ANALYSIS OF PROFIT EFFICIENCY OF KILOMBERO PADDY-RICE FARMERS USING WAREHOUSE RECEIPT SYSTEM

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ABSTRACT

A Warehouse Receipt System (WRS) is important in a paddy value chain because the commodity requires storage before it reaches consumers. Furthermore, a WRS may enhance speed of transactions and lower costs along the supply chain. However, little is known about the overall profit efficiency of paddy-rice farmers using warehouses. This study investigates the profit of the farmers in Kilombero District by examining the role of WRS on profit. In this study, a stochastic profit frontier and inefficiency effects model was employed. The findings show rice farmers using WRS are efficient than those who are not. The mean level of efficiency for paddy-rice farming was 44.5 percent which implied that an estimated 55.5 percent of the profit is lost due to a combination of both technical and allocative inefficiency in the paddy-rice production. The efficiency differences were explained largely by the cost of transport, storage, shelling and by the distance from farmers' household to the nearest warehouse. Major result is that, there is no significant difference in technical efficiency between users and non-users of WRS. The study concludes that there are potential opportunities for increasing profit from paddy-rice production by smallholder farmers in Kilombero by using WRS as the business model. This would be achieved by addressing constraints that face farmer organizations linked to WRS in the District. It is therefore recommended that through collective bulking, transport and storage costs could be reduced to make WRS more efficient in Kilombero. Moreover, potential stakeholders such as government should put in place initiatives which will improve availability of credit, affordable farm inputs and reduce transaction costs through WRS. Lastly, WRS should be implemented with high transparency involving all current potential stakeholders particularly farmers.

DECLARATION

I, **MBOKA MWANITU**, do hereby declare to neither the Senate of Sokoine University of Agriculture that this dissertation is of my own original work and has neither been submitted nor being concurrently submitted for a higher degree award in any other institution.

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DEDICATION

I dedicate this dissertation to my lovely Late mother, ***Sarah Ng'onda***. She is the reason I became patient, independent, strong and intelligent woman today. For the love she had to her family and friends, to date they all managed to provide me with their guidance, encouragement and material support that inspired me throughout my life. In this regard as I recently became a mother, I decided to pass-on the passion and wisdom I carried and learnt during my study time to my lovely daughter, ***Bella Ipyane Tsatsawani.*** May the Almighty God bless the two women I will everyday love, Amen.

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LIST OF ABBREVIATIONS AND SYMBOLS

ADB	African Development Bank
AERC	African Economic Research Consortium
AGRA	Alliance for Green Revolution
AKIRIGO	Apex Kilombero Rice growers Organization
C-D	Cobb-Douglas
COLS	Corrected Ordinary Least Squares
CSDI	Center for Sustainable Development Initiatives
DD	Profit Frontier of Farms
DEA	Data Envelopment Analysis
EAC	East Africa Community
FAO	Food and Agriculture Organization of the United Nations
GM	Gross Margin
GRN	Goods Received Note
GoT	Government of Tanzania
Ha	Hectare
HDI	Human Development Index
kg	Kilogram
L-Y	Lau-Yotopolous
MDG	Millennium Development Goals
MLE	Maximum Likelihood Estimation
MMA	Martch Makers Associates
MRR	Marginal Rate of Returns
MVP	Marginal Value Product

NBS	National Bureau of Statistics
NMB	National Microfinance Bank
OLS	Ordinary Least of Square
RUDI	Rural Urban Development Initiatives
SACCOS	Saving and Credit Cooperatives Society
SUA	Sokoine University of Agriculture
TAS	Tanzanian Shillings
TE/PE	Technical Efficiency/Profit Efficiency
TR	Total Revenue
TVC	Total Variable Costs
UCDA	Uganda Coffee Development Authority
UNDP	United Nations Development Programme
URT	United Republic of Tanzania
USAID	United States Agency International Development
USD	United State Dollars
WH	Warehouse
WR	Warehouse Receipt
WRS	Warehouse Receipt System
WTO	World Trade Organization

CHAPTER ONE

1.0 INTRODUCTION

1.1 Background Information

The agricultural sector still presents particular challenges with direct linkages to growth, poverty, and competitiveness. In general, yields are low, while production costs are high and income remains low. The National Development Strategy (URT, 2010) emphasizes improvement in technological inputs, rural infrastructure and small holder financing (including through creation of an Agricultural Bank). There is, however, a need to fully integrate such interventions into a commercial value chain, which is indispensable for attracting large investments in the sector and realizing economies of scale. This investment is crucial, especially in transportation, processing and marketing of agricultural produce, a significant proportion of which is currently wasted through post-harvest losses (AGRA, 2014)

In an effort to improve the situation, Tanzania, launched the input and credit strategy under the Agricultural Sector Development Programme (ASDP) in 2006 on the philosophy of supporting 'poor of the poorest' and includes measures like directed targets (URT, 2008). While this approach is generating concerns over economic and commercial use of financial resources, other models of lending to the agriculture sector, which has been used by countries like India, have managed to improve the farmers' credit availability and refinance to the banks at softer terms. Lower down-payment, longer maturity period and lower rates of interest have helped in facilitating easier access and affordable credit to marginal and smallholder farmers (URT, 2010).

Global trends show agriculture is becoming increasing commercialized, particularly on food crops such as rice, which its marketing is more geared towards producing for specific markets. Paddy-rice is one of those commodities which recently became more commercialized than other food staple crops (FAO, 2015) despite this potential; paddy-rice marketing chain is poorly organized. In the traditional selling system, farmers produce commodities that are pushed into the marketplace. Farmers are generally isolated from end consumer and have little control over input costs or profit received for their goods. In most traditional selling systems, farmers tend to receive minimal profit (RIU, 2010). At present, most of the agricultural produce in the country are marketed through private trade operating in gradual organized markets/channels. This is an exception for traditional cash crops such as cashew nuts and coffee, which are marketed on formal auction through structures such as Warehouse Receipt System (WRS). However, it is still observed there are restrictions on movement of agriculture goods and marketing of produce outside the regulated markets hinders free movement of agro-goods under normal forces of demand and supply.

1.1.1 Overview on production capacity of paddy-rice in Tanzania

In Tanzania, rice is the second most important crop and mostly used as a cash crop. Tanzania is the second largest producer of rice in Southern Africa after Madagascar, with production level of 818 000 tones (MMA, 2010). The cultivated area is 681 000 ha and this represents 18% of Tanzania's cultivated land. About 71% of the rice grown in Tanzania is produced under rain fed conditions, where irrigated land presents 29% of the total land with most of it in small village level traditional irrigations with the average yield of 1-1.5 t/ha (Kibanda, 2008). Farmers grow a number of traditional varieties which have long maturity and yield but are affected with irregular rainfall pattern and occurrence of pests which contribute to decline in the yield. Rice consumption in Tanzania is estimated to be 930 t/year, and rice imports of 55 t/year (Kibanda, 2008).

1.1.2 Paddy-rice production comparison with other countries

Countries can experience low paddy-rice production capacity due to various reasons. According to Jesus and Festo (2012), this is mainly associated with low adoption of yield enhancing inputs and technologies. Thus, majority of smallholder farmers in EAC are still relying on rain fed agriculture and traditional seed varieties. Moreover, from 2007 yields in Tanzania seem to show a diminishing trend compared to other EAC member countries. Surprisingly, the yield of Rwanda is more than double compared to that of Uganda and Tanzania. Hence, efficient allocation of resources such as farm inputs at the farm level would change the yield status of these EAC countries. In general, yields of paddy-rice in Tanzania have been lower compared to most of other countries such as EAC member countries such as Rwanda, Burundi and Kenya. Figure 4 represents paddy rice yields in selected East African countries for the period, 2005 – 2011. However, the production capacity is comparable among countries within EAC countries and other Eastern African countries (Table 1). For instance, yields in Uganda can be compared with the yields of Tanzania; also they are lower than those in other EAC member countries **Error! Reference source not found.** and **Error! Reference source not found.**(FAOSTAT, 2011)

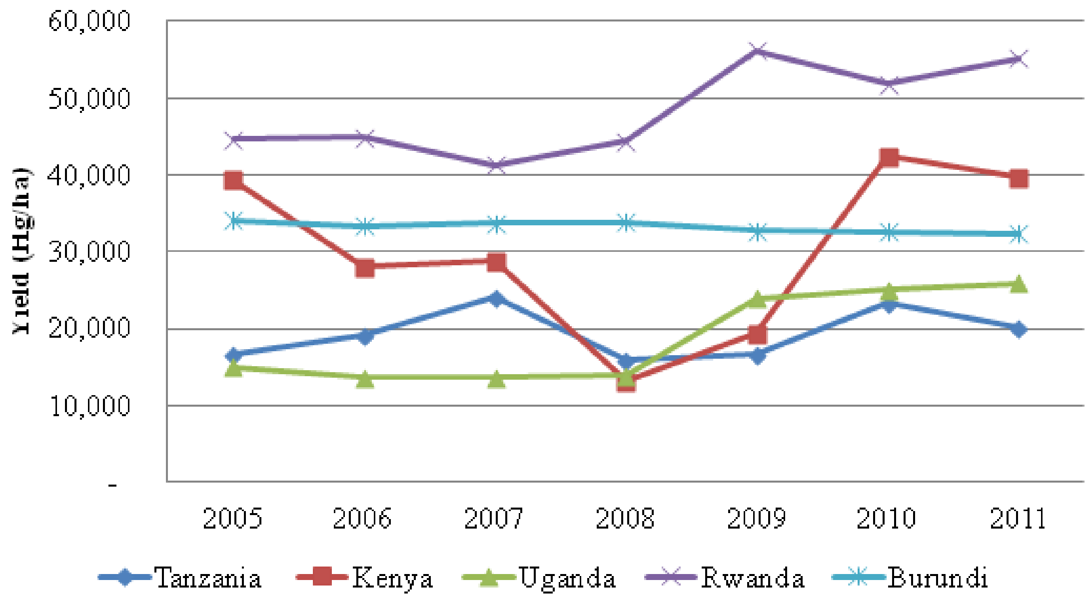

Figure 1: Paddy-Rice Yields in EAC Countries, 2005-2011

(Source: FAOSTAT, 2011)

Error! Reference source not found. represents area harvested, yields and production capacity for all EAC countries. On average Tanzania produce larger quantity of paddy rice at local level compared to other EAC countries, however, the country is harvesting its produce from largest area. Generally, Tanzania and Uganda have lower level of farm productivity, thus, the production level per area harvested (MT/ha) ratio have been low for these countries compared to other EAC countries such as Rwanda, Kenya and Burundi. Despite their small land size, Rwanda is making full use of available land and efficiency allocation of other resources at farm level and experience higher productive efficiency compared to other EAC countries (FAOSTAT, 2011).

Table 1: Paddy-rice production capacity in EAC, 2005-2011

Country	Element	2005	2006	2007	2008	2009	2010	2011	Average	Ratio (MT/Ha)
Tanzania	Area Harvested (Ha)	701,990	633,770	557,981	896,023	805,630	1,136,290	1,119,320	835,858	1.943
	Yield (Hg/Ha)	16,634	19,031	24,048	15,854	16,568	23,323	20,086	19,363	
	Production (MT)	1,167,690	1,206,150	1,341,850	1,420,570	1,334,800	2,650,120	2,248,320	1,624,214	
Kenya	Area Harvested (Ha)	15,940	23,106	16,457	16,734	21,829	20,181	28,031	20,325	3.062
	Yield (Hg/Ha)	39,321	28,062	28,715	13,076	19,333	42,384	39,681	30,082	
	Production (MT)	62,677	64,840	47,256	21,881	42,202	85,536	111,229	62,232	
Uganda	Area Harvested (Ha)	102,000	113,000	119,000	128,000	86,000	87,000	90,000	103,571	1.798
	Yield (Hg/Ha)	15,000	13,628	13,613	13,895	23,926	25,070	25,889	18,717	
	Production (MT)	153,000	154,000	162,000	177,857	205,765	218,111	233,000	186,248	
Rwanda	Area Harvested (Ha)	13,922	14,034	15,005	18,455	14,433	12,975	14,592	14,774	4.816
	Yield (Hg/Ha)	44,673	44,843	41,320	44,432	56,178	51,833	55,195	48,353	
	Production (MT)	62,194	62,932	62,000	82,000	81,081	67,253	80,541	71,143	
Burundi	Area Harvested (Ha)	19,900	20,500	21,000	22,000	24,000	25,500	28,200	23,014	3.318
	Yield (Hg/Ha)	34,144	33,322	33,767	33,860	32,680	32,556	32,417	33,249	
	Production (MT)	67,947	68,311	70,911	74,492	78,432	83,019	91,415	76,361	

(Source: FAOSTAT, 2011)

1.1.3 Paddy-Rice Production and Consumption in Tanzania

Rice is more commercialized than other staple food crops. According to the 2002-03 National agricultural sample censuses, 42% of rice production is marketed, compared to 28% of maize and just 18% of sorghum (NBS, 2007). Tanzania is both an importer and an exporter of rice. Tanzanian rice imports averaged 71 000 tons over 2005/2007, mostly from Asia, and represents about 8% of apparent domestic consumption (NBS, 2007). Rice exports over this period were about 10,000 tons, mostly to Kenya, Zambia, and other countries in the region (Delgrado *et al*., 2005). Imported rice is considered inferior to local rice by Tanzanian consumers and thus sells at a discount compared to domestic rice. There is inadequate knowledge especially on the study area, on how paddy-rice marketing is organised, how the various actors are performing in terms of distribution of gains along the chain. The challenges facing actors along the paddy-rice value chain in the country and their feasible solutions are not clearly known. Thus, research on paddy-rice subsector farmers is important so as to provide insights on the profitability of the
system.

1.2 Problem Statement and Justification

While Tanzania offers promising prospects on both the agricultural products demand and supply side, issues related to market failures within agricultural marketing systems are yet to be solved. On the demand side, there is a big domestic market for food and other agricultural produce while marketing costs could be significantly reduced if better roads and marketing facilities were built. Imperfect market integration for Tanzania rice indicate that there may be substantial benefits in developing better infrastructure facilities to effectively link production areas to market centers (Binswanger ,2010).

The introduction of WRS in Tanzania is a fundamental effort as an alternative solution for commodity producers and traders to access short-term financing for operations, take advantage of price fluctuations, and secure the storage of their produce. The framework for establishment of a WRS focuses on structural components, including legislation, registration, licensing and inspection of public warehouses; and development of financial instruments for collateralized loans, insurance and indemnity funds (Shepherd, 2004).

In Tanzania, the WRS pilot programmes have shown great improvement of traditional cash crops prices such as coffee, cotton and cashew nut. The system has been reported to enhance quality and standard aspects from 60% to 95% as indicated in WRS Strategy (2009). Moreover, Kuserwa (2009) recognize the successes of the system being brought forward by farmers' ability to learn and adapt compliance on standard and quality requirements as a pre-requisite to enjoy stable high prices. It is further reported that a total loan portfolio under the system in coffee and cashew nuts has reached to more than US $120 million for the past two years. t is worth noting the present impressive marketing outcomes on cash crops are constrained by challenges , among many which have already been outlined in many literatures ; Here are possible useful insights which could be worth looked at for other crops such as paddy-rice as indentified by Kilama, (2013) that, in order for farmers to sell in the WRS, they must belong to a farmer group, in particular primary society where farmers use their output as collateral to receive loans from banks; however this does not necessarily mean WRS using farmers are better off because the repay is guaranteed once their produce has been sold at auction. Producers can thus wait and sell their produce when the market is more favourable. WRS ensures that farmers receive a constant price throughout the trading season and assurance to receive subsidized farm inputs that are provided through the primary society. This argument might be true for cashew nut farmers, however thorough investigation is needed to examine whether the gains are relevant to farmers specifically paddy-rice farmers who are members of farmer primary society or farmer organizations linked to WRS attains to higher profits than non members. This is an important piece of information to justify all efforts put in up-scaling WRS. If it is found that farmers using WRS are significantly more efficient than their counterparts, this would give policy makers a bigger opportunity to advocate for WRS. On the farmers side this knowledge could spur the need to form reputable farmer organizations and encourage them to participate in the selling their produce through WRS. This study wants to empirically test that hypothesis and fill this knowledge gap. In particular the study intends to assess whether in Kilombero the WRS achieves such a desired situation. We ask ourselves is the WRS in Kilombero economically effective to the level of influencing farmers profitability?

1.3 Objectives of the Study

1.3.1 Overall objective

The overall objective of this study is to analyse the effects of using WRS on profitability of paddy-rice farmers.

1.3.2 Specific objectives

i) To estimate and compare the profit efficiency of Kilombero paddy-rice producers using WRS and non- WRS users.

ii) To identify socio-economic factors influence profit efficiency of Kilombero paddy-rice farmers using WRS system.

1.4 Hypotheses of the study

H1: The Kilombero paddy-rice farmers are profit efficient through using the WRS

H2: Socio-economic factors for farmers using WRS do not significantly affect the overall efficiency of paddy-rice farmers in Kilombero.

1.5 Study limitations

The major limitation to this study was data collection time, the survey was done in April 2013 and not as expected in 2012 as it was expected because the candidate had to attend course work at a shared Facility in South Africa during that year. Also the use of terminologies may affect interpretation of members to WRS and non members and users of WRS and non-users, may mean the same thing for primary society or farmer group members who were at that particular point were using WRS to sell their paddy. This may either hinder their accuracy, compatibility and reliability on current situation in Kilombero district. Another limitation was time and recourses; the study was limited to one year, and fixed fund, it was so difficult to deal with some uncertainties during the study. These include lapse of one year as candidate had to take a “noble role of motherhood” hence the submission of work was done in September 2014. Therefore during all this time until 2015 the result stayed pending until 2015, therefore some of data, information and principles of analysis did not change and as they are all based on the year when the data was collected in 2013 . To overcome these problems the study employed different harmonized sources of data (qualitative information checking) with synchronized format for cross checking and fill the gaps. That has made the results be reliable for policy recommendations despite the problem encountered.

1.6 Organization of the study

Chapter two begins with a discussion of the overview of paddy production in Tanzania, post-harvest handling, WRS and concept of economic efficiency. The rest of the chapter covers issues concerning model development, and factors associated with measurement of economic inefficiency. The chapter concludes with a review of recent empirical studies pertaining of measuring allocative and technical efficiency. Chapter three provides a detailed presentation of the methodology adopted for this study. This includes the empirical model used in the study and data sources. Both descriptive and econometric results and findings of this study have been discussed in chapter four. The chapter is divided into a number of sections which include summary on, profit efficiency and distribution at farm level, paddy farm sizes and their distributions, while conclusions and recommendations are presented in chapter five.

CHAPTER TWO

2.0 LITERATURE REVIEW

2.1 Paddy Production, Post-Harvest Handling and Introduction of WRS in Tanzania

2.1.1 Paddy-rice production

In Tanzania, per capita consumption of rice is roughly 16 kilograms, contributing 8% of the caloric intake among the Tanzanian population (NBS, 2007). This makes rice the third most important source of calories in Tanzania after maize (33% of caloric intake) and cassava which makes 15% (NBS, 2007). Rice is a preferred grain in the sense that as income rises, consumers shift from sorghum and maize toward rice and wheat products. As a result of steady economic growth in Tanzania over the past seven years, per capita rice consumption has increased, stimulating both increased domestic production and rising rice imports. About half of the production is concentrated in Morogoro, Shinyanga, and Mwanza regions and virtually, 99% of rice is grown by smallholders in Tanzania, although some of them are part of large-scale rice irrigation schemes that were formerly state-managed farms (NBS, 2007).
Rice is more commercialized than other staple food crops. According to the 2002-03 National agricultural sample censuses, 42% of rice production is marketed, compared to 28% of maize and just 18% of sorghum (NBS, 2007).

Among the critical issues facing Tanzanian agriculture, the price distortion due to long supply chain in farm produce marketing and resultant low share of farmers in price is an important matter for discussion. Integrated systems for value addition, processing, storage and product handling are yet to materialize., in spite of the initiatives by The Government of Tanzania (GoT) has put in place enabling institutional environment, arrangement for agricultural marketing and contract farming, however, it is yet to evolve in many districts and regions. One of the recently observed setbacks has been institutions implementation challenges to address inefficiency in market functions to reduce postharvest losses and stimulate smallholder producer access to input and output markets.

2.1.2 Postharvest handing through grain warehouse receipt system

As an effort to mitigate post-harvest losses, paddy- rice is one of the recent agricultural commodities piloted within the model of inventory marketing facilities such as WRS in Mbarali and Kilombero Districts (RUDI, 2011). The concept of WRS is based on the use of storage facilities, licensed as public warehouses, which receive right to store grains of third parties and issue warehouse receipts. Figure 1 represents the way WRS operates in the paddy-rice subsector. Generally, warehouse receipts, as negotiable instruments backed by the underlying commodities, are an integral part of the marketing and financial systems of the most industrial countries as they can be traded, sold, swapped and used as collateral to support borrowing or accepted for delivery against a derivative instrument such as future contracts.

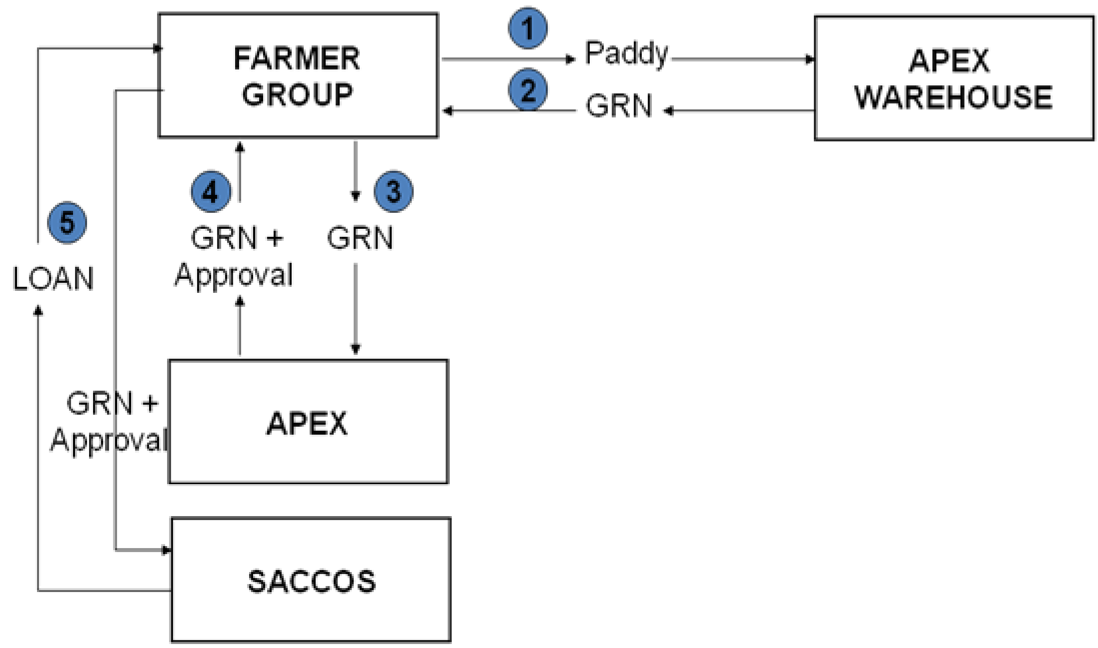

Figure 2: WRS Operation Model

Source: Modified from RUDI (2010)

The warehouse receipt system (WRS), including its in-built financing mechanism(s) for farmers, inputs delivery service and marketing tasks, appeals as one method that captures the three tasks. The question is whether the systems at Kilombero have any role to play in farmers' profit. This would come in place if WRS in Kilombero is managed in a manner that inputs are availed in time and at affordable prices, credit is availed and repaid at high levels and farmers are satisfied with the services. Assuming similar knowledge (production of paddy) the difference in profitability between farmers could be due to an efficient use of inputs and output selling system used.

2.1. 3 The introduction, role and implementation of warehouse receipt system

The operationalization of WRS in Tanzania has been minimal. Lack of an appropriate legal environment and policy incentives is one of the most important constraints on the creation and acceptance of warehouse receipts in Tanzania. It is only in 2005 that the Parliament of United Republic of Tanzania enacted the "Warehouse Receipts Act, 2005" *(Warehouse Receipts Act No. 10 of 2005)* and regulations put forward in 2006.

The use of warehouses as delivery locations will allow transparent trade in agricultural commodities to develop - between producers and large traders or processors - thereby reducing the length of the marketing chain and narrowing distribution margins. Producers are also able to defer the sale of produce by making use of inventory credit to satisfy immediate consumption needs. Increased storage by participants in the commodity system will moderate seasonal price variability and reduce trade margins for the benefit of both producers and consumers. Storage will also occur in well-run warehouses or silos, thereby reducing post-harvest losses, which are quite substantial and often mean significant loss of income to farm households (CSDI, 2006). Hence, there is a need to find out what level of economic and operation efficiency in deepening access of finance of paddy-rice within warehouse receipt system.

2.1.2 The role of farmer organization (FO)

Farm organization is an important node without which WRS operations would be hampered. In her recent study, Kilama (2013) emphasize on farmers to belong to farmers' groups' in particular primary societies when comparing the Cashew nut sectors of Tanzania and Vietnam. The aim of forming these groups is centered on the importance of FO in coordinating activities related to production. FO can assist in tackling the problem of supplying inputs for pest and disease control, distributing knowledge from research institutes and finding markets for their members. The study intended to show if being a member of FO and selling through WRS has impact on profit efficiency.

2.2 Theoretical and Conceptual Framework

The view on how to measure efficiency has received considerable attention in the economic literature. For this particular study, the theoretical and analytical work will be based on measuring profit efficiency. Profit efficiency is a broader concept since it takes into account the effects of the choice of vector of production on both costs and revenues.

Therefore it will be important to understand the generic principals of efficiency as presented by different scholars in order to synthesize well the decision made on using profit function approach which combines the concepts of technical and allocative scale inefficiency as measure of efficiency.

Efficiency can be defined as the ability to produce a given level of output at lowest cost. Farrell (1957) presented the traditional concept of efficiency as defined in three components: technical, allocative and economic. "Technical efficiency" is defined as the ability to achieve a higher level of output, given similar levels of inputs. "Allocative efficiency" deals with the extent to which farmers or firms make efficient decisions by using inputs up to the level at which their marginal contribution to production value is equal to factor cost. Technical and allocative efficiencies are components of economic efficiency.

In a production context, technical efficiency relates to the degree to which a farmer produces the maximum feasible output from a given bundle of inputs (an output oriented measure), or uses the minimum feasible level of inputs to produce a given level of output (an input oriented measure). Allocative efficiency, on the other hand, relates to the degree to which a farmer utilizes inputs in optimal proportions, given the observed input prices (Coelli *et al*., 2002). The popular approach to measure efficiency, the technical efficiency component, makes use of frontier production function (e.g. Battese and Coelli, 1995 and Battese, 1992).

However, Yotopoulos and Lau (1973) argued that a production function approach to measure efficiency may not be appropriate when farmers face different prices and have different factor endowments. This led to the application of stochastic profit function models to estimate farm specific efficiency directly (e.g., Ali and Flinn, 1989; Rahman, 2003). Coelli, (1996); Battese and Coelli (1995) extended the stochastic production frontier model by suggesting that the inefficiency effects can be expressed as a linear function of explanatory variables, reflecting farm-specific characteristics. According to Reddy (2003), farm profitability can be affected by production cost changes or total revenue changes (both are function of output). Whereby, it is assumed that, farmers can raise farm profit if they manage the factors within their control. These include raising farm efficiency and productivity, and reducing costs by using optimal levels of inputs.

The advantage of Battesse and Coelli (1995) model is that it allows the estimation of a profit function, which is assumed to behave in a manner consistent with the stochastic frontier concept.

2.2.1 Measures of Efficiency

2.2.1.1 Technical, allocative and economic efficiency

Measurement of economic efficiency requires an understanding of the decision making behaviour of the producer. A rational producer, producing a single output from a number of inputs, $x = x_1 \ldots\ldots x_n$, that are purchased at given input prices, $w = w_1 \ldots\ldots w_n$ and operating on a production frontier will be deemed to be efficient. But if the producer is using a combination of inputs in such a way that it fails to maximize output or can use less inputs to attain the same output, then the producer is not economically efficient. A given combination of input and output is therefore economically efficient if it is both technical and allocative efficient; that is, when the related input ratio is on both the isoquant and the expansion path. These contentions are best illustrated by Coelli (1995).

2.2.1.2 Profit function and its measurement

A profit function is an extension and formalization of the production decisions taken by a farmer. According to production theory, a farmer is assumed to choose a combination of variable inputs and outputs that maximize profit subject to technology constraint (Sadoulet and De Janvry, 1995). The underlying production function can be generalized as h (q, x, z) = 0 where q is a vector of output, x is a vector of variable inputs, z is a vector of fixed inputs and h is a technology. Assuming the technology to be homogeneous across farms, restricted profit function is specified as follows:

Max $p.q-wx$,…………….,

s.t. $h(q,x,z) = 0$ ....(1)

Where: p is a vector of prices of outputs and w is a vector of prices of variable inputs

Considering a set of inputs and outputs the profit maximizing input demand and output supply functions are generally respectively expressed as:

$X \quad = \quad x\,(p, w, z)$……………………………………………………………(2)

$Q \quad = \quad q\,(p, w, z)$……………………………………………………………(3)

Substituting equation 2 and 3 into1 gives a profit function which is the maximum profit that the farmer can obtain given prices of p and w, availability of fixed factors z and production technology h. The profit function can be written as

$\pi \quad = \quad p'q(p,w,z) - w'x(p,w,z)$……………… ………………(4)

Since this present study used the normalized profit function outlined in equation 5 given the fact that the study dealt with a single output, that is, paddy-rice (Sadoulet and De Janvry, 1995). Hence for paddy-rice, the profit is:

$\pi_i \quad = \quad f(P_{ij}, Z_{ik}).\ \exp\,(e_i)$… ………………………………………………(5)

This makes profit non-linear in its error term. However, the profit function can be loglinearized to obtain the form:

$\ln \pi_i = \ln f(P_{ij}, Z_{ik}) + e_i$………….whereby:

π_i = normalized profit on firm $_i$ defined as gross revenue minus variable cost divided by the output price.

P_{ij} = prices of variable input j on firm i divided by the output price.

Z_{ik} = level of fixed input on firm $_i$ where k are a number of fixed inputs.

i = 1………., n number of farms in the sample.

e_i = error term assumed to behave in a manner consistent with the frontier concept (Ali and Flinn, 1989).

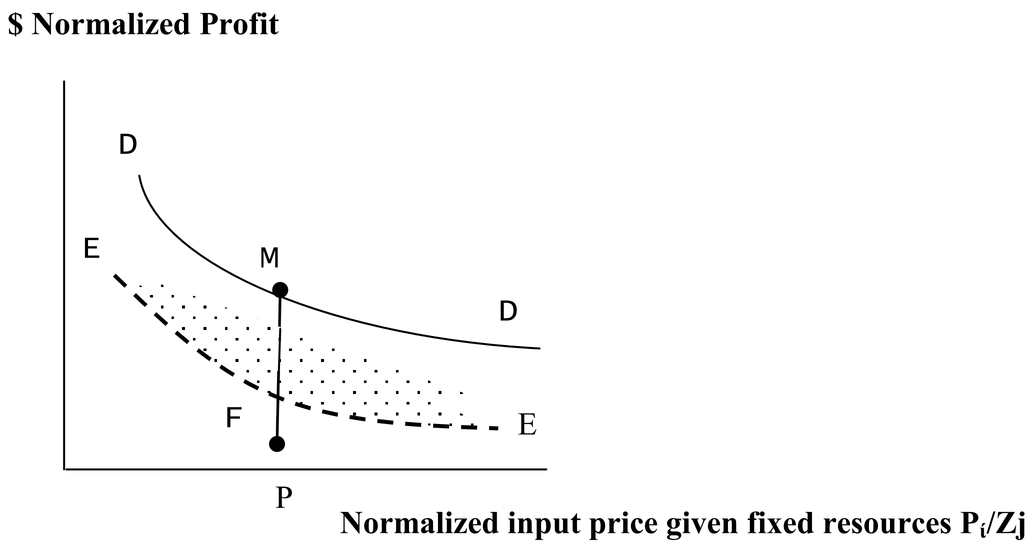

Figure 3: Frontier MLE and OLS Stochastic Profit Function

Source: Ali and Flinn (1989)

Figure 3 shows the stochastic profit frontier function adopted from Ali and Flinn, (1989). The stochastic profit frontier function is an extension of the frontier production function incorporating farm level prices and input use. The incorporation of the farm specific level prices leads to the profit function approach formulation (Ali and Flinn, 1989; Wang *et al.,* 1996). A production approach to measure efficiency may not be appropriate when farmers face different prices and have different factor endowment (Ali and Flinn, 1989). Hence the use of stochastic profit functions to estimate farm specific efficiency directly (Ali and Flinn, 1989; Wang *et al.,* 1996).

In the context of frontier literature, DD in Figure 3 represents profit frontier of farms in the industry (the best practice firm in the industry with the given technology). On the other hand EE is the average response function (profit function) that does not take into account the farm specific inefficiencies. All farms that fall below DD are not attaining optimal profit given the prevailing input and output prices in the product and the input markets. They are producing at allocative inefficient point F in relation to M in Figure 3. Profit inefficiency is defined as profit loss of not operating on the frontier. In Figure 3, a firm operating at F is not efficient and its profit inefficiency is measured as FP/MP (Ali and Flinn, 1989; Sadoulet and Janvry, 1995).

The profit function approach combines the concepts of technical, allocative and scale inefficiency in the profit relationships and any errors in the production decision translate into lower profits or revenue for the producer (Rahman, 2003). Profit efficiency is defined as the ability of a farm to achieve highest possible profit given the prices and levels of fixed factors of that farm and profit inefficiency in this context is defined as the loss of profit from not operating on the frontier (Ali and Flinn, 1989).

2.3 Review of Empirical Studies

2.3.1 Estimation of profit efficiency

A stochastic profit frontier analysis was conducted by Kolawole (2006) in 50 rice farms per each of the four agriculturally oriented regions of Nigeria. The stochastic frontier estimation produced more sound outcomes compared to the OLS estimation, in which the random inefficiency impact is neglected. The average profit efficiency of rice farms was found out to be 60.1 %. Besides, the reasoning of the profit efficiency was attributed to both technical and allocation of resources inefficiencies.

The flexible functional forms for the profit function include the normalized quadratic, normalized translog, and generalized Leontif. Abdulai and Huffman (2000) used normalized translog stochastic profit function in estimating economic efficiency of rice farmers which is assumed to be “well behaved”. This study is going to utilize same function form. This is due to the assumption that competitive input and output markets exist. However, what is essential is the fact that allow output and input prices be exogenous to the agricultural household and farm. This applies fully in the case of inputs used in paddy production and price of rice in the country.

According to Pinkey (1993), he suggests that ability to store and length of time of storage is determined by the amount of input costs the farmer is willing to pay for any storage technique and the ability to wait till the commodity stored command high price as suggested. The viability of storage technique depends if storage value (revenue) exceeds total expense in the storage process. Alimi *et al.* (2000) employed partial budgeting as a tool for estimating costs and benefits between techniques and thus compared them.

Partial budgeting has four categories: additional income, reduced costs, reduced income and additional cost (Goetz, 2002). To determine economic effects of changing from one technique to other different methods can be employed. For the purpose of this study marginal analysis will be used. A marginal rate of returns between the techniques is calculated. Marginal rate of returns (MRR) as defined by (Eskersley, 2004) as change in gross income to change in total variable input costs between the techniques. The use of MRR is compared in order to choose the best. After determining net benefit has for each technology, dominance analysis is performed which is done by sorting the technologies, including the current technology the producer is using, on the basis of costs, listing them from the lowest to the highest, together with their respective net benefit. In moving from the lowest to the highest, any technology that costs more than the previous one but yields less net benefits is said to be dominated and can be excluded from further analysis. The computed marginal rate of return gives an indication of what a producer can expect to receive, on average, by switching technologies.

A stochastic model on the other hand, takes into account random factors, which are outside the control of the farmer. The model addresses the noise problem characterizing deterministic frontier. In other words, the model enables the researcher to provide more explanation of the inefficiency observed than before. This was not possible before because of the violation of certain maximum likelihood regularity conditions. The coefficients estimated this way are expected to be more efficient parameters and its popularity by researchers may be due to this held view (Thiam *et al.,* 2001). However, the model has its own shortcomings. It lacks a priori justification for the selection of a particular distributional form for the one sided inefficiency term μ. In this study a stochastic approach is adopted due to many reasons: the provision of better explanation on observed inefficiency at farmer level using WRS and getting more efficient parameter estimates at farm level.

Furthermore, Mwinuka (2013) presented empirical findings of 116 smallholder coffee farmers on farm size and productive efficiency as lessons from Mbinga District, Tanzania. He used profit function and results indicated that farmers would increase their profit if they allocate farm inputs more efficiently including increase farm size. In his study, Mwinuka pointed out that Data Envelopment Analysis (DEA) method as the nonparametric approach can produce robust results. However, the method differs from the parametric method in that the researcher does not have to make arbitrary assumptions about the functional form of the frontier and distributional form of the μ. Additionally, DEA does not make assumptions about the efficiency of farms since it measures relative efficiency of farms, given a set of inputs, DEA also differs from Farrell's single-input, single output efficiency analysis to multi-input, multi-output efficiency analysis. Moreover, the DEA method has been used by various scholars such as Philip (2009), Mbowa (1996) and others. According to Coelli (1995), the method also suffers from the same weaknesses as that of the deterministic model covered before.

2.3.2 Estimation of socio-economic factors

The socio-economic factors that affect efficiency includes education, age, gender, labour, household size, and being a member to FO using WRS. These factors can be treated as variables to be regressed after determining the efficiency level using profit frontier approach. The dependent variable reflecting efficiency such as is Profit obtained from calculating the Gross Margin and the independent variables are age, gender, hectares of land owned, and education. Also look at whether they have accounts, recording keeping experience and value of assets owned.

In modeling economic efficiency, stochastic production frontier approach is thought appropriate to measure level of efficiency. This is consistent with past economic studies employed on efficiency measurement. On the basis of Sharif and Dar, 1996; Wang *et al.* (1996), the predicted efficiency indices were regressed against a number of household characteristics, in an attempt to explain the observed differences in efficiency among farms, using two-stage procedure.

Battesse and Coelli (1995) extended the stochastic production frontier model by suggesting that the inefficiency effects can be expressed as a linear function of explanatory variables, reflecting farm-specific characteristics. The advantage of Battesse and Coelli model is that it allows estimation of farm specific efficiency scores and the factors explaining efficiency differentials among farmers in a single stage estimation procedure. This study has utilized Battesse and Coelli (1995) model by postulating a profit function, which is assumed to behave in a manner consistent with the stochastic frontier approach. This model has been applied to a reasonable sample of paddy-rice producers in two agro-ecological divisions of Kilombero District differentiated by participating and not participating in WRS.

Previously, Aigner *et al.* (1977) have shown how profit function models do not provide a numerical measure of firm-specific efficiency and popularized the use of the frontier approach. Profit or economic inefficiency in this framework is defined as profit loss from operating on the profit frontier, taking into consideration firm-specific prices and fixed factors.

Based on the reviewed literatures, MLE of stochastic frontier production/profit function model is a strong analytical tool for measurement of technical efficiency in agricultural production. This is because it allows joint estimation of Cobb-Douglas profit function and efficiency model. This study adopted MLE approach for the estimation of Stochastic Frontier Profit Function Model, in order to examine profitability of paddy-rice farmers. This study also adds to the literature of efficiency studies by modeling several variables into the efficiency model and also considers possible inefficiency effects.

CHAPTER THREE

3.0 METHODOLOGY

3.1 Overview of the Study Area

This study was undertaken in Kilombero District from March to June 2013 (Figure 3). Kilombero is one of the five districts of Morogoro region. Its headquarter offices are located at Ifakara, 410 km away from Dar-es-Salaam City. It is bordered by Morogoro rural to the East and Kilosa district to the North-East. The North and West borders are shaped by Mufindi and Njombe districts of Iringa region. In the South-East, is bordered by Songea Rural District and Ulanga District of Morogoro.

The District is linked to the Tanzania-Zambia road highway through a stretch of unpaved road up to Kidatu. According to the Census data of 2002, the population of the district is 321,611; however, on the basis of recent Census of 2012 the population figure increased significantly. Kilombero District occupies about 400,000 hectares of a plain land that is suitable for agricultural practices were paddy is the dominant crop estimated to contribute about 95% of staple food consumed in the district, and others are maize and banana.

Kilombero District is very famous for paddy-rice production in Tanzania. Some of villages which are involved in the production of this crop are Mang'ula A, Mang'ula B, Bwawani, Mkasu, Katulukila, Mbasa, and Michenga and others. Thus, this study interviewed farmers from major five wards, namely: Ifakara, Kibaoni, Kidatu, Mang'ula and Sanje (**Error! Reference source not found.**).

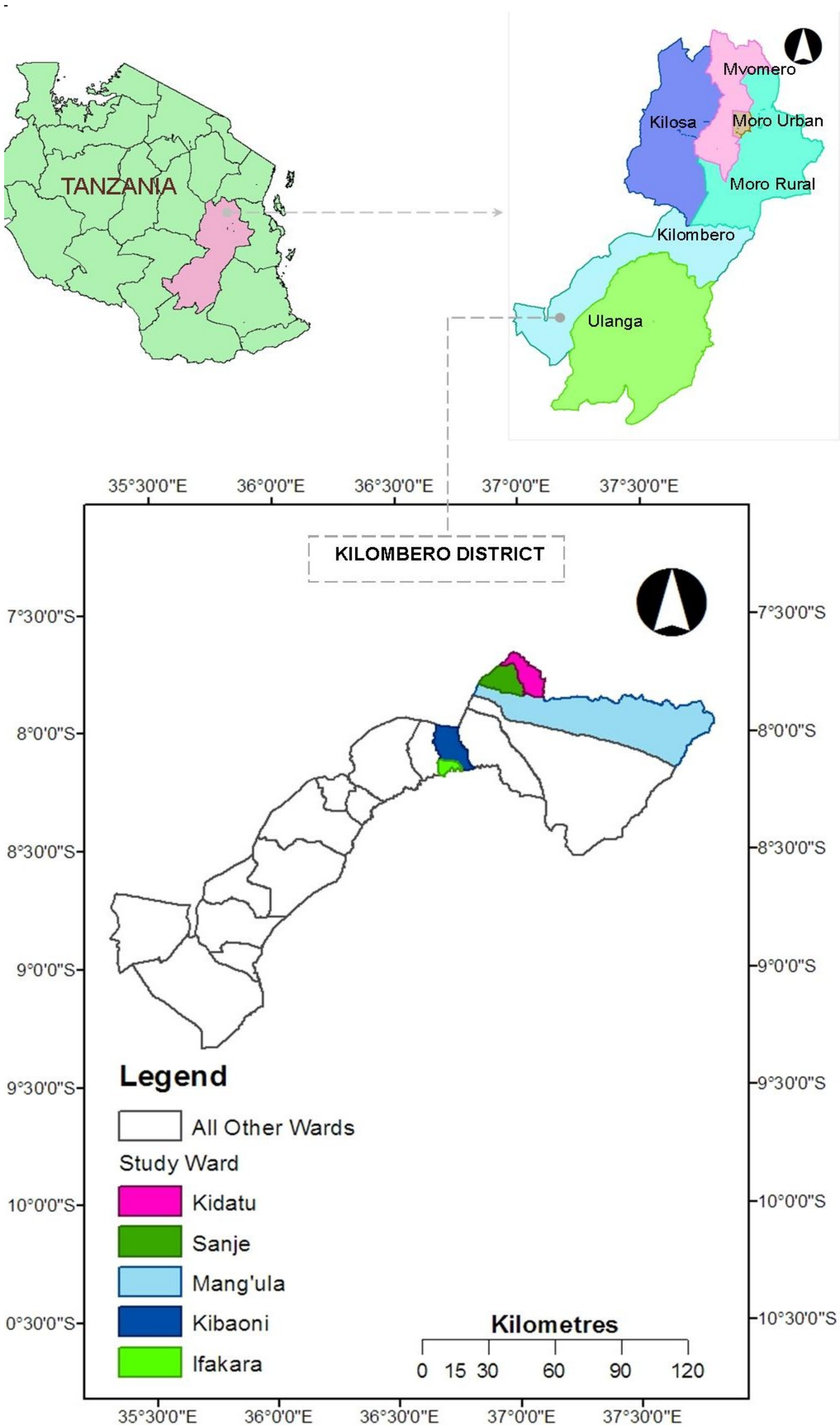

Figure 3: Map of Kilombero District showing study area

3.2 Research Design

3.2.1 Source and type of data

This study employed cross sectional research design as data was collected only at once. Both primary and secondary data were regarded as source of information. Primary data was obtained through a survey conducted in Kilombero district from April 16th -21st, 2013. Information from respondents was collected from important stakeholders currently participating in the paddy-rice value chain such as small holder paddy-rice growers' farmers, AKIRIGO, support institutions like the Kilombero district department of agriculture and livestock office, RUDI, and National Microfinance Bank (NMB). Face to face interviews using questionnaire was administered to targeted households. Focus group discussions and key informant interviews with major stakeholders in the sector were also used to supplement the information not obtained through formal questionnaire tool. Secondary data were obtained from web-based materials, National Agricultural library at Sokoine University of Agriculture and Postgraduate Library at University of Pretoria South Africa.

3.2.2 Sampling procedure and sample size

Kilombero District was purposively selected as the study area because of its record in paddy production. Two divisions were chosen to represent zones where rice farming is commercialized hence a total of five wards which include eight villages were involved in this study. Generally, Kilombero paddy-rice farmers were the target respondents for this study. Both small and medium scale farmers were considered based on acreage in obtaining the sample for this study. A total of 172 farmers were interviewed from eight (8) villages. Random selection was done to identify and interview 77 farmers who were non WRS members and 95 WRS members were identified and interviewed based on AKIRIGO membership list and services charter.

3.2.3 Research Instruments

Both questionnaire and interview schedules were used in this study to collect required data from the paddy farmers (Appendix 2). The questionnaire consisted of a set of structured questions which reflected the study objectives. Sampled farms were used to collect data related to yield, land area under cultivation (acres), input prices such as price per kg of fertilizer, and average price for transport, harrowing, seeds, sowing ,weeding, bird watching, threshing, winnowing, gunny bag, rope and load and unloading . Also, data were collected on the socioeconomic variables such as farming experience in growing paddy-rice (years), educational level (years of schooling), and household size etc. The data collected (on quantity of paddy-rice harvested and output price) were used to compute farm total revenue as P×Q, where P is the price of the output and Q is the quantity produced while the farm level profit (π) was computed as difference between the total revenue and total variable cost expended on producing the paddy *i.e.* [Gross Margin (π) = TR - WX_i].

3.3 Data Analysis

The data obtained from the field were subjected to analysis using descriptive and inferential statistics in which the latter involved testing hypotheses. The stochastic profit functions as suggested by several scholars as an appropriate measure of efficiency when farmers face different price levels and factor endowments was defined as:

$$\pi_i = f(P_{ij}, Z_{ik}).\exp(\varepsilon) \qquad (6)$$

The error term ε_i is assumed to behave in a manner consistent with the frontier concept (Ali and Flinn, 1989), *i.e.* $\varepsilon_i = V_i + U_i$ where π_i is normalized profit of the i^{th} paddy-rice farm defined as gross revenue less variable cost, divided by farm specific output price; P_{ij} is the price of j^{th} variable input faced by the i^{th} farm divided by output price; Z_{ik} is level of the k^{th} fixed factor on the i^{th} farm. V_i's are assumed to be identically and normally distributed with mean zero and constant variance as N (0, δ^2v). U_i is the one-sided disturbance form used to represent profit inefficiency and it is independent of V_i; and i = 1, 2 …n, is the number of paddy-rice farms in the sample.

The profit efficiency of farm *i* in the context of the stochastic frontier profit function is defined as:

$$EFF = E[\exp(U)] / \varepsilon_i = E \exp \delta_o \sum_{d=1} \delta_d W_{di} / \varepsilon_i \qquad (7)$$

Where: W_{di} is the d^{th} explanatory variable associated with inefficiencies on farm *i,* δ_0 and δ_d are the unknown parameters and E is the expectation operator.This is achieved by obtaining the expressions for the conditional expectation U_i upon the observed value of ε_i. The method of maximum likelihood was used to estimate the unknown parameters, with the stochastic frontier and the inefficiency effects functions estimated simultaneously.

The likelihood function is expressed in terms of the variance parameters, $\sigma^2 = \sigma v^2 + \sigma u^2$ and $\gamma = \sigma u^2 / \sigma^2$ (Battesse and Coelli, 1995). The parameter γ represents the share of inefficiency in the overall residual variance with values in interval 0 and 1. A value of 1 suggests the existence of a deterministic frontier, whereas a value of 0 can be seen as evidence in the favour of OLS estimation.

3.3.1 Stochastic profit frontier model specification

Profit efficiency in this study is defined as profit gained from operating on the profit frontier, taking into consideration farm-specific and WRS prices and factors. Given a farm that maximizes profit subject to perfectly competitive input and output markets and a singular output technology that is quasiconcave in the (n x 1) vector of variable inputs, and the (m x 1) vector of fixed factors (farm size), Z the actual normalized profit function which is assumed to be well behaved can be derived as follows:

Paddy-rice farm profit was measured in terms of Gross Margin (GM) which equals the difference between the Total Revenue (TR) and Total Variable Cost (TVC).That is:

$$GM(\pi) = TR - TVC = P.Q - WX_i \text{ ....(8)}$$

To normalize the profit function, gross margin (π) is divided on the both sides of the equation above by P which is the market price of the output (paddy) i.e. after harvest (farm level) and off-season prices (WRS).That is:

$$\frac{\pi(p,z)}{P} = \frac{(PQ - WX_i)}{P} = Q - \frac{WX_i}{P} = f(X_i, Z) - P_i X_i \text{ ....(9)}$$

Where: TR represents total revenue from sale of paddy product(s), TVC represents total variable cost spent in paddy-rice production and WRS operations (i.e. harrowing, fertilizer, storage, transport etc). TR was obtained by multiplying quantity of resources by their corresponding unit price. P represents price of output (Q), X represents the quantity of optimized input used, Z represents price of fixed inputs used, W represents, $P = W/p_i$ = which represents normalized price of input X_i while f (X_i, Z) represents production function.

An analysis of GM per acre and t-test statistics was employed to evaluate the relative profitability of the paddy crop grown by farmers. They were also used to estimate the cost of production and cost of marketing. The values obtained were used to compare WRS users and non-users.

The Cobb-Douglas profit function in implicit form which specifies production efficiency of the farmers is expressed as follows:

$$\pi = f(P_{ij}, Z_{ik}).\exp(V_i + U_i)\text{, i = 1, 2....n} \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots (10)$$

Where: π, P_i, Z, V_i and U_i represents; the profit efficiency is expressed as the ratio of predicted actual profit to the predicted maximum profit for a best-practiced paddy-rice farmer at farm level and in WRS. This is represented as follows:

3.3.2 Profit efficiency

$$(E\pi) = \frac{\pi}{\pi^{\max}} = \frac{\exp[\pi(p,z)]\exp(\ln V)\exp(\ln U)\theta}{\exp[\pi(p,z)]\exp(\ln v)\theta} \ldots\ldots\ldots\ldots (11)$$

Farmers specific profit efficiency is again the mean of the conditional distribution of U_i given by $E\pi$ and is defined as: $E\pi = E[\exp(U_i)/E_i]$ $E\pi$ takes the value between 0 and 1. If $U_i = 0$ *i.e.* on the frontier, obtaining potential maximum profit given the price it faces and the level of fixed factors. For $U_i > 0$, the farm would be inefficient, and losses profit as a result of inefficiency.

Regarding this study, Coelli (1996) model was used to specify the stochastic frontier function with behavior inefficiency components and to estimate all parameters together in one step Maximum Likelihood Estimation (MLE). The profit efficiency of paddy-rice farmers in *i* in the context of the stochastic frontier profit function was defined as:

$$\ln \pi' = \beta_o + \sum_{j=1}^{6} \beta_j \ln P'_j + \frac{1}{2} \sum_{j=1}^{2} \sum_{k=1}^{2} \beta_{jk} \ln P'_j \ln P'_k + \sum_{j=1}^{6} \sum_{l=1}^{1} \beta_{jl} \ln P'_j \ln Z_l + V - U$$

(12)

Where:

π' = restricted profit (computed as total revenue less variable cost) normalized by price of specific average paddy-rice output (P_y)

P' = price of the *j*th input (P_j) normalized by the average paddy-rice output price (P_y)

j = 1, fertilizer price; 2, harrowing price; 3, transport price; 4, storage price

Z_l = quantity of fixed input, l

l = farm size (number of acres)

v = two sided random error

u = one sided half-normal error

ln = natural logarithm

β_0, β_j, and β_{jk} are parameters to be estimated

In this C-D function the coefficients of the variable (elasticity) indicate the responsiveness of the quantity (output) obtained as a result of a unit change in input used which are “fertilizer, area, and other inputs”. Assuming that errors are small and normally distributed such a logarithmic transformation of variables presumes a nearly normal distribution of errors in the data. By using this model, it was expected that more than one factor used by paddy-rice farmers would have a positive influence on the paddy profits.

3.3.3 Technical inefficiency model

Profit-loss is defined by Rahman (2003) as the amount that has been lost due to inefficiency in production given prices and fixed factor endowments and is calculated by multiplying maximum profit by (1 – PE). The maximum profit per paddy-rice grown is computed by dividing the actual profit per acres of individual farms by its efficiency score. To identify factors associated with profit-loss, a multiple regression model was estimated as follows:

The inefficiency model (Ui) is defined by:

$$U_i = \delta_0 + \delta_1 L_{1i} + \delta_2 L_{2i} + \delta_3 L_{3i} + \delta_4 L_{4i} + \delta_5 L_{5i} + \delta_6 L_{6i} + \delta_7 L_{7i} \text{................}(13)$$

Where: δ_0 is a constant, δ_i are model coefficient and L_1, L_2, L_3, L_4, L_5, L_6, L_7, represent household size (number), farming experience (years), level of education (years), distance from household, distance from farm and distance from nearest warehouse and option of being a WRS user of non-user was treated as (dummy variable). These socio-economic variables were included in the models to indicate their possible influence on the profit efficiencies of the paddy-rice farmers (determinants of profit efficiency). The estimate for all parameters of the stochastic frontier profit function and the inefficiency model were simultaneously obtained using the program FRONTIER VERSION 4.1d.

CHAPTER FOUR

4.0 RESULTS AND DISCUSSIONS

4.1 Results Based on Key Variables

Socio-economic characteristics have significant implications on how the household behaves in production and marketing. The interaction of these variables can influence negatively or positively, the level of output in rice farms.

It has been revealed that the paddy farms were generally small with average sizes of 2.3 acres which is almost equivalent to one hectare. Also, the average level of education of the paddy-rice farmers was almost 7 years of schooling, whereby, years of farming experience reported to be less than 10 on average. On the other hand, the travelling distance for smallholder paddy rice farmers from their residence to the farmstead is more than the distance from places farmers residing to the nearest warehouses (Table 2).

Table 2: Descriptive statistics of the variables in the stochastic frontier and inefficiency models

Variables	Mean	Standard Deviation
Number of Household members	4.7	2.1
Experience (Years)	9.5	11.9
Education Level (Years)	7.1	2.4
Distance – from Household (Unit)	39.2	111.6
Distance – from Farm (Unit)	14.6	35.9
Distance – from nearest Warehouse (Unit)	41.5	104.4
nbership to Farmer Organization		
Total Observation	172	
Total Observation (Store their Produce)	63	

Membership to FO using WRS had a significant influence due to collective bulking of paddy at reasonable volumes. Marketing structure alone cannot improve the whole system of production, and it will depend largely on how the social structure is organized. While household is the basic unit of production in all sectors of the economy as it provides labour to farms, the combination of efforts is noted to be necessary in developing industries such as paddy-rice in making sure that the WRS management, and source of all other people involved in the marketing chain is closely linked to collective marketing mechanism to influence volumes hence attract potential buyers.

4.1.1 Paddy costs, profits and prices

It was also found from estimated results that, paddy-rice farmers are getting higher profit if they sell their produce in off-season rather than soon after harvest. This is due to higher prices on average which had been experienced during the off-season period. **Error! Reference source not found.** present summary statistics for the various variables used in arriving to this conclusion.

Table 3: Paddy costs, profits and prices

Variables	Mean	Standard Deviation
Price – After Harvest (TAS/100Kg)	68 578	37 005
Price – Off Season (TAS/100Kg)	109 180	29 058
Profit – After Harvest (TAS)	467 128	690 408
Profit – Off Season (TAS)	770 743	938 006
Farm Size (Acres)	2.3	1.7
Harrowing (TAS)	134 685	250 540
Seeds (TAS)	62 484	120 884
Sowing (TAS)	40 786	88 165
Weeding (TAS)	121 832	212 414
Fertilizer (TAS)	39 878	52 537
Bird Watching (TAS)	20 560	42 142
Threshing (TAS)	64 317	86 338
Winnowing (TAS)	31 707	43 215
Transport (TAS)	64 664	128 567
Gunny Bag (TAS)	16 280	19 694
Rope (TAS)	2 639	3 870
Load + Unload (TAS)	6 446	14 688

Source: Author Survey 2013

4.1.2 Input use and their ratio

Based on basic features which have been presented in paddy-rice production structure, namely, the input shares and profit for whether farmers would sell their produce soon after harvest or off-season including changes in variable input prices and fixed factors. Represents major inputs which used in production of paddy-rice and their corresponding ratio of use. It was shown that, farmers are spending significant amount of financial resources for harrowing and weeding by 22.2% and 20.1% of total production cost respectively. Whereby, less amount of money has been spent for bird watching, gunny bag, rope, loading and unloading. This could be associated with the use of family labour into some of these activities.

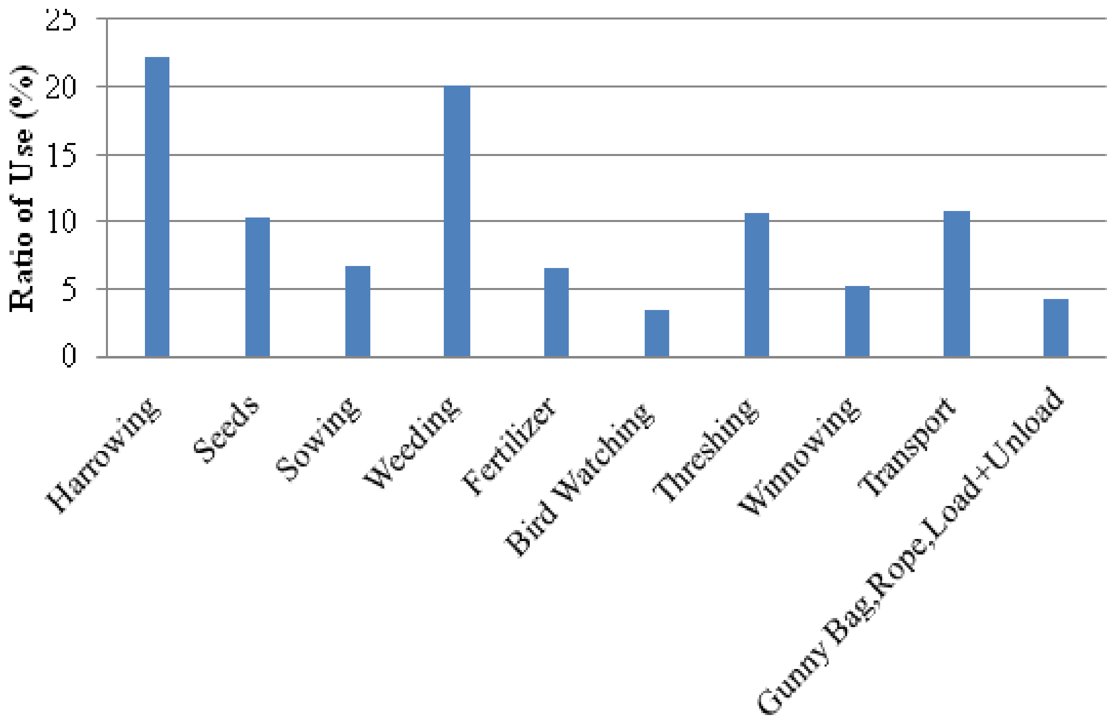

Figure 4: Inputs use ratio

Moreover, farmers were getting a reduced amount of produce (technically inefficient) compared to what was expected. This could be attributed to lesser use of fertilizer; only 6.6% of total production costs have been spent on fertilizers. In this regard, farmers tend to use rates which are not recommended for some of these inputs hence experiencing lower level of paddy production. This is not a surprise; the same phenomenon has been reported from other crops such as coffee (Mwakalobo, 2000; Mwinuka, 2013).

4.1.3 Price levels of paddy-rice for various periods

The price pattern of paddy-rice in Kilombero District has been changing overtime with slight fluctuations. Generally, price of produce has been smaller during harvest season compared to off-season. The differences between prices and corresponding profits during harvest and off-season are presented in Figure 6. Thus, farmers who manage to store their paddy are also benefiting with higher prices. In this regard, farmers who were involved in WRS are somehow better off compared to those who were not involved in the system. It has been revealed that, some paddy-rice farmers double their profit after selling the produce off-season or use WRS and sell at the right time when prices are highest

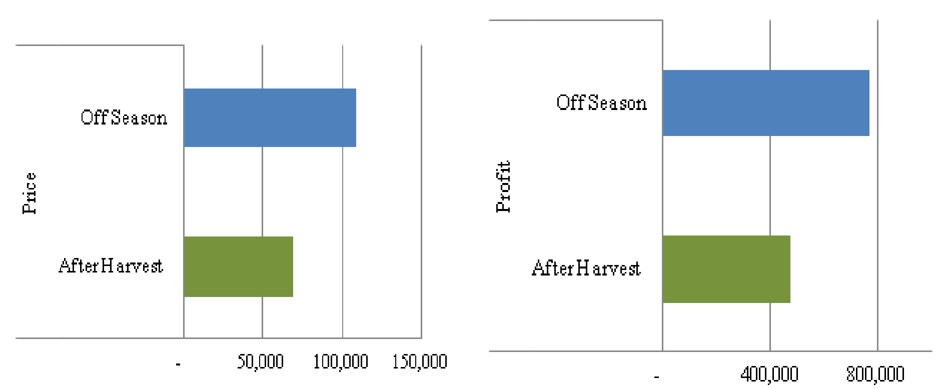

Figure 5: Level of prices and profits during off season and after harvest

In this regard, as mentioned above, level of prices tend to vary overtime. Off course, the higher the paddy-rice supply in Kilombero district also the corresponding price tend to lower and vice versa is true when supply is low in the market. Represents average prices level for paddy-rice in various months in a year.

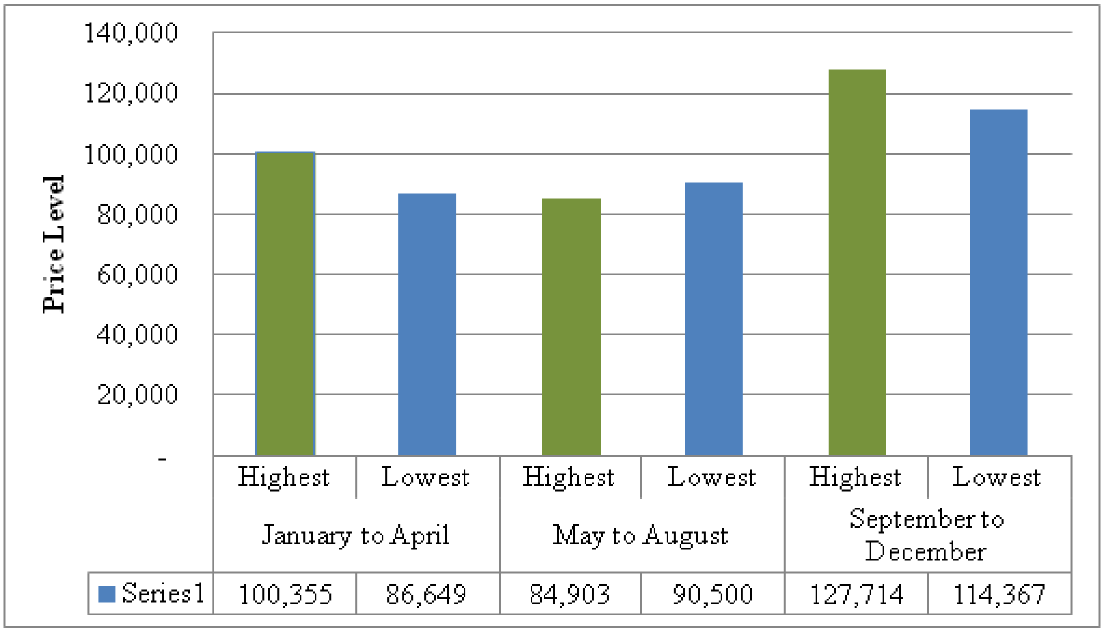

Figure 6: Average price levels of paddy-rice for various periods

On the basis of this study is concerned, it was revealed that, there was a noticeable time for farmers to sell their produce at profit. Above (represent average of year 2012/2013), the period between September and December is the profitable interlude for farmers to sell their produce. During this period, both "highest" and "lowest" prices were reported to be higher compares to other month mentioned in an annum. However, the period during the beginning of January showed that some farmers experienced and benefited from higher prices of their produce.

4.2 Hypothesis Testing

4.2.1 H1: The Kilombero paddy-rice farmers are profit efficient through using the WRS

The decision on the hypothesis was based on the results found after examining the parameter estimates of the production frontier and factors that affect the efficiency of the smallholder paddy-rice farmers, investigation on the validity of the model (equation 12) and (equation 13) chapter three, was used for analysis. The test for the null hypotheses for the parameters in the frontier production functions and in the inefficiency models were performed using generalized likelihood-ratio test statistic defined by λ=2{log[L(H1)]}, where L(H0) and L(H1) denote the value of likelihood function under the null(H0) and alternative (H1) hypotheses, respectively. The decision was based on the notion; if the null hypothesis is true, the LR test statistic has an approximately a chi-square or a mixed distribution with degrees of freedom equal to the difference between the number of parameters in the restricted and unrestricted models. First null hypothesis is tested H0: $\gamma=\delta_0=\delta_1=\ldots\delta_{10}=0$, which specifies that the technical inefficiency effects are not present in the model i.e The Kilombero paddy-rice farmers are economically efficient and have no room for inefficiency growth.

Based on the ML estimates results of the production frontier as presented in Table 4, the hypothesis is rejected as gamma parameter is 0.999 significant at 1 percent probability level, which means about 99 percent of the disturbance term is due to inefficiency. The specifications for the inefficiency effects as defined before in chapter three were obtained using FRONTIER 4.1 (Coelli, 1996). The results of the profit frontier was based on generalized estimated variables are; Fsize = farm size, Harr = harrowing, Sed = seeds, Wed = weeding, Fert = fertilizer, Thr = threshing, Win = winnowing, Tras = transport, Gub = gunny bags, Rop = rope.

Table 4: Maximum likelihood estimates (MLE) of translog stochastic frontier profit function and inefficiency model for Kilombero WRS

Table 4: Profit function

Variable	Parameter	Coefficient	Std Error	T-ratio
Constant	β_0	3.553***	0.005	777.9
lnShel	β_1	0.437***	0.002	223.7
1/2lnShelXlnShel	β_2	0.045***	0.0006	72.20
lnDry	β_3	-0.046***	0.001	-47.68
lnTras	β_4	0.150***	0.001	120.3
1/2lnTrasXlnTras	β_5	-0.024***	0.0003	-89.31
lnMat	β_6	0.743***	0.003	246.2
lnStor	β_7	0.031***	0.005	5.684
1/2lnStorXlnStor	β_8	-0.006***	0.0009	-6.790

Table 5: Inefficient effects

Variable	Parameter	Coefficient	Std Error	T-ratio
Constant	δ_0	7.541***	2.114	3.567
Household Size	δ_1	-2.222***	0.956	-2.326
Education Level	δ_2	-1.753**	0.967	-1.812
Farmer's Experience	δ_3	-0.731*	0.504	-1.452
Distance from Household	δ_4	-0.012	0.244	-0.050
Distance from Farm	δ_5	0.161	0.313	0.514
Distance to nearest WH	δ_6	-0.188	0.206	-0.911
Variance Parameters				
$\sigma^2=\sigma_u^2+\sigma_v^2$	σ^2	3.600**	1.697	2.121
$\gamma=\sigma_u^2/\sigma_u^2+\sigma_v^2$	Γ	0.999***	0.3E-07	0.27E+08
Log Likelihood	LLF	-83.97		
Number of Observations		63		
Mean Technical Efficiency		37.9%		

Note: *** Significant at 1 percent level (P<0.01)

** Significant at 5 percent level (P<0.05)

* Significant at 10 percent level (P<0.10)

Also, Shel = shelling, Dry = drying, Tras = transport, Mat = material, Stor = storage.

As presented in Table 4a above, based on parameters results of the given profit function, all costs which were associated with WRS are significantly (P < 0.01) influencing level of WRS profit efficiency. It is worth mentioning that, the costs for drying, transporting and storing paddy-rice are significant negatively influencing WRS profit efficiency when they increase further (Table 4a). Hence, any initiative which would target minimizing transport and/or storage costs around the available warehouses in Kilombero would positively increase profit efficiency of farmers who are using WRS for the paddy-rice, thus, improve their livelihood and reduce poverty level.

4.2.1.1 The influence of using WRS and not –using on farmers profit

Despite the inefficiencies of WRS operations and other farm level inefficiencies for farmers who are involved in the WRS and those who are were not to store produce in the warehouse, the result revealed that it was to store produce on WRS compared with storage of the same produce on farm (Figure 8). Figure 8 represents average costs in terms of shares for whether farmers store their paddy-rice produce on designated warehouse, store on farm or sell after harvest. Average costs which were associated with selling produce after harvest made them to be small compared to other criteria mentioned earlier, however, farmers were losing significantly due to lower prices if they sell their produce after harvest. Thus, warehouse storage was plausible option for either minimizing costs or maximizing profit for farmers; however, the WRS was not operating efficient because of other factors noted to be related on the number of farmers belonging to farmer organization or primary society depositing the produce (Figure 6, Figure 8 and Table 6).

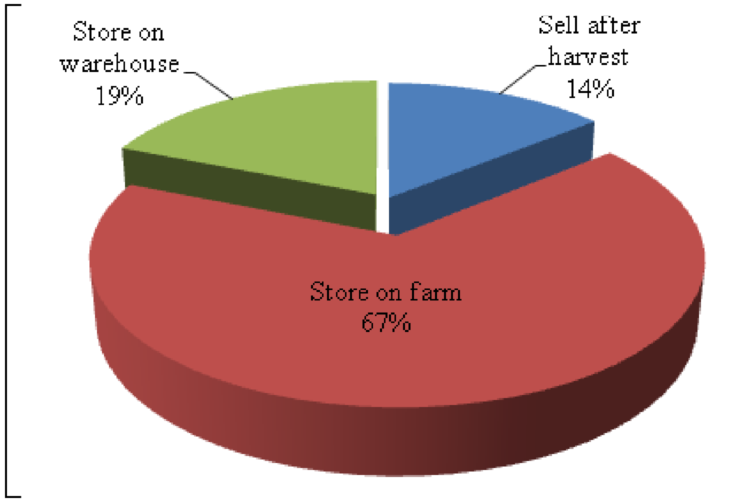

Figure 7: Shares of costs on averages

Error! Reference source not found. represents average costs in terms of shares for whether farmers store their paddy-rice produce on designated warehouse, store on farm or sell after harvest. Average costs which were associated with selling produce after harvest made them to be small compared to other criteria mentioned earlier, however, farmers were losing significantly due to lower prices if they sell their produce after harvest. Thus, warehouse storage was plausible option for either minimizing costs or maximizing profit for farmers (Figure 6,). It was further revealed that, the use of WRS will be useful if is done in connection to improving farmer organization service charters so that more members can join for collective bulking of paddy to get reasonable volumes in time of storage.

From the total paddy-rice farmers considered, 55 percent are members of farmer based organization (WRS users as treatment group) and the remaining 45 percent are found to be non-members. Paddy –rice farmers belonging to farmer based organization are more literate, older, have large farm size, travel longer distance to the market relative to non-members

4.2.1.2 Distribution of farm level efficiency scores

The distribution of farm level profit efficiency scores of paddy-rice farmers is presented in Table 6. The average farm level profit efficiency score was 44.5% implying that the average farm producing paddy could increase profits by 55.5% through improving their technical and allocative efficiency. Paddy-rice farmers exhibited a wide range of profit inefficiency in the respective production season, ranging from 97.9% less than the maximum profit to 2.1% less than the same. This is not surprising, observation of wide variation on profit for paddy-rice farmers were also reported in Uganda, Bangladesh and Pakistan. For instance, Rahman (2003) and Ali and Flinn (1989) reported the mean profit efficiency level of 0.77 (with a range from 16.8 to 94.1%) and 0.69 (with a range from 13 to 95%) for rice producers in Bangladesh and Pakistan respectively.

Despite the wide range of inefficiencies of farmers in the present study, more than 25% of farmers have more than 60% efficiency level. In this regard, most of the paddy-rice farmers seemed to be skewed towards profit efficiency of less than 59% (Table 5 and). Moreover, the results imply that a considerable amount of profit can be obtained by improving further technical and allocative efficiency of paddy-rice production in Kilombero.

Table 6: Frequency distribution of farm level TE scores with respect to membership

	NON-MEMBER	MEMBER	ALL
Above 80%	2	3	5
70% - 80%	10	12	22
60% - 70%	9	10	19
50% - 60%	14	17	31
40% - 50%	12	14	26
30% - 40%	13	11	24
20% - 30%	6	8	14
10% - 20%	5	11	16
below 10%	6	9	15
TOTAL	**77**	**95**	**172**

Production / profit efficiency and distribution

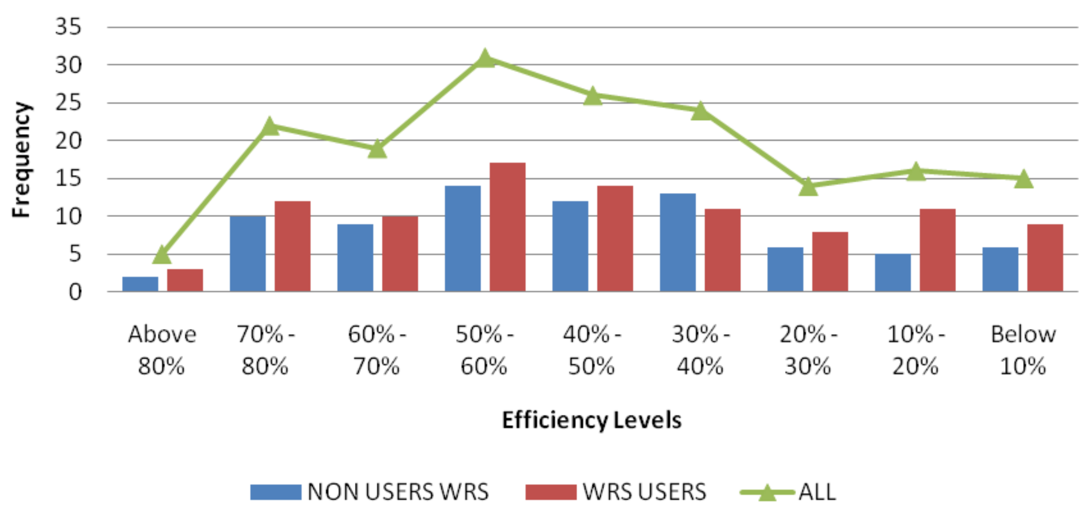

Figure 8: Distribution of farm level TE scores

Note: Average score (TE or PE) is 44.5%

4.2.2 H2: Socio-economic factors for farmers using WRS do not significantly affect the overall efficiency of paddy-rice farmers in Kilombero.

The second null hypothesis which is tested is H0: =…=10=0 implying that the farm-level technical inefficiencies are not affected by the farm/farmer-oriented variables, policy variables and/ or socio-economic variables (included in the inefficiency model have collectively significant contribution in explaining technical inefficiency effects for the paddy-rice farmers. The results of ML ratio test (LR=0.19) confirms that farmers' low and variable productivity predominantly relate to the variance in farm management (efficient use of available resource). The hypothesis is rejected as gamma parameter (Table 5) is 0.889 and significant at 5 percent probability level, which means about 99 percent of the disturbance term is due to inefficiency. Thus, the inclusion of the technical inefficiency term is a significant parameter to the model. In addition, a stochastic production frontier is estimated as a test of robustness in the choice of functional form. The form of this model encompasses the Cobb-Douglas form.

Moreover, Table 6 presents results for testing hypothesis that the farm level efficiency effects jointly estimated with profit frontier function are not simply random errors. The key parameter is $\gamma = \sigma_u^2/\sigma_u^2+\sigma_v^2$, which is the ratio of the errors in equation (10) as stipulated in the chapter three and is bounded between zero and one, where if $\gamma = 0$, inefficiency is not present, and if $\gamma = 1$, there is no random noise. On the basis of Table 2 results, the estimated value of γ is 0.889 which is coming what may close to 1 and is significantly different from zero, thereby, establishing the fact that a high level of inefficiencies exist in Kilombero paddy-rice farming.

Table 7: Maximum likelihood estimates (MLE) of stochastic frontier inefficient effects for Kilombero paddy-rice farmers

Variable	Parameter	Coefficient	standard-error	t-ratio
Constant	delta 0	-0.349	1.056	-0.330
Hhold Size	delta 1	-0.186	2.977	-0.625
Edu Level	delta 2	0.506	4.398	1.150
Farmer’s Exp	delta 3	-0.297	0.379	-0.784
Distance from Home	delta 4	-0.098	0.109	-0.899
Distance from Farm	delta 5	-0.284	0.144	-1.972
Distance from WRS	delta 6	-0.139	0.086	1.617
Membership to org.	delta 7	0.244	0.290	0.842
sigma-squared		0.889***	0.356	2.498
gamma		0.870	0.433	0.201

log likelihood function = -0.23214155E+03

LR test of the one-sided error = 0.199332394E+02
with number of restrictions = 9
[note that this statistic has a mixed chi-square distribution]

Number of observations=172
Mean Technical Efficiency 44.5%

Note: ***; **; * Significant at 1 percent level (P<0.01), 5 percent level (P<0.05), and at 10 percent level (P<0.10) respectively

4.2.2. 1 Factors explaining WRS iinefficiency (Socio-economic factors)

The impact of socio-economic factors accounting for this inefficiency in WRS for paddy-rice production is presented in the lower panel of Table 4. Based on prior assumptions which guided the investigation of the given variables, it was expected that, most of them would be positively related to efficiency such as household size, farmers’ experience of growing paddy-rice, and level of education; while distance from household, from farm and from nearest warehouse would be negatively related to efficiency.

Generally, despite the mentioned prior assumptions, most of factors which were expected to positively influence efficiency did the vice versa. For instance, level of education was significantly ($P<0.05$) negatively impact on WRS efficiency. This is not surprising, because their average level of education was below eight, and according to similar results which had been reported in the past analyses of technical efficiency in Bangladesh rice production (Rahman, 2003); the average education levels of less than eight years (Table 4b) seemed to not clearly explain the role of education. It was further noted that paddy-rice farmers with no education seemed to incur higher production costs hence experiencing higher profit loss and performed at significantly lower levels of profit efficiency within WRS, hence their effect was not well captured in the regression analysis of the present study. On the other hand, farmers who are located nearby warehouses are experiencing higher profit efficiencies within WRS compared to those who are located very far from respective warehouse. This is due lower transport costs which were experiences by those paddy-rice farmers who were not very far from warehouses. Not only that, but also the distance from a paddy-rice farm to the household also had the related impact on WRS profit efficiencies. Thus, the larger the distance the less the WRS profit efficiencies revealed from farmers (Table 4b).

4.2.2.2 Implications on being a member and non-member of farmer based organization

AKIRIGO is apex membership based organizations which facilitate and represent issues of concerns on behalf of Kilombero rice growers. According to their annual report based on the farming season 2011/2012, the organization indicates reduced commitment of members towards using the WRS. This was a concern raised by members after AKIRIGO failed to meet some of the members' objectives such as providing on service like supply of inputs, on-time assurance of loans and finding reliable buyer of the produce deposited in the WR. The organization information is not different from the presented results such that the results are found to be insensitive to hidden bias and contradicts the idea that farmer based organizations enhance members efficiency by easing access to productive inputs and facilitating extension linkages.

From the total paddy-rice farmers considered, 55 percent are members of farmer based organization (WRS treatment group) and the remaining 45 percent are found to be non-members. Paddy –rice farmers belonging to farmer based organization are more literate, older, have large farm size, travel longer distance to the market relative to non-members.

From the results, (Table 7 and Table 8) the descriptive statistics show a higher level of technical efficiency among non-members than members.

Table 8: Descriptive statistics technical efficiency

	N	Mean	Std. Deviation	Std. Error	95% Confidence Interval for Mean		Minimum	Maximum
					Lower Bound	Upper Bound		
Non member	77	.45494	.212390	.024204	.40673	.50314	.030	.810
Member	95	.43621	.227330	.023324	.38990	.48252	.060	.830
Total	172	.44459	.220328	.016800	.41143	.47775	.030	.830

The results reveal that, average technical efficiency of members and non-members are 0.43 and 0.45 respectively. However mean difference between members and non-members is not statistically significant. This means that there is no significant difference in the technical efficiency of members and non-members of farmer based organization. This imply that, while farmers who use WRS seem to be using less costs compared to non users, it does not guarantee them to be more efficient than their counter parts. The indication is that, most likely the motivation of using WRS is not driven by the cost of storage only. As it was identified by studies in raw Cashew nut marketing, more volumes are key in influencing buyers to follow WRS which have reasonable storage of produce. For the case of Kilombero paddy-rice farmers, it was known that most of WR are actually functioning at their lowest capacity (AKIRIGO, 2013).

Table 9: ANOVA technical efficiency

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	.015	1	.015	.306	.581
Within Groups	8.286	170	.049		
Total	8.301	171			

However, Binam *et al* (2003) found a negative and statistically significant relationship between membership in a farmers' association and technical efficiency for coffee farmers in Cote d' Ivoire. The importance of membership in farmer organizations was also reported by Idiong(2007) among smallholder swamp rice producer crop producers in Nigeria; and Tchale(2009) among smallholder crop producers in Malawi. Collectively they observed that farmers who are members in producer organizations are able to benefit not only from shared knowledge among themselves with respect to modern farming methods, but also from economies of scale in accessing input markets as a group. Hence, such farmers become more technically efficient in production.

4.2.3 Decision on the Hypothesis

H1: The Kilombero paddy-rice farmers are profit efficient through using the WRS

The hypothesis is rejected as gamma parameter (Table 5) is 0.999 and significant at 5 percent probability level, which means about 99 percent of the disturbance term is due to inefficiency. Thus, the inclusion of the technical inefficiency term is a significant parameter to the model

H2: Socio-economic factors for farmers using WRS do not significantly affect the overall efficiency of paddy-rice farmers in Kilombero.

The hypothesis is rejected as gamma parameter (Table 6) is 0.898 and significant at 5 percent probability level, which means about 99 percent of the disturbance term is due to inefficiency. Thus, the inclusion of the technical inefficiency term is a significant parameter to the model

4.3 WRS Roles, Constraints and Suggested Solutions

This section attempts to consolidate the earlier discussion by presenting roles and constraints of the WRS and finally coming out with suggested solutions presented by farmers during the survey. Figure 10 presents WRS roles, constraints and suggested solutions as a summary of main points which emanated from paddy-rice farmers surveyed.

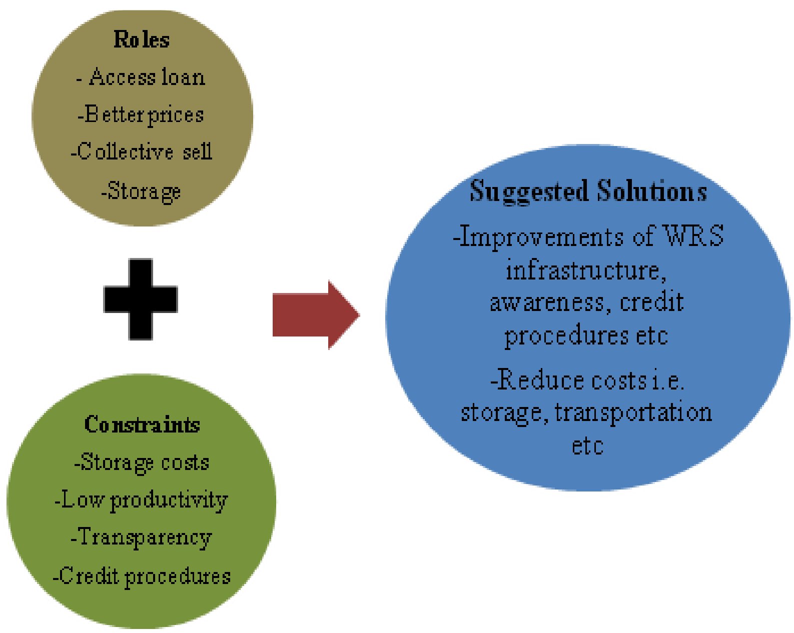

Figure 9: WRS roles, constraints and suggested solutions

CHAPTER FIVE

5.0 CONCLUSIONS AND RECOMMENDATIONS

5.1 Conclusions

5.1.1 Summary of key findings

The result on the study conducted in Kilombero district was based on qualitative and quantitative information collected from respondents who included smallholder farmers and Kilombero based WRS main stakeholders such as (AKIRIGO, NMB, RUDI and Tanzania Warehouse Licensing Board). The empirical analysis was based on stochastic profit frontier functions to analyse profit efficiency of Kilombero paddy-rice farmers using WRS. A total of 172 paddy-rice farmers were involved during the survey, whereby, 95 out of them only 63 were associated with direct storage of paddy in the warehouse during that season and 77 were not associated with WRS.

The study overall objective was to analyze profit efficiency of Kilombero paddy-rice farmers using WRS and recommend policy measures for improving efficiency of the rice marketing systems. To meet this objective the following two specific objectives and their main resulting conclusion are discussed below:-

5.1.1.1 The first specific objective was to estimate and compare the profit efficiency between paddy-rice producers using WRS and non users.

The analysis was quantitative based on the estimation of profit efficiency on farmers, using WRS and later comparing their efficiencies with non users of WRS.

The results from computed measures of profit efficiency at farm level show a wide range of variation. The mean level of efficiency for paddy-rice farming was 44.5%. These point out that, there are no difference in technical efficiency, between WRS users and non WRS users, but potential opportunities for increasing profit of paddy-rice farmers through farming and using WRS as the business model. This would be achieved by improving technical and allocative efficiency at farm level.

5.1.1.2 The second specific objective was to identify socio-economic factors that influence profit efficiency of Kilombero paddy-rice farmers.

This was done by including factors which would likely affect efficiency such as education, age, gender, labour, household size and being a member of farmer organization linked to WRS. These factors were treated as variables and regressed after determining the efficiency level using profit frontier approach. It was found that, the impact of socio-economic factors accounted for inefficiency in WRS for paddy-rice production as presented in the lower panel of Table 4 was not significant to both members and non members who used WRS; But, it is worth mentioning that, the level of education for most of farmers was not sufficient to have positive impact on level of efficiency. However, the location of the WRS close to farmers proximity indicated significant difference; the near the distance of farmers from warehouse the higher the profit a farmers would get. Thus, transport and storage costs revealed to have significant impact on the use of WRS, hence, any initiative for reducing them would significantly increase level of efficiency in Kilombero and the vice versa is also true. Moreover, it was not costly to store produce using WRS compares to store on farm. Also, it was profitable to sell produce off-season compared to after harvest.

In this regard, farmers are advised to sell the produce between September and December, whereby, both minimum and maximum prices were reported to be highest compared to other periods. Thus, farmers can easily increase income hence improve their livelihoods and reduce poverty through paddy-rice subsector.

5.2 Recommendations

On the basis of the findings of this study, the following are key recommendations to be followed by difference stakeholders currently involved in WRS.

5.2.1 Farmers

It is economically known that at farm level, the decision made by a farmer is to maximize the profit given the available resources. On this production point of view, it is true to mention that both technical and allocative efficiencies must be met by a farmer to produce the maximum feasible output as utilization of inputs are in optimal proportions given the observed input prices. As it was realized, farmers are getting little in the business hence not being able to meet their basic needs as a result of a number of factors, one being input availability and use, storage costs and loan guarantee. Local government and stakeholders should organize them, supply appropriate input at affordable price while providing time-to-time trainings on the use, by the use of extension officers, research and training institutions on agribusiness aspects to quantify and analyze logistics & operation costs such as storage and transport cost. This will impart knowledge to them on how to encounter every cost in the production process, including the family labour. Efficiency in input combination is also a knowledge gap need to be filled by trainers. This was noted for both farmers who are members and non members of WRS the reason is because at production level, WRS was thought to offer better price to farmers at time of harvest due to their collective bulking mechanism to guarantee buyer enough volumes.

5.2.2 The warehouse receipt system (WRS) potential stakeholders

Within the WRS operations farmers expected to be provided with subsidized inputs through their groups. This was not true for farmers in Kilombero district at that time of study because most of the farmer groups and primary societies who were members to the WRS had experienced difficulties. One could be on the jaggon of belonging to a farmer based organization or primary society becoming a contradiction and making farmer's decision making process being difficult. This was revealed on the aspects of number of farmers using WRS being seen as efficient at relatively close level to non-users. This put the WRS being not that attractive to them hence opt for other open market system. However, the storage costs indications as reveled by the study shows non-users incur a lot of costs which is very much related to individual storage mechanism linked to very small volumes of produce which could be raised by collective bulking mechanism through WRS hence reducing storage costs.

According to (Akyoo and Mpenda, 2013), in their study , there is presented benefits of farmer groups and primary societies in making the WRS function in cashew nut marketing, the situation is not the same for Kilombero District paddy-rice farmers. It was observed that service provision was among the major issue hampering functionality of WRS in Kilombero district. It is therefore recommended that, operators such as TWLB operation officers were the key stakeholders involved in the system need to improve their customer service and effectively collaborate with potential stakeholders involved such as AKIRIGO and RUDI.

5.2.3 Financial institutions

One of the main areas of members concern was timely provision of loans hampered by not getting competitive buyer of the stored produced hence the produce was not treated as collateral which was reflected as risk for banks such as NMB, Kilombero brunch to provide such loans on time. It is recommended that, while inputs are currently available at market price and some being available to beneficiary farmers through subsidy scheme, farm inputs such as improved seeds and fertilizer should be provided as loans in order for farmers to use them soon as the farming season starts to assure and encourage farmers to produce more and have get enough outputs which are sensible for attracting storage in the WRS. While WRS became an option for storage and marketing of paddy-rice, WRS is like any other business model, the system need to be implemented with high transparency involving fully all potential stakeholders particularly farmers. Farmers should be freely to opt where they can store their produce hence maximize profit and reduce food and income poverty considerably.

5.2.4 Policy makers

Government is advised to continue refining the legal and regulatory framework of the system in order for it to function effectively. Transaction costs such as transport and storage could be reduced by government budgets through allocation of enough funds to infrastructures such as rural roads and community warehouses. Understanding and harmonization of the legal structure and regulation is important to minimize confusion while the principals of management and functions of WRS will be generic. This can be also be improved by emphasizing on localization of operationalization especially on aspect of farmer inclusion and linkage to the system with respect to their apex organization service charters.

5.2.5 Areas for further research

While WRS useful and it was expected to work properly for farmers to be able to use their produce to get income enough to cover the family costs, the family matters ranked higher among the factors which make farmers to sell paddy- rice before time. Inability to sustain the family from season to season is caused by lacking the alternative source of money. The study recommends further research should be done in improving involvement, logistics and supply chain management to make WRS more attractive to farmers. Also thorough analysis should be done on other sectors which offer immediate alternative source of income to farming. Looking into Livestock and Aquaculture farming as alternative practice by farmers because is not very seasonal in terms of return. Developing small scale farms on dairying, piggery and poultry farming linked to commercial oriented buyers, collection centers are useful farm enterprise in filling this gap.

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APPENDICES

Appendix 1: Definition of Terms

Warehouse receipt system (WRS): This is a commodity marketing system that make use of paper or electronic documents of title (warehouse receipts) which stipulate the commodity, quality grade, location and ownership of the commodity deposited in the warehouse (USAID, 2010)

Warehouse Receipt (WR): Document issued by warehouse operators as evidence that specified commodities of stated quantity and quality have been deposited at particular locations by named depositors.

Depositor: Producer, farmer group, trader, exporter, processor or any individual of body corporate to whom Goods Received Note (GRN) for storage of grain has been issues

Goods Received Note (GRN): Grain storage receipt giving evidence of a quantity of grain deposited, grade and other information.

Warehouse operator: Any person who operates a grain warehouse

Efficiency: Defined as the ability to produce a given level of output at lowest cost

Economic efficiency: describes the way in which a given target is achieved and the costs are related to this process. In this study economic efficiency is therefore describing whether returns are higher than investment, or incomes are higher than costs, both at AMCOS/SACCOS and at individual farmer level.

Operational efficiency: is centred on whether inputs are delivered in time, affordable; whether loans are availed and repaid (repayments rates and defaults etc) and whether farmers are satisfied.

Appendix 2: Farmers Questionnaire

This study is conducted to assess Economic and Operational efficiency of Warehouse Receipt System (WRS) in Kilombero district .Information provided play an important role in formulating policies and programmes that will improve performance of WRS. All information will be treated as confidential. Your cooperation is highly appreciated.

Date of interview ____

Questionnaire number____

Name of enumerator ____

Farmers' name____

District____

Division____

Location (e.g kitongoji)________________ ______________________________

Village ____.

1.0 Farmers' background information

1.1Gender/sex: ☐ Male ☐ Female (*Tick where appropriate*)

1.2 Age (in years) ____

1.3 Relation to head (*Tick where appropriate*)

i) Head ☐

ii) Wife ☐

iii) Sibling ☐

iv) Other (specify)____

1.4 Education level (*Tick where appropriate*). Did you receive any education?

(1) YES ☐ (2) NO ☐. . If yes, mention number of years attended (e.g 7, 12 years):

i) Primary school______________________

ii) Secondary school______________________

iii) Tertiary. Specify______________________

iv) Others (*specify*)____

1.5 Household size (number of people in the household including the Household Head)____

	Age	**Activity**	**Family Labour(man days per activity)**
1.			
2.			
3.			
4.			
5.			
TOTAL			

1.6 How many acres do a) you have? ______________________________

b) you have under paddy production (2011/2012)? ____

1.7 How many years have you been in paddy farming? ___________

1.8 How many bags (100kg) in the 2011/2012 did **a**) you get per acre? ____

b) How much did you sell? ______________________

1.9 What is the sale price per bag (TZS)? a) Soon after harvesting?________

b) After storage in warehouse? ____

2.0 Physical and economic factors

2.1 What is the status of land tenure under paddy production: (1) Owner ☐ (2) Leasehold ☐ (3) Communal ☐ (*tick*)

Specify other ______________________

2.2) Do you access credit to purchase farm inputs? (*tick*)

Yes ☐ No ☐

2.3) Where do you access from? (*tick*)

(1) Farmer organization ☐

(2) Primary Society or SACCOs ☐

(3) Microfinance Institution ☐

(4) Government ☐

(5) Other. (Mention) _______________________

2.4) What form of credit do you access? (*tick*)

(1) Farm Inputs ☐

(2) Government Voucher-Ruzuku ☐

(3) Cash ☐

2.5) Are you a member of any Farmer organization-FO?

Yes ☐ No ☐

(Mention the name of FO)______________________

2.6) if yes, how many farmers organizations are you a member? _______________

2.7) what do you benefit from belonging to the organization?

I. Access to inputs. (1) YES ☐ (2) NO ☐

II. Access to training. (1) YES ☐ (2) NO ☐

III. Access to Credit. (1) YES ☐ (2) NO ☐

IV. Access to market information/ marketing of produce. (1) YES ☐) NO ☐

V. Assistance in bulking the produce. (1) YES ☐(2) ☐

VI. Sharing transport. (1) YES ☐ (2) NO ☐

VII. Sharing resources: Mention_______________

VIII. Other (Specify): _______________

2.8 If NO, why do you not belong to any farmer organization?

1. I do not see benefit_______________

2. I do not know any farmer organization_______________

3. Farmer organizations are not useful_______________

4. I do not know what farmer organization is_______________

5. Other (specify) _______________

2.9 Do you belong to any partnership project/program that Government and Development partners work on improving paddy production/marketing?

(1) YES ☐NO ☐ If YES, Mention the name of the project or program:

____

3.0 Sources of Agronomic and marketing information

3.1) How do you receive information about good agronomic practices?

1) Radio ☐
2) Television ☐
3) Group members ☐
4) Field days and exhibitions ☐
5) Newspapers ☐
6) Internet ☐
7) Mobile phone ☐
8) Others (*specify*) ________________________________

3.2) How do you receive marketing information (e.g. Prices)?

1) Radio ☐
2) Television ☐
3) Group members ☐
4) Field days and exhibitions ☐
5) Newspapers ☐
6) Internet ☐
7) Mobile phone ☐
8) Government-E.g extension workers ☐
9) Others (*specify*) ________________________________

4.0 Paddy crop production cost (2011/2012)

Total area under paddy 2011/2012 ______________ (acres)

INPUT	DESCRIPTION	UNIT	UNIT COST	QUANTITY	TOTAL
Land preparation (Harrowing)		ACRE			
Seed					
Broadcasting					
Direct sowing					

Nursery care					
Transplanting					
Weeding (per weeding*2)					
Fertilizer (DAP/UREA) in 50KG					
Irrigation (Water usage)					
Bird watching (for 30 days)		**DAYS**			
Casual labour					
Permanent labour					
	Collecting				
	Threshing				
	Winnowing				
	Transport (per bag)				
	Loading and unloading (per bag)				
Storage	Gunny bags				
	Sisal rope				
Phone					
TOTAL COST					

5.0 Information on WRS

5.1) Do you know about WRS (Tick) YES ☐ NO ☐

5.2) level of awareness of WRS (tick where appropriate)

1= Not aware at all ☐

2=Aware but does not participated ☐

3=Aware and participating ☐

5.3). If you are aware of WRS, how do you perceive it?

1= Not important ☐

2 = Important ☐

3 = Highly important ☐

4.3 Do you know the importance or role of WRS? Mention at least 4

I. ______________________

II. ______________________

III. ______________________

IV. ______________________

4.4) List constraints that you encounter in participating in WRS

Constraints ranks		**Perceived possible solution**	
1		1	
2		2	
3		3	
4		4	
5		5	

Constraints codes:

1=low farm productivity

2=lack of information

3= attaining paddy-rice quality standards required

4=transportation challenges

5=farmers group challenges

6=complexity in accessing credit

7=financial obligations

8=high storage costs charged by warehouse

6.0 Post harvest details

6.1) What do you do with your paddy produce surplus soon after harvest?

Varieties	Trading option	Number of bags(100kg)
SARO	On farm storage	
	Open sale	
	Sale WRS	
	Total marketable SARO	
	Sale	
	On farm storage	
	Warehouse storage	
	Total marketable paddy-rice produce	
	Sale	
	On farm storage	
	Warehouse storage	
	Total marketable paddy-rice produce	
	Sale	
	On farm storage	
	Warehouse storage	
	Total marketable paddy-rice produce	

6.2) Name of the nearest grain handler ____________________________________

6.3) Distance to the nearest market (from household) (km)______________

6.4) Distance to the nearest market (from the farm) (km)_____________

6.5) Distance to the nearest grain warehouse (km)____________________________

6.6) Total transport cost to the market (TZS)_________________________________

7.0 Post harvest costs

7.1) Indicate the post harvest costs on the paddy-rice produce per 100kg bag

Activity	cost per 100kg bag		
	Post harvest trading options		
	Sell after harvest	**On farm storage**	**Warehouse storage**
Shelling			
Drying			
Chemical costs			
Fumigation cost			
Renting of store			
Transportation cost			

Storage loss cost			
Material costs			
Interest cost on loan			
Loan arrangement fees			
Handling cost			
Storage cost			
Unofficial costs			
Total cost			

7.2 How much is household off-farm income per year (TZS)? __________

	Source	**Income(TZS)**
1.		
2.		
3.		
4.		
TOTAL		

8.0 Paddy-rice price movement

Month	Price per 100 kg bag(TZS)	
	Highest	Lowest
January		
February		
March		
April		
May		
June		
July		
August		
September		
October		
November		
December		

Thank you for responding.