression for sellers given as follows

2. $q^{s*} = p_m\beta_m + z^s_t\beta^s_t + z_q\beta_q$ ……..……..(3.2.12)

The linear expression for the production threshold levels are thus given as

3. $q^s = z^t_s\alpha^s_t + z^s_t\alpha^s_t + z_c\alpha^s_c$ ……...……(3.2.13)

Where Z_t are exogenous characteristics which affect transaction costs when selling, Z_q are production shifters, Z_c are consumption shifters and α^s_t, α^s_c are the coefficients respectively, while β^s_t, β_q are coefficients of $z^s_t \; and \; z_q$ respectively. Where q^{s*} is a latent supply if a household is a seller and observed if it is higher than a threshold for market participation q^s.

Thus if $q^{s*} > \; q^s$ then the household is participating in the market as a seller and the parameters for this equation $q^{s*} > \; q^s$ can be identified using a probit model, it enables to identify the factors that influence the household to participate in the rice market or not as shown bellow

$q^{s*} > \; q^s \equiv$ Prob (y=1) = Xi + u ……..……. (3.2.14)

While the estimation of $\beta_m, \beta^s_t \; and \; \beta_q$ carters for the intensity of the market participation among the sellers.

3.3: Analytical framework

The study used the Heckman's (1979) two step procedure because of its ability to handle the anticipated problem of selection bias in the sample. Selection bias was anticipated in the data because only 50 percent of rice producers participated in the 2011/12 marketing season hence the anticipation of selection bias in the data (GRZ, 2013). The Heckman two-step uses the probit model is the first stage to determine the probability of selling in the market as shown below;

$$\Pr(Z_i = 1|w_i, \alpha) = \Phi(h(\boldsymbol{w}_i, \alpha)) + u_i \quad \text{..... (3.3.1)}$$

Where, Z_i is an indicator variable equal to unity for household that sold rice, Φ is the standard normal cumulative distribution function, $\boldsymbol{w}$ is a vector of factors affecting market participation outlined in table 3.1, $\boldsymbol{\alpha}$ is a vector of coefficients to be estimated, and u_i is the error term assumed to be distributed normally with a mean of zero and a variance σ^2. The variable Z_i takes the value 1 if the marginal utility household i gets from participating is greater than zero and zero otherwise, as shown below;

$$Z_i^* = \alpha w_i + v_i \quad \text{..... (3.3.2)}$$

Where Z_i^* is the latent variable of utility the household gets from participating in the rice market and the error term is assumed $V_i \sim (N, 1)$, so we have,

$$\left.\begin{array}{l} Z_i = 1 \; if \; Z_i^* > 0 \\ Z_i = 0 \; if \; Z_i^* \leq 0. \end{array}\right\} \quad \text{..... (3.3.3)}$$

The second stage uses a regression model as shown below;

$$Y_i = \boldsymbol{X}_i\boldsymbol{\beta} + \varepsilon_i, \quad \text{..... (3.3.4)}$$

where $\boldsymbol{X}_i$ represents a vector of explanatory variables determining market intensity outlined in table 3.1, $\boldsymbol{\beta}$ is a vector of coefficients and ε_i the error term. The regression model yields biased

results when run using OLS because the error terms for the probit model and regression models are correlated with$\text{corr}(u, \varepsilon) = \rho$. To correct for the bias, an inverse Mills' ratio is introduced in the regression model calculated from the probit model. That is, the Mills' ratio is included as an explanatory variable and the regression model becomes:

$$E[|Y_i|Z_i\boldsymbol{\gamma} > 0] = \boldsymbol{X_i\beta} + \rho\sigma_\varepsilon\lambda_i \text{ ,} \qquad \text{..... (3.3.5)}$$

where $\boldsymbol{X}_i$ represents a vector of explanatory variables determining market intensity after correction for selection bias, $\boldsymbol{\beta}$ is a vector of coefficients, σ_ε and σ_u are standard errors for the random terms for the regression and selection models respectively. λ_i represents the inverse Mills' ratio, given as (Siziba *et al*., 2010)

$$\lambda_i = \frac{\emptyset\left(\frac{Z_i\boldsymbol{\gamma}}{\sigma_u}\right)}{\boldsymbol{\Phi}\left(\frac{Z_i\boldsymbol{\gamma}}{\sigma_u}\right)}, \qquad \text{..... (3.3.6)}$$

where, Φ and $\emptyset$ represent the standard normal cumulative distribution function and standard normal distribution respectively.

Table 3.1 highlights the hypothesized variables and their expected signs for both the probit and OLS models.

Table 3.1: Definition of variables hypothesized to influence the probability and intensity of market participation in Western province of Zambia

Dependable Variable	
Probit Model ((1 = sold, 0 = otherwise)	
OLS Model (quantity of rice in kg sold)	
Independent Variables	**Expected Sign**
Socio-Economic Factors	
Age of household head in years	+/-
Gender of household head, 1= male; 0= female	+
Education level of household head in years	+
Household size in persons	+/-
Household Assets	
Household owns transport mode. 1 = yes; 0 = otherwise	+
Household owns a working radio. 1 = yes; 0 = otherwise	+
Household owns livestock for traction. 1 = yes; 0 = otherwise	+
Land size owned by the household in hectares	+
Production Factor	
Household used production technology. 1 = yes; 0 = otherwise	+
Quantity of output produced in kg	+
Institutional factors	
Number of extension trainings per year	+
If household had price information prior to sell. 1 = yes; 0 = otherwise	+
Anyone in the household being a member of a farmer organization. 1 =yes; 0 = otherwise	+
If household accessed formal credit in last 24 months. 1 = yes; 0 = otherwise	+
Market Factors	
Output price in kwacha	+
Distance to market in kilometers	-

Geographical Factors	
If household is from Limulunga district. 1 = yes; 0 = otherwise	+/-
If household is from Mongu district. 1 = yes; 0 = otherwise	+
If household is from Kalabo district. 1 = yes; 0 = otherwise	+/-

Source: Author

3.4 Justification for inclusion of hypothesized variables

Age of household head

The age of the household head was used as a proxy measure of experience in production and marketing. Age of the household head was captured as a continuous variable. Olwande and Mathenge (2011) found that age of the household head negatively influenced the decision to enter the market, but did not influence intensity of market participation among milk producers in Kenya. On the other hand Martey *et al*. (2012) found age to positively influence the intensity of market participation among maize producers, while among cassava producers it negatively influenced them. Based on this evidence, age of the household head was hypothesized to have an indeterminate relationship with the probably of market participation and intensity of market participation.

Gender of the household head

Gender of the household head was captured as a dummy variable indicating whether the household was headed by a male or female. The gender of the household head was hypothesized to influence market participation positively because male households might have more information on production techniques and input access than their female counterparts. Male-headed households could also be wealthier than their female-headed counter-parts and this could

allow male-headed households to own more productive assets which increase the chances of producing a marketable surplus. Rayes *et al*. (2012) found that the gender of the household head positively influenced the probability of market participation but had no influence on the intensity among potato producers in Mozambique. Siziba *et al.* (2010), on the other hand, found gender not to significantly influence the probability and intensity of market participation among cereal producers in SSA. Further Omiti *et al.* (2009) found gender of the household head to positively influence intensity of market participation among kale producer in Kenya. Therefore, the study hypothesized that male headed household had a positive influence on both the probability and intensity of market participation among rice producers in Zambia.

Level of education of household head

Education level of the household head was captured as a continuous variable, indicating the number of years spent in formal school by the household head. The education level of household head has been found to influence market participation because heads of households with relatively more education may have better abilities to negotiate and have more information than those with relative less education Lubungu *et al.* (2012). Further, the study found that the level of education of the household head positively influenced farmers' decision to enter livestock markets in Zambia. The study only considered the factors that influenced the decision to enter the livestock market and did not go further to determine intensity of market participation. Boughton *et al.* (2007) found the level of education for the household head to positively influence both the probability and intensity of market participation among tobacco producers in Mozambique. In this regard, education level of the household head was hypothesized to

positively influence both the decision to the enter market and intensity of market participation among rice producers.

Household size in persons

Household size was captured as a continuous variable indicating the number of members who were directly dependant on the household. A larger household may have more family labour for production compared to a smaller one. However, a large household may reduce the marketable surplus to meet household consumption needs (Martey *et al*., 2012). Siziba *et al*. (2011) found household size to negatively influence the decision to participate in cereal market among cereal producers in SSA. However, the same variable had no impact on the intensity of participation. Boughton *et al*. (2007) found number of adults in a household to positively influence the decision to enter the tobacco market in Mozambique, but had no influence on the on the intensity of market participation. In this study, therefore, an indeterminate relationship between household size and the probability and intensity of market participation was hypothesized.

Output Price

Output price was captured in Zambian Kwacha (ZMK) as a continuous variable. According to Key *et al.* (2000), when the household is faced with transaction costs, its entry into the market is delayed until the price is large enough to cover the fixed transaction costs. Chilundika (2011) found output price to negatively influence intensity of market participation among female bean producers in Zambia. On the other hand, Komarek (2010), found output price to positively influence both the probability and intensity of market participation among banana producers in Uganda. Omiti *et al*. (2009) found output price to positively influence intensity of market

participation among maize and kale producers in peri-urban Kenya. The variable was positively hypothesized to influence both the decision to enter the market and intensity of market participation among rice producers in Zambia.

Household owns Livestock for traction

Ownership of livestock was captured as a dummy variable, indicating if the household owned oxen or donkeys used for traction. Livestock is an important production shifter because they increase the capacity for a household to produce surplus hence increasing the chances of a household's market participation (Barrett, 2008). Households can also use livestock to plough for other households who do not own oxen and make additional income which can be used for purchasing inputs. Boughton *et al.* (2007) found ownership of cattle or donkey for traction to only positively influence the probability of entering the market among tobacco producers in Mozambique. In addition, the study found that among maize and cotton producers, ownership of cattle or donkey only influenced intensity of market participation positively. In this study, ownership of livestock was hypothesized to positively influence both the probability and intensity of market participation among rice producers in Zambia.

Size of land owned by household

The size of land owned by a household was captured in hectares as a continuous variable. Land is an important factor in production and ownership of land is crucial for households to engage in production. Jagwe (2011) found that the size of land owned by a household only positively influenced the probability to enter the market among banana producers in East Africa. In addition, Komarek (2009) found size of land owned by a household to only influence intensity of market participation positively in Uganda among banana producers. In this study, the size of land

owned by the household was hypothesized to be positively related to the probability and intensity of market participation among rice producers in Zambia.

Household owns transportation asset

Ownership of transportation asset was treated as a dummy variable. Two transportation assets were considered, ownership of bicycle or ox-cart because of the nature of the areas where the study was conducted. In this area poverty levels are still high standing at 80% (CSPR, 2011). Hence, very few would own a vehicle for transporting commodities to the market. Ownership of means of transport increases the chances of smallholder farmers to participate in markets as it reduces transportation costs (Jagwe, 2011). Mather *et al.* (2011) found that ownership of an ox-cart positively influenced both the probability and intensity of market participation among maize producers in Zambia. In addition, Reyes *et al*. (2012) found that ownership of a bicycled only influenced the intensity of market participation positively among potato producers in Mozambique. In this study, ownership of transportation asset was hypothesized to positively influence both the probability as well as intensity of market participation among the smallholder rice farmers in Western Province of Zambia.

Household owns a working radio

Ownership of a working radio was captured as a dummy variable. Ownership of a working radio has been found to influence market participation because it reduces fixed transaction costs associated with information search on market availability and prices. In addition, a radio could broadcast productivity-enhancing programs which would influence the quantity of produce marketed. Siziba *et al*. (2011) found that ownership of a radio positively influenced the intensity

of market participation but not the probability of participating in the market. This study hypothesized a positive relationship between ownership of a radio and the probability as well as the intensity of market participation among smallholder rice farmers in Western Province of Zambia.

Household used Productive Technology

Productive technology was captured as a dummy variable if the household used improved hybrid seed or chemical fertilizer in its production system. According to Barrett (2007), the barriers to market participation could also depend on production technologies such as access to hybrid seed and fertilizer needed to generate adequate surpluses to induce crop sales. Chilundika (2011) found use of production technology (hybrid seed or fertilizer) to positively influence the probability of entering the market among bean producers in Zambia, but had no influence on the intensity of market participation. Mather *et al.* (2011) found that use of chemical fertilizer to positively influence both the probability and intensity of market participation among maize producers in Kenya. The study further found that, use of hybrid seed only influenced the intensity of market participation positively. Therefore it was expected that households that had used hybrid seed or fertilizer were more likely to participate in the market and also have a higher marketable output than those which did not.

Access to extension services

Access to extension services was captured by the number of extension visit a household had in the last 12 months. Producers that are in contact with extension agents have better understanding on new technologies such as better seed varieties and other better production practices, which increases their likelihood to produce more. Additionally, they may also have increased access to

market information on the output price and available markets due to their interaction with extension workers. Siziba *et al.* (2011) found access to extension training among cereal production to positively influence the intensity of market participation among cereal producers in SSA. However, it did not influence the probability of market participation. In this study, access to extension services was hypothesized to be positively related to the probability and intensity of market participation among rice farmers in Western Zambia.

Household accessed credit

Access to credit was captured as a dummy variable indicating whether the household had received any formal credit in the past 24 months or not. Access to credit is important with regard to market participation because it enables households to purchase hybrid seed, fertilizer and productive assets which increase the likelihood of producing a marketable surplus. Several studies have found a positive relationship between the probability as well as the intensity of market participation. For instance, Olwande and Mathenge (2011) found that households which accessed credit had higher intensity of market participation compared to those that did not. In this study, access to credit was hypothesized to be positively associated with both the probability and intensity of market participation.

Access to market information

Access to market information was captured as a dummy variable whether the household had information on the prices prior to selling. Access to information on available markets and prices for the commodity is important because it enables farmers to make informed decisions which market to sell and when to sell the commodity. Kemarek (2006) found that access to price

information prior to sell positively influenced the probability of entering the market among banana producers in Uganda. On the other hand, it negatively influenced the intensity of market participation. Siziba *et al.* (2010) found that access to price information positively influenced both the probability and intensity of market participation among cereal producers in SSA. Therefore, this study hypothesized access to market information to positively influence both the decision to enter the market and intensity of market participation.

Membership in a farmer organization

The variable was captured as a dummy variable if any of the household members was a member in a famer organization. Membership in a farmer organization has been found to increase market participation of households because it improves the capabilities of the famers' production and marketing (Bahta and Baver, 2012). It does this through improved access to inputs, increasing bargaining power for better factor and product prices as well as increasing access to farming and market information. It also allows producers to reach economies of scale by bulking (Olwande and Mathenge, 2011). In this study, it was hypothesized that membership in a farmer organization would positively influence both the probability and intensity of market participation among rice producers in Western Zambia.

Distance to market in kilometers

The distance to the nearest market was captured in kilometers. Omiti *et al*. (2009) found households that were in urban centers sold more than those that were in rural areas because the former could access markets at lower transportation and transaction costs than the latter. Renkow *et al.* (2004) also found that areas that were closer to the market had higher market participation

because of reduced proportional transaction costs. Additionally, market participation was higher in areas with reliable transport system. Therefore, distance to the market was hypothesized to negatively influence the probability and intensity of market participation among rice producers in Western part of Zambia.

Quantity of output produced

Output was measured in kilograms of rice produced. Households under semi-commercial will first produce for household consumption and sell the surplus (Jaleta, 2009). Chilundika (2011) found yield to positively influence both probability and intensity of market participation among bean producers in Zambia. Hence, output was hypothesized to positively influence both the decision to enter the market and intensity of participation.

Agro-ecological and Geographical Locations

The difference in agro-ecological conditions among the four districts was considered by including the districts in the model. Further, the inclusion of districts facilitates to capture the differences in infrastructure development and level of integration into the market among producers which is important in determining market participation (Barrett, 2008). Three districts were included to avoid a dummy variable trap namely; Mongu, Kalabo and Limulunga.

3.5 Economic Activities in Western Province of Zambia

Western province has the highest incidences of poverty in the country and about 80 percent of the people in the province estimated to be poor. It is estimated that the majority of the people in the region depend on agriculture as main economic activity (Tripathi et al., 2009). The major crop grown in the region is rice and it is estimated that every fourth household grows rice in the

region (CSPR, 2011). The province has two agro-ecological conditions. The first part which receives less than 800 mm of rainfall per annum and the second one, the region which receives rainfall equal or greater 800mm but less than 1000mm per annum (Ndiyoi and Phiri, 2010). Most of the agriculture activities use the traditional farming practices along the Zambezi flood plains.

3.6 Data Types and Sources

The study reviewed literature and collected primary data for analysis purpose. Primary data were collected using a semi-structured questionnaire to capture farmers' information on socio-economic factors, asset ownership, institutional factors, market factors, production factors and geographical information.

3.7 Sampling procedure

A two-step sampling procedure was used. The first step involved listing all the sites where Conservation Farming Unit (CFU) an NGO working with rice and wheat farmers on conservation techniques in production has its presence in Mongu, Senanga and Limulunga districts. Within these sites there are camps which fall under MAL structure. The district structure for Ministry of Agriculture and Livestock (MAL) is as follows; the district is divided into blocks and the block is further subdivided into camps. Then within the camp, villages fall under. Simple random sampling was used in the first step to select camps in each district. In Mongu District, 7 camps were selected, 2 in Senanga District and 3 in Limulunga District. The proportion of farmers that should have been drawn in each district informed the selection of number of camps in each district. The proportion was 45 percent from Mongu, 25 percent Kalabo, 18 percent Limulunga and 12 percent Senanga. The proportions are in accordance with the number of farmers from the four districts. The second step used systematic sampling to select villages and households within the camps. Two villages were selected in each camp and every 3rd

village was selected after the first one was selected. Twelve households were selected from each village using systematic sampling technique; every 4th household was selected and interviewed. Two villages were selected in each camp because the villages are sparsely located and the study had limited resources hence, could not select farmers across villages.

For Kalabo District, CFU had no presence so the MAL structure was used to sample farmers. Two blocks were purposively selected with the help of MAL because it was difficult accessing other blocks as the place is very sandy. The camps were listed in the two blocks and five camps in total were selected using simple random sampling technique. Three camps were selected from Kalabo central Block because it has the largest number of rice farmers in the district and two camps in Sishekanu block. Two villages were then selected using systematic sampling in two camps of Kalabo Central block; every 3rd village was sampled after the first one was selected. 12 households were selected in each village using systematic sampling and every 4th household was selected. The third camp that was selected in Kalabo central block only one village was selected and 6 households were selected in the village using systematic sampling. Every 4th household was selected using systematic sampling technique. For Sishekanu block two villages were selected using systematic sampling in each camp and every 3rd village was sampled after the first one was selected. 12 households were selected in each village using systematic sampling and every 4th household was selected.

3.7.1 Sample Size Determination

The Cochran (1963) formula was used to determine the sample size. The formula is as shown below;

$$n = \frac{z^2 pq}{e^2}$$ ……..…….. (3.9.1)

where:
n= sample size
Z^2= the abscissa of the normal curve that cuts off an area α at the tails (1-α equals the desired confidence level)

e= the desired level of precision

P = implies maximum possible variance
q= 1-p

The study desired a 95 percent confidence level and 5 percent precision level. P was assumed to be 0.5 because variation in the population of rice producers was not known at the time of the survey. Hence, a variance of 0.5 was conservatively, leading to the largest possible variance for proportion. Thus, the samples size was calculated as:

$$n = \frac{(1.96)^2(0.5)(0.5)}{(0.05)^2}$$

= 385 respondents

The 385 was rounded off to 390 respondents to enable the distribution of the sample in the four districts. The study did not use a stratified sampling because it would have altered the true picture on market participation among rice farmers in Western Province of Zambia. Accordingly, 168 respondents were drawn from Mongu District, 102 from Kalabo District, 48 Senanga and 72 from Limulunga District.

3.8 Data analysis

The data were captured using the Statistical Package for Social Sciences (SPSS) version 16. Descriptive statistics were computed to characterize the farming and marketing systems in the

four study districts as well as the sample attributes. The Heckman two-step model equations 3.3.1 & 3.3.5 was estimated using STATA version 10 to identify the factors that influence both the probability and the intensity of market participation of smallholder rice farmers in Western Province of Zambia.

3.9.0: Diagnostic tests

3.9.1: Multicollinearity

Multicollinearity exists in the data when variables in a model are highly correlated. It affects cross-section data and if not addressed, the confidence intervals tend to be artificially wide leading to accepting the null hypothesis even when it is not true. In addition it causes the ordinary least squares (OLS) estimates and standard errors to be sensitive to small changes in the data (Gujarati, 2007). Two tests were used to test for multicollinearity in this study; correlation matrix and Variance Inflation Factor (VIF).

3.9.2: Correlation matrix

A Pearson pairwise correlation matrix was generated in STATA 10 (see Appendix 1). According to Gujarati (2007), if the pair-wise correlation is in excess of 0.8, then the data has a serious problem of multicollinearity. From the correlation matrix in Appendix 1, no variables had a pair-wise correlation above 0.5, which shows that the data was free from multicollinearity

3.9.3: Variance Inflation Factor (VIF)

The Variance Inflation Factor (VIF) shows how the variance of an estimator is inflated by the presence of multicollinearity. With increased multicollinearity, the VIF approaches infinity and in the absence of multicollinearity, VIF will be equal to 1 (Gujarati, 2007). The VIF is given as:

$$\mathrm{VIF} = \frac{1}{(1-r^2)} \qquad \ldots\ldots (3.11.3)$$

where:

r^2 = the artificial regression with the i^{th} as a dependable variable.

According to Alauddin and Nghiem (2010) a VIF of less than 5 indicates absence of multicollinearity. The results showed that all the variables had VIF values of less than 5, which indicates absence of muilticollinearity among the right-hand side variables. (See appendix 2).

3.9.4: Heteroscedasticity

Heteroscedasticity refers to the absence of constant variance of each disturbance term conditional on the chosen value of the explanatory variables. If present in the data the estimates will not be the Best Linear Unbiased Estimates (BLUE) (Gujarati, 2007). The data were tested for heteroscedasticity using the Breusch-Pagan test (Wooldridge, 2009). The Breusch-Pagan test evaluates the null hypothesis of a constant variance in the data.

The Chi-square value with 22 degrees of freedom was 27.99 (p=0.17). Therefore, the null hypothesis of a constant variance was sustained implying absence of heteroscedasticity in the dataset.

3.9.5: Testing for outliers

The presence of outliers has the potential to bias or distort both the estimates and p-values, resulting in faulty conclusions. Four variables were checked for outliers: price, distance to market and size of land owned. Scatter plots were used to check for outliers. See appendix 3 which highlights the scatter plots.

The variable price had four extreme outliers but when the mean was used to check if they were affecting the data, before removing them, the average was 89.1 with a standard deviation of 42.6 and when they were removed the mean became 86.5 with a standard deviation of 28.7. A

difference of means was conducted to check if there was any significant difference between the two average prices and it was significant hence the decision to remove the four outliers.

3.9.6: Normality Test on OLS Model for Intensity of market participation

According to Torres-Reyna (2007) plotting the residuals using a Kernel density shows if the OLS is normally distributed. Figure 3.3 shows the kernel density plotted for the residuals. The graph shows that the data was almost normally distributed, hence the running of the OLS model.

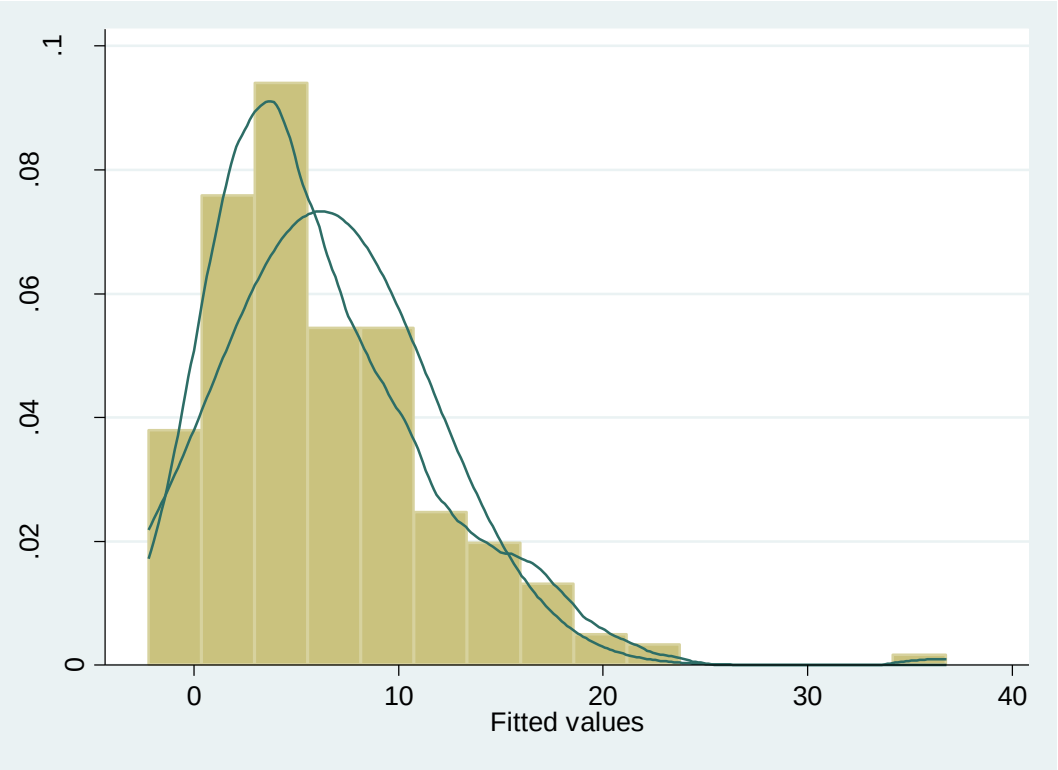

Figure 3.3: Kernel Density
Source: Survey data

Summary

The chapter highlighted through the conceptual framework the factors that influence market participation among smallholder producers. The factors can be categorized into institutional factors, transaction costs, access to productive assets and social-economic factors.

CHAPTER 4

RESULTS AND DISCUSSION

4.1: Comparison of demographic and Socio-economic characteristics of survey respondents

4.1.1 Demographic Characteristics of Rice Farmers

The sample of 390 showed that 257 farmers had participated in the rice market and 133 farmers did not participate. Table 4.1 highlights the differences in the demographic characteristics between participants and non-participants. The average age in years among participants was 48.67 years, while for non-participants it was 51.88. The mean number of years that had been spent in formal school by participants was 7.96 and 5.58 years for non-participants. The number of years spent in school was significantly different between the two groups at 1%. This indicates that participants were more educated than non-participants. The average number of household members among participants was 7.19 persons, while 5.65 persons among non-participants. The number of persons in a family was also significant at 5% between the two groups.

Variable	**Participants (n=257)**		**Non participants (n=133)**		
	Mean	**Std**	**Mean**	**Std**	**T-Value**
Age (years)	48.67	15.2	51.88	15.88	0.86
Education (years of schooling)	7.96	2.57	5.58	2.69	-8.51***
Family size in the year 2012	7.19	2.91	5.65	2.66	-2.96**

Table 4.1: Demographic characteristics of rice farmers in Western Province Zambia

Source: Survey data (2013)
*****, **,* = significant at 1, 5 and 10 percent respective**

4.1.2 Gender and Marital status Distribution among rice farmers in Western Province of Zambia

Gender distribution between participants and non-participants was as shown in table 4.2. Among participants, 28.79 percent were female headed households and 39.10 percent among non-

participants. The chi-square value of 4.25 showed that there was a significant difference between the two groups in terms of female headed households in participation and non-participation. The sample also showed that among participants 10.12 percent were single, 67.70 percent were married, 13.62 percent were widowed, 7.39 percent had been divorced and 1.17 percent was on separation. The data also highlighted that among non-participants 11.28 percent were single, 56.39 percent were married, 18.05 percent had been widowed, 12.78 percent were divorced and 1.57 percent were on separation.

Table 4.2: Gender and Marital status distribution among farmers in Western Zambia

Variable	**Participants (n=257)**	**Non participants (n=133)**	
	percentage	**percentage**	**Chi-square**
Gender distribution in sample (Female Household head)	28.79	39.10	4.2548**
Single	10.12	11.28	
Married	67.70	56.39	
Widowed	13.62	18.05	
Divorced	7.39	12.78	
Separation	1.17	1.57	

Source: Survey data (2013)
*****, **,* = significant at 1, 5 and 10 percent respective**

4.2: Access to institutional factors among rice farmers in Western Province of Zambia

The distribution of access to institutional factors among rice producers is highlighted in table 4.3. Access to formal credit in the sample was 11.73 percent, while among participants was 17.12

percent and 1.50 percent among non-participants. Access to credit was statistically significant between the two groups at 1% as shown by the chi-square value of 13.08. Being a member to a farmer organization was as shown; 66.93 percent of the participants were members, while 15.79 percent among non-participants were members to a farmer organization and 49.49 percent in the pooled sample were members to a farmer organization. The chi-square value of 53.57 also showed that there was a significant difference in membership to farmer organization between the two groups at 1%.

The results also shows that 52.53 percent of the participants had information on the price of rice prior to selling, while 6.77 percent had information on the price of rice prior to selling among non-participants and a total of 36.92 percent in the pooled sample had information of rice price prior to selling. There was a significant difference in the two groups in knowledge of prices prior to selling at 1% as shown as shown by a chi-square value of 50.38. Lastly, access to extension training shows that 65.92 percent of participants had accessed extension training in the last 12 months, while 40.60 percent among non-participants had accessed extension training and 56.91 percent in the pooled sample had accessed extension training. The chi-square value of 7.57 showed that there was statistical difference between the two groups in access to extension training at 1%.

Table 4.3: Access to institutional factors among rice farmers in Western Province Zambia

Variable	**Participants (n=257)**	**Non participants (n=133)**	**Pooled Sample (n=390)**	
	percent	**percent**	**percent**	**Chi-square**
Accessed formal credit	17.12	1.50	11.73	13.0852***

Membership to farmer organization	66.93	15.79	49.49	53.5681***
Had knowledge on price information prior to sell	52.53	6.77	36.92	50.3810***
Accessed extension service in last 12 months	65.92	40.60	56.91	7.5666***

Source: Survey data (2013)
*****, **,* = significant at 1, 5 and 10 percent respective**

4.3: Distribution of assets among rice farmers in Western Province of Zambia

Ownership of assets among rice farmers was as shown in table 4.4. Ownership of bicycle among participants was 42.05 percent, 19.55 percent among non-participants and 53.70 percent in the pooled sample. The chi-square value of 11.31 showed that there was a significant difference in bicycle ownership between participants and non-participants at 1%. Ownership of oxcart among participants was 20.26 percent, while 14.29 percent among non-participants and 23.35 percent in the pooled sample. The chi-square value of showed that there was no statistical difference between the two groups in terms of oxcart ownership.

The sample further showed that ownership of a working radio among participants was 62.82 percent, 35.35 percent among non-participants and 77.04 percent in the pooled sample. A chi-square value of 14.58 showed that there was a significant difference in ownership of a working radio between participants and non-participants at 1%. Ownership of cell phone and livestock among participants was 54.62 and 32.82 percent respective. Among non-participants 26.32 percent owned a cell phone, while 5.26 owned livestock for traction. Ownership of cell phone and livestock were significantly different between the two groups at 1% with chi-square values of17.45 and 25.47 respective. Ownership of land was not significantly different between the two groups and 96.15 percent of the farmers in the pooled sample owned land.

Table 4.4 Asset ownership among rice farmers in Western Province of Zambia

Variable	Participants (n=257)	Non-participants (n=133)	Pooled Sample (n=390)	
	Percentage	Percentage	Percentage	Chi-square
Percentage who owned bicycle	42.05	19.55	53.70	11.3137***
Percentage who owned oxcart	20.26	14.29	23.35	1.2757
Percentage who owned working radio	62.82	35.35	77.04	14.5815***
Percentage who owned cell phone	54.62	26.32	69.26	17.4499***
Percentage who owned Livestock for traction (cattle and donkey)	32.82	5.26	47.08	25.4711***
Percentage who owned Land	96.89	94.74	96.15	0.5208

*****, **,* = significant at 1, 5 and 10 percent respective**
Source: Survey data (2013)

4.4: Rice production and consumption among farmers in Western Province of Zambia

Table 4.5 highlights the production and consumption patterns among rice farmers in Western province of Zambia. The average size of land planted under rice among participants was 2.11 hectares, 0.86 hectares among non-participants and 1.68 hectares in the pooled sample. The t-value showed that there was a significant difference in the size of land under rice between participants and non-participants at 5%. The mean kilograms (kg) of rice produced among participants were 637.5 kg, 226 kg among non-participants and 496 kg for the pooled sample. There was a significant difference in rice produced between participants and non-participants at 1%. Yield between the two groups was also significant at 1% with mean yield of 577.5kg among

participants and 440 kg among non-participants. Rice consumption among participants was 145 kg on average per annum, 121 kg among non-participants and 137 kg on average in the pooled sample. A significant difference was also observed in consumption between the two groups at 10%.

Table 4.5: Production and consumption of rice among farmers in Western Province Zambia

Variable	Participants (n=257)	Non participants (n=133)	Pooled Sample (n=390)	
	Mean	mean	mean	T-Value
Size of land planted in hectares	2.11	0.86	1.68	-2.46**
Quantity of rice produced in kg	637.5	226	496	-6.74***
Output per hectare (Yield)	577.5	440	530.5	-2.82***
Quantity of rice consumed in kg	145	121	137	-1.68*

Source: Survey data (2013)
*****, **,* = significant at 1, 5 and 10 percent respective**

The distribution of output was as shown in figure 4.1. Out of the 193575 kgs of rice that were produced among the respondents, 72.43 percent was sold, 16.32 percent was consumed and 11.25 percent was kept for seed. The shows that rice in this region is mainly grown as a cash crop and not a food crop, hence its importance as a source of income among producers.

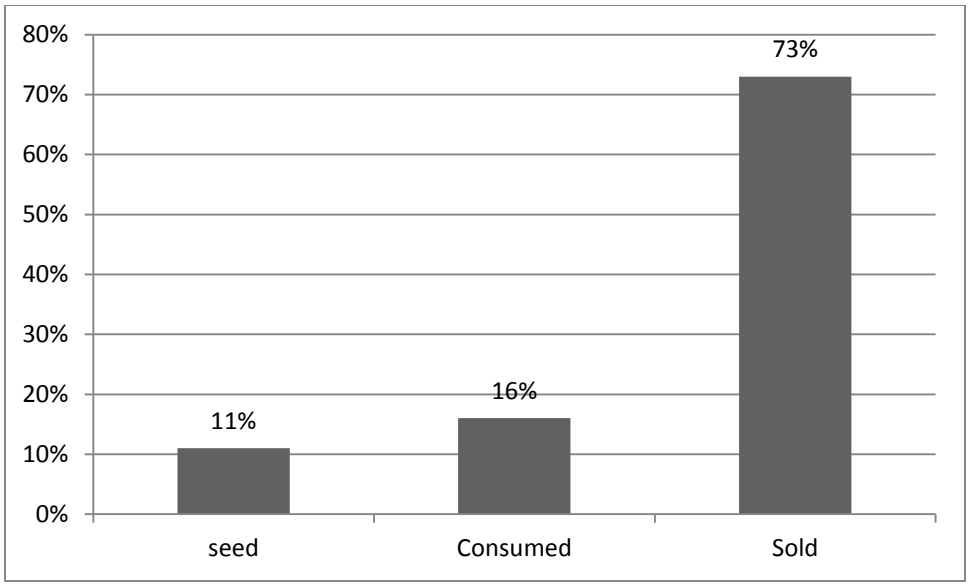

Figure 4.1: Output distribution among rice farmers in Western Province of Zambia
Source: Survey data (2013)

4.5: Sources of income among rice farmers in Western Province of Zambia

Table 4.6 shows the sources of income among rice farmers. Income from crop sales had the highest mean, with participants having ZMK 914.84, while non-participants had ZMK 59.17 from crop sales and ZMK 649.13 in the pooled sample. There was a statistical difference between the participants and non-participants in income from crop sales at 1%. This shows the importance of rice as an income generating crop. Income from livestock sales and off farm activities was not significant between the two groups, while total average income was significant different between the two groups at 1%. The average total income among participants was ZMK 1890.49, ZMK 581.44 among non-participants and ZMK 1472.53 in the pooled sample.

4.6: Income sources among rice farmers in Western Province of Zambia

Variable	Participants (n=257)	Non participants (n=133)	Pooled Sample (n=390)	
	Mean(zmk)	Mean(zmk)	Mean(zmk)	T-Value
Income from crop sales	914.84	59.17	649.13	7.017***
Income from livestock sales	234	134.74	203.93	-1.390
Income from off farm activities	89.10	85.41	87.61	1.390
Total average income	1890.49	581.44	1472.53	4.952***

Source: Survey data (2013)
*****, **,* = significant at 1, 5 and 10 percent respective**

4.6 Distribution of Market participation among farmers in Western Province of Zambia

Overall market participation from the survey of 390 shows that 65.90 percent of rice producers participated (sold) in the rice market. Market participation by districts was as shown in figure 4.1. In Mongu district 65.24 percent of the farmers sold, 64.15 percent sold in Kalabo district, 72.92 percent in Senanga and 65.28 percent for Limulunga.

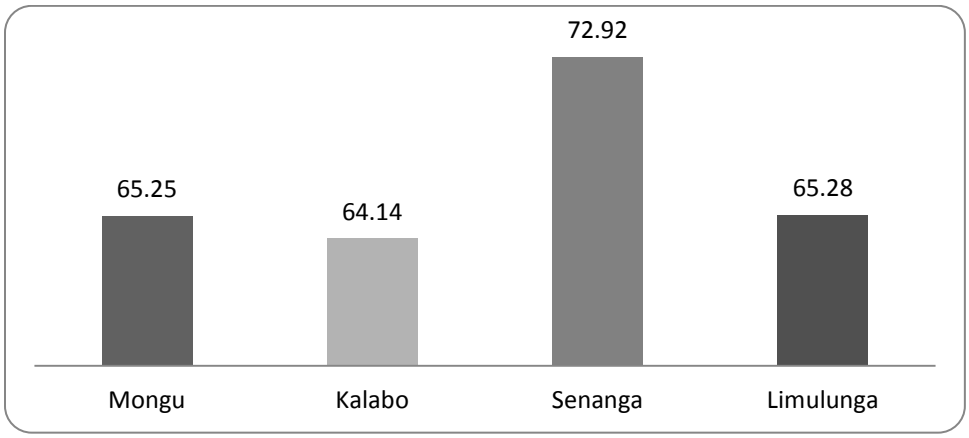

Figure 4.2: Market Participation by District
Source: survey data (2013)

The point of sale is important in market participation because it facilitates in targeting specific policies to improve market participation. Figure 4.2 shows that 60.08 percent of the farmers sold at the farm, 5.04 percent sold by the road side, 1.68 percent sold at the Food Reserve Agency

(FRA), 31.51 percent sold at the market in town (Mongu or Kalabo district) and 1.68 percent sold in Lusaka. The high percentage sales at the farm show how important traders are in the rice market.

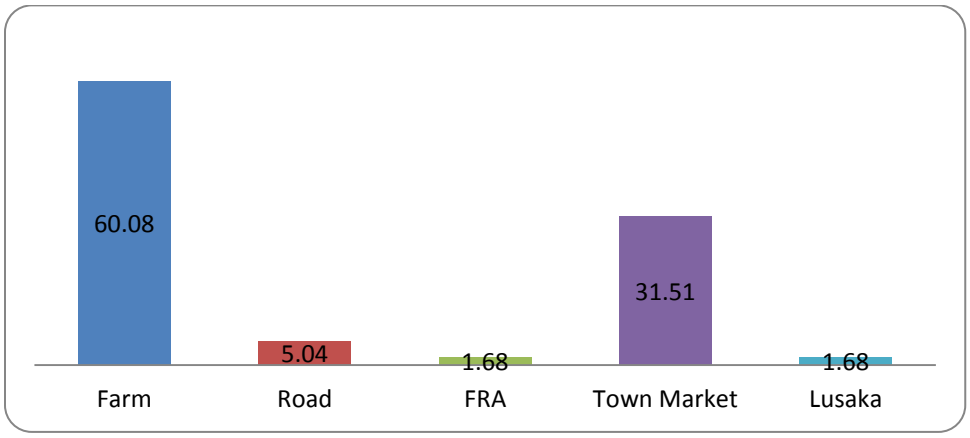

Figure 4.3: Point of sales by Participats
Source: Survey data (2013)

4.7: Value addition among rice farmers in Western Province of Zambia

Value addition enables farmers to gain more income unlike sale of raw output. In the rice value chain, one way in which farmers can increase their income by value addition is through polishing of rice. The survey shows that 9.01 percent of the participants polished and since government is promoting value addition in the sector it is important to understand the reasons why farmers are not polishing their rice. Table 4.7 shows the reasons why farmers are not adding value through polishing. The challenges indicated are as follows; 29.66 percent of the farmers indicated that they were not polishing due to unavailability of polishing machine in the community, 37.93 percent highlighted that there was no market for polished rice, 26.90 percent indicated high cost of polishing and 5.52 percent indicated that their output was too small to be polished. The stated

reasons mentioned above inform policy makers to also consider improving market availability and accessibility of polishing machines as they push for value addition in the rice sector.

Table 4.7 Challenges in value addition among rice farmers in Western Province of Zambia

Reason for not polishing	Participants (n=257)
	percent
No polishing machine near by	29.66
No market for polished rice	37.93
Expensive	26.90
Quantity too small to polish	5.52

Source: Survey data (2013)

4.8: Discussion

The survey showed that education level of the household and household size were significantly different between participants and non-participants. The mean education level of the household in the pooled sample was 7.15 years. This is consistent with CSO 2012 which shows that the average number of years spent in school in Zambia is 5.22 when the standard deviation is considered. The household size of 6.66 persons was also consistent with AGRA (2010) which found that an average Zambian household size in Central, Southern, Eastern and Northern Provinces was 7.19 persons person. The figure could have been slightly lower because Western Province has the lowest population in the country (CSO, 2010). Further the survey showed that 32.31 percent of the households were headed by females. This is consistent with MACO (2011), which found that about 32 percent of rice farmers in the country are females.

All the institutional factors were significantly different between participants and non-participants. Access to institutional factors improves the ability to produce sufficient output for consumption and surplus for the market. Access to credit in the pooled sample was 11.73 percent

and 17.12 percent among participants is consistent with the findings of Zambia Rice Baseline Survey (ZRBS) (2008). The ZRBS (2008) found that 16 percent of the rice farmers in Western Province had accessed some formal credit, which is more consistent with participants as 17.12 percent accessed formal credit in the last 12 months. Access to price information is lower when compared to bean producers who had about 70 percent knowledge of the price prior to selling (Chilundika, 2011). Access to extension was higher when compared to the AGRA (2010) report which showed that 26 percent of the farmers accessed extension services in Northern, Central, Southern and Eastern Province. The higher accessibility of extension services in Western Province among rice farmers could be attributed to the heavy presence of CFU promoting rice and wheat production among small scale farmers in the region.

Ownership of assets between the two groups showed that participants had more assets. This is highlighted in that all the assets that were considered were significant except ownership of land. According to Carter and Barrett (2006), there is always a minimum level or threshold for asset ownership for a household to escape from the poverty trap because asset ownership enables household to increase the output and have marketable surplus. Ownership of a working radio which reduces information search costs and also improves access to extension information was is not very different from what Chilundika (2011) among bean producers. The author found that 64 percent of the bean producers in the country had a working radio and the survey has shown that 77 percent of rice producers had a working radio. Ownership of transportation asset is low in the region when compared to what (*Ibid*) found. The author found that 70 percent owned a form of transport asset, while the survey has shown that ownership of bicycle was 53.70 percent among rice farmers. This difference could be attributed to the fact that Western province has the highest incidences of poverty in the country (CSPR, 2011).

Market participation in the sample was 65.9 percent higher than what was found by CSO, (2012) of 40.2 percent in the same region. The difference could be attributed to the rice farmers the sample was extracted from. The survey sampled farmers working with CFU in rice and wheat production in Mongu, Senanga and Limulunga. CFU is also promoting access to production inputs among rice farmers and also access to market. This could be the reason why market participation was higher when compared with for CSO (2014). Market participation was also very high at farm level with 60.08 percent of rice being sold at the farm. This is consistent with USAID (2009) which found that about 60 percent of rice is marketed in the informal sector, which is formed by traders who normally purchase at farm gate. This shows that the rice value chain is skewed towards the informal sector hence the importance of traders as key players in the rice value chain.

4.9: Factors Influencing Market Participation among Smallholder Rice Producers

Table 4.9 highlights the factors that influenced the probability of participation in the rice market among farmers in Western Province of Zambia. The model was fitted with 19 variables and 9 of them were significant. Education level of household, ownership of livestock, ownership of a working radio, access to price information prior to selling, being a member to a farmer organization and quantity of output were all significant at 1%. Age of the household head, size of the household and output price were significant at 5%

Table 4.9: Maximum likelihood estimates of the market participation probit model for Western Province, Zambia

Variable	Parameter Estimates		Marginal Effects	
	β-coefficient	Std Error	Coefficient	Std Error
Age of household head (years)	-0.0171*	0.0066	-0.00303	0.00118
Gender of household head	0.00879	0.209	-0.0168	0.0396
Education level of HH head	0.176***	0.0387	0.0371	0.0067
HH size in number	0.0875*	0.0387	0.0210	0.0067
Output price	0.0101*	0.0050	0.0012	0.0008
HH own livestock for traction	1.025***	0.323	0.155	0.0466
Size of land owned in hectares	-0.0231	0.0311	-0.0059	0.0042
HH own transport mode	0.297	0.205	0.0883	0.0417
HH owns a working radio	0.700**	0.213	0.179	0.0418
HH used productive technology	0.264	0.286	0.0510	0.0487
Number of extension visits to HH	-0.0361	0.0731	-0.0096	0.0132
HH accessed credit facility	-0.0808	0.525	-0.0681	0.0660
HH had price information	1.225***	0.269	0.193	0.0429
HH member belongs to a farmer organization	0.980***	0.226	0.233	0.0417
Distance to market	-0.00937	0.00747	-0.00215	0.0014
Quantity produced	0.0744***	0.0212	0.000709	0.0019
HH is located in Mongu District	-0.0194	0.385	-0.0399	0.0707
HH is located in Kalabo District	0.0757	0.336	-0.0343	0.0645
HH is located in Limulunga District	-00757	0.368	-0.0841	0.0696
CONSTANT	-2.968***	0.782		
Pseudo R^2	0.5547			
Prob> Chi^2	0.0000			
Loglikelihood	-110.50			

Source: Survey data (2013)

***, **, *** indicate significance at 10%, 5% and 1% levels respectively.**

Education level of household head positively influenced the decision to participant in the rice market as expected and was significant (p=0.000). Household heads with higher level of education are more likely to participate in markets because with increased level of education utilization of market opportunities tend to be higher (Lubungu *et al.,* 2012). The marginal effect of education level of household head was 0.037 implying that a unit increase in the level of education by household head would increase the probability of entering the market by 37 percent.

Ownership of livestock for traction was found to be statistically significant (p=001) and positively related to the probability of participation as expected. Ownership of productive assets such as oxen which are used for direct production increases the area planted by the household, thereby increasing the chances of producing a marketable surplus (Boughton *et al.,* 2007). The marginal effect for owning livestock used for traction was 0.155 implying that a unit addition in number of animals used for traction would increases the likelihood of participation by 15.5 percent.

As expected ownership of a working radio was significant (p=0.046) and positively influenced the chances of participation in the rice market. A radio is considered to reduce fixed transaction costs for information search and also increases access to information on production techniques (Azam *et al*., 2012). In addition a radio can be used for extension services and allowing farmers to have more information on improved production techniques. The marginal effect of owning a working radio would account up to 17.9 percent of market participation holding all other factors constant with a 1% increase in information programs.

Access to price information was positive and significant at (p=0.000). Access to price information could have been positive because household with price information are more likely to make informed decision on whether to enter or not enter the market based on if they are able to meet their fixed transaction costs (Key *et al*., 2000). These finding are consistent with Ohen *et al.* (2013) who also found that access to information prior to selling was positively significant among rice farmers in Nigeria. The marginal effect was 0.193 implying that a unit addition in information would increase the likelihood of participation by 19.3 percent.

Being a member to a farmer organization was significant at (p=0.000) and had a positive influence on the decision to enter the rice market as expected. Membership to group is important for information access on available market and this reduces fixed transaction costs. Member to a farmer organization also reduces transaction costs in cases where there is collective marketing among member (Bahta and Bauer, 2012). Membership to a farmer organization could have been significant in the province because there is great effort by Zambia National Farmers Union (ZNFU) through Conservation Farming Unit (CFU) to promote their farmers district association through provision of group extension to their members, facilitate input access, group marketing and access to credit. The marginal effect of being a member to a farmer organization was 0.233 which implies that holding other factors constant, an additional family member joining the farmer organization on average would increase the likelihood of selling rice by 23.3 percent.

Quantity of output as expected positively influenced the decision to enter the market and was significant at (p=0.000). Higher outputs increase the likelihood of market participation because it enables households to have a marketable surplus (Mather et al., 2011). The marginal effect was 0.0007 implying that an additional unit of rice produced does not influence the decision to enter

the rice market. According to Komarek (2010), quantity of output is more significant on the intensity of market participation unlike on the decision to enter the market.

Age of the household head was significant at (p=0.053) and related negatively to market participation. The variable could have been negative because older households tend to be risk averse, than younger household heads. Older household head may opt to wait for buyers at village level or farm unlike younger household heads who may travel to town to sell their commodity. In addition, older heads have limited access to market information; whereas younger heads could sell a relatively large portion of their product through a better access to price information (Demeke and Haji, 2014). The marginal effect for age of the household head was -0. 00303 implying that a unit addition in the years of the household would not influence the decision to enter the market negatively. Household size was also significantly at 5% and positively related to the probability of market participation at (p=0.068). This could be due to the fact that rice is labour intensive; hence larger households would provide family labour required for rice production, which would eventually increase the likelihood of a household participating in the (Martey *et al*., 2012). The marginal effect for household size was 0.021, implying that a unit addition in the number of household members would increase the likelihood of participation by 2.1 percent.

Output price as expected positively influenced market participation at (p=0.086). Price level is important in the decision to enter the market because producers will only enter a market at a particular threshold when they are able to cover the transaction costs (Key *et al*., 2000). The marginal effect for price was 0.0012, which means that a unit addition in the price level will have no effect in the decision to enter the market.

Finally, the constant was significant at (p=0.000) and had a negative sign indicating that the variables that were not included in the model negatively influence the decision to enter the market. The Pseudo R^2 was 0.5547, log likelihood of -110.50 and the model was highly significant (prob>chi^2 0.000).

4.10: Factors influencing intensity of market participation among rice farmers in Western Province of Zambia.

Intensity of market participation was measured by quantity of rice sold in kilograms. Table 4.10 presents the variables that influence intensity of participation among rice farmers in Western Province of Zambia. Out of 19 variables that were fitted 6 were significant plus the Inverse Mills' ratio. Age of the household head, size of land owned by the household and quantity of output produced were significant at 1%. Access to formal credit was significant at 5%, while access to price information prior to selling and being a member to a farmer organization were significant at 10%. The model was significant at (prob>chi2=0.0000). The Inverse Mills' Ratio (IMR) was also significant at 10%. The IMR being significant shows that the data had the problem of selection bias and Heckman two-step was the correct model that was used because of its ability to handle selection problem. The constant was also significant at 10%, implying that factors not included negatively affected the intensity of market participation.

Table 4.10: OLS results showing intensity of market participation among rice farmers in Western Province Zambia.

Variable	Parameter Estimates	
	B-coefficient	**Std Error**
Age of household head (years)	-0.0634***	0.0220
Gender of household head	-0.935	0.702
Education level of HH head	0.0632	0.132
HH size in number	-0.0580	0.123
Output price	0.0205	0.0126
HH own livestock for traction	0.250	0.785
Size of land owned in hectares	0.184***	0.0659
HH own transport mode	0.0122	0.770
HH owns a working radio	-0.698	0.819
HH used productive technology	-0.206	0.780
Number of extension visits to HH	0.0682	0.233
HH accessed credit facility	2.517**	0.986
HH had price information	1.322*	0.754
HH member belongs to a farmer organization	1.584*	0.810
Distance to market	-0.0064	0.0289
Quantity produced	0.692***	0.0286
HH is located in Mongu District	-0.684	1.314
HH is located in Kalabo District	-0.283	1.108
HH is located in Limulunga District	-0.169	1.233
CONSTANT	-1.905*	2.791
Mills ratio	3.93*	1.395
Prob> Chi^2	0.0000	
Loglikelihood	1192.00	

Source: Survey data (2013)

***, **, *** indicate significance at 10%, 5% and 1% levels respectively.**

Size of land owned by the household as expected positively related to intensity of market participation and was significant at (p=0.005). Land is an important factor in production and the larger the size of productive land the producer owns, the higher the production levels are likely to be due to larger hectares produced and subsequent the quantity sold. This shows the importance of size of productive land available in enabling a household to produce a market surplus and be able to not only participate but also sell substantial amount of produce (Adeoti *et al*., 2014). The marginal effect of size of land owned 0.184, implying that a unit hectare addition of land owned by a household would increase the amount sold by 18.4 kgs.

Availability of price information prior to sale was significant (p=0.079) and positively influenced intensity of market participation. According to Randela *et al*. (2008) availability of price information prior to selling reduces transaction costs and thus increases the quantity sold. This finding is consistent with Omiti *et al.* (2009) who found that knowledge of prices prior to selling was significant among milk producers. The marginal effect of knowledge of prices prior to selling was 1.322, meaning that holding other factors constant increasing the knowledge levels of prices prior to selling would increase the quantity by 132.2 kgs.

Access to formal credit as expected positively related to intensity of market participation among rice farmers and was significant at (p=0.011). Access to credit enables producers to increase the quantity of inputs and other productive assets acquired such as (fertilizer, seed, ploughs) which in turn increase output produced and surplus for the market (Sindi, 2008). In addition, the cost of accessing credit should be affordable among smallholders so they can benefit from its potential benefits (*Ibid*). The marginal effect of 2.517 implies that an increase by ZMK 100 in the amount accessed through credit would increase the quantity sold by 251.7 kgs.

The quantity of rice produced positively related to intensity of market participation and was significant at (p=0.000). Quantity produced is critical for semi-commercial farmers who first of have to produce for home consumption and only sell surplus. Therefore higher output enables to have marketable surplus (Jaleta *et al.,* 2009). This finding is consistent with the finding of Martey *et al*. (2012) who found that quantity of cassava produced significantly influenced intensity of market participation in Ghana. The marginal effect was 0.692; meaning that a one percent increases in output produced increases quantity sold by 69.2 kg.

Finally, being a member to a farmer organization was significant at (p=0.050) and positively related to intensity of market participation. Belonging to a famer organization allows farmers to market together and reduce costs associated with products reaching the market. It also increases access to information such as production techniques and available markets. This finding is consistent with Chilundika (2011) who found that alliance or being a member to a farmer group was significant and positively influenced intensity of market participation. The marginal effect was 1.58, implying that an additional family member joining a farmer organization would increase the quantity of rice sold by 158.4 kg.

CHAPTER 5

CONCLUSION AND POLICY RECOMMENDATIONS

5.1 Summary of results and conclusion

Western Province of Zambia still remains to have the highest incidences of poverty in the country and having the majority of rice producers in the country. The Zambian government is working towards increasing market participation in the rice sector in the region and the country at large. The thrust behind these efforts include among, the government wanting to reduce poverty levels by commercialization of the rice sector, the country is still experiencing deficits in the commodity and farmers are not participating in the rice markets thereby leaving them poor. The government is also trying to promote production of crops based on comparative advantage and reduce mono-cropping of maize by farmers in areas where it does not have the comparative advantage. The study provided the empirical evidence on what factors need to be targeted by policy makers in the bid to increase market participation and alleviate poverty in Western Province of Zambia.

The study found that the decision to enter the rice market was positively influenced by education level of household head, assets owned by household (ownership of livestock for traction and a working radio), institutional factors (access to price information prior to selling and being a member to a farmer organization), price level and quantity of output produced. Further, intensity of market participation was positively influenced by size of land owned, access to credit, quantity of output produced, access to price information prior to selling and being a member to a farmer organization. Access to institutional factors such as credit, price information prior to

selling and being a member to a famer organization be made available and encouraged. In addition there is need to increase quantity of output produced such as increasing access to seed and fertilizer as it increases the quantity sold.

5.2: Policy recommendations

To increase entry and quantity of rice sold in the rice market the following policy recommendations are suggested;

1. The study found that ownership of livestock for traction positively influenced the decision to enter the rice market. Policies that encourage livestock ownership, such as livestock restocking in areas where the stocks have dwindled due to diseases should be implemented. Such a policy will also influence the level of output produced positively which was significant because the size of land to be tilled will increase which increases the chances of producing a marketable surplus.
2. Farmer organizations should be strengthened in the study area and awareness campaigns should be conducted to let those farmers who do not belong to any farmer organization join as they increase market participation levels. Being a member to a farmer organization reduces transportation costs through collective marketing. Members of a farmer organization easily acquire information on available markets, negotiate for better prices, access extension services easily and are more exposed to information than non-members. The farmer organization could be linked to group financing to improve access to credit and improve intensity of market participation. Such credit could also be used to purchase transportation assets owned by the farmer organization which would improve haulage of commodity and increase market participation among members.

3. The study found size of land owned to positively influence intensity of market participation. The findings suggest that policies that not only consider ownership of land but also the size owned is important in market participation. Government should ensure that the land policy which is being drafted should consider the vulnerable in society for land acquisition as a form of empowerment, but importantly should consider the size owned as this will improve market participation which in turn increases their income.
4. Access to price information prior to selling was positively related to both the decision to enter the market and intensity of participation. Policies that encourage access to such information should be enhanced. This could be through introducing agriculture programs on radio which was also significant in the decision to enter the rice market. Increasing the radio frequency radius is also another way in which more rice farmers would have access to such information which increases market participation.
5. Output price policies should also be considered to improve market participation. Futures contracts could be implemented to hedge against low prices just after harvests and this would improve market participation.
6. Finally, these policies should take into account of the age and education level which is low. This could be considered by ensuring that programs on radio being in the local language.

5.3 Limitations of the study and suggestion for further research

1. The sample was collected from one province of Zambia which has a different agro-ecological zone and poverty index level; this means that some inferences made in this

study may only apply to the study region and not the whole of Zambia as the country has three agro-ecological regions.

2. The other limitation is the growing concern that to appropriately determine what influences market participation or commercialization, there is need to use time series data because this study used cross-sectional data. Future studies should consider using time series data to capture how sequential change in a household influence market participation.

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APPENDICES

Appendix 1: Person Correlation Matrix

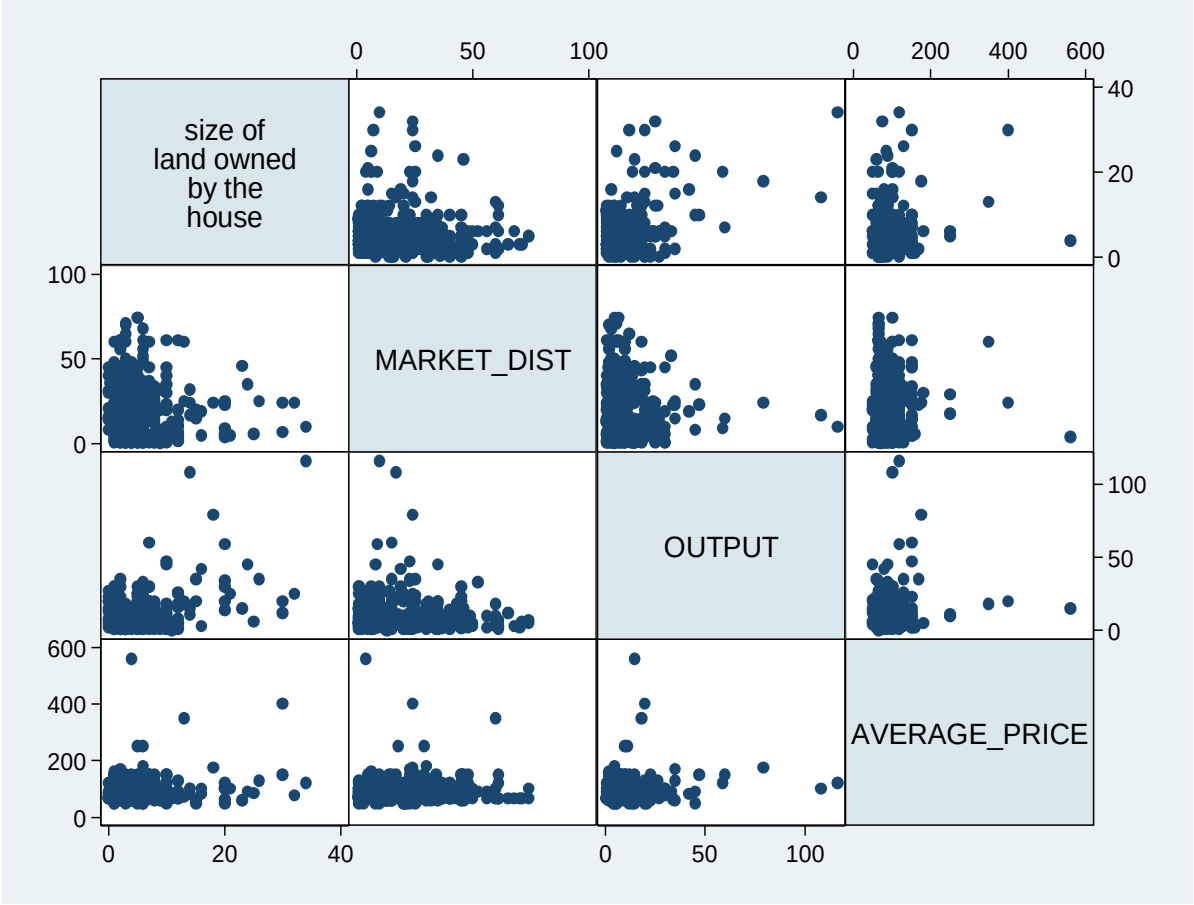
	AGEHAERD	GENDER	EDUCATION	HSIZE	PRICE	LIVESTOCK	LANDSIZE	TRANSPORT	RADIO	PROD_TECH	EXTENSION
AGEHAERD	1										
GENDER	-0.06	1									
EDUCATION	-0.10	0.07	1								
HSIZE	0.16	0.13	0.04	1							
PRICE	-0.04	-0.004	0.04	-0.02	1						
LIVESTOCK	0.07	0.11	0.17	0.22	-0.05	1					
LANDSIZE	0.01	0.08	0.16	0.15	-0.006	0.30	1				
TRANSPORT	-0.004	0.05	0.07	0.09	-0.06	0.17	0.10	1			
RADIO	-0.0007	0.09	0.18	0.09	-0.06	0.27	0.20	0.17	1		
PROD_TECH	-0.015	0.05	0.13	0.006	0.03	0.02	0.10	0.07	0.04	1	
EXTENSION	0.07	0.06	-0.003	0.06	0.12	-0.04	-0.02	0.17	0.05	-0.003	1
CREDIT	-0.01	0.07	0.17	0.02	0.06	0.36	0.32	0.15	0.26	0.04	0.07
MARKET _INF	-0.05	0.19	0.14	0.14	-0.05	0.36	0.19	0.10	0.26	0.05	0.003
FARMER_ORG	0.07	0.09	0.23	0.19	-0.04	0.36	0.23	0.14	0.29	0.15	0.05
MARKET_DIST	0.02	0.18	-0.18	-0.02	0.11	-0.03	-0.13	0.10	-0.11	0.03	0.06
OUTPUT	0.08	0.14	0.19	0.21	0.03	0.46	0.47	0.10	0.25	0.05	-0.05
MONGU	-0.003	0.17	-0.14	0.17	0.10	0.12	-0.004	0.14	-0.15	-0.01	0.18
KALABO	0.03	-0.09	-0.03	-0.04	-0.33	-0.08	-0.04	-0.14	0.02	-0.04	-0.26
LIMULUNGA	-0.001	-0.10	0.13	-0.09	0.18	-0.08	0.11	0.03	0.11	0.14	0.19

	CREDIT	MARKET_INF	FARMER_ORG	MARKET_DIST	OUTPUT	MONGU	KALABO	LIMULUNGA
CREDIT	1							
MARKET _INF	0.22	1						
FARMER_ORG	0.30	0.32	1					
MARKET_DIST	-0.01	0.01	-0.08	1				
OUTPUT	0.40	0.32	0.31	-0.12	1			
MONGU	0.17	0.11	0.11	0.61	0.02	1		
KALABO	-0.16	0.002	-0.05	-0.34	-0.02	-0.52	1	
LIMULUNGA	0.01	-0.14	0.009	-0.24	0.007	0.42	-0.30	1

Appendix 2: VIF values for hypothesized variables

VARIABLE	VIF	1/VIF
AGEHEAD	1.08	0.92
GENDER	1.12	0.89
EDUCATION	1.18	0.84
HSIZE	1.20	0.83
PRICE	1.18	0.85
LIVESTOCK	1.56	0.64
LANDSIZE	1.39	0.72
TRANSPORT	1.13	0.89
RADIO	1.30	0.77
PROD_TECH	1.07	0.93
EXTENSION	1.21	0.83
CREDIT	1.43	0.70
MARKET_INF	1.32	0.76
FARMER_ORG	1.41	0.71
MARKET_DIST	1.84	0.54
OUTPUT	1.70	0.59
LIMULUNGA	2.42	0.41
MONGU	3.90	0.26
KALABO	2.60	0.38

Appendix 3: Testing for Outliers



Appendix 4: Questionnaire

Questionnaire Number…….

FACTORS INFLUENCING MARKET PARTICIPATION AMONG SMALLHOLDER RICE PRODUCERS IN ZAMBIA

Thesis Research (CMAAE)

University of Nairobi

Kenya

Section A: Household Identification

Province Code		Province Name……..
District Code		District Name…….
Block Code		Block Name……
Camp Code		Camp Name…….

Village Name: ……..

Chiefdom: ……

Name of Household Head: ……

Name of Household Head (if different from Head): ……

Name of Enumerator: ……..

Date of Enumeration:

Time Started:

Time ended:

Name of field supervisor: ……

Date Checked

Section B: household demographics Characteristics official use

1. Name of respondent……
2. Age as at last birthday…….
3. Sex of respondent
   (a) Male 1. ☐
   (b) Female 2. ☐
4. Marital Status
   (a) Single (Never Married) (d) Divorced 1. ☐ 4. ☐
   (b) Married (e) Separated 2. ☐ 5. ☐
   (c) Widowed 3. ☐
5. Relationship to Household Head (if different from Household head)
   (a) Head (F) Nephew/Niece 1. ☐ 6. ☐
   (b) Spouse (g) In-Law 2. ☐ 7. ☐
   (c) Child (h) Grandchild 3. ☐ 8. ☐
   (d) Parent (I) Others, specify …… 4. ☐ 9. ☐
   (e) Brother/ Sister 5. ☐
6. Sex of the Household Head
   (a) Male (b) Female
7. Age of Household Head as at last birthday if different from respondent. …… _____
8. Number of years spent in school by Household head …… _____
   (see codes below)

Level of Education		
0. None		
1. Grade 1	7. Grade 7	13. Student
2. Grade 2	8. Grade 8	14. College certificate
3. Grade 3	9. Grade 9	15. College Diploma
4. Grade 4	10. Grade 10	16. University degree
5. Grade 5	11. Grade 11	17. Masters degree
6. Grade 6	12. Grade 12	18. PHD

9. Number of household members…… _____

Section C: Household Market Participation

1. What was the size of land you planted for rice during the 2011/12 season……(Hectors) _____
2. What was the yield for 2011/12 season No. of 50kg bags…… _____
3. Did the household sell some rice in 2011/12 season
   (a) Yes 1. ☐
   (b) No 2. ☐
   (If no, please go to question 27, page 6)
4. What quantity did you sell for cash…….. _____
5. Which month(s) did the household sell …….. _____
6. To whom did you sell (tick all that apply)

(a) Trader/Marketer	(f) Direct to market	1. ☐ 6. ☐
(b) FRA	(g) Out grower……	2. ☐ 7. ☐
(c) Cooperative	(h) NGO specify……	3. ☐ 8. ☐
(d) Miller	(i) Others specify……..	4. ☐ 9. ☐
(e) Own stand		5. ☐

7. If sold to more than one indicate the quantity sold to each in No. 50kg bags

(a) Trader……..	(e) Market ……	_____ _____
(b) FRA ……	(f) Out grower ……	_____ _____
(c) Cooperative……..	(g) NGO, specify ……	_____ _____
(d) Miller ……..	(h) Others specify……..	_____ _____

8. What was the price per 50 kg bag to each (ZMK) Total _____

(a) Trader……..	(f) Market ……..	_____ _____
(b) FRA ……	(g) Out grower ……..	_____ _____
(c) Cooperative……..	(h) NGO specify ……	_____ _____
(d) Miller ……..		_____

Average Price _____

9. At what point did you sell, (tick all that apply and quantity sold at each point)

(a) At the farm ……. (50 kg bag) 1. ☐ _____

(b) By the road side …… 2. ☐ _____

(c) FRA depot …… 3. ☐ _____

(d) In town (mongu) …….. 4. ☐ _____

(e) Lusaka …… 5. ☐ _____

(f) Others specify …… 6. ☐ _____

10. How far is this point of sale from your house?

(a) By the road side …… (km) _____

(b) FRA depot …… _____

(c) In town (mongu) …….. _____

(d) Lusaka …… _____

(e) Others specify …… _____

11. How much did you pay for transport per bag to the point of sale Average Dist. _____

(a) At the farm ……. (ZMK) _____

(b) By the road side …… _____

(c) FRA depot …… _____

(d) In town (mongu) …….. _____

(e) Lusaka …… _____

(f) Others specify …… _____

12. Did some crop spill over during transportation Average Price _____

(a) Yes 1. ☐

(b) No 2. ☐

13. If yes what quantity spilled ……. _____

14. Did you sell the same day you transported the commodity to Mongu/Lusaka

(a) Yes 1. ☐

(b) No 2. ☐

15. If no, how many days did it take you to sell ……..…….. _____

16. Where did you spend the night/s

(a) Friend (c) Lodge/Guest house 1. ☐ 3. ☐

(b) Market Others specify…… 2. ☐ 4. ☐

17. If at lodge/guest house how much did you pay per night (ZMK) ……..…… _____

18. Did you polish the rice before you sold

(a) Yes 1. ☐

(b) No 2. ☐

(If no, go to question 22)

19. If yes how far is the polishing machine from home…….(KM) _____

20. How much did it cost to polish per kg (ZMK)…….. _____

21. If no, specify the reasons why you did not polish rice before sale

(i) …….. _____

(ii) …….. _____

22. Do you have some rice in storage from 2011/12 season

(a) Yes 1. ☐

(b) No 2. ☐

23. If yes what quantity do you have from 2011/12 season …… (50 kg bags) _____

24. Had you planned to sell some by April 2013

(a) Yes 1. ☐

(b) No 2. ☐

25. If yes please specify why the household did not sell by April 2013

(i) …….. _____

(ii) …….. _____

26. What quantity had you planned to sell by April 2013……(50 kg bags) _____

27. Did the household barter (exchange) rice for other commodity ☐

(a) Yes 1.

(b) No 2. ☐

28. If yes what quantity did you barter ……..(kgs) _____

29. Which month(s) did the household barter…… _____

30. Purpose of the exchange (barter)

(a) Farming labour 1. ☐

(b) Exchange of goods 2. ☐

(c) Others specify…… 3. ☐

If did not sell or non sellers

1. Why didn't the household sell rice

(i) …….. _____

(ii) …….. _____

(iii) …… _____

2. Does the household have some rice in storage

(a) Yes

(b) No

(If no, please go to question 10)

3. If yes what is the quantity……(50 kg bags) _____

4. Had the household planned to sell some rice by April 2013

(a) Yes 1. ☐

(b) No 2. ☐

5. What quantity had the household planned to sell by April 2013……(50 kg bag) _____

6. Did the household run out of the commodity by April 2013

(a) Yes 1. ☐

(b) No 2. ☐

7. If yes which month and year …… _____

8. If no which month will the household run out of the commodity for 2011/12 season …… _____

Section D: Household Consumption:

Commodity / Crops	Quantity produced in 2011/12 season	Quantity consumed by household up to April 2013 from own production	Quantity reserved for seed	Did the household buy any of these crops 1. Yes 2. No	What quantity did it buy (kg)	What was the price per kg	Did the household work for food 1. Yes 2. No	What quantity of each crop did you work for
1. Maize								
2. Rice								
3. Cassava								
4. Sorghum								
5. Wheat								
6. Millet								
7. Beans								
Others, specify								

Section E: Rice Production and Input use

1. What size of land did you plant for rice …….(hectors) _____
2. Who is the owner of the land
   (a) Own land 1. ☐
   (b) Leased 2. ☐
3. If leased how much per hector …… (ZMK) _____
4. Method of field preparation
   (a) Ox-drawn plough 1. ☐
   (b) Hand 2. ☐
   (c) Tractor 3. ☐
5. Which month did you prepare the field for planting …… _____
6. What type of rice did you plant
   (a) Upper land 1. ☐
   (b) Paddy rice 2. ☐
7. If paddy rice, which month did you flood the field……. _____
8. Which month did you transplant the seedlings to main field ……. _____
9. Which month did you drain the water from field …….. _____
10. Did you apply animal manure
    (a) Yes 1. ☐
    (b) No 2. ☐
11. If yes what quantity …….. (Number of Ox-carts) _____
12. What was the source of the animal manure
    (a) Bought 1. ☐
    (b) From own craw 2. ☐
    (c) Others specify …… 3. ☐
13. If bought how much per Ox-cart …….. (ZMK) _____
14. Did you apply fertilizer
    (a) Yes 1. ☐
    (b) No 2. ☐

15. What quantity did you apply

    (a) Basal …… (kgs) _____

    (b) Top dressing …… (kgs) _____

16. Which month did you apply

    (i) Basal …….. _____

    (ii) Top …….. _____

17. Did you plant hybrid seed

    (a) Yes 1. ☐

    (b) No 2. ☐

    (If no, please go to section F, page 11)

18. If yes how many kgs …….. _____

19. What variety did you plant …… _____

20. What was the source of the fertilizer and seed (tick all that apply)

    (a) Bought 1. ☐

    (b) FISP 2. ☐

    (c) Both 3. ☐

    (If from FISP only, go to question 25)

21. If bought where did you buy from

    (a) Agro agent within the community 1. ☐

    (b) Agro dealer in town 2. ☐

    (c) Others specify …….. 3. ☐

22. How far is the agro dealer from household…….. (KM) _____

23. Cost of fertilizer per bag (i) Basal …….. (ZMK) _____

    (II) Top …….. (ZMK) _____

24. Cost of seed per bag …… (ZMK) _____

25. If from FISP how much did you pay for the pack……..(ZMK) _____

26. Which month did you receive the inputs …… _____

Production and Input use for other crops grown

Crop produced	Size of area planted (hectors)	Quantity harvested. No. of 50kg bags	Quantity of hybreed seed used (kgs)	Quantity of fertilizer Applied (Besal + Top) No. of 50 kgs	Source of Input 1. FISP 2. Bought
3. Maize					
4. Cassava					
5. Wheat					
6. Sorghum					
7. Millet					
8. Beans					
Others, please specify					

Section F: Household Income

Income from Crop sales from (April 2012 to April 2013)

crop	Quantity produced	Quantity sold up to April 2013	Price per 50 kg bag	Total sales
Maize				
Rice				
Cassava				
Wheat				
Sorghum				
Millet				
Beans				
Others, specify				

Income from Livestock sales (April 2012 to April 2013)

Livestock	Quantity sold from April 2012 to April 2013	Price per unit	Total Sales
1. Cattle			
2. Goats			
3. Sheep			
4. Donkey			
5. Chicken/ducks			
6. Pigs			

Income from off farm activities

Income from employment January – December 2012

Name of Household member	Permanent Employed Yes no	Type of employment	Salary per month	Annual salary	Amount from piece works	Total income from member

Income from Business activities from April 2012 –April 2013

Type of Business activity	Income per month on average	Annual Income

Income from Remittance April 2012 –December 2013

Remittance Received from	Amount (ZMK)	month

Section G: Access to Extension services

1. Did the household receive any information on rice production in the past 24 months
   (a) Yes 1. ☐
   (b) No 2. ☐
2. If yes please indicate type of information received

Type of extension received	2010/11 Yes No	2011/12 yes No	Frequency Monthly Quarterly Half yearly Annually ……	Provider of extension MACO NGO…….. Cooperative Radio/TV Farmer org. ……
Field layout				
Planting date				
Irrigation				
Fertilizer application				
Crop rotation				
Minimum tillage				
Conservation farming				
Post harvest technique				
Gender/HIV/AIDS				

3. How did the household receive the information above
   (a) Fellow farmer 1. ☐
   (b) Radio 2. ☐
   (c) Books/ broachers 3. ☐
   (d) Field visit 4. ☐
   (e) MACO extension 5. ☐
   (f) Others specify …….. ☐

6.

4. Did the household apply the information received

   (a) Yes 1. ☐

   (b) No 2. ☐

5. If yes, after using the information did the yield improve

   (a) Yes 1. ☐

   (b) No 2. ☐

6. If no what could be the cause of not improving the yields, specify

   ……. _____

7. Has anyone in the household attended field days/visit

   (a) Yes 1. ☐

   (b) No 2. ☐

8. If yes how many times have they attended ……(2011/12) _____

9. Who organized the field day/visit ……. _____

   (a) MACO 1. ☐

   (b) ZNFU 2. ☐

   (c) CFU 3. ☐

   (d) SNV 4. ☐

   (e) Others specify …… 5. ☐

Sources of Marketing Information

1. Was Marketing information (price) on rice available to you before you sold rice

   (a) Yes 1. ☐

   (b) No 2. ☐

2. If yes what was the source of the information …….. _____

   (see codes below

3. Does the household have marketing information on other crops

   (a) Yes 1. ☐

   (b) No 2. ☐

4. What is the source of the information …….. _____

   (see codes below)

5. Marketing information on livestock

   (c) Yes 1. ☐

   (d) No 2. ☐

6. What is the source of the information …… _____

Codes for sources of information

1. MACO	8 Mobile phone
2. ZNFU	
3. CFU	
4. SNV	
5. Cooperative	
6. Radio	
7. TV	

8. Have you used the Zambia National Information Service (ZANIS) to get agriculture and marketing information before

   (a) Yes 1. ☐

   (b) No 2. ☐

9. If no, please specify why you do not use it,

   (a) ……. _____

   (b) …… _____

   (c) …… _____

Section H: Household Asset Ownership

1. Does anyone in the household own a cell phone

   (a) Yes 1. ☐

   (b) No 2. ☐

2. Have you used it to get information on prices for commodities

   (a) Yes 1. ☐

   (b) No 2. ☐

3. How many kilometers to where you can catch network …….. _____

4. Do you own Tv/Radio

   (a) Yes 1. ☐

   (b) No 2. ☐

5. Do you listen to agriculture programs on Radio/TV

   (a) Yes 1. ☐

   (b) No 2. ☐

6. If yes which programs do you listen to…….. _____

   …….. _____

7. Ownership of Livestock

Type of Livestock owned	1. Yes 2. No	Number
Cattle		
Sheep/sheep		
Donkey		
Chicken		

8. Transportation asset

Type	Yes No	Number	Do you use to transport commodity to market Yes No
Vehicle			
Motorcycle			
Bicycle			
Ox-cart			

9. Does the household own land

   (a) Yes 1. ☐

   (b) No 2. ☐

10. If yes what is the size of the land ……(Hectors) _____

11. Is it communal land

   (a) Yes 1. ☐

   (b) No 2. ☐

12. If no do you have title deed for land

   (a) Yes 1. ☐

   (b) No 2. ☐

13. Production Assets

Production assets	2011/12 Yes No	Number in good condition	Estimated value of the Asset ZMK
Ploughs			
Harrows			
Cultivators			
Rippers			
Tractors			
Hand driven tractor			
Scotch carts			
Water pumps			
Hammer mills			
Hand Hammer Mills			
Rump press/ Oil expeller			
Sprayers			
Treadle pump			
Solar Panel			
Hoe			
Vehicle			
TV			
Radio			

Mobile Phone			
Fridge			
Others, specify			

Section I: Access to Credit and Membership to farmer Organization

1. Did the household access credit in the last 24 months

   (a) Yes 1. ☐

   (b) No 2. ☐

2. If yes who provided it……. _____

3. In what form was the credit provided

   (a) Inputs 1. ☐

   (b) Cash 2. ☐

4. If received credit in form of inputs, please specify the quantity for each

   (i) Seed …… (kgs) _____

   (ii) Fertilizer…….. (kgs) _____

5. If cash how much …….. _____

6. Does anyone belong to a farmer organization in the Household

   (a) Yes 1. ☐

   (b) No 2. ☐

7. If yes which one

   (a) Cooperative (d) CFU ……. 1. ☐ 3. ☐

   (b) ZNFU (e) Others, specify ……. 2. ☐ 4. ☐

   (c) Women group

8. What services does the farmer organization offer

services	(0) No, (1) Yes
Access to credit	
Marketing of commodity/ provision of	

market information	
Products Bulking	
Input acquisition	
Extension services	

Section J: Public Goods provision

1. What is the state of the nearest road to town/market

   (a) Good 1. ☐

   (b) Bad 2. ☐

   (c) Impassable 3. ☐

2. Has the road been resurfaced before

   (a) Yes 1. ☐

   (b) No 2. ☐

3. If yes when was the last time it was resurfaced…… (year) _____

4. Distances to selected infrastructure

Infrastructure	Distance in KM
BOMA	
Road/Tired Road	
FRA Deport	
Point of sale to Private buyer	
Clinic/Hospital	
School	
Bank	
Agriculture Camp Officer	
Electricity power line	
Market place where you sell	
Rice polishing mills	
Borehole	

I thank you for sharing your experiences with me and taking your time!!!!!