

**Sokoine University of Agriculture**



**PhD Thesis**

**Smallholder Rice Farmers'  
Competitiveness within  
Agricultural Marketing Co-  
operative Societies in Selected  
Districts, Tanzania**

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March 2024**

**SMALLHOLDER RICE FARMERS' COMPETITIVENESS WITHIN  
AGRICULTURAL MARKETING CO-OPERATIVE SOCIETIES IN  
SELECTED DISTRICTS, TANZANIA**

*Thesis Submitted in Fulfilment of the Requirements for the  
Degree of Doctor of Philosophy of Sokoine University of  
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## EXTENDED ABSTRACT

Rice is the most important staple crop for most of the world's population, particularly in Asia and sub-Saharan Africa. Smallholder rice farmers account for a significant proportion of rice production worldwide. Yet, they face numerous challenges that limit their competitiveness in terms of Technical Efficiency (TE), profitability and access to agricultural information and market outlets in farming activities. Agricultural Marketing Co-operative Societies (AMCOS) have the potential to enhance smallholder farmers' competitiveness by sharing resources and knowledge. Yet, smallholder farmers' competitiveness in AMCOS has not sufficiently been explored in Tanzania. The overall objective of the study was to assess smallholder rice farmers' competitiveness in rice farming among smallholder farmers in Mbarali and Mvomero Districts of Tanzania. Specifically, the study sought to (i) Determine smallholder rice farmers' productivity and TE in rice farming, (ii) Estimate the profitability of smallholder rice farmers, (iii) Evaluate the contribution of AMCOS to agricultural information access by smallholder rice farmers in rice farming, and (iv) Assess the drivers of market outlet selection among smallholder rice farmers in the study area. A cross-sectional research design was employed whereby 382 respondents were randomly selected from three AMCOS during the 2021/22 cropping season. Data were collected through interviews and Focus Group Discussions (FGDs). Quantitative data analysis employed the Cobb-Douglas stochastic frontier model, Enterprise Budgetary Technique, Sensitivity Analysis, Ordinal Logistic Regression and Multivariate Probit Regression. IBM SPSS Statistics, Stata and Excel software were used for descriptive and inferential statistical analysis while content analysis was used to analyse qualitative data. The findings on TE showed that the mean TE indices for Kapunga, Madibira and "*Umoja wa Wakulima Dakawa*" (UWAWAKUDA) AMCOS were 84.9%, 87.6% and 79.1% respectively with a mean TE of 83.8% for the whole sample. Across AMCOS, it was found that intermediate costs, labour costs, fixed costs and quantity of fertilizer

influenced productivity ( $p < 0.05$ ) while access to training, water distribution, ploughing time, planting systems, and access to credit influenced TE ( $p < 0.05$ ). The study found an average Return on Investment of 0.42, a Benefit Cost Ratio of 1.42 and a Profit Margin of 24%. The level of profitability differed among co-operatives whereby UWAWAKUDA had the highest return per acre (TZS 524 417), followed by Kapunga (TZS 414 111) and Madibira (TZS 316 638). Smallholder rice farmers' Gross Margins were significantly affected by changes in Total Variable Costs, output price and yield per acre. Although smallholder farmers had access to adequate (52.6%), relevant (35.6%) and reliable (37.7%) agricultural information from the AMCOS, information on rice agronomy was the most important information accessed by the majority of farmers (77.2%). The adequacy of information was influenced by membership in social groups, access to rice agronomy information, financial information and information on value addition at  $p < 0.05$ . Wholesale, retail, millers, middlemen and private buyers were the existing market outlets among smallholder rice farmers with the majority (65.71%) of farmers selling to more than one outlet. The quantity of paddy sold, access to market information, smartphone ownership, access to credit, the quantity of rice sold and frequency of extension services were the important determinants of selection of market outlets of rice producers ( $p < 0.05$ ). The study concludes that rice farming in terms of TE has not reached a plateau and rice farms have been operating below the maximum level of production frontier; hence there is a potential for improvement to increase rice production by 16.2%, given the available technology. The smallholder rice production is profitable in the study area. AMCOS are potential platforms for providing good quality information in rice farming, and the majority of farmers access multiple market outlets, contributing to livelihood improvement. To enhance smallholder rice farmers' competitiveness, the Local Government Authorities, AMCOS and other stakeholders should improve drivers that lead to increased TE and profitability such as the water infrastructures, organizing markets and training programmes for farmers.

Stakeholders responsible for improving smallholder farmers' livelihoods should ensure farmers' access credits and such credits are channelled to rice farming. Local Government Authorities should put efforts to strengthen AMCOS by providing them with resources, training, and support to enhance their capacity to deliver accurate and timely information to farmers. This includes collaboration with agricultural extension service providers and leveraging their networks to access up-to-date information on agronomic practices, weather forecasting, and market trends to enhance farmers' competitiveness in rice farming. Policymakers should prioritize increasing smallholder rice farmers' access to market outlets by building rural infrastructures, improving market information systems, and promoting public-private partnerships.

## IKISIRI KUU

Mpunga ni zao kuu la chakula kwa idadi kubwa ya watu duniani, hasa katika Asia na Afrika Kusini mwa Sahara. Wazalishaji wadogo wa mpunga wanachangia sehemu kubwa ya uzalishaji wa mpunga ulimwenguni. Hata hivyo, wanakabiliwa na changamoto nyingi ambazo zinapunguza ushindani wao katika Ufanisi wa Kiufundi, faida, upatikanaji wa taarifa za kilimo na masoko. Vyama vya Ushirika wa Masoko ya Mazao ya Kilimo vina uwezo wa kuboresha ushindani wa wakulima wadogo kwa kushirikiana katika utumiaji wa rasilimali na maarifa. Hata hivyo, ushindani wa wakulima wadogo katika vyama hivyo haujachunguzwa vya kutosha nchini Tanzania. Lengo kuu la utafiti huu ilikuwa ni kutathmini ushindani wa wakulima wadogo wa mpunga kwenye Vyama Ushirika wa Masoko ya Mazao ya Kilimo katika Wilaya za Mbarali na Mvomero nchini Tanzania. Utafiti ulilenga (i) Kujua uzalishaji na ufanisi wa kiufundi wa wakulima wadogo wa mpunga, (ii) Kukadiria faida wanayopata wakulima wadogo wa mpunga, (iii) Kutathmini mchango wa Vyama vya Ushirika wa Masoko ya Mazao ya Kilimo katika upatikanaji wa taarifa za kilimo kwa wakulima wadogo wa mpunga, na (iv) Kuchunguza sababu za wakulima wadogo wa mpunga kuchagua masoko katika eneo la utafiti. Muundo wa utafiti wa usanifu muhula ulitumika ambapo wahojiwa 382 walichaguliwa kutoka Vyama Ushirika wa Masoko ya Mazao ya Kilimo vitatu katika msimu wa uzalishaji wa 2021/22. Data zilikusanywa kupitia mahojiano na majadiliano ya vikundi lengwa. Uchanganuzi wa kitaamuli kwa kompyuta ulitumia kielelezo cha mpaka cha *Cobb-Douglas*, Mbinu ya Bajeti ya Biashara, Uchanganuzi wa umakini (sensitivity analysis), *Ordinal Logistic Regression* na *Multivariate Probit Regression*. Takwimu za IBM SPSS, Programu za takwimu za stata na *excel* zilitumiwa kwa uchanganuzi wa takwimu wa maelezo na mkabala hitimizi huku uchanganuzi wa maudhui ukitumiwa kuchanganua data kitaamuli. Matokeo ya utafiti yalionyesha kuwa, kwa wastani ufanisi kwa vyama vya Kapunga, Madibira na Umoja wa Wakulima Dakawa (UWAWAKUDA) ulikuwa 84.9%, 87.6% na

79.1% kwa mfululizo na wastani wa 83.8% kwa sampuli nzima. Katika vyama hivi, ilibainika kuwa gharama za uzalishaji na wingi wa mbolea viliathiri tija katika uzalishaji ( $p < 0.05$ ) wakati upatikanaji wa mafunzo, usambazaji wa maji, wakati wa kulima, mifumo ya upandaji na upatikanaji wa mikopo uliathiri ufanisi wa kiufundi ( $p < 0.05$ ). Utafiti uligundua Mapato ya wastani ya uwekezaji ilikuwa TZS 0.42, Uwiano wa gharama kwa faida ulikuwa 1.42 na kiwango cha faida cha 24%. Faida ilitofautiana kati ya vyama vya ushirika ambapo UWAWAKUDA ilikuwa na faida ya juu zaidi kwa ekari (TZS 524 417), ikifuatiwa na Kapunga (TZS 414 111) na Madibira (TZS 316 638). Faida kwa wakulima wadogo iliathiriwa kwa kiasi kikubwa na mabadiliko ya gharama za uzalishaji, bei ya mazao na mavuno kwa ekari. Ingawa wakulima wadogo walipata taarifa za kutosha (52.6%), muhimu (35.6%) na za uhakika (37.7%) za kilimo kutoka kwenye vyama, taarifa kuhusu shughuli za shambani ndizo taarifa muhimu zaidi zilizofikiwa na wakulima wengi (77.2%). Utoshelevu wa taarifa ulichangiwa na uanachama katika vikundi vya kijamii, upatikanaji wa taarifa za kilimo cha mpunga, taarifa za kifedha na taarifa za uongezaji thamani ( $p < 0.05$ ). Uuzaji wa jumla, rejareja, wasagishaji, wafanyabiashara wa kati na wanunuzi binafsi ndiyo masoko yaliyokuwepo miongoni mwa wakulima wadogo wa mpunga huku wakulima wengi (65.71%) wakiuza kwa zaidi ya soko moja. Kiasi cha mpunga unaouzwa, upatikanaji wa taarifa za soko, umiliki wa simu janja, upatikanaji wa mikopo, wingi wa mpunga unaouzwa na huduma za ugani za mara kwa mara vilikuwa viashiria muhimu vya uchaguzi wa soko la wakulima wa mpunga ( $p < 0.05$ ). Utafiti unahitimisha kuwa kilimo cha mpunga kwa mujibu wa ufanisi kiufundi hakijafikia uwanda na mashamba ya mpunga yamekuwa yakifanya kazi chini ya kiwango cha juu cha mpaka wa ufanisi katika uzalishaji; hivyo basi kuna uwezekano wa kuboreshwa ili kuongeza uzalishaji wa mpunga kwa 16.2%, kutokana na teknolojia iliyopo. Uzalishaji wa mpunga kwa wakulima una faida katika eneo la utafiti. Vyama vya Ushirika wa Masoko ya Mazao ya Kilimo ni majukwaa yanayotoa taarifa bora katika kilimo cha mpunga, na wakulima wengi wana uwezo wa kupata masoko, hivyo kuchangia katika

kuboresha maisha. Ili kuongeza ushindani wa wakulima wadogo wa mpunga, Mamlaka za Serikali za Mitaa, Vyama vya Ushirika wa Masoko ya Mazao ya Kilimo na wadau wengine wanapaswa kuboresha maeneo ambayo yanasababisha kuongezeka kwa ufanisi na faida kama vile miundombinu ya maji, kuandaa masoko na programu za mafunzo kwa wakulima. Wadau wanaohusika na kuboresha maisha ya wakulima wadogo wanapaswa kuhakikisha upatikanaji wa mikopo kwa wakulima na mikopo hiyo inaelekezwa kwenye kilimo cha mpunga. Mamlaka za Serikali za Mitaa ziweke juhudi za kuimarisha Vyama vya Ushirika wa Masoko ya Mazao ya Kilimo kwa kuvipatia rasilimali, mafunzo, na msaada ili kuviongezea uwezo wa kutoa taarifa sahihi na kwa wakati kwa wakulima. Hii ni pamoja na kushirikiana na watoa huduma za ugani na kutumia mitandao yao kupata taarifa za kisasa kuhusu mbinu za kilimo, utabiri wa hali ya hewa, na mwenendo wa soko ili kuongeza ushindani wa wakulima wadogo katika kilimo cha mpunga. Watunga sera wanapaswa kuweka kipaumbele katika kuongeza upatikanaji wa masoko kwa wakulima wadogo wa mpunga kwa kujenga miundombinu ya vijijini, kuboresha mifumo ya taarifa za soko, na kukuza ubia kati ya sekta ya umma na sekta binafsi.

## DECLARATION

I, **CONSESA RICHARD MAUKI**, do hereby declare to the Senate of Sokoine University of Agriculture that this thesis is my original work done within the period of registration and that it has neither been submitted nor being concurrently submitted for a higher degree award in any other institution.

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Consesa Richard Mauki  
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Date

The above declaration is confirmed by:

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Prof. John N. Jeckoniah  
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Date

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Date

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## **DEDICATION**

This thesis is dedicated to the Almighty God who gave me strength and courage in several times of need. To my late father, Richard Peter Mauki who is not with us today to share the success of his lovely daughter. May the Almighty God rest his soul in eternal peace, Amen.

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**LIST OF ABBREVIATIONS AND ACRONYMS**

AMCOS	Agricultural Marketing Co-operative Society
ASDS	Agricultural Sector Development Strategy
BCR	Benefit-Cost Ratio
CGIAR	Global Research Partnership
EBT	Enterprise Budgetary Technique
FAO	Food and Agriculture Organisation
FGD	Focus Group Discussion
GM	Gross Margin
Ha	Hectare
IRR	Internal Rate of Return
KI	Key Informants
MT	Metric Tonnes
MVP	Multivariate Probit regression model
NPV	Net Present Value
NRDS	National Rice Development Strategy
ROI	The Return on Investment
SDG	Sustainable Development Goals
SFA	Stochastic Frontier Analysis
SPSS	Statistical Package for Social Sciences
SSA	Sub-Saharan Africa
TCDC	Tanzania Co-operative Development Commission
TCT	Transaction Cost Theory
TE	Technical Efficiency
TZS	Tanzanian Shillings
UNDP	United Nations Development Programme
URT	United Republic of Tanzania
UWAWAKUDA	“ <i>Umoja wa Wakulima wa Mpunga Dakawa</i> ”, i.e., Dakawa Rice Farmers’ Co-operative Society

## CHAPTER ONE

### 1.0 INTRODUCTION

#### 1.1 Background Information

Rice is an important staple food for more than half of the global population (CGIAR, 2016). It is regarded as one of the strategic crops and plays a great role in ensuring food security and employment in both developing and developed economies (Gadal *et al.*, 2019). Therefore, it is important to note that rice production is important in attaining the Global Sustainable Development Goal (SDG) number 2 on zero hunger. Countries worldwide need the crop so as to eradicate hunger and ensure food security by providing food and humanitarian relief and establishing sustainable food production by 2030 (UNDP, 2021).

In Africa, rice is not only a strategic food and economic crop but also a vital aspect of cultural heritage. For instance, the African rice whose scientific name is *Oryza glaberrima* is unique to Africa and is an integral part of the culture of some communities and has been grown for more than 2000 years (AfricaRice, 2020). Demand for rice is increasing at 6% annually faster than any other staple food in the region and is a vital source of income for more than 35 million smallholders, dietary energy and is the second most important source of calories in Africa (CGIAR, 2016; Africa Rice, 2020).

Rice is the second most grown food and commercial crop in Tanzania after maize. The 2019/2020 National Sample Census of Agriculture results show that 2.9 million MT of rice was produced, which is a more than 100% increase compared to the 2007/08 Agriculture Census which recorded 1.4 million MT (URT, 2020). Rice is produced in almost twenty-five (25) regions in Tanzania out of 31 regions of the country, the leading ones being Tabora, Morogoro, Mbeya and Geita (URT, 2017). For several decades, rice has been one of the widely produced crops that contribute to Tanzania's food and nutrition security, socio-economic development and country's

foreign exchange earnings (URT, 2019). Rice has been identified as a strategic crop by the Government of Tanzania (GoT) aiming at improving incomes, livelihoods of smallholder rice farmers and sustainably integrating them into the rice value chain.

In Tanzania, approximately 71% of rice farming land is dedicated to rain-fed lowland rice ecosystems, while another 20% is allocated to rain-fed upland rice ecosystems. Together, these rain-fed ecosystems account for approximately 91% of rice production in the country (URT, 2019). Only 9% of rice grown is under irrigated rice ecosystem. The irrigated ecosystem is the rice production system whereby rice farms have a guaranteed water supply throughout the farming season (Kitilu, 2019). It is characterized by the use of modern mechanization technology such as tractors, rice planters, agrochemicals and best farming practices. In this system most farmers in Tanzania have 1 to 2 seasons for rice planting per year. The improved rice varieties commonly used in this system include TXD 306 SARO 5 whose productivity ranges from 4.5 to 5.5 t/ha with great scope for further yield improvement (up to 8.5 t/ha) through improved crop management and further intensification (Kitilu, 2019). About 90% of rice produced in Tanzania is under a smallholder system with sizes of rice farms ranging from 0.9 to 3 ha, with an average farm size of 1.3 ha (URT, 2019; Rugumamu, 2014).

Smallholder farmers play a crucial role in global food security, and their competitiveness in the rice farming sector is essential for sustainable agricultural development. Enhancing smallholder farmers' competitiveness is an effective approach to increase returns to value chain actors, hence reducing rural poverty and improving livelihoods (Rigg, 2019; Abdul-Rahaman and Abdulai, 2020). To enhance the competitiveness among smallholder rice farmers in general, measures should include improved productivity, technical efficiency, enhanced profitability and access to market information (Antriyandarti, 2015). However, smallholder farmers' ability to catch up with the competition in the domestic as well as

international markets remains a major challenge in developing countries as smallholder farmers often find themselves in unfavourable bargaining positions with other actors (Trebin, 2014). Smallholder farmers face a number of challenges in the rice farming sector, including limited access to resources, market constraints, and low productivity. These conditions result in higher production costs that reduce smallholder farmer competitiveness along the value chains in Sub-Saharan Africa (SSA); hence smallholder farmers receive only a small fraction of the value of what they produce compared to other actors (Nkuba *et al.*, 2016; Senanayake 2016; Ngenoh *et al.*, 2019; Tray *et al.*, 2020).

Latruffe (2010) defines competitiveness as the ability to sell products that meet demand requirements in terms of price, quality and quantity and at the same time ensure profits over time that enable the firm to succeed. Smallholder farmers' competitiveness in rice farming means their ability to reduce costs, produce and sell profitably in a given market (Aikael, 2014). While transacting along the rice value chain, smallholder farmers benefit less from the chain in comparison with other actors like traders and collectors (Trebin, 2014; Gyau *et al.*, 2016; Ebata and Hernandez, 2017; Hao *et al.*, 2018).

Factors influencing smallholder farmers' competitiveness include information asymmetries, poor access to markets, lack of credits and inadequate collaborations (Mutero, 2016; Pigatto *et al.*, 2019). Also, it is argued that, if only one or some parts of the chain appropriate all the gains, then the value chain becomes unsustainable in the market (Goletti, 2004). Improved competitiveness in the rice value chain enhances returns to its actors (Rigg, 2019). The competitiveness rests on strategies to reduce costs which are attained through economies of scale in terms of input provision, technical assistance or commercial logistics through farmer organizations (Estelle and Danies, 2005). Agricultural Marketing Co-operative Societies (AMCOS) have emerged as important institutions that can enhance

smallholder farmers' competitiveness by providing them with collective market access, support services, and increased bargaining power (Nkuba *et al.*, 2016).

AMCOS are institutional vehicles for increasing smallholder farmers' production and linking them to markets, as well as a source of credit, inputs, finance, information and collaborations (Sifa, 2014). AMCOS are farmer associations organized to meet members' needs in the production and marketing of different crops and enable them to realize economic benefits that smallholder farmers usually could not have achieved alone (Rwekaza *et al.*, 2019). With well-managed AMCOS, smallholder farmers can access production and marketing information, credits, and inputs and be able to reduce transaction costs and profitably compete with other actors along the rice value chain (Rigg, 2019). Therefore, AMCOS, in collaboration with other supporting actors, are expected to play an important role in improving the competitiveness of smallholder rice farmers in rice farming in Tanzania.

Improving productivity and efficiency, profitability, and market participation are essential measures of competitiveness among smallholder farmers (Akite *et al.*, 2023; Kangile *et al.*, 2020). The research that centres on Tanzanian smallholder rice farmers' competitiveness within AMCOS is essential for comprehending and tackling critical elements impacting technical efficiency, profitability, information accessibility, and market outlet choices. Analysing technical efficiency and productivity in co-operative organizations sheds light on smallholder rice farmers' production and resource use (Abate *et al.*, 2014). Opportunities for increasing efficiency by improved agronomic practices, mechanization, or adoption of contemporary technologies are identified by examining farming practices, input consumption, and production strategies. The AMCOS's profitability assessment provides insight into the smallholders' ability to make rice production economically viable (Kangile and Mpenda, 2016). A thorough understanding of the cost

structure, revenue streams, and profit margins can aid in the identification of profitable initiatives, such as cutting input costs, raising yields, or diversifying revenue streams by growing alternative crops or value-added activities.

Since information affects decision-making and market involvement, smallholder farmers' competitiveness depends critically on their ability to access it (Ndimbwa *et al.*, 2021). Examining how farmers obtain market information, agricultural extension services, and technological advancements can highlight areas of improvement for training programmes, digital platforms, and information distribution channels to improve farmers' decision-making skills. In addition, AMCOS can reduce transaction costs and information asymmetry by strengthening farmers' ability to negotiate (Trebbin, 2014). This will, in turn, increase farmers' incomes through their bargaining power which will increase the price of the products and lower the costs of inputs (Ahmed and Mesfin, 2017). Improved access to information itself does not necessarily guarantee its use and increase in competitiveness, especially if farmers are not committed to its use and farmer associations lack management strategies (Pigatto *et al.*, 2019).

A closer look into AMCOS and market outlets can reveal information about market integration, price transparency, and smallholder farmers' access to various market outlets (Mhagama and Mmasa, 2022). Interventions targeted at enhancing market connection, and negotiating leverage for smallholder rice farmers are better informed by identifying obstacles to market access, such as infrastructures, market concentration, or irregularity in market information. According to Dlamini-mazibuko *et al.* (2019), understanding the relationships between the marketing channels and the factors that determine the use of each market channel is beneficial to policymakers and smallholder producers who aim to access such market outlets. Market outlet selection has an implication on price and overall market exposure. Enhancing smallholders' competitiveness is

crucial for improving their income, livelihoods, and overall agricultural sustainability of smallholder rice farming communities.

### **1.2 Problem Statement**

Smallholder farmers' competitiveness in farming in SSA is low (Ngenoh *et al.*, 2019; Lemus *et al.*, 2020). Smallholder rice farmers in Tanzania experience a loss of efficiency in production hence lowering their price competitiveness (Kangile and Mpenda, 2016). Other scholars have reported that smallholder rice farmers receive lower profit margins as compared to traders, millers and other actors in the rice value chain (Mwakasendo, 2015). The low competitiveness of smallholder rice farmers results in poverty due to low profit margins and less efficiency in production. As a result, they do not receive a fair share of the value of what they produce and hence struggle to become food secure to gain a viable sustainable livelihood. In harnessing the potential level and food security goals, the issue of competitiveness in rice production with the consideration of AMCOS will be particularly important. Also, the low competitiveness of smallholder rice farmers in Tanzania gives room for imported rice from various countries in the world, especially Asian countries, and this leads to a decline in profit margin among smallholder farmers and a lower market for domestically produced rice. Lemus *et al.* (2020) attributed smallholder farmers' low levels of competitiveness to a lack of information, low levels of schooling as well as poor infrastructures.

Efforts have been made by the GoT to increase production efficiency, productivity and profitability along the rice value chain by addressing challenges facing smallholder rice farmers. The main focus has been on the provision of quality seeds, extension services, agricultural co-operative formation and facilitating rice commercialization to promote smallholder farmer competitiveness along the rice value chain. The initiatives include the development of Tanzania's Agricultural Sector Development Strategy (ASDS) II, notably from 2015 to 2025, which intends to enhance the

competitiveness of farmers' organizations for competitive value chains (URT, 2017). The government has also established the National Rice Development Strategy (NRDS) II, which aims at enhancing the market competitiveness of locally produced rice by reducing costs of production to increase efficiency and improving milling operation standards (URT, 2019).

Several studies have measured the competitiveness of smallholder farmers in Africa (Akite *et al.*, 2023; Bahta and Malope 2014; Nyam *et al.*, 2022; Ngenoh, 2019; Mutero *et al.*, 2016); Mutambara and Mujeyi, 2020). Akite *et al.* (2023) measured the smallholder farmers' competitiveness in the rice value chain in terms of profitability and market participation. Bahta and Malope (2014) used profit efficiency to investigate the competitiveness of smallholder beef farmers in Botswana where the drivers of efficiency were education, distance to market, herd size, access to information, and access to income from crop production. The study concluded that low profitability of smallholder beef producers can be increased through increased cropland area and reduced input prices. Nyam *et al.* (2022) used Porter's Diamond Model Framework to measure the competitiveness of smallholder sheep farmers and constraints faced by sheep farmers in South Africa. Ngenoh (2019) determined the main role of households' capital, institutional, and access-related factors in conditioning the decision of smallholder farmers of African indigenous vegetables to access pillars of competitiveness in high-value market chains in Kenya. In this study, more than two-thirds of the interviewed farmers had access to at least one pillar of competitiveness. Mutero *et al.* (2016) established the impact of access to capital, access to markets, access to information and access to technology on the competitiveness of smallholder farmers in the market in South Africa. Mutambara and Mujeyi (2020) assessed the competitiveness of cotton production by smallholder farmers under contract farming in Zimbabwe; the study proposed strategies for enhancing sector performance and concluded that there was a need to reform the sector to enhance competitiveness.

Furthermore, Kangile and Mpenda (2016) measured the price competitiveness of smallholder rice farmers under irrigation schemes in Tanzania using translog stochastic frontier and reported low competitiveness among rice farmers due to high production costs.

Yet, smallholder farmers still have limited competitiveness in terms of profitability and production efficiency in rice farming despite the prevalence of AMCOS in Tanzania (Chiambo *et al.*, 2020). Given the importance of rice farming among smallholder farmers in Tanzania, there is still limited empirical information available on the potential of AMCOS on the competitiveness of smallholder farmers in terms of technical efficiency, profitability, information access, and market outlets. Therefore, research on the competitiveness of smallholder rice farmers in AMCOS is important to fill in the gap in knowledge and offer insights into farmers' decisions about resource allocation and the factors hindering competitiveness. AMCOS have been reported in various literature sources as among initiatives developed to help smallholder rice farmers improve competitiveness through its benefits of cooperation. AMCOS in the study area were initially formed by rice farmers for input provision, finance and marketing which are the primary functions. The idea here is that through well-functioning co-operatives, all kinds of fixed costs can be spread over a large number of small actors and, subsequently, make these actors competitive in their markets.

### **1.3 Justification of the Study**

Some previous studies on TE, profitability, access to market outlets and agricultural information were conducted in various rice farming ecologies in Tanzania and in the study area but did not show the competitiveness of smallholder rice farmers in the context of AMCOS as well as the services provided to farmers. Therefore, this study was undertaken to determine the smallholder farmers' competitiveness in terms of TE, profitability, access to agricultural information and market outlets. Findings from this study, especially

on TE and smallholder rice farmers' profitability, inform AMCOS and other actors along the rice value chain on how to improve productivity, maximize profit and expand markets for smallholder farmers. On the other hand, the findings shade light on factors that influence indicators of farmers' competitiveness as described in this thesis.

Smallholder rice farmers' competitiveness has been a concern of policymakers in Tanzania for many years, and it is argued in literature to be contributed by AMCOS, among other things. This explains the importance of highlighting the services provided by AMCOS in improving smallholder rice farmers' competitiveness today. The findings from this research contribute to the existing body of literature but also inform interventions to improve the performance of development partners such as the Tanzania Co-operative Development Commission (TCDC) and policymakers in the Ministry of Agriculture to understand sources of inefficiencies in smallholder farmers' competitiveness and be able to address them accordingly. The competitiveness of smallholder production is essential in improving the income and livelihoods of farmers and assuring food security.

This study provides useful information that differs from information provided by previous studies in various ways. The study has generated empirical information on the smallholder rice farmers' competitiveness in terms of TE, profitability, access to agricultural information and market outlet selection in the light of SDGs goal number two, Agricultural Sector Development Strategy (ASDS) II and National Rice Development Strategy (NRDS) II to reflect the problem of low farmers' competitiveness in rice farming. Moreover, this study generated empirical findings on the levels of TE among smallholder rice farmers and examined the determinants of TE among farmers with a special focus on irrigation schemes in UWAWAKUDA, Kapunga and Madibira AMCOS. Also, the study generated information related to costs and benefits associated with

smallholder rice farming, determined profit distribution among farmers and assessed the risk-bearing ability of smallholder rice farmers under changing circumstances of total variable costs, price and yield in the study area. The study generated information on the quality of the information received from AMCOS and the market choice of smallholder rice farmers when it comes to what drives farmers to choose a particular market. The generated empirical information is useful to inform agricultural development practitioners including researchers and extension workers to develop ways how to help the smallholder farmers in AMCOS improve their competitiveness. Therefore, this study assessed smallholder rice farmers' competitiveness in rice farming among smallholder farmers in Mbarali and Mvomero districts of Tanzania.

At a global level, the study contributes empirical information on the requirements for meeting Sustainable Development Goals number 1 and 2(3) which aim at reducing poverty and zero hunger for improved livelihood. The results of this study highlight AMCOS in enhancing smallholder rice farmers' competitiveness today.

## **1.4 Study Objectives**

### **1.4.1 Overall objective**

The overall objective of this study was to determine the competitiveness of smallholder rice farmers in Agricultural Marketing Co-operative Societies for better incomes and improved livelihoods in Tanzania.

### **1.4.2 Specific objectives**

The specific objectives of the study were to:

- i. Determine smallholder rice farmers' productivity and technical efficiency in rice farming in the study area
- ii. Estimate profitability of smallholder rice farmers.
- iii. Evaluate the contribution of AMCOS to agricultural information access by smallholder rice farmers in rice farming.

- iv. Assess the drivers of market outlet selection among smallholder rice farmers

### **1.4.3 Research questions**

The study was guided by the following research questions:-

- i. Are smallholder rice farmers technically efficient in rice farming?
- ii. Is the rice farming managed by AMCOS in the study area a profitable business? What is the profitability of rice farming in the study area?
- iii. Can AMCOS provide quality agricultural information to smallholder rice farmers?
- iv. Which smallholder rice market outlets exist in the study area?
- v. What are the factors influencing the choice of market outlets for smallholder rice farmers in the study area?

### **1.4.4 Research hypothesis**

The research had one null hypothesis, the following one, which is related to the fourth specific objective:

**H<sub>0</sub>:** There is no statistically significant association between the type of produce sold and the choice of market outlet in the study area.

## **1.5 Theoretical Framework**

### **1.5.1 Porter's Diamond Model of Competitiveness**

This study was guided by Porter's Diamond Model of Competitiveness (Porter, 1998). Smallholder farmers' competitiveness analysis was done by reviewing the attributes/factors outlined below. In his study on competitive advantage, Porter (1998) identified six (6) factors as determinants of the competitiveness of firms. He argued that a firm is likely to succeed in a particular industry because of certain conditions. The first is the factor conditions which include created factors for production that give smallholder farmers a competitive advantage

over other actors. The second attribute is the demand conditions which include factors that enable smallholder farmers to meet the needs and wishes of the consumer. The third attribute is related to supporting industries such as access to research and financial institutions. The fourth attribute is the strategy, structure and rivalry which include conditions in a nation governing how firms are formed, organized and managed. The fifth attribute is government supportive policy which is well viewed by considering its impact on other attributes and not as a detached entity. The sixth is the role of chance which includes factors that can harm or benefit the competitive position of farmers and are out of farmers' control, such as unreliable rainfall, drought and diseases. Meeting such conditions implies the competitiveness of smallholder rice farmers.

The model has been successfully used by several researchers to analyse determinants of competitiveness of various agricultural industries (Nesamvuni *et al.*, 2014; Sinngu and Antwi, 2014; Nesamvuni *et al.*, 2017; Humbulani, 2018), and was therefore regarded as appropriate for this study. In a study conducted by Nesamvuni *et al.* (2017) on the competitiveness of citrus farming in South Africa, supportive industries and demand conditions were the two determinants of competitiveness. Factors extracted from the two attributes included markets, electricity, financial institutions and output prices. The strength of this model is that it can help to identify the competitive advantages of the industry and provide guidance for policy development and investment decisions among smallholder rice farmers. The arguments for this model are limited to research and financial institutions as supporting industries in firm competitiveness while, in reality, agricultural co-operatives have roles to play in smallholder farmers' competitiveness along value chains. In this study, the six attributes were broken down to form determinants which were identified and tested to establish smallholder farmers' competitiveness in Mbarali and Mvomero Districts, Tanzania.

### **1.5.2 Transaction Cost Theory**

The study was also guided by the Transaction Cost Theory (TCT), which was first presented by Coase (1937) while attempting to characterize the interaction between a corporation and the market. According to the notion, if transaction costs are not reduced to the barest minimum, smallholder farmers won't be motivated to actively participate in the market which has an implication on the competitiveness in terms of profit levels. Kirsten and Vink (2005) defined transaction costs to include ones related to finding a trading partner with whom to exchange goods and services, screening and haggling with the partner and upholding the terms of the trading partner's contract.

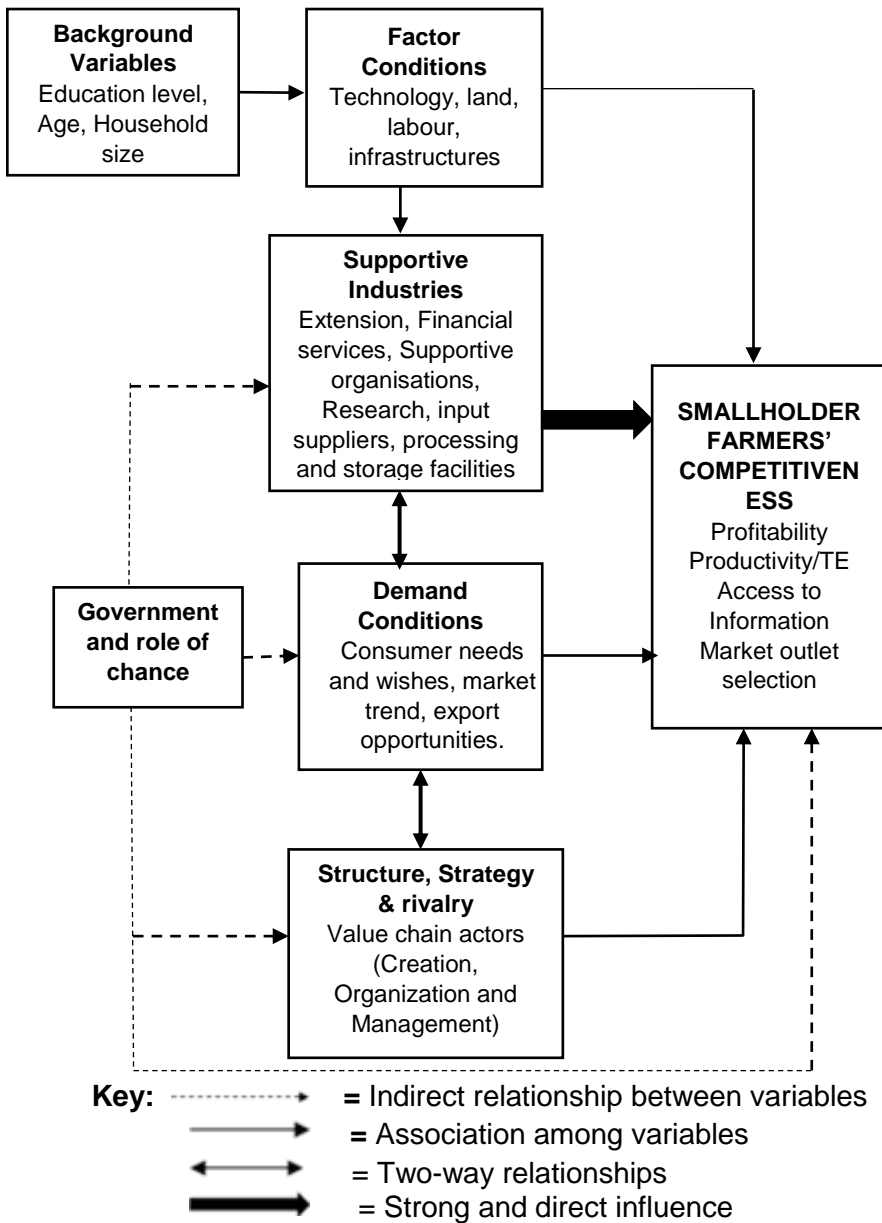
The TCT refers to costs that occur before (ex-ante) and after (ex-post) market, and the farmers physically exchange agricultural commodities. Ex-ante transaction costs include the costs of obtaining information and bargaining for an exchange of goods or services to occur while ex-post transaction costs, on the other hand, are incurred in coordinating production, harvesting, transportation, and processing as well as monitoring and enforcing compliance with the agreement (Mugwagwa *et al.*, 2020). Focusing on transactions makes sense as transaction costs are the underlying reason why smallholder farmers engage in AMCOS. In this regard, a TCT-based type of AMCOS can help smallholder farmers select an appropriate co-operative society for known transaction characteristics. The idea of opportunity cost is typically utilized to capture transaction costs because they are by nature hidden expenditures (Kirsten and Vink, 2005). The theory has widely been used in agricultural economics studies and related fields in developing countries (Jagwe, 2011; Maina, 2015; Otekunrin *et al.*, 2019; Mugwagwa *et al.*, 2020). The theory works well for evaluating how transaction costs affect competitiveness and helps farmers pinpoint areas of focus to reduce transaction costs. In the studies by Jagwe (2011) and Maina (2015), the TCT was used to assess the effect of transaction costs on farmers' participation in markets where a positive impact was reported. The limitation of using this theory is that it can be difficult to

measure transaction costs, particularly in the context of smallholder rice farming. For example, it can be challenging to quantify the time and effort required to negotiate with buyers or to resolve disputes with input suppliers. To address this challenge, the study used a mixed-methods approach whereby qualitative information supplemented the quantitative information to provide a more holistic view of the transaction costs incurred by smallholder rice farmers.

More thorough knowledge of the variables affecting the competitiveness of smallholder farmers can be obtained by integrating Transaction Cost Theory with Porter's Diamond Model of Competitiveness. Furthermore, by creating focused interventions to enhance AMCOS's functionality for the sustainable growth of smallholder agriculture, this integration can result in stronger policy recommendations for enhancing the competitiveness of smallholder farmers.

### **1.6 Conceptual Framework**

The concept of competitiveness and its measurement is multifaceted, and there are several ways to evaluate and measure competitiveness. The following conceptual framework was used to analyse smallholder farmers' competitiveness; it was derived from Porter's Diamond Model of Competitiveness (Porter, 1998) to explain how AMCOS influence smallholder farmers' competitiveness as shown in Figure 1.1. This framework indicates that attributes such as factor conditions, demand conditions, related and supporting industries, strategy, structure and rivalry, government and role of chance may determine smallholder farmers' competitiveness in the rice value chain. Meeting such conditions has implication for the competitiveness of smallholder rice farmers in terms of productivity, profit levels, access to information and market outlet selection. The competitiveness of smallholder farmers can also be impacted by some background variables such as education level, age and household size. According to Porter (1990), the government's role is best observed in terms of its effect on the determinants of competitiveness rather than as a separate determinant by itself.



**Figure 1.1: Conceptual framework on smallholder farmers' competitiveness, adapted from the work of Porter (1998)**

## **1.7 General Methodology**

### **1.7.1 Description of the study area**

The study from which this thesis emanates was conducted in Mbarali and Mvomero Districts in Mbeya and Morogoro Regions respectively. The districts were purposely selected for the study as they fall within suitable agro-ecological zones for rice production and are among the top rice-producing districts with a considerable number of rice value chain actors (URT, 2017). Also, Mbeya and Morogoro Regions are known to be among the key rice-producing regions. Morogoro Region recorded the highest paddy production in Mainland Tanzania with 332 280 tons (24.0 %) and an average crop yield of 4.0 tons/ha, followed by Mbeya Region with an average yield of 246 649 tons accounting for (17.8%) of total rice production in Tanzania (URT, 2017). Mbarali District is located at latitude: 8° 51' 60" south and longitude: 33° 51' 0" east. It is one of the seven districts of Mbeya Region, bordered to the north and east by Iringa Region, to the south by Mbeya Rural District and the west by Chunya District. Mvomero District lies at latitude 6° 26' 0" south and longitude 37° 32' 0" east and is bordered by Handeni District (Tanga Region) in the north, Bagamoyo District (Coast Region) in the east, Kilosa District (Morogoro Region) in the west and Morogoro Urban District (Morogoro Region) in the south.

### **1.7.2 Research design**

The study adopted a cross-sectional research design whereby data were collected at a single point in time. The design was chosen because it entails the collection of data on a number of cases at a single point in time in order to collect a body of quantitative and/or qualitative data with a broad scope of incorporating a number of variables at once, which are then examined to detect patterns of association (Bryman, 2004). Data collection was done during the 2021/2022 crop season.

### 1.7.3 Sampling procedure

The area of the study was Mbarali and Mvomero Districts in Mbeya and Morogoro Regions, respectively. From the two districts, three AMCOS were purposively selected; the criteria for selection were that an AMCOS should be registered, active (good performance) and involved in the rice farming business. Kapunga smallholders and Madibira AMCOS met the criteria and were selected in Mbarali District while UWAWAKUDA AMCOS was selected from Mvomero District. The study involved three hundred and eighty-two (382) respondents; the sample size was determined using the formula by Yamane (1967). The selection of respondents was done based on the sampling frame of 4749 members whose names were obtained from the relevant AMCOS offices, and the criteria were farmers having sizes of rice farms ranging from 0.9 to 3 ha in an irrigation scheme.

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

Where:

n = sample size

N = population size = 4749

e =level of precision (Sampling error) = 5% or 0.05

Proportionate stratified sampling technique was used to select sub-samples of farmers from the three co-operatives. Simple random sampling procedure was used to select respondents from lists of smallholder rice farmers obtained from the AMCOS offices.

### 1.7.4 Data collection

For this study, data were collected from primary and secondary sources whereby primary data were collected through farmer surveys, Key Informant Interviews (KIIs), and Focus Group Discussions (FGDs). The study involved four FGDs and five KIIs, whereby one FGD was conducted in UWAWAKUDA AMCOS, one in

Kapunga Smallholders and the other two in Madibira AMCOS. FGD participants included paddy farmers who were registered members of the respective AMCOS. Moreover, KIIs involved Ward Extension Officers, Managers of the three AMCOS and Co-operative Officers for Mvomero and Mbarali Districts. Selection of FGD participants and KI was by virtue of their knowledge and experience in rice farming and working with smallholder rice farmers, respectively. A structured questionnaire, a checklist of questions and an FDG guide were used to collect primary data which covered socio-demographic characteristics, paddy yields per area and sales, costs of production and revenues, access to agricultural information and market outlets. Before the main data collection phase, a pilot survey was conducted to measure the validity of the data collection tools hence the instruments were calibrated. The purpose of this pretesting was to ensure that the instruments used to collect data accurately measured the constructs they were intended to measure. Secondary data collected were on the characteristics of the three co-operative societies including years of formation, formation procedures, financial support provided to members, and the paddy varieties grown.

#### **1.7.5 Data transformation and analysis**

In order to facilitate the analysis, the paddy-rice equivalence was calculated using the 100% paddy to 62% milled rice conversion ratio. This study adopted the conversion ratio used by Omar (2019). According to FAO (2018), land productivity is calculated by dividing crop production by the amount of planted land, expressed in standard area units such as hectares or acres, and typically measured by physical yields such as kg per hectare, kg per acre or sacs per acre. In this study, the amount of all inputs and outputs used were standardised into an acre (URT, 2015; Mahoney *et al.*, 2007).

### **1.7.5.1 Productivity and technical efficiency among smallholder rice farmers**

Descriptive statistical analysis was done to establish farming characteristics, production inputs and levels of TE among smallholder farmers in the study area. Data analysis on factors affecting smallholder rice farmers' TE was done using STATA software in the SFA framework. Estimates of the generalized Cobb-Douglas production were projected using a single-stage maximum likelihood estimates (MLE) method for the TE and technical inefficiency effects. According to Greene (2002), MLE is more effective than corrected ordinary least squares because it employs the precise distribution of the disturbance term. ML estimations is the most effective estimating method in the class of estimators that use the information on the distribution of the endogenous attributes given the exogenous attributes (Greene, 2002; Wooldridge, 2002).

Content analysis was used to organize, re-arrange and manage the qualitative data obtained from the FGDs and KIs. The codes were created according to the thematic aspects of the study questions used.

### **1.7.5.2 Profitability analysis**

The analysis of costs and benefits associated with smallholder rice farming and estimating profitability realised by smallholder farmers was undertaken using an Enterprise Budgetary Technique (EBT) devised by Engle and Neira (2005). To determine profit distribution among farmers, profitability percentiles were calculated using the weighted average method and Tukey Hinges for quartiles calculation (Everitt and Skrondal, 2010; Tukey, 1977). The profitability structure and distribution were determined by categorizing profits or loss earning scale as less than 5%, from 5% to 25%, 25% to 75%, 75% to 95% and 95% to 100%.

Sensitivity analysis was undertaken to assess the risk-bearing ability of smallholder rice farmers under varying circumstances of price and

yield and variable costs (Robert, 1984). This method was used to assess the effect of output price, yield and variable costs on the gross margin as a measure of the profitability of the enterprise by varying 10% above and below (that is  $\pm 10\%$ ) the received price, attained yield and total variable costs of rice farming. Break-even analysis is a useful tool for determining the minimum price or yield required for a business to cover its costs and achieve a profit of zero. Regardless of whether it optimizes profit, an organization frequently finds it useful to understand what price (or output level) must be reached for total revenue to be exactly equal to the total costs (Abera and Assaye, 2021). This can be done with a break-even analysis; hence in break-even analysis was done to determine the minimum output and price necessary to prevent a loss for the smallholder rice farming business.

#### **1.7.5.3 Factors influencing adequacy of information**

The ordinal logistic regression analysis was used to determine the influence of various factors on the adequacy of information received from AMCOS. In this model, the dependent variable (adequacy of information) was ranked as 0 = Inadequate, 1 = Partially Adequate and 2 = Adequate. The model validity was determined by considering parallel assumption which restricts using the model when it is violated. Content analysis was employed to organize, rearrange and manage the qualitative data obtained through FGDs on the farmers' information needs and the quality of the information received from co-operative societies.

#### **1.7.5.4 Determinants of market outlet selection**

Descriptive statistical analysis such as mean, frequency and percentages was computed to describe socio-demographic information of respondents and their participation in different market outlets. A Multivariate Probit regression model (MVP) was used to examine the factors influencing smallholder rice farmers' market outlet choices in the study area. The smallholder rice producers were mapped into five marketing outlets: wholesalers, retailers,

millers, middlemen and private buyers. Rice producers were able to choose numerous, non-exclusive outlets in order to get a better price. The analysis was executed using the STATA software. The Multivariate Probit regression model was used to assess factors influencing market outlet choice among smallholder rice producers. The model was applied due to its ability of handling non-mutual exclusive events, as smallholder rice farmers may choose more than one market outlet. The model accounts for potential correlations between unobserved disturbances as well as relationship between market outlet selections while simultaneously illustrating the impact of a collection of explanatory variables on market outlet choice (Belderbos *et al.*, 2004). A Multivariate Probit model was appropriate and used to capture farmers' variation in market outlet selection and estimate multiple binary outcomes jointly due to the possibility of contemporaneous outlet selection and the potential correlations among these market outlet selection decisions.

### **1.8 Organization of the Thesis**

This thesis is organised in the publishable manuscript format. The thesis is organised into six chapters and starts with general introduction of the study in Chapter One. This sets up the overall theme of the study and methodology. This is followed by four chapters from Chapter Two to five, where four publishable manuscripts are presented. Chapter Two, comprises Paper One, which focuses on objective one which addresses smallholder rice farmers' productivity and technical efficiency in rice farming. Chapter Three comprises Paper Two, which entails estimations of profitability among smallholder rice farmers in the study area. Chapter Four contains Paper Three, which is about smallholder rice farmers' access to agricultural information in rice farming. Chapter Five contains Paper Four, which evaluates the smallholder rice farmers' selection of the existing market outlets and their drivers in Mvomero and Mbarali Districts. Finally, chapter 6 presents a summary of major findings, conclusions, recommendations, theoretical implications of the findings and areas for further research.

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## CHAPTER TWO

### 2.0 SMALLHOLDER RICE FARMERS' TECHNICAL EFFICIENCY: IMPLICATION FOR COMPETITIVENESS THROUGH AGRICULTURAL MARKETING CO-OPERATIVE SOCIETIES IN TANZANIA

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#### ABSTRACT

Agricultural Marketing Co-operative Societies (AMCOS) are increasingly being advocated by the Government of Tanzania as a way to enhance smallholder farmers' competitiveness countrywide. Yet, the smallholder rice farmers' competitiveness is low. This paper analysed the smallholder rice farmers' competitiveness in terms of Technical Efficiency (TE) in Morogoro and Mbeya Regions, Tanzania. Data were collected from 382 smallholder rice farmers. The Cobb-Douglas stochastic frontier model was used to establish the frontier line of the farmers' production potentials by a single-stage Maximum Likelihood Estimates. The findings show that the mean TE indices for Kapunga, Madibira and UWAWAKUDA AMCOS were 84.9%, 87.6% and 79.1% respectively. Across AMCOS, it was found that intermediate costs, labour costs, fixed costs and amount of fertiliser influenced productivity ( $p < 0.05$ ) while access to training, water distribution, ploughing time, planting systems, and access to credit influenced TE ( $p < 0.05$ ). The mean

TE for the whole sample was 83.8% indicating that smallholder rice farms in the study area have been operating below the maximum level of production frontier and given the available technology, farmers can increase their production by 16.2%. The rice production in terms of TE has not reached a plateau; hence there is a potential for improvement. This study recommends that policymakers should prioritize the implementation of targeted training programmes and enhance access to agricultural inputs and credit facilities to improve the technical efficiency of smallholder rice farmers. The Local Government Authorities and development partners responsible for improving smallholder farmers' livelihoods should ensure farmers' access to credit and increase farmers' linkages to credit providers in the rice farming schemes.

**Keywords:** Competitiveness, technical efficiency, smallholder farmers, credits.

## 2.1 Introduction

Rice is consumed by many people globally because of its high nutritional value (Patunru and Ilman, 2020). In Sub-Saharan Africa (SSA) rice is considered to be an important food crop for fighting hunger and malnutrition. Tanzania ranks second after Madagascar in rice production and consumption within the SSA region (Kadigi *et al.*, 2020). Demand for rice has been increasing by 6% annually faster than any other staple food in SSA (CGIAR, 2016; Africa Rice, 2020). The 2019/2020 National Sample Census of Agriculture in Tanzania results show that 2.9 million Metric Tonnes (MT) of rice was produced, which is a more than 100% increase compared to the 2007/08 Agriculture Census which recorded 1.4 million MT (URT, 2020). About 90% of rice produced in Tanzania is under a smallholder system with sizes of farms ranging from 0.9 to 3 hectares (ha), with an average farm size of 1.3 ha (URT, 2019). The average rice yields in the 2016/17 cropping season for Morogoro and Mbeya were 4.0 and 2.2 tonnes/ha respectively, with a national average yield of 2 tonnes/ha (URT, 2018; URT, 2019). However, this productivity is far below that of the top three rice-producing countries of China, Japan, and Brazil which had average yields of 7.1, 6.8, and 6.1 tonnes per ha, respectively (Mtembeji and Singh, 2021).

Rice production in Tanzania does not meet the increased demand which is largely caused by rapid population growth and a shift in consumption status (Kulyakwave *et al.*, 2020). The potential of Agricultural Marketing Co-operative Societies (AMCOS) lies in their ability to foster collective action, enhance market access, reduce transaction costs and provide support services to smallholder rice farmers (Bijman and Iliopoulos, 2014). By leveraging these potentialities, AMCOS can contribute to reducing the gap between production and demand, ensuring a more sustainable and profitable rice farming sector. AMCOS in the co-operative context is viewed as a vehicle for increasing smallholder farmers' productivity and linking them to markets, as well as sources of credit, inputs, finance, information and collaborations (Tyagi *et al.*, 2019). AMCOS play a

great role in ensuring the supply of inputs and increasing output among smallholder farmers (Brito *et al.*, 2015). Agricultural co-operatives play a valuable role by offering support services that greatly enhance the TE of their members. They achieve this by making it easier for members to obtain production inputs and establishing connections for extension services (Abate *et al.*, 2014). Demand for rice is forecast to increase due to increase in population size, urbanization and change in life style and dietary habits. Various government interventions have been in place to address the rice demand in Tanzania. Such initiatives include the National Rice Development Strategy, input subsidy programs, training and development, rehabilitation of irrigation infrastructures and co-operative formation. Yet, smallholder farmers experience high production costs that reduce farmers' competitiveness in terms of Technical Efficiency (TE) in Sub-Saharan Africa (SSA), Tanzania inclusive (Nkuba *et al.*, 2016; Ngenoh *et al.*, 2019). Enhancing smallholder farmers' competitiveness in terms of TE is believed to be an effective approach to increasing returns, reducing rural poverty and improving livelihoods (Rigg, 2019).

Studies have been conducted in Bangladesh, Nigeria, Myanmar, Tanzania and Ghana to analyse the TE in rice farming among smallholder farmers (Idiong, 2007; Rahji and Omotesho, 2007; Anang *et al.*, 2016; Mkanthama *et al.*, 2017; Hasnain *et al.*, 2015; Linn and Maenhout, 2019; Chukwujekwu *et al.*, 2020). Regarding TE, studies revealed significant inefficiencies in production and thus a high scope for improving farmers' TE through better use of available resources. Furthermore, factors such as education level, sex, experience, membership of co-operative/farmer association, access to credit, quantity of inputs and access to irrigation revealed to have an influence on TE among smallholder farmers. Despite this plethora of studies, limited literature is available on the competitiveness of smallholder rice farmers in terms of their productivity and TE in the context of Agricultural Marketing Co-operative Societies in Tanzania. For example, a study by Kangile &

Mpenda (2016), focused on the price competitiveness of smallholder rice farmers under irrigation schemes in the Coast and Morogoro regions of Tanzania. It was found that farming experience, planting methods, frequency of weeding, degree of specialization and source of purchased inputs influenced cost efficiency. This study focused on price efficiency leaving TE among smallholder rice farmers untouched. Similarly, another study compared the TE of farmers in the irrigated and rain-fed lowland ecologies in the Coast and Morogoro Regions of Tanzania (Mkanthama *et al.*, 2017). The two studies were conducted in the same regions. Moreover, the latter study considered lowland rain-fed sites in Morogoro, leaving aside the irrigation schemes managed by AMCOS. This paper addresses this research gap by assessing competitiveness among smallholder rice farmers in terms of TE and examining factors influencing TE in the context of AMCOS in Mvomero and Mbarali Districts. Specifically, the study assessed productivity and TE; estimated levels of TE among smallholder rice farmers, and examined the determinants of TE among smallholder rice farmers in the study area.

## **2.2 Review of Concepts**

### **2.2.1 Smallholder farmers' TE and productivity**

Smallholder farmers are considered technically efficient in production if they can achieve maximum output with a given level of inputs and production technology (Adeyemi *et al.*, 2017). Farrell (1957), in his pioneering study, distinguished three types of efficiency: (1) TE, (2) allocative or price efficiency, and (3) economic efficiency. TE represents a farm's ability to produce a maximum level of output from a given level of inputs (Khan and Saeed, 2011). Various methods of estimating smallholder farmers' efficiency exist in the economic literature (Anang *et al.*, 2016). Measuring efficiency can be technically defined by non-parametric and parametric methods (Latruffe, 2010). The parametric approach employs SFA while the non-parametric approach normally employs DEA (Anang *et al.*, 2016). This paper focuses on TE using the Cobb-Douglas SFA

function which is the most widespread method to measure efficiency. Hasnain *et al.* (2015), Kibiego *et al.* (2015), Anang *et al.* (2016), and Tadesse *et al.* (2017), in their studies, fitted SFA to input and output data to measure TE in Ghana, Bangladesh, Kenya, Ethiopia and Nigeria where results showed significant inefficiencies in production. When appropriately applied, the Cobb-Douglas SFA can provide valuable insights into TE and inform policy interventions to enhance productivity. The same model was used by Bahta (2014); Osung *et al.* (2014) in measurement of competitiveness of smallholder livestock systems in Botswana and cassava production in Nigeria, respectively. Productivity has been used as an indicator of competitiveness among smallholder livestock systems in Botswana (Bahta, 2014). The higher the productivity, the greater the level of competitiveness. Increasing productivity per unit of land and labour through efficient use of resources in production is a definite way of reducing the per-unit cost of production and ensuring competitiveness in production (Osung *et al.*, 2014).

### **2.2.2 Smallholder farmers' competitiveness**

Competitiveness is an ambiguous concept that can be defined in several ways and addressed from different perspectives. It has been termed by various scholars as a multidimensional and relative concept since the criteria of competitiveness vary with time and context (Pigatto, 2020). The current study contributes to the analysis of competitiveness at the level of smallholder farmers by applying the concept developed by (Latruffe, 2010) that competitiveness entails the capability of smallholder farmers to offer goods that satisfy consumer demands in terms of price, quality, and quantity while making profits that allows them to thrive. The smallholder farmers' competitiveness has a close relationship with AMCOS as they play a great role in ensuring the supply of inputs and increasing output among smallholder farmers (Brito *et al.*, 2015).

## 2.3 Methodology

### 2.3.1 Study area, sampling techniques and sample size

The research on which this paper is based was conducted in Mbarali and Mvomero Districts in Mbeya and Morogoro Regions, respectively. The regions are among the major rice-growing regions, with the two districts being located within suitable agro-ecological zones for rice production (URT, 2019). Mbarali District is located at latitude: 8° 51' 60" south and longitude: 33° 51' 0" east. It is one of the seven districts of Mbeya Region, bordered to the north and east by Iringa Region, to the south by Mbeya Rural District and to the west by Chunya District. Mvomero District lies at latitude 6° 26' 0" south and longitude 37° 32' 0" east bordered by Handeni District (Tanga Region) in the north, Bagamoyo District (Coast Region) in the east, Kilosa District (Morogoro Region) in the west and Morogoro Urban District (Morogoro Region) in the south.

The study adopted a cross-sectional research design and a mixed-methods approach in data collection and was collected from 382 smallholder rice farmers. The sampling frame consisted of smallholder rice farmers in Mbarali and Mvomero Districts with individual smallholder farmers as the unit of analysis and unit of observation. Purposive and simple random sampling techniques were used in the selection of geographical areas and individual respondents. From the two districts, three AMCOS were purposively selected based on their dominance in rice farming and their involvement in the business. Simple random sampling procedure was used to select respondents from the list of smallholder farmers obtained from the AMCOS offices. The sample size was estimated using the formula by Yamane (2001) assuming a 95% confidence level and a  $p = 0.05$ .

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

Where:

n = sample size

$N$  = population size = 4749

$e$  =level of precision (Sampling error) = 5% or 0.05

Proportionate stratified sampling technique was used to determine sub-samples of the farmers who were selected from the three AMCOS giving a sample size of 369 respondents as shown in Table 2.1.

**Table 2.1: Proportionate stratified sampling of rice farmers in the study area**

<b>AMCOS</b>	<b>Number of registered farmers</b>	<b>Sample size</b>
UWAWAKUDA	949	74
Madibira	3,000	233
Kapunga	800	62
<b>Total</b>	<b>4,749</b>	<b>369</b>

### 2.3.2 Data collection

The methods used to collect data were a household survey, Focus Group Discussions (FGDs), and Key Informant Interviews (KIIs). Quantitative data were collected by using a pre-structured questionnaire with both open and close-ended questions. Moreover, four FGDs were conducted, each accommodating eight participants to collect qualitative data. Additionally, seven key informant interviews were held with extension officers, co-operative officers, input suppliers and co-operative leaders. Data were gathered in February 2022, and farmers were asked to provide information on the previous cropping season (2020/2021).

### 2.3.3 Data analysis

Descriptive statistical analysis was done to establish farming characteristics, production inputs and levels of TE among smallholder farmers in the study area. Data analysis on factors affecting smallholder rice farmers' TE was done using STATA software in the SFA framework. Estimates of the generalized Cobb-Douglas production were projected using a single-stage maximum

likelihood estimates (MLE) method for the TE and technical inefficiency effects. According to Greene (2002), MLE is more effective than corrected ordinary least squares because it employs the precise distribution of the disturbance term. ML estimation is the most effective estimating method in the class of estimators that use the information on the distribution of the endogenous attributes given the exogenous attributes (Greene, 2002; Wooldridge, 2002). The parameterization of the half-normal model by Tsionas (2023) was used in terms of  $\sigma^2 = \sigma_v^2 + \sigma_z\delta^2$  and  $\gamma^2 = \frac{\sigma_z\delta^2}{\sigma_v^2} \geq 0$ . If  $\gamma = 0$

there is no technical inefficiency, and all inefficiencies in the SFA are due to stochastic process. By using the above kind of parameterization, the log likelihood function is specified as:

$$\ln L(y|\beta, \sigma, \gamma) = -1/2 \ln(\pi\sigma^2/2) + \sum_{i=1}^1 \ln\phi(-\varepsilon_i\gamma/\sigma) - 12\sigma^2 \sum_{i=1}^1 \varepsilon_j^2 \dots \dots \dots (2)$$

Where:  $y$  is a vector of log output (kg/acre),  $\varepsilon_1 = v_i - z_i\delta_i = \ln q_i - x_i$ ,  $\beta$  is a composite error term, and  $\phi(\cdot)$  is the accumulative distribution function of the standard normal variable, evaluated at  $x$ . Therefore, the generalized likelihood ratio is given by:

$$\gamma = -2\ln[L(H_0)|L(H_1)] = -2[L(H_0) - L(H_1)] \dots \dots \dots (3)$$

Where:  $L(H_0)$  and  $L(H_1)$  are values of the likelihood function under specification of the null  $H_0$  and alternative  $H_1$  hypotheses. The Cobb-Douglas production frontier is given by:

$$Y_i = f(x_i\beta_i) \exp(v_i - z_i\delta_i - w_i) \dots \dots \dots (4)$$

$$\ln Y_i = \beta_0 \sum_{n=1}^N x_n^{\beta_0} \exp(v_i - z_i\delta_i - w_i) \dots \dots \dots (5)$$

$$\ln Y_i = \beta_0 + \beta_1 \ln TIC_1 + \beta_2 \ln TLC_2 + \beta_3 \ln TFC_3 + \beta_4 \ln QPF_4 + \beta_5 \ln QTF_5 + v_i - (\delta_0 + \delta_1 Z_1 + \delta_2 Z_2 + \delta_3 Z_3 + \delta_4 Z_4 + \delta_5 Z_5 + \delta_6 Z_6 + \delta_7 Z_7 + \delta_8 Z_8 + \delta_9 Z_9 + \delta_{10} Z_{10} + \delta_{11} Z_{11} + w_i) \dots \dots \dots (6)$$

$$\ln Y_i = \beta_0 + \beta_1 \ln TIC_1 + \beta_2 \ln TLC_2 + \beta_3 \ln TFC_3 + \beta_4 \ln QPF_4 + \beta_5 \ln QTF_5 + v_i - \delta_0 - \delta_1 Z_1 - \delta_2 Z_2 - \delta_3 Z_3 - \delta_4 Z_4 - \delta_5 Z_5 - \delta_6 Z_6 - \delta_7 Z_7 - \delta_8 Z_8 - \delta_9 Z_9 - \delta_{10} Z_{10} - \delta_{11} Z_{11} - w_i \dots \dots \dots (7)$$

The technical efficiency of the  $i^{th}$  farmer is defined as:  
 $TE = \text{Exp}(-z_i\delta_i - w_i) \dots \dots \dots (8)$

Technical inefficiency of the  $i^{\text{th}}$  farmer is defined as:

$$z_i \delta_i = \delta_0 + \delta_1 Z_1 + \delta_2 Z_2 + \delta_3 Z_3 + \delta_4 Z_4 + \delta_5 Z_5 + \delta_6 Z_6 + \delta_7 Z_7 + \delta_8 Z_8 + \delta_9 Z_9 + \delta_{10} Z_{10} + \delta_{11} Z_{11} + w_i \dots \dots \dots (9)$$

All variables from equation four to eight are defined as:

$v_i$  stands for inefficiency effects and all deviations or inefficiencies from the frontier due to noise;  $Y_i$  represents the normalized output of the  $i^{\text{th}}$  productive units for  $i=1,2,3,\dots, n$  where the output refers to yield in rice farming kg/acre and productive units refers to farmers. TLC = Total Intermediate Costs, TFC = Total Labour Costs, TFC = Total Fixed Costs, QPF = Quantity of Planting Fertilizer and QTF = Quantity of Topdressing Fertilizer.  $u_i$  stands for inefficiency effects;  $Z_1$ = Age of respondent,  $Z_2$  = Household size,  $Z_3$ = Planting systems,  $Z_4$ = Water distribution,  $Z_5$ =Attended training,  $Z_6$ = Access to credit,  $Z_8$ =Source of seeds,  $Z_9$ = Ploughing time,  $Z_{10}$ = Sex,  $Z_{11}$ = Education level,  $Z_{12}$ = Marital status,  $Z_{13}$ = Economic activities,  $\vartheta_i$ = error term,  $\delta_0$ = a constant term,  $\delta_1$ - $\delta_{12}$ = Estimated parameters. The variables that were subjected to SFA and the inefficiency model are specified in Table 2.2.

**Table 2.2: Variables used in the Cobb-Douglas production frontier**

SN	Variable(unit)	Definition	Expected hypothesis
1.	Intermediate costs (TZS)	Expenditures on intermediate inputs, which are goods or services used in the production (cont...)	-
2.	Labour costs (TZS)	Expenses incurred in employing workers in rice farming (cont...)	-
3.	Fixed costs (TZS)	Constant expenses paid to AMCOS every year in rice farming (cont...)	-
4	Productivity	Total yield harvested in kg per acre (cont...)	+
5	Quantity of planting fertilizer	Quantity of fertilizer used in kg per acre (cont...)	+
6	Quantity of top dressing fertilizer	Quantity of fertilizer used in kg per acre (cont...)	+
7	Farming experience	Number of years in rice farming (cont...)	+
8	Access to credit	1=access, 0=otherwise(dummy)	+
9	Attended training	1 if the farmer attended training, 0=otherwise(dummy)	+
10	AMCOS experience	Years of membership in AMCOS (cont...)	+
11	Age	Age of respondents in years (cont...)	-
12	Planting system	1=row planting, 0=Zig-zag planting (dummy)	+
13	Water distribution	2= Good, 1= Fair, 0=Poor (cat....)	+
14	Sex	1=male 0=female (dummy)	+
15	Source of seeds	3=Fellow farmers, 2=Research institute, 1=farmer groups 0=Own saved seeds (cat...)	-
16	Education level	3=Informal education 2=Primary 1=Secondary 0=Tertiary (cat...)	+
17	Economic activities	2= Livestock 1=Business 0=Farming, livestock and business (cat...)	+/-
18	Ploughing time	1=early, 0=late ploughing (dummy)	+

In addition to quantitative analysis, content analysis was used to organise, re-arrange and manage the qualitative data obtained from the FGDs and KIIs for triangulation purposes. The themes were

created according to the thematic aspects of the research questions used.

## **2.4 Results and Discussion**

### **2.4.1 Socio-demographic characteristics**

The results on smallholder rice farmers' socio-demographic characteristics, shown in Table 2.3, indicate that the majority (73.6%) of farmers had at least primary school education. Level of education is anticipated to be an important factor that would affect the level of competitiveness in rice farming as educated farmers find it easier to comprehend information concerning production technologies and farming practices. These findings agree with the findings of Ndakije (2020) in which 82% of rice farmers had formal education. The study further revealed that the majority (70.7%) of the respondents were males while 29.3% of them were females. This implies that there was male dominance in rice production in the study area which is supported by the study of Tadesse *et al.* (2017) on rice farming in Ethiopia. Also, 11.5% of farmers were recorded as having rice farming as their only economic activity. This means that farmers in this category devote most of their time to rice farming, but also having only one source of income, which is risky as it may influence their competitiveness.

**Table 2.3: Socio-demographic characteristics among farmers in the study area (n = 382)**

Variable	Classes	AMCOS			Pooled statistics n = 382
		Kapunga %	Madibira %	UWAWAKUDA %	
Sex	Male	74.2	72.6	62.80	70.7
	Female	25.8	27.4	37.2	29.3
Marital status	Single	11.3	10.3	7.1	9.7
	Married	88.7	89.7	92.9	90.3
Education level	Informal education	1.6	3.8	5.8	3.9
	Primary	69.4	71.4	82.6	73.6
	Secondary	4.8	19.2	7.0	14.1
	Tertiary	24.2	5.6	4.7	8.4
Economic activities	Farming (Other crops)	40.3	42.7	22.1	37.7
	Livestock	0.0	1.3	2.3	1.3
	Business	0.0	12.8	23.3	13.1
	Farming, livestock and business	46.8	34.6	33.7	36.4
	Rice farming only	12.9	8.5	18.6	11.5
Household size	Mean	5	5	5	5
	Max	9	14	15	15
	Min	2	1	1	1
Experience in rice farming	Mean	21.24	17.77	16.35	18.02
	Max	50	41	50	50
	Min	3	2	3	2
Years in AMCOS	Mean	11.85	15.21	12.43	14.04
	Max	22	33	19	33
	Min	2	2	3	2

The study also found that the average household size was 5 members. Larger household sizes have the potential for providing cheap labour in farms that can enhance productivity and TE. Yet, larger household size puts more pressure on household income that can be used to purchase inputs to improve productivity, henceforth the negative effect on TE. This finding is in agreement with Kulyakwave *et al.* (2019) who reported an average household size of

5 members in rice farming households. The average years in AMCOS were 14.04. Mean years were found highest in Madibira (15.21) and lowest in Kapunga (11.85). This implies that Madibira had more experience in working with rice farmers and was probably able to deal with members pressing issues compared to Kapunga and UWAWAKUDA.

#### 2.4.2 Farming characteristics

The results on farming characteristics are presented in Table 2.4. The overall average paddy produced (kg/acre) was 2 783, with the highest mean observed in Madibira (2 886), followed by Kapunga (2884) and UWAWAKUDA (2421). This is above the target yield for irrigated rice production in 2019. The findings are different from the productivity of 1 450 kg/acre and 1 720 kg/acre reported by Mkanthama *et al.* (2017) and Nkuba *et al.* (2016) in Tanzania. One of the major reasons for the gains in productivity is that this study involved farmers in AMCOS who grew high-yield improved variety TXD 306 (Saro 5) in the irrigation schemes. The highest production by Madibira farmers can be attributed to the irrigation infrastructures which enable them to manage appropriately the water levels and availability throughout the season as revealed by having the highest number of farmers (62%) with access to good water distribution as shown in Figure 2.1.

**Table 2.4: Farming characteristics**

Variables	AMCOS			Pooled statistics n=382
	Kapunga n=(62)	Madibira n=234	UWAWAKUDA n=86	
Productivity	2884	2886	2421	2783
Intermediate costs (TZS/acre)	656242	641548	470474	605419
Labour costs (TZS/acre)	256879	250581	253890	252348
Fixed costs (TZS/acre)	34000	148800	118000	123234
Land size (acres)	3.38	3.39	3.05	3.32
Quantity planting fertilizer (kg/acre)	47.90	20.98	52.44	32.65
Quantity of topdressing fertilizer (kg/acre)	93.06	102.89	69.88	93.87

The average land size under rice farming was 3.32 acres. This is in line with the average land size for smallholder rice farmers in Tanzania which is 3.25 acres (URT, 2015). Farmers in UWAWAKUDA had a minimum land size of 1 acre with the minimum land size of 2.5 acres in Madibira and Kapunga respectively. This variation was because the maximum average land rented to farmers in UWAWAKUDA was 1 acre while for Madibira and Kapunga the maximum land size rented to farmers was 2.5 acres per AMCOS member. The additional land was due to land borrowing from fellow farmers in respective AMCOS. The average fixed costs incurred were found to be 123 234 TZS/acre. These costs entail the cost of land and water infrastructures paid directly to AMCOS every season. The average intermediate cost of production was 605 419 TZS/acre. These entail land preparation costs, storage, harvesting and transport costs, and costs involved in buying inputs including seeds, fertilisers, pesticides, herbicides and insecticides. The average labour costs per farmer were 252 348 TZS/acre. The overall mean value of fertilizers was 126.52kg/acre. The findings of the current study do not support the previous research of Mkanthama *et al.* (2017) who reported rice farmers using 76kg/acre. The less use of planting fertilizer was attributed to the fact that most farmers used decomposed paddy remains from the previous season. It was found that intermediate costs, planting fertilizers and top dressing fertilizers were positively related to the quantity of rice produced in kg/acre as shown in Table 2.6. For every unit increase in the intermediate costs which included costs of land preparation, irrigation, and costs of all inputs, the amount of rice produced increased by 0.210 kg/acre. Also, farmers' productivity was highly influenced by the amount of fertilizers used. These findings agree with the results by Tadesse *et al.* (2017) and Mwangi *et al.* (2020) who reported a positive influence of fertilizer on productivity among smallholders. Fixed costs were negatively associated with the quantity of rice produced (kg/acre) at the 5% level of significance as assumed before.

### 2.4.3 Smallholder rice farmers' practices in AMCOS

The results on farmers' practices as presented in Figure 2.1 show that a good number of farmers in Madibira had good water distribution (86.5%) in their plots, Kapunga at 79% and UWAWAKUDA at 77.9%. This suggests that water infrastructures and management in Kapunga and UWAWAKUDA were not in good condition, resulting in low TE and hence low competitiveness. The findings are in line with Lemus *et al.* (2020) who attributed smallholder farmers' low levels of competitiveness to poor infrastructures. The majority of farmers in all AMCOS used a zigzag planting system. The observation opens a salient fact on the planting system as observed in Table 2.4 that farmers at Madibira had high productivity, and the gap was also revealed in technical efficiencies in Table 2.5. With training, 27.8% of farmers at Madibira were trained on rice farming with 10.5% and 9.7% for UWAWAKUDA and Kapunga respectively. Access to training may influence smallholder farmers' productivity and hence their competitiveness. The majority of farmers in Madibira had access to credit. This was attributed to the presence of Mufindi Community Bank, Victoria Finance, lending groups and Madibira SACCOS at Madibira town centre.

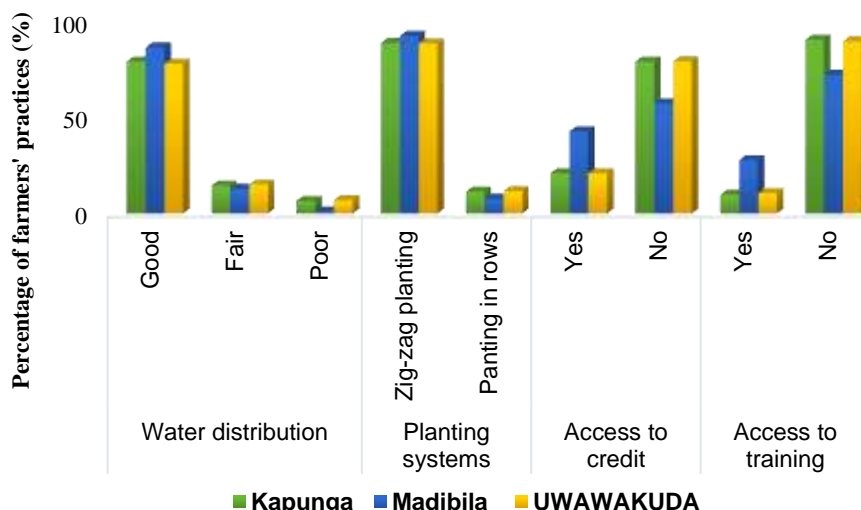


Figure 2.1: Farmers' practices through AMCOS

#### **2.4.4 Distribution of TE as predicted by SFA**

The findings presented in Table 2.5 show that the mean TE indices for Kapunga, Madibira and UWAWAKUDA AMCOS were 84.9%, 87.6% and 79.1%, respectively. The main reason for the differences in TE is that Madibira members had higher water distribution in the rice farms and more members with access to training and credit as illustrated in Figure 2.1. The overall mean TE for the whole sample was 83.8%, suggesting that rice farming was on average about 16.2% below the potential due to the specific inefficiencies connected to farming. Regarding this range of TE levels, for the inefficient farmers, there was a 0.162 chance to improve. The findings are in line with those by Chukwujekwu *et al.* (2020) who found a mean TE of 84.76%, implying that the co-operatives were operating at 15.24% below their optimum production capacity in Nigeria. However, TE is less than the average TE of 96% reported by Mkanthama *et al.* (2017) in Tanzania. One of the reasons for the difference is that a study by Mkanthama *et al.* (2017) was conducted on a research site under International Rice Research Institute. Also, TE in Table 2.5 ranges from 41.3% to 97.9%. This range agrees with that of cassava farmers reported by Osung *et al.* (2014) which ranged from 41.90 to 97.34% in Nigeria. The distribution of statistics in Table 2.5 follows a similar distribution revealed by Mwangi *et al.* (2020) on TE in tomato production among smallholder farmers in Kenya.

**Table 2.5: Summary statistics of smallholder rice farmers TE in the study area (n=382)**

Description	Efficiency range	TE score (%)			Pooled %
		Kapunga (n=62)	Madibira (n=234)	UWAWAKUDA (n=86)	
Low	Less than 0.50	7.3	0.9	4.9	4.4
Medium	0.50-0.59	5.5	0.9	7.3	4.6
	0.60-0.69	1.8	5.4	9.8	5.7
	0.70-0.79	1.8	6.8	15.9	8.2
High	0.80-0.89	27.3	27.6	46.3	33.7
	0.90-1.00	56.4	58.4	15.9	43.6
Total		100	100	100	100
Mean		84.9	87.6	79.1	83.8
Maximum		97.4	98.5	97.8	97.9
Minimum		40.2	43.8	40.1	41.3

The findings presented in Table 2.5 also demonstrate the distribution of TE by AMCOS and the total distribution, whereby about 4% of rice farmers were operating below 50% TE, while about 10.3% of the rice farmers were operating between 60% and 69% efficiency level. The findings further signpost that roughly 33.7% of farmers were operating between 80% and 89% level of efficiency while 43.6% managed to achieve above 90% efficiency level. This indicates that the majority of farmers utilized their resources effectively and could produce output at a relatively high level compared to their inputs. They also suggest that there was room for other farmers to improve their efficiency levels by learning from the successful practices of the majority of farmers.

#### **2.4.5 Factors influencing smallholder farmers' TE**

The Maximum Likelihood Estimates for the parameters of the SFA and the inefficiency model are shown in Table 2.6. The variables with negative signs contributed to the TE while those with positive signs contributed to technical inefficiency. Farmers with poor water distribution were highly associated with technical inefficiency at the 1% level of significance. This implies that an increase in the number of farmers with poor water distribution would decrease rice output by

0.503 units. This means that water supply is an important component for rice to grow well. The findings stand with those by Anang *et al.* (2016) who found that access to irrigation water enables farmers to maximise the use of other inputs such as fertiliser and seeds. Farmers who had attended training in AMCOS were technically efficient at the 5% level. This implies that farmers who had been trained increased their rice output by 0.274 units in the area. These findings are consistent with those by Tadesse *et al.* (2017) who found a positive significant effect of training on TE among rice farmers in Ethiopia.

In addition, farmers' technical inefficiency was associated with farmers' access to credit. This implies that most farmers who had access to credit either had small amounts that couldn't affect their TE or they failed to commit the borrowed money to the rice production, resulting in a decrease in rice output by 0.101 units. These findings are consistent with those by Anang *et al.* (2016) who found insignificant effect of credit on TE among rice farmers in Ghana. However, Idiong (2007) reported that access to credit positively influenced farmers' efficiency in the Cross River State of Nigeria. It was found that farmers who had attained a tertiary level of education were highly associated with technical inefficiency. The argument posited by the findings was supported by FGD participants who reported that:

*"... farmers with tertiary level of education are more likely to catch up jobs outside farming which may restrict the time allocated to farming activities"* (FGD, Dakawa Village, February 2022).

The findings suggest that the level of education of smallholder rice farmers may not affect their TE due to the time allocated to farming as one Key Informant stated:

*"... but we also provide services through telephone, especially for the farmers who are employees. They also communicate with the labourers on the phone due to their tight schedules"* (Key Informant, Madibira Ward Extension Officer, February 2022).

The findings from the key informant indicate that farmers with tertiary level of education had a negative impact on the TE as the farmers might have less physical visits to their farms and rely on labour. The meagre effect of education level on farming isn't surprising; similar findings have been reported by Balde *et al.* (2014) and Anang *et al.* (2016) who found that educated farmers had technical inefficiencies in the rice production in Northern Ghana and Guinea respectively.

**Table 2.6: Maximum Likelihood Estimates of the SFA in Smallholder Rice Farming**

Ln (paddy kg/acre)	Coefficient.	Std Error	P>z	Sig.
<b>Frontier parameters</b>				
Ln(Intermediate cost)	0.210	0.068	0.002	***
Ln(Labour cost)	0.016	0.029	0.577	
Ln(Fixed cost)	-0.006	0.002	0.006	***
Ln(Planting fertilizers)	0.001	0.000	0.000	***
Ln(Top dressing fertilizers)	0.003	0.000	0.000	***
Constant	4.907	0.897	0.000	***
<b>Inefficiency parameters</b>				
Farming experience	0.000	0.004	0.956	
AMCOS experience	-0.003	0.007	0.607	
Age	0.003	0.003	0.338	
Household size	-0.012	0.010	0.229	
Zig-zag planting	0.567	0.257	0.028	**
Poor water distribution	0.503	0.097	0.000	***
Access to training	-0.274	0.108	0.011	**
Access to credit	0.101	0.055	0.067	*
Inputs from farmer groups	-0.016	0.091	0.863	
Late ploughing time	0.064	0.025	0.009	***
Sex	0.036	0.055	0.510	
Level of education	0.406	0.167	0.015	**
Marital status	-0.068	0.079	0.393	
Economic activities	0.255	0.075	0.001	***
Constant	-1.031	0.434	0.018	**
U Sigma constant	-3.075	0.256	0.000	***
V sigma constant	-4.945	0.179	0.000	***
Sigma u	0.215	0.027	0.000	***
Sigma v	0.084	0.008	0.000	***
lambda	2.548	0.029	0.000	***

\*\*\* = Significant at 1%, \*\* = Significant at 5% and \* = Significant 10% levels, std = standard deviation

The findings opposed those by Idiong (2007), Osung *et al.* (2014), Linn and Maenhout (2019), and Tadesse *et al.* (2017) who found that rice farmers' TE increased with an increase in years of schooling. Likewise, farmers with no other economic activity were associated with technical inefficiency at the 1% level, compared to farmers with other economic activities such as trade, livestock and farming other crops. This means that smallholder rice farming is not a standalone business as farmers may depend on other sources of income to sustain their farming business. Therefore, a farmer having no other economic activity and solely dependent on rice farming had a decrease in rice output by 0.255 units.

#### **2.4.6 Smallholder rice farmers competitiveness in AMCOS**

The overall average amount of paddy produced (kg/acre) was 2 783.691, with the highest mean observed in Madibira (2 886.329), followed by Kapunga (2884.016) and UWAWAKUDA (2 421.209). Productivity has been used as a measure of competitiveness among smallholder livestock systems in Botswana (Bahta, 2014). The higher the productivity, the greater the level of competitiveness. Therefore, members of Madibira were more competitive in terms of productivity, compared to those of Kapunga and UWAWAKUDA. The possible reasons for the differences in productivity were because Madibira members had higher water distribution in the rice farms, and more members had access to training and credit. This is contribution of AMCOS in improving the competitiveness of smallholder rice farmers in Tanzania through increased productivity from the current 0.81 tonnes/acre to the potential of 1.62 tonnes/acre by 2030 for self-sufficiency in rice productivity with a margin to export to neighbouring countries in the region (URT, 2019).

A technically efficient firm produces the maximum output for a given amount of inputs, conditional on the production technology available to it (Adeyemi *et al.*, 2017). Efficiency is one of the main drivers of competitiveness whereby the higher the TE, the lower the unit cost

of production, hence more competitiveness (Balde *et al.*, 2014). Madibira is therefore classified as competitive in terms of TE when compared to Kapunga and UWAWAKUDA. A study by Rahji and Omotesho (2007) on TE and competitiveness of rice farming in Nigeria found that about 85% of the farmers had their TE greater than or equal to the mean TE; hence they were classified as competitive with respect to rice production. Likewise, a study conducted by Sinaga *et al.* (2021) on the competitiveness of cassava farming in Indonesia revealed that the TE of cassava production becomes a determinant of competitiveness and the more efficient the production at the farm level, the higher the competitiveness. Consequently, more efficient rice farmers would have better chances of persisting and flourishing in the future than less efficient ones.

## **2.5 Conclusions and Recommendations**

Smallholder rice farmers in Madibira AMCOS are more competitive compared to Kapunga and UWAWAKUDA due to their high productivity, slightly higher TE than the average, and a good number of members in the high-level TE. The rice farms in the study area have been operating below the maximum level of production frontier; hence there is a potential for improvement. Factors influencing smallholder rice farmers' TE are access to training, water distribution, ploughing time, planting systems and access to credit. Despite the establishment of AMCOS being increasingly advocated by the government, the findings provide no evidence that co-operatives have so far directly affected agricultural productivity and TE. Instead, the findings provide evidence that AMCOS has affected the TE of smallholder farmers through coordinated training, the use of water-saving irrigation technologies, water infrastructures and access to credit. AMCOS in the irrigation schemes should consider proper water distribution in the rice plots, planting in rows and providing training on rice farming best practices to increase smallholder farmers' TE. Policymakers should prioritize the implementation of targeted training programs and enhance access

to agricultural inputs and credit facilities. The Local Government Authorities and development partners responsible for improving smallholder farmers' livelihoods should make sure that farming credits are properly channelled to farming and are given to farmers who exhibit the need for it. Further studies should be done to compare the competitiveness of smallholder farmers who are members of AMCOS and those who are not members.

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## CHAPTER THREE

### 3.0 SMALLHOLDER RICE FARMERS PROFITABILITY IN AGRICULTURAL MARKETING CO-OPERATIVE SOCIETIES IN TANZANIA: A CASE OF MVOMERO AND MBARALI DISTRICTS

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#### **ABSTRACT**

Smallholder rice farming in Tanzania is an important economic activity that has the potential to livelihood improvement of smallholder farmers. Yet, the profitability of the crop remains low due to several challenges it faces. This paper analyses costs and benefits associated with smallholder rice farming, determines profit distribution among farmers, and assesses risk bearing ability of smallholder rice farmers under changing circumstances of total variable costs, price and yields. The paper is based on a study which was conducted in Mvomero and Mbarali Districts and adopted a cross-sectional research design, with a sample size of 382 smallholder rice farmers who were selected from three Agricultural Marketing Co-operative Societies during the 2020/21 cropping season. Data were collected through a questionnaire-based survey and key informant interviews. Data were analysed using IBM SPSS Statistics and Excel software whereby Enterprise Budgetary

Technique and Sensitivity Analysis were performed. The study found an average Return on Investment of 0.42, a Benefit Cost Ratio of 1.42 and a Profit Margin of 24%. The levels of profitability differed among co-operatives whereby “*Umoja wa Wakulima Dakawa*” (UWAWAKUDA) had the highest return per acre (TZS 524 417), followed by Kapunga (TZS 414 111) and Madibira (TZS 316 638). Furthermore, smallholder rice farmers' gross margins were significantly affected by changes in Total Variable Costs, output price and yield per acre. The study concludes that rice production is a profitable business in the study area. Therefore, the Local Government Authorities, co-operatives and other stakeholders are urged to improve drivers that lead to increased rice profitability such as the water infrastructures, organize markets and build farmers' capacities to improve yields and profitability among smallholder rice farmers.

**Keywords:** Profitability, Rice, smallholder farmer, Co-operatives

### **3.1 Introduction**

#### **3.1.1 Background information**

Enhancing smallholder farmers' profitability<sup>1</sup> and competitiveness<sup>2</sup> is imperative for agricultural development in Tanzania. Rice production is the most important sub-sector in Tanzania since it plays a crucial role in the creation of jobs, income generation especially from rice exports, food security and poverty reduction. It is the most rapidly growing source of food in Africa and is of significant importance to food security and food self-sufficiency. It is a strategic crop mostly produced by smallholder farmers in various agro-ecological zones. About 92% of all rice produced in Tanzania is under upland and lowland rain-fed systems while only 8% is under irrigation schemes [1] and [2]. For several decades, rice has been one of the widely

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<sup>1</sup> Profitability in smallholder rice farming refers to the ability of the farmer to generate a financial profit from their rice production activities

<sup>2</sup> Competitiveness refers to the ability of smallholder farmers to offer goods that satisfy consumer demands in terms of price, quality, and quantity while making profits that allows them to thrive (Latruffe, 2010).

produced crops that contribute to Tanzania's food and nutrition security, socio-economic development and country's foreign exchange earnings [3]; [4]; [5]. Also, the livelihood of over two million people countrywide has been influenced by rice production and marketing [6]. About 2.9 million MT of rice was produced in the 2019/2020 crop season which is a more than 100% increase compared to 1.4 million MT which was recorded in the 2007/08 crop season [7]. The smallholder farming system produces about 90% of rice in farm sizes ranging from 0.9 to 3 hectares (ha), with an average farm size of 1.3 ha [3]; [6].

Efforts have been made by the Government of Tanzania to increase smallholder rice farmers' profitability along the rice value chain by addressing challenges facing smallholder rice farmers' competitiveness. The main focus has been on the provision of quality seeds, extension services, agricultural co-operatives formation and facilitating rice commercialization to promote smallholder farmers' competitiveness along the rice value chain [3]. The initiatives also include the development of Tanzania's Agricultural Sector Development Strategy (ASDS) II, notably from 2015 to 2025, with intention to enhance the competitiveness of farmers' organizations for competitive value chains [8]. The National Rice Development Strategy (NRDS) II has been established to enhance the market competitiveness of locally produced rice by reducing costs of production to increase efficiencies and improving milling operation standards [3]. Yet, smallholder farmers still have limited competitiveness in terms of profitability, hence a serious effect on their livelihood [9].

Agricultural Marketing Co-operative Societies (AMCOS) earn credit for encouraging farmers to adopt modern production technologies which have enabled Tanzania to achieve nearly a self-sufficient status in rice production. However, the growth of populations, poor access to farm inputs, lack of access to market information and technologies, and price instability make it difficult for smallholder rice

farmers to maintain sustainable profits in the coming decades [10]. The issue of smallholder farmers' profitability in rice farming has recently received considerable attention, and researchers have shown an increased interest in the matter.

The study adopted the most popular method of estimating smallholder farmers' profitability which is the cost and return analysis [11]. Among the driving forces of smallholder farmers' adoption of rice farming best practices advocated in AMCOS is the amount of profit generated. Profits derived by smallholder farmers can be a measure of their competitiveness [12]. Therefore, the higher the profit margin, the greater the competitive level [13]. Several attempts have been made to examine the profitability and its drivers in different production systems in rice farming in Vietnam, Nigeria, Bangladesh and Tanzania [14]; [15]; [16]; [17]; [10]; [18]; [19]. [20], [10], [16], [21], [22], in their studies, employed Farm Budgetary Technique (FBT) to input and output data as an analytical tool to measure farmers' profitability using gross margins and benefit-cost ratios in Tanzania, Bangladesh and Nigeria. The results showed significant profits in rice farming. [23] also applied the FBT in estimating the profits of paddy production in Nigeria. [13] and [24] utilized the Cobb-Douglas stochastic frontier production function to estimate the profit efficiency of smallholder milk production in Kenya and rice production in Nepal. This paper employed the Farm Budgetary Technique devised by [26] to examine smallholder rice farmers' profitability. The key strength of using FBT in cost-benefit analysis for smallholder rice farming is that it provides a comprehensive and detailed picture of the financial performance of the enterprise. By breaking down costs and revenues into their component parts, farmers and analysts can identify the specific inputs or activities that are driving costs up or revenues down. This information can then be used to make informed decisions about how to allocate resources and improve the financial performance of the enterprise.

The Return on Investment (ROI), Gross Margin (GM), Net Present Value (NPV), Internal Rate of Return (IRR), Break-even Analysis, and Benefit-Cost Ratio (BCR) are a few examples of profitability metrics. The measurements vary from one another in terms of how profit is expressed and how easily a project's financial viability is analysed. BCR and IRR are worthwhile in expressing project feasibility for several years (t). The NPV, as defined by [27], is the financial profitability of an investment that takes into account the risk of future profits. Investment in a project is lucrative when the NPV is greater than 0. IRR is the discount rate at which the investment's NPV of benefits equals its NPV of expenses. The benefit of the investment outweighs the cost of the investment if the BCR ratio is larger than 1. According to [28], GM is an important measure of resource efficiency in Small and Medium Enterprises (SMEs). GM, which can be stated as a normal value (TZS), a ratio, or a percentage of return, is the gross return less the sum of all variable expenses. When calculating ROI, fixed costs and variable costs are both taken into account.

When used as profit indicators, NPV and IRR appear more complicated than GM and ROI, especially for smallholder rice farmers like those in the Mvomero and Mbarali Districts [28]. ROI ignores the time component, although this is not a concern for this paper because the profitability analysis of selected smallholder rice farmers only takes the 2020/2021 growing season into account. Return on Investment (ROI), Gross Margin (GM), Benefit Cost Ratio (BCR), and Break-even Analysis, however, were used in this paper since they are widely utilized by different scholars, simple, yet effective parameters for assessing the financial performance of a particular business [29,30,31]. These metrics are used to assess the performance of small and medium businesses. The four measures were used due to the seasonal nature of smallholder rice production and the desire of the corresponding farmers to raise income and lessen poverty in the study area. Smallholder rice farmers want to know their profit in terms of the precise income (TZS) they receive

after paying production costs, which include both fixed and variable costs. Also, ROI is worthwhile for smallholder farmers so that they can measure returns in terms of how much TZS is created for every single TZS invested in production.

Surveys such as those conducted by [17], [25], [10], [18] and [19] have reported that rice farming is a profitable business among smallholder farmers in Tanzania. However, assessment of the risk-bearing ability of smallholder rice farmers under changing circumstances of total variable costs, price and yield have not been well established. Scant evidence on the same exists in the previous studies. This research presents findings that can be used to fill this gap in the literature by showing the optimum level of production using the existing resources.

The focus was given to rice production because of the growing rice demand, especially with an increasing household income in the cities [10]. Therefore, there was a need to analyse the profitability of smallholder rice farmers under the context of AMCOS which has been reported to be effective in providing information for the new entrant into the business become necessary. Information from this study will enrich the existing literature and inform policymakers in developing effective policies to enhance the performance of AMCOS to reduce poverty and improve members' well-being. The overall objective of this paper was to examine smallholder rice farmers' profitability. Specifically, the paper (i) analysed costs and benefits associated with smallholder rice farming, (ii) determined profit distribution among farmers, and (iii) assessed risk-bearing ability of smallholder rice farmers under changing circumstances of total variable costs, price and yield in the study area.

### **3.1.2 Theoretical framework**

#### **3.1.2.1 Porter's Diamond Model of Competitiveness**

This study on which this paper is based was guided by Porter's Diamond Model of Competitiveness [32]. In his study on competitive

advantage, [32] identified six (6) factors as determinants of the competitiveness of firms. He argued that a firm is likely to succeed in a particular industry because of certain conditions. These conditions are factor conditions; demand conditions; related and supporting industries; strategy, structure and rivalry; government-supportive policy; and the role of chance which includes factors that can harm or benefit the competitive position of farmers and are out of farmers' control, such as unreliable rainfall, drought and diseases. Meeting such conditions has an implication on the competitiveness of smallholder rice farmers in terms of profit levels. The strength of this model is that it can help to identify the competitive advantages of the industry and provide guidance for policy development and investment decisions among smallholder rice farmers regarding their returns. The model has been successfully used by several researchers to analyse determinants of competitiveness of various agricultural industries [33]; [34]; [35]; [36], and was therefore regarded appropriate for the study on smallholder rice farmers who are members of AMCOS in Tanzania.

### ***3.1.2.2 Transaction Cost Theory***

The study was also guided by the Transaction Cost Theory (TCT), first presented by [37] while attempting to characterize the interaction between a corporation and the market. According to the notion, if transaction costs are not reduced to the barest minimum, smallholder farmers won't be motivated to actively participate in the market which has an implication on profit levels. [38] defined transaction costs to include those costs related to finding a trading partner with whom to exchange goods and services, screening and haggling with the partner and upholding the terms of the trading partner's contract.

The TCT refers to costs that occur before (ex-ante) and after (ex-post) market and the farmer physically exchanges the agricultural commodity. Ex-ante transaction costs include the costs of obtaining information and bargaining for an exchange of goods or services to

occur while ex-post transaction costs, on the other hand, are incurred in coordinating production, harvesting, transportation, and processing as well as monitoring and enforcing compliance with the agreement [39]. Focusing on transactions makes sense as transaction costs are the underlying reason smallholder farmers engage in AMCOS. In this regard, a TCT-based type of AMCOS can help smallholder farmers select an appropriate co-operative society for known transaction characteristics. The idea of opportunity cost is typically utilized to capture transaction costs because they are by nature hidden expenditures [38]. The theory has been widely used in agricultural economics studies and related fields in developing countries [40, 41, 42, 39]. The limitation of using this theory is that it can be difficult to measure transaction costs, particularly in the context of smallholder rice farming. For example, it can be challenging to quantify the time and effort required to negotiate with buyers or to resolve disputes with input suppliers. The linkage between the Porter's Diamond model and the Transaction Cost Theory lies in their combined ability to explain the determinants of competitiveness and the challenges faced by smallholder rice farmers in their market transactions. The Porter's Diamond model helps identify the broader determinants of competitiveness, while the Transaction Cost Theory provides a lens to analyse the specific transactional costs and challenges that influence farmers' competitiveness.

### **3.1.3 Characteristics of the studied Agricultural Marketing Co-operative Societies**

This section summarizes the characteristics of the three co-operative societies that were the focus of this study. Kapunga AMCOS was initiated in October 2007 via local collective action with assistance from USAID. Kapunga has a relatively small member base (800 members). Although there is potential in offering similar services in the future, there was no financial support for members in the form of subsidized input costs or credit at the time the data was gathered. Agricultural training and study tours were organized by co-

operative leadership for members of neighbouring co-operatives. Instead of using the co-operative, middlemen were used to sell most of the rice that was produced and few managed to sell at Chimala Centre which is 32km from the scheme. All members under the irrigation scheme grew high-yielding improved variety TXD 306 (Saro 5). No land rent was paid to the co-operative society.

By comparison, UWAWAKUDA is older and formally organized with a member base of 949. By virtue of these differences, the UWAWAKUDA offers some services that the Kapunga co-operative does not. The UWAWAKUDA co-operative was formed in 2007 via collective action and a government initiative with support from Agricultural Development Denmark Asia (ADDA) and Rural Economic and Agriculture Development Agency (READA). This AMCOS does not have a Savings and Credit Co-operative Society attached to it as it is the case for Kapunga and Madibira. It is the only AMCOS that was very close to a research institute (CHOLIMA Research Institute), compared to the other two co-operatives which had to travel to CHOLIMA, Uyole and TARI Ifakara for similar services. The co-operative organizes training and demonstrations on farm preparations and use of inputs and has employed an extension officer. As for Kapunga, middlemen were used to sell most of the rice that was produced and few managed to sell at Dakawa town Centre which is 20 km from the scheme. Land rent is paid to the co-operative.

Madibira was the oldest, more formally organized with a member base of 3 000. By virtue of its time of existence, it offers some services that the Kapunga and UWAWAKUDA co-operatives do not. The Madibira co-operative was formed in 1997 via a government initiative with support from African Development Fund (ADF) and Rural Economic and Agriculture Development Agency (READA). This AMCOS has a Savings and Credit Co-operative Society attached to it as it is the case of Kapunga. This co-operative secured research services from CHOLIMA Research Institute, Uyole and

TARI Ifakara. The co-operative organizes training and demonstrations on farm preparations and the use of inputs and shares a government extension officer found at the district level. As for Kapunga and UWAWAKUDA, middlemen were used to sell most of the rice that was produced and few managed to sell at Mafinga Centre which is 70km from the scheme. Land rent was paid to the co-operative as one of its sources of income. In addition, the three co-operatives do not provide credit and agricultural inputs, such as fertilizer at subsidized cost to their members instead they organize the service providers for easy access by farmers.

### **3.2 Methodology**

The study from which this paper emanates was conducted in Mbarali and Mvomero Districts in Mbeya and Morogoro Regions, respectively. The districts were purposely selected for the study as they fall within suitable agro-ecological zones for rice production and are among the top rice-producing districts with a considerable number of rice value chain actors [8].

The study adopted a cross-sectional research design whereby data were collected at a single point in time. The study involved three hundred and eighty-two (382) respondents who were estimated using the [43] formula. From the two districts, three AMCOS were purposively selected; the criteria for the selection were good performance and involvement in the rice farming business. Kapunga smallholders and Madibira AMCOS were selected from Mbarali District while UWAWAKUDA AMCOS was selected from Mvomero District. The selection of the respondents was done based on the sampling frame of 4 749 members whose names were obtained from the relevant AMCOS offices, and the criteria were farmers having sizes of rice farms ranging from 0.9 to 3 ha in the irrigation scheme. The sampled individuals were selected from lists of farmers by using a simple random sampling technique. A structured questionnaire was used to collect quantitative information from individual smallholder rice farmers.

The analysis of costs and benefits associated with smallholder rice farming and estimating profitability realized by smallholder farmers was undertaken using the Enterprise Budgetary Technique (EBT) devised by [26]. The EBT was specified as follows:

<b>Farm budget</b>	<b>Equation</b>
TR	$\Sigma$ Income from paddy, rice , rice bran and broken rice
TIC	$\Sigma$ Intermediate costs
TLC	$\Sigma$ Labour costs
TVC	TIC + TLC
TVC	$\Sigma$ All variable costs
GM	TR-TVC
TFC	$\Sigma$ All fixed costs
TC	TVC + TFC
NP	TR – TC
PM (%)	(TR-TC/TR) 100
ROI	NP/TC
OER	TVC/TR
BCR	NFI/TC
Break-even price	TC/Yield
Break-even yield	TC/Sale price

where: TR = Total Revenue, TIC = Total Intermediate Costs, TLC = Total Labour Costs, TVR = Total Variable Costs, GM = Gross Margin, TFC = Total Fixed Costs, TC = Total Costs, NP = Net Profit, PM = Profit Margin, ROI = Return on Investment, BCR = Benefit Cost Ratio, and NFI=Net farm Income. Competitiveness was determined using profit levels, which allowed for analysing farmers' profitability based on PM.

To determine profit distribution among farmers, profitability percentiles were calculated using the weighted average method and Tukey Hinges for quartiles calculation [44, 45]. The profitability structure and distribution were determined by categorizing profits or

loss earning scale as less than 5%, 5% to 25%, 25% to 75%, 75% to 95% and 95% to 100%. The medium profitability was from the 1<sup>st</sup> quintile to the 3<sup>rd</sup> quintile which was the inter-quintile range. Extreme outliers in the distribution were used to categorize extreme losses from 0% to 5% and extreme profits from 95% to 100%. Smallholder rice farmers had different profit margins; low profits/losses typically range between 5% and 25%, while high profits range between 75% and 95%. This demonstrates the variation in profitability among smallholder rice farmers, some of whom fared substantially better than others.

In this study, Sensitivity Analysis was undertaken to assess the risk-bearing ability of smallholder rice farmers under varying circumstances of price and yield and variable costs [46]. This method was used to assess the effect of output price, yield and variable costs on the gross margin as a measure of the profitability of the enterprise by varying 10% above and below (that is  $\pm 10\%$ ) the received price, attained yield and total variable costs of rice farming.

Break-even analysis is a useful tool for determining the minimum price or yield required for a business to cover its costs and achieve a profit of zero. Regardless of whether it optimizes profit, an organization frequently finds it useful to understand what price (or output level) must be reached for total revenue to be exactly equal to the total costs [31]. This can be done with a break-even analysis and in this case, break-even analysis was done to determine the minimum output and price necessary to prevent a loss for the smallholder rice farming business

$$\text{Break – even price} = \frac{\text{Total Costs}}{\text{Yield}}$$

The agricultural operation generates an economic profit if unit farm-gate prices are higher than the break-even price.

$$\text{Break – even yield} = \frac{\text{Total Costs}}{\text{Sale price}}$$

The smallholder rice farming business makes a profit if per-acre yields are higher than the break-even yield.

### **3.3 Findings and Discussion**

#### **3.3.1 Smallholder rice farmers benefit-cost analysis**

The findings on revenues, as presented in Table 3.1, indicate that the average revenue of TZS 1 360 236 was obtained by smallholder rice farmers per acre. This means that, on average, the sales from paddy, rice, rice bran and broken rice amounted to an average of TZS 1 360 236 per acre for every farmer. The findings are comparable with the average revenue of TZS 1 218 270 observed earlier among smallholder rice farmers reported by [15]. The findings of this study differ from the average revenue of TZS 2 030 000 reported by [22] in the profitability analysis of Ofada rice production in Nigeria.

**Table 3.1: Average Farm Budget Structure among Smallholder Rice Farmers (in TZS per acre)**

Budget Items	AMCOS			Overall
	Kapunga	Madibira	UWAWAKUDA	
Income from paddy	1 120 821.32	1 109 510.64	1 247 351.80	1 142 378.71
Income from milled rice	238 519.13	244 498.25	118 901.13	215 252.03
Income from rice bran	0.00	33.76	0.00	20.68
Income from broken rice	1 892.45	3 524.36	527.13	2 584.73
<b>Total Revenue(TR)</b>	<b>1 361 232.90</b>	<b>1 357 567.02</b>	<b>1 366 780.07</b>	<b>1 360 236.15</b>
Ploughing cost	54 790.32	61 064.10	45 011.63	56 431.94
Harrowing cost	56 516.13	59 645.30	42 976.74	55 384.82
Cost of borrowing land	81 225.81	99 572.65	0.00	74 178.01
Cost of seeds	38 915.32	43 162.45	39 413.36	41 629.09
Cost of Planting fertilizer	61 426.08	25 594.53	65 517.44	40 398.00
Cost of topdressing fertilizer	97 125.84	106 429.16	79 477.91	98 851.64
Cost of Insecticides	3 088.71	137.18	6 216.28	1 984.82
Cost of Herbicides	16 445.48	13 563.95	16 118.60	14 606.76
Cost of pesticides	4 125.16	845.64	4 953.49	2 302.72
Harvesting	130 451.61	131 854.70	74 534.88	118 722.51
Transport	49 653.23	59 215.81	47 372.09	54 997.38
Storage	36 911.29	17 128.21	26 831.40	22 523.56
Cost of Sacks	25 567.42	23 333.85	22 050.00	23 407.33
<b>Total Intermediate Costs (TIC)</b>	<b>656 242.40</b>	<b>641 547.53</b>	<b>470 473.83</b>	<b>605 418.58</b>
Nursery preparation	13 951.61	11 345.30	20 546.51	13 839.79
Transplanting	70 496.77	84 318.80	101 279.07	85 893.72
Planting Fertiliser application	4 474.19	2 034.19	5 825.58	3 283.77
Top Dressing application	6 277.42	6 239.32	5 488.37	6 076.44
Herbicide application	5 370.97	5 989.32	5 372.09	5 750.00
Pesticide application	2 903.23	641.03	2 744.19	1 481.68
Insecticide application	1 000.00	123.93	1 872.09	659.69
Weeding	47 677.42	43 585.47	47 406.98	45 109.95
Bird scaring	967.74	45 017.09	88 081.40	47 562.83
Irrigation labour	548.39	504.27	1 744.19	790.58
Loading and offloading	14 483.87	14 497.86	12 936.05	14 143.98
Drying labour	15 941.94	22 793.59	17 867.44	20 572.51
Levelling labour	4 774.19	9 307.69	0.00	6 476.44
<b>Total Labour Costs (TLC)</b>	<b>256 879.03</b>	<b>250 581.20</b>	<b>253 889.53</b>	<b>252 348.17</b>
<b>Total Variable Cost (TVC)</b>	<b>913 121.44</b>	<b>892 128.72</b>	<b>724 363.36</b>	<b>857 766.75</b>
<b>Gross Margin (GM)</b>	<b>448 111.47</b>	<b>465 438.30</b>	<b>642 416.72</b>	<b>502 469.40</b>
Cost of renting land	0.00	70 000.00	50 000.00	54 136.13
Irrigation cost	34 000.00	78 800.00	68 000.00	69 097.38
<b>Total Fixed Costs (TFC)</b>	<b>34 000.00</b>	<b>148 800.00</b>	<b>118 000.00</b>	<b>123 233.51</b>
<b>Total Costs (TC)</b>	<b>947 121.43</b>	<b>1 040 928.72</b>	<b>842 363.36</b>	<b>981 000.26</b>
<b>Net Profit (NP)</b>	<b>414 111.47</b>	<b>316 638.29</b>	<b>524 416.71</b>	<b>379 235.89</b>
<b>Profit Margin (PM) %</b>	<b>27.18</b>	<b>19.23</b>	<b>35.21</b>	<b>24.12</b>
<b>Return On Investment (ROI)</b>	<b>0.47</b>	<b>0.33</b>	<b>0.64</b>	<b>0.42</b>
<b>Operating Expenses Ratio (OER)</b>	<b>0.70</b>	<b>0.69</b>	<b>0.56</b>	<b>0.66</b>
<b>Benefit To Cost Ratio (BCR)</b>	<b>1.47</b>	<b>1.33</b>	<b>1.64</b>	<b>1.42</b>
<b>Break-even yield</b>	<b>1 990.54</b>	<b>2 248.52</b>	<b>1 513.05</b>	<b>2 035.91</b>
<b>Break-even price</b>	<b>354.61</b>	<b>378.17</b>	<b>364.65</b>	<b>371.31</b>

The breakdown of costs in rice farming per acre is illustrated in Table 3.1. On average, rice farmers incurred a total cost amounting to TZS 981 000 which was the summation of Total Variable Costs (TZS 857 766) and Total Fixed Costs (TZS 123 233). Total Variable Costs were the summation of TIC and TLC while Total Fixed Costs were the sum of irrigation costs and land rent costs paid to the co-operative society at the beginning of every season. The highest costs were experienced in Madibira while the lowest costs were in UWAWAKUDA. These results on TC differ from [16]'s earlier estimates of TZS 621 348, TZS 753 520 by [22], and TZS 562 000 by [47], but they are broadly similar to earlier TZS 846 470 estimated by [10]. The most interesting finding was that the average TLC was estimated to be TZS 252 348. The findings of the current study are different from those reported by [47] and [18]. A possible explanation for these results is the use of machines in most of the activities reported in this study unlike in previous studies where most of the activities were done by humans including ploughing, transport, and harvesting.

The findings in Table 3.1 show that UWAWAKUDA farmers had a Profit Margin (35%) higher than the overall average (24%). This means that farmers in UWAWAKUDA were selling their produce at a high-profit level compared to the rest of the farmers. This is due to the fact that UWAWAKUDA worked closely with a research institute and is situated about 21 km from the main road where most input suppliers and traders are found. These results are informed by Porter's Diamond model of competitiveness which postulates that supportive and related industries such as research institutes enhance the competitiveness of a firm. Also, UWAWAKUDA had the lowest transaction costs in terms of transport (TZS 47 372) which supports the TCT which explains the effect of transaction costs on profit levels. The overall results differ from the estimates of 45% in Ethiopia and Nigeria [48]; [20]. The findings in Table 3.1 also show that the overall mean Return on Investment (ROI) per farmer was 0.42, which means that, for each TZS 1 invested in rice production,

a farmer received TZS 0.42 as a gross margin. Thus, from the overall profitability analysis result, irrigation scheme rice farming is a profitable enterprise in the study area. This is an indication that smallholder rice farmers in the study area were able to meet the demand, wishes and needs of the markets as explained in the second attribute of Porter's Diamond model of competitiveness.

The overall average BCR 1.422 shown in Table 3.1 indicates that the expected benefit exceeded the expected Total Costs. This means that the Total Costs had to rise by 42.2% before the ratio would be reduced to a break-even point. The Gross Margin of rice was calculated by deducting the total variable cost from the total return which was TZS 502 469 per acre as shown in Table 3.1. This indicates that, after deducting all the variable costs associated with producing one acre of rice, farmers were left with a profit of TZS 502 469. This is a positive sign for the farmers, as it suggests that rice farming is a profitable venture for them, at least in the short term.

Results on break-even analysis show that the break-even price in paddy was TZS 371.31 per kilogram whereas the break-even yield was 2035.91 kg per acre. This means that the smallholder rice farmers need to sell their paddy at a minimum price of TZS 371.31 per kilogram in order to cover their total costs and break even. Similarly, the break-even yield was 2035.91 kg per acre, which means that the farmers needed to produce at least 2035.91 kg of paddy per acre in order to cover their total costs and break even. If they produced less than this amount, they would not be able to cover their costs and would incur losses.

Therefore, smallholder rice farmers should take advantage of this profitability by investing money into other economic activities for improved livelihood. The findings compare well with those reported by other studies [11]; [16]; [20]; [49]. Other scholars [15]; [10] have also reported high returns among smallholder rice farmers.

### 3.3.2 Profit distribution among smallholder rice farmers

The findings on profit and loss among smallholder rice farmers in the study area as presented in Table 3.2 ranged from TZS -469 600 to 1 008 500. In UWAWAKUDA, 10(11.64%) smallholder farmers had profits at > 95 percentile, while only 5(2.14%) farmers in Madibira and 4(6.45%) in Kapunga were found at the same level. The results mean that the proportion of UWAWAKUDA farmers in the extreme profits category was more than twice as large as that of farmers at Kapunga and Madibira. There was a higher proportion of farmers with extreme profits in UWAWAKUDA, compared to the other AMCOS since the mentioned co-operative society was more formally organized and was able to provide farmer training from the co-operative extension and obtained seeds from the research institute at low costs. The findings are informed by the TCT that smallholder farmers made informed decisions and actively participated in the market due to minimum transaction costs.

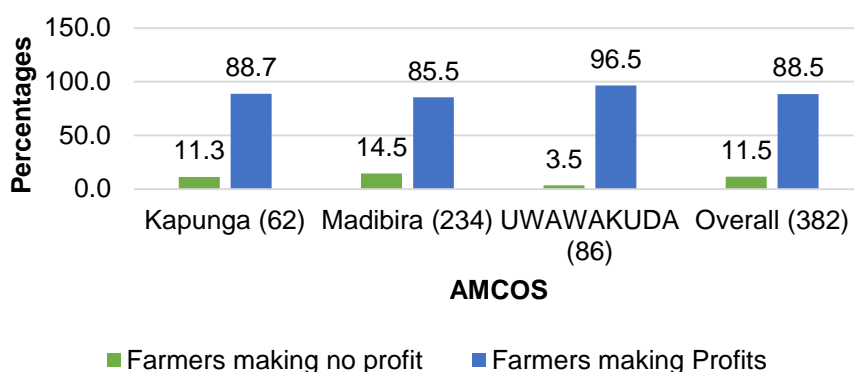
**Table 3.2: Descriptive Statistics for Profit/Loss Percentiles**

Percentiles	Profits Groups(TZS)	AMCOS					
		Kapunga		Madibira		UWAWAKUDA	
		n	%	n	%	n	%
<5%	-469 600 to -241 449	2	3.23	16	6.84	1	1.16
5% - 25%	-241 450 to 166 750	9	14.52	59	25.21	8	9.30
25% - 75%	167 000 to 625 750	35	56.49	117	50.00	40	46.51
75% - 95%	626 000 to 835 595	12	19.35	37	15.81	27	31.40
>95%	836 000 to 1 008 500	4	6.45	5	2.14	10	11.64
<b>Total</b>		<b>62</b>	<b>100</b>	<b>234</b>	<b>100</b>	<b>86</b>	<b>100</b>

At Madibira AMCOS, 75(32.05%) farmers had profits/loss at less than 25 percentile as extreme loss among farmers. This means that the proportion of farmers in Madibira in the extreme loss category was more than twice as large as the UWAWAKUDA and among Kapunga smallholder farmers. However, 117 (50%), 40(46.51%) and 35(56.49%) farmers in Madibira, UWAWAKUDA and Kapunga had their profits in the inter quintile range of 75% - 95% (medium) of profits (Table 3). This means that at least half of smallholder rice farmers in every AMCOS had their profits at the medium level. The

findings observed in this study compare well with those reported by [50] and [20] in Liberia and Ethiopia who reported a significant number of rice farmers with medium profits from rice farming respectively.

The majority (88.5%) of smallholder farmers in the surveyed AMCOS made profits while 11.5% of farmers had negative profits (loss) as shown in Figure 3.1. This result indicates that, on average, the smallholder farmers were able to generate a positive return on their investment in farming activities. This is a positive sign for the smallholder farming sector, as profitability is a key factor in ensuring the sustainability of farming operations. The findings are similar to those reported by [25]; [22] in Tanzania and Nigeria.



**Figure 3.1: Profit distribution among smallholder farmers**

### 3.3.3 Sensitivity analysis

The sensitivity analysis results in Table 3.3 show that there is a relationship between total variable costs, output price, yield and the Gross Margin of smallholder rice farmers in the study area. The results indicate that smallholder rice farming was likely to be more sensitive to both price and yield than total variable costs. With a 10% increase in total variable costs, smallholder rice farming resulted in a Gross Margin of TZS 416 693 which is a 17% decrease, while a

10% decrease in the same variable resulted in a Gross Margin of TZS 588 246 which is a 17% increase. The implication is that smallholder rice farmers' profitability is sensitive to changes in variable costs. The results of the present study corroborate those by [31] where a decrease or increase in total variable cost by 10% increased or decreased the Gross Margin by 11% in rain-fed upland rice production managed by smallholder farmers in Ethiopia.

**Table 3.3: Sensitivity analysis of smallholder rice farming**

Item	Actual	TVC per acre		Price of rice/paddy		Yield of rice/paddy	
		10%	10%	10%	10%	10%	10%
		Increase	Decrease	Increase	Decrease	Increase	Decrease
Total Variable Cost (TVC)	857 767	943 543	771 990	857 767	857 767	857 767	857 767
Paddy yield sold(kg/acre)	2 345	2 345	2 345	2 345	2 345	2579	2 110
Unit price(TZS)	453	453	453	498	408	453	453
Value of paddy(TZS)	1 142 379	1 142 379	1 142 379	1 256 617	1 028 141	1 256 617	1 028 141
Rice yield sold(kg/acre)	278	278	278	278	278	306	251
Unit price(TZS)	841	841	841	925	757	841	841
Value of rice(TZS)	215 252	215 252	215 252	236 777	193 727	236 777	193 727
Value of rice bran(TZS)	21	21	21	21	21	21	21
Value of broken rice(TZS)	2 585	2 585	2 585	2 585	2 585	2 585	2585
Total return	1 360 236	1 360 236	1 360 236	1 495 999	1 224 473	1 495 999	1 224 473
Gross margin	502 469	416 693	588 246	638 232	366 706	638 232	366 706
% change in gross margin		-17	17	27	-27	27	-27

The findings in Table 3.3 show that a 10% decrease or increase in output price brought a 27% decrease or increase in gross margin. A slight change in output price had a substantial effect on the profitability of smallholder rice farmers. This means that smallholder rice farmers' profit margins were significantly affected by changes in the price they receive for their rice. In particular, a 10% increase in the price the smallholder rice farmers received for their rice led to a 27% increase in their gross margin, while a 10% decrease in the price they receive for their rice led to a 27% decrease in their gross margin. Similarly, a 10% increase in yield led to a 27% increase in their gross margin, while a 10% decrease in yield led to a 27% decrease in their gross margin. This means that smallholder rice farmers' profit margins are significantly affected by changes in the amount of rice they are able to produce per acre. Similar results were found in a study by [31] where a 10% decrease or increase in the price and yield of rice grain brought a 18% decrease or increase in gross margin in smallholder rain-fed upland rice farming in Ethiopia.

### **3.4 Conclusions and Recommendations**

The Gross Margin, Benefit Cost Ratio, Return on Investment and Break-even analysis results suggest that Smallholder rice growing under irrigation schemes managed by AMCOS is a profitable business that should be encouraged, considering the changing consumer preferences in Tanzania. Farmers in UWAWAKUDA have been able to achieve higher profits than the rest of the farmers due to their close collaboration with a research institute and proximity to input suppliers and traders. Alongside profitability, smallholder rice farming was sensitive in changes in total variable costs, yield and output price as shown in the Sensitivity Analysis results. Since smallholder rice farming is a profitable business, the findings of this study suggest that its production could enhance self-sufficiency and foreign exchange earnings in Tanzania.

It is, therefore, recommended that AMCOS should build farmers' capacity on proper use of inputs such as fertilizers and herbicides to reduce costs of production per acre. A well-managed programme or mechanism that aims at increasing rice yield per area, and organizing markets and value addition should be introduced. This could be implemented through bulk procurement of inputs by the co-operative society or by organizing suppliers. A good practice of organizing input suppliers for easy access was observed in UWAWAKUDA, and hence it can be a derivative to other co-operatives. Further studies should be done to evaluate smallholder rice farmers' profitability in terms of NPV and IRR. The profitability of rice farming in the irrigation schemes could be enhanced and become more attractive by farmers seeking market information on output prices prior to selling and organizing group marketing. The study recommends policies that will improve linkages between farmers and co-operatives for better implementation of agronomic practices to improve farmers' yields. Also, a fair price policy should be designed by Local Government Authorities in collaboration with AMCOS to control price fluctuations in rice so that smallholder rice farmers can earn more profit from rice and invest in other economic activities for improved livelihood.

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## CHAPTER FOUR

### 4.0 SMALLHOLDER RICE FARMERS' ACCESS TO INFORMATION IN TANZANIA: CAN AGRICULTURAL MARKETING CO-OPERATIVE SOCIETIES PROVIDE QUALITY INFORMATION?

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#### ABSTRACT

Access to quality information plays a crucial role in enhancing the competitiveness of smallholder rice farmers in Tanzania. Agricultural co-operatives have the potential to overcome smallholder farmers' information asymmetry. Yet, there is a lack of comprehensive understanding regarding the extent to which Agricultural Marketing Co-operative Societies (AMCOS) can effectively provide quality information to smallholder farmers as required by Co-operative Principle number five (Education, Training, and Information). This paper analyses the current level of access to information among smallholder rice farmers in AMCOS, evaluating the relevance, adequacy and reliability of information provided by AMCOS to its members and identifying the factors influencing the adequacy of the information provided by AMCOS. The study was conducted in Mvomero and Mbarali Districts. A cross-sectional research design was used and data were collected using a questionnaire that was administered to 382 randomly selected farmers based on registers

availed by co-operative managers in three co-operatives. Data were analysed using IBM SPSS software whereby ordinal logistic regression was used to estimate the influence of various factors on the adequacy of information obtained from AMCOS. The study found that 77.2% of farmers accessed information on rice agronomy. Smallholder rice farmers obtained adequate (52.6%), relevant (35.6%) and reliable (37.7%) information from their respective AMCOS. The adequacy of information was influenced by membership in social groups, access to rice agronomy information and financial information at  $p < 0.05$ . It is concluded that agricultural co-operatives are potential platforms for providing quality information in enhancing smallholder rice farmers' informed decision-making. The study recommends that efforts should be made to strengthen AMCOS by providing them with resources, training, and support to enhance their capacity to deliver accurate and timely information to farmers. This should include collaboration with agricultural extension service providers and leveraging their networks to access up-to-date information on agronomic practices, weather forecasts, and market trends to enhance farmers' competitiveness in rice farming.

**Keywords:** rice farming, adequacy, relevance, reliability and information access

#### **4.1 Introduction**

Smallholder agriculture contributes significantly to economic growth, job creation, and food self-sufficiency. Meeting farmers' information needs could help smallholder rice farmers increase agricultural productivity, and market accessibility as a key tool for rural development, poverty reduction, and food security. Different types of collective organisations including agricultural co-operatives have emerged and been recognised by academia, governments, and donors in the early years of the 21<sup>st</sup> century to improve the productivity and competitiveness of smallholder farmers (Tefera *et al.*, 2017). Smallholder farmers' challenges in farming include poor access to credit services (Deresse & Zerihun, 2018), shortage of training and low market access (Gashaw & Kibret, 2018), high transaction costs and information asymmetries (Cheng *et al.*, 2022), especially those living in rural remote areas.

In view of the above, one of the major issues impeding smallholder farmers' attempts to raise their output is access to relevant, timely and adequate agricultural information (Ndimbwa *et al.*, 2021). This may result in uninformed decisions on what to produce, when to produce, potential markets available, the quantities, and how to store produce (Singh *et al.*, 2018). To limit the effect of such risks and doubts, smallholder farmers need to make well-versed decisions by having access and use of agricultural information that empowers them with the ability to plan and make informed decisions about farming activities (Ndimbwa *et al.*, 2021). This is made possible when smallholder farmers have acceptable access to quality agricultural information. Mur *et al.* (2016) argue that the main criteria to assess the quality of information service to farmers include its relevance (being timely, addressing farmers' needs, affordable, applicable, tailored to farming and socioeconomic contexts), and reliability (being consistent, accurate, transparent, locally validated). To access the required type of information such as price and market information, post-harvest handling, rice agronomy information, and

financial information, farmers must select pertinent and appropriate sources of agricultural information (Hilary *et al.*, 2017; Mtega, 2021).

Mass media and mobile phones, fellow farmers, agricultural extension agents, and Agricultural Marketing Co-operative Societies (AMCOS) are the commonly used sources of agricultural information among smallholder farmers (Deresse & Zerihun, 2018; Mtega, 2021; Ndimbwa *et al.*, 2021; Nikam *et al.*, 2022). However, co-operatives have gained attention as potential vehicles for the economic and social development of smallholder farmers, as they provide support for accessing information and advisory services through its operating principles. “Education, Training and Information” is one of the principle of co-operatives that requires AMCOS among other things to provide reliable and quality information to its members and general public (Cheng *et al.*, 2022; Mamo *et al.*, 2021; Muench *et al.*, 2021; Tumenta *et al.*, 2021).

It is well-established in the literature that AMCOS enhance farmers’ access to information. For example FAO (2012), Deresse & Zerihun (2018), Liu *et al.* (2019), Bachke (2019), Achamyelh & Hailemariam (2020), Muench *et al.* (2021), Tuna & Karantininis (2021), Nikam *et al.* (2022) reported that agricultural co-operatives enhance smallholder farmers’ access to information on markets, agronomy, credit, climate change and innovations. In particular, agricultural co-operatives serve as an information-exchange platforms where a farmer benefits from other farmers’ experience, which helps them to implement the best agricultural practices to increase their productivity and livelihoods (Mahmood *et al.*, 2021; Mamo *et al.*, 2021). It has been reported by Buadi *et al.* (2013), Jona & Terblanché (2015), Maake & Antwi (2022) and Sylla *et al.* (2019) that smallholder farmers receive relevant services from public and private agricultural extension service providers in various countries. However, farmers had mixed opinions concerning the services with respect to their adequacy, availability, effectiveness (Maake & Antwi, 2022) and timeliness of supply (Buadi *et al.*, 2013).

Studies such as ones by Hilary *et al.* (2017) and Kassem *et al.* (2020) have reported on the quality of extension services provided through various communication channels in Uganda and Egypt. In those studies, extension services were perceived as relevant to farmer operations and needs. Studies have further reported the level of education, farm size, diversity of farming activities, annual incomes and participation in extension services as factors influencing farmers' satisfaction with the quality of extension services (Kassem *et al.*, 2021; Misozi & Chrispin, 2019). Evidence from Hilary *et al.* (2017) on information quality in farmer organisations in Bugiri and Luwero districts of Uganda reported an exchange of quality and valuable information among farmer organisations, with information from government actors being the least reliable and that from the private actors being the most reliable.

In Tanzania, smallholder rice farmers face significant challenges in accessing quality information necessary for their agricultural practices. Despite the extensive literature on potential benefits of information dissemination through AMCOS, it remains unclear whether these co-operative societies can effectively provide smallholder rice farmers with the quality information basing on their needs. The lack of access to reliable and accurate information hampers the ability of smallholder rice farmers to make informed decisions regarding farm management and post-harvest practices. Therefore, it is essential to investigate whether AMCOS can fulfil the role of reliable information providers and address the information gap faced by smallholder rice farmers in Tanzania. This paper addresses this research gap by assessing the current level of access to information among smallholder rice farmers in AMCOS, evaluating the relevance, adequacy and reliability of information provided by AMCOS to smallholder rice farmers and identifying the factors influencing the adequacy of the information provided by AMCOS in Tanzania.

## **4.2 Methodology**

The study was conducted in Mvomero and Mbarali districts of Morogoro and Mbeya Regions, respectively, in Tanzania. The districts were specifically chosen for the study because they are among the top rice-producing districts in Tanzania and include a significant number of rice value chain actors. The lack of access to reliable and accurate information in the study area hampers the farmers' ability to make informed decisions regarding crop management and post-harvest practices. The two districts also fall within acceptable agro-ecological zones for rice production in Tanzania (URT, 2017).

A cross-sectional research design was employed whereby sample of 382 respondents was selected from three registered Agricultural Marketing Co-operative Societies (AMCOS), namely Kapunga smallholders and Madibira AMCOS in Mbarali District and UWAWAKUDA AMCOS in Mvomero District. The sample size was estimated using Yamane's (2001) formula. The three AMCOS were purposefully chosen from the two districts. The selection was based on their functionality as well as information sharing with farmers along the rice value chain, and the period they had been engaged in rice farming activities. Simple random sampling procedure was used to select respondents from the list of smallholder farmers obtained from the AMCOS offices. A structured questionnaire was used to collect quantitative information from individual smallholder rice farmers. A Focus Group Discussion (FGD) guide was used to gather information on the quality of agricultural information from farmers. Four FGDs were conducted, and each comprised eight participants, purposively selected from smallholder farmers by the virtue of having high knowledge and experience in rice farming.

Data were analysed by using IBM SPSS Statistics software to compute descriptive statistics to describe farmers' access to agricultural information in AMCOS, its adequacy, relevance and reliability. Three attributes of quality were measured on a three-point

rating as follows: adequacy (inadequate, partially adequate and adequate), relevance (irrelevant, relevant and highly relevant) and reliability (not reliable, reliable, and highly reliable). The Kruskal-Wallis Test was employed to establish the variation of smallholder farmers' responses regarding adequacy, relevance and reliability between Kapunga, Madibira and UWAWAKUDA AMCOS.

Ordinal logistic regression analysis was used to determine influence of various factors on the adequacy of information received from AMCOS. In this model, the dependent variable (adequacy of information) was ranked as 0 = Inadequate, 1 = Partially Adequate and 2 = Adequate. The ordinal logistic regression equation was specified as:

$$Y_{i1} = \lambda_j \left( \vec{x} \right) = \ln \left\{ \frac{p}{1-p} \right\} = \alpha_j + \beta_1 X_1 + \beta_2 X_2 + \dots + \beta_p X_p$$

Where:

$Y_i$  = Dependent variable (Adequacy of information received from AMCOS)

$\lambda_j \left( \vec{x} \right)$  = Logit link function of explanatory variables

$\vec{x}$  = Vector of explanatory variables

$X_1 - X_p$  = Explanatory variables

$\alpha_j$  =  $j^{\text{th}}$  intercept estimate (Threshold).

$\beta_1 - \beta_p$  = Location parameter estimates or slopes of explanatory variables.

$p$  = Probability that information received is adequate compared to partially adequate and inadequate.

$1 - p$  = Probability that information received is inadequate compared to partially adequate and adequate

**Table 4.1: Variable specifications**

Symbol	Variable	Explanation	Expected sign
$y_i$	Adequacy of information received from AMCOS	0=Inadequate, 1=Partially Adequate and 2=Adequate.	
$x_1$	Experience	Years in AMCOS (cont...)	-
$x_2$	Land size	Land size of respondents (cont...)	+
$x_3$	Smartphone ownership	0=No 1=Yes(dummy)	-
$x_4$	Membership in other social groups	0=No 1=Yes(dummy)	-
$x_5$	Information on rice agronomic practices	0=No 1=Yes(dummy)	+
$x_6$	Information on storage	0=No 1=Yes(dummy)	+
$x_7$	Information on value addition	0=No 1=Yes(dummy)	+
$x_8$	Information on marketing	0=No 1=Yes(dummy)	+
$x_9$	Financial information	0=No 1=Yes(dummy)	+
$x_{10}$	Education level	0=No formal education 1=Formal education (dummy)	+
$x_{11}$	Water distribution	0=Poor 1=Good(dummy)	+

The model validity was determined by considering parallel assumption which restricts using the model when it is violated. During the test of parallel line, once the p-value is less than 5% the null hypothesis was rejected. It was observed that the information comprising explanatory variables adequately fitted the model as the difference between -2 log-likelihood for the model with intercept only and the model with explanatory variables was positive and statistically significant at the p-value < 0.05 level. Also, there was a goodness of fit since both Pearson chi-square and Deviance test were not statistically significant (p-value > 0.05); hence the model had no over-dispersion problem. The model agreed with parallel lines assumptions as the score test (Chi-square test) was not

statistically significant ( $p$ -value  $> 0.05$ ); hence, the parameter estimates were the same across all categories of the dependent variable. Therefore, the fitted model was appropriate, and the selected explanatory variables were appropriate for discussion of the factors influencing the adequacy of information received from AMCOS.

Content analysis was employed to systematically organise, re-arrange and manage the qualitative data obtained through FGDs in order to derive meaningful insights and patterns. The qualitative information that was collected was mainly on the farmers' information accessibility and the quality of the information received from co-operative societies.

### **4.3 Findings and Discussion**

#### **4.3.1 Farmers' socio-demographic attributes**

The findings in Table 4.2 show that 73.6% of the respondents had at least primary school education. Level of education is anticipated to be an important factor that would affect the quality of information in rice farming as educated farmers find it easier to comprehend information concerning production technologies and farming practices. Also, the study revealed that 70.7% of the respondents were males while 29.3% of them were females. Men are dominant in rice production in the research area as shown in Table 4.2. This is because in many households men often have greater power in decision-making and control over resources including land and agricultural activities. It implies further that extension services should mobilise women for more involvement in rice production and enable interventions tailored to their needs. Likewise, 11.5% of farmers were recorded in all co-operatives having rice farming as their only economic activity. The study also found that the average household size was 5 people. This emphasizes the importance of considering the dynamics of household decision-making, information sharing, and resource allocation when designing strategies for information dissemination and support services targeted at smallholder rice

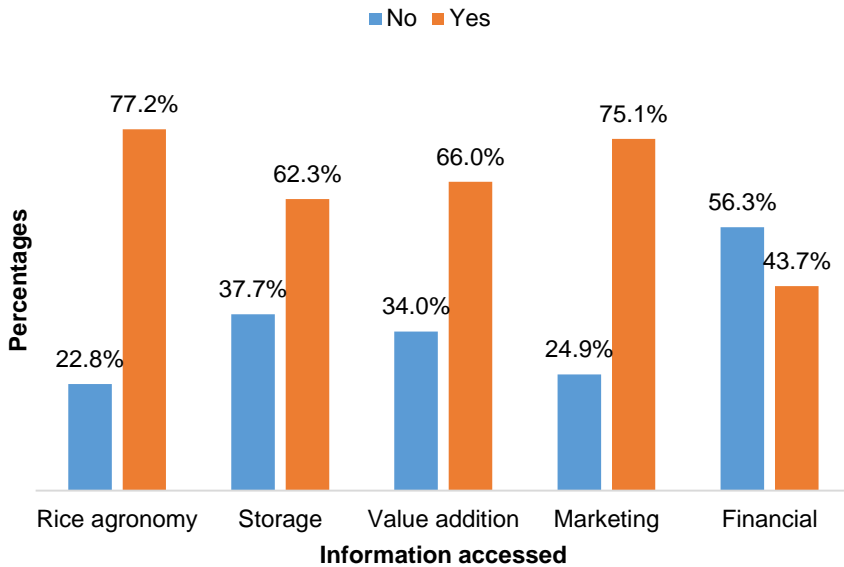
farmers. The average number of years in AMCOS and experience in rice farming were 14.04 and 18.02 years respectively. Mean years were found highest at Madibira (15.21) and lowest at Kapunga (11.85). Experience in rice farming can affect smallholder farmers' access to agricultural information. Farmers with more experience may have already acquired knowledge and skills through trial and error or through interactions with other farmers, while less experienced farmers may have limited knowledge and may require more information and support.

**Table 4.2: Socio-demographic characteristics among farmers (n=382)**

Variable	Classes	AMCOS			Pooled statistics n=382
		Kapunga (%)	Madibira (%)	UWAWAKUDA (%)	
Sex	Male	74.2	72.6	62.80	70.7
	Female	25.8	27.4	37.2	29.3
Marital status	Single	11.3	10.3	7.1	9.7
	Married	88.7	89.7	92.9	90.3
Education level	Informal education	1.6	3.8	5.8	3.9
	Primary	69.4	71.4	82.6	73.6
	Secondary	4.8	19.2	7.0	14.1
	Tertiary	24.2	5.6	4.7	8.4
Economic activities	Farming (Other crops)	40.3	42.7	22.1	37.7
	Livestock	0.0	1.3	2.3	1.3
	Business	0.0	12.8	23.3	13.1
	Farming, livestock and business	46.8	34.6	33.7	36.4
	Rice farming only	12.9	8.5	18.6	11.5
					<b>Mean</b>
Household size		5	5	5	5
Experience in rice farming		21.24	17.77	16.35	18.02
Years in AMCOS		11.85	15.21	12.43	14.04

### **4.3.2 Smallholder Farmers Access to Information**

The findings on smallholder rice farmers' information accessibility indicated that the majority of farmers obtained information on rice agronomic practices (77.2%) and marketing (75.1%) from AMCOS as shown in Figure 4.1. This means that these co-operative societies were playing a key role in disseminating information on rice agronomic practices and marketing to smallholder farmers. The agronomic practices include land preparation, seed selection and preparation, nutrient management, irrigation, weeding and pests/disease management in rice farming. Co-operative societies can leverage their network and resources to provide agricultural information to their members, which can be especially beneficial for smallholder farmers who may have limited access to other information sources. The fact that the majority of smallholder rice farmers obtained information on rice agronomy and marketing from their co-operative societies suggests that these societies were effective in disseminating information to their members. This can contribute to improving the productivity and income of smallholder farmers hence competitiveness in rice farming. The findings are in line with those by Misozi & Chrispin (2019) and Phiri *et al.* (2019) who reported that the majority of co-operative farmers' information needs were in areas of agricultural technology and agronomic practices in Chibombo District of Zambia and Malawi, respectively. On the other hand, only 43.7% of farmers obtained financial information from AMCOS as shown in Figure 4.1. This was due to the presence of a number of financial institutions in the study areas including the Mufindi Community Bank, Victoria Microfinance, Access Bank, and Savings and Credit Co-operative Societies where the majority of farmers obtained financial information about rice farming. These were the alternative sources of financial information to smallholder rice farmers in the study area.



**Figure 4.1: Information Accessibility among Smallholder Rice Farmers**

Smallholder farmers reported having received no weather forecast information. Impliedly, the co-operatives societies had no expertise on information on weather condition. The results differ from those by Phiri *et al.* (2019) who found that 50% of smallholder farmers in Malawi obtained weather/ climate information from service providers, co-operatives inclusive. Other sources of agricultural information for AMCOS members in the study area included input dealers, extension officers, research institutes, fellow farmers, mass media and traders. The rating on the quality of their information is as shown in Appendix 4.

#### **4.3.3 Adequacy, Relevance and Reliability of Information Obtained from AMCOS**

##### **4.3.3.1 Adequacy**

The majority of the respondents (52.6%) reported having received adequate information while 29.3% and 18.1% of them claimed to

have received partially adequate and inadequate information respectively from their respective co-operative societies as shown in Table 4.3. This means that majority farmers feel the information provided is sufficient for their needs to some extent, but there may be some gaps or areas where more information is needed since farmers have different experiences in rice farming. This information can be helpful in identifying areas where additional information or support is required to address the specific needs and challenges of smallholder farmers. The results on adequacy are well comparable with those by Buadi *et al.* (2013) who reported that farmers perceived agricultural information received to be adequate in the central region of Ghana. They are also comparable with findings by Jona and Terblanché (2015) who reported that farmer associations were ranked second after research institutes in the provision of adequate information to farmers in Namibia.

**Table 4.3: Distribution of information adequacy among AMCOS members**

Name of AMCOS	Adequate		Partially adequate		Inadequate	
	n	%	n	%	n	%
Kapunga	24	11.9	25	22.3	13	18.8
Madibira	140	69.7	67	59.8	27	39.1
UWAWAKUDA	37	18.4	20	17.9	29	42
<b>Pooled</b>	<b>201</b>	<b>52.6</b>	<b>112</b>	<b>29.3</b>	<b>69</b>	<b>18.1</b>

Among the three AMCOS considered, Madibira AMCOS had the highest proportion of farmers reporting adequate information (69.7%), followed by UWAWAKUDA AMCOS (18.4%) and Kapunga AMCOS (11.9%). These findings suggest that Madibira AMCOS had been more successful in providing agricultural information that meets the farmers' needs, while Kapunga AMCOS lagged behind in terms of providing adequate information to their members. Agricultural information received from AMCOS was sufficient for the majority of farmers in making informed decisions on rice farming.

However, within co-operatives, 42% of respondents in UWAWAKUDA reported having received inadequate information as shown in Table 4.3. Similarly, the results through FGDs revealed that the majority of farmers in UWAWAKUDA had inadequate information from the AMCOS. One participant summarised the views of other respondents:

*“...Our productivity and profitability in rice farming are directly impacted by the limited information flow that currently exists. Our co-operative society does not have a stationed extension officer; instead we rely on a government officer who has a large number of farmers to serve, and shortage of resources to facilitate him” (FGD, Dakawa Village, March 2022).*

A similar matter was raised by another FGD participant who enlightened that:

*“... we need other actors to help us connect to the markets by providing us with enough information on rice farming and to connect our co-operative society to buyers, input suppliers, millers, exporters, and financial institutions, among others”(FGD, Kapunga Village, February 2022).*

Also, it was reported that:

*“In the co-operative budget template, we have a section for farmers' capacity building every year, where farmers are trained and taken for study tours for adequate information on rice farming. In fact, Madibira has got a stationed extension staff; therefore, this co-operative society is providential and one step ahead when compared to Kapunga (FGD, Charisuka Village, February 2022).*

The study findings are supported by information from the FGDs that one of the reasons for inadequate information received in UWAWAKUDA, among others, was absence of a stationed government extension officer for the irrigation scheme. The practice

was different in the other co-operative societies, namely Madibira and Kapunga. Additionally, availability of resources and connection with other actors like traders, input suppliers is vital for adequate information availability to smallholder rice farmers. In estimating the variations of smallholder farmers' responses regarding the adequacy of information in the three co-operative societies in the study area, the Kruskal-Wallis Test results showed the significance ( $p = 0.000$ ) less than the critical value of 0.05. This means that the responses of farmers in the three co-operative societies differed significantly [ $H_{(2)} = 0.639, p = 0.000$ ]. Further analysis was done to find out factors influencing the adequacy of information received from AMCOS.

#### **4.3.3.2 Relevance**

Assessment of the relevance of information received by farmers in terms of timeliness, addressing farmers' needs, and applicability in rice farming was done. An even distribution was revealed from the overall findings where 35.6%, 34.6% and 29.8% were observed in terms of highly relevant, relevant and irrelevant as shown in Table 4.4. The majority of farmers generally perceived the information to be highly relevant and relevant. When the majority of smallholder rice farmers rate agricultural information as highly relevant and relevant, it indicates that the information provided is perceived to be useful and valuable to them. This means that the information meets their needs and expectations and can help them improve their farming practices, increase productivity, and potentially increase their incomes. This positive feedback from smallholder rice farmers is important because it suggests that the agricultural information is effective in addressing their specific needs and challenges. It also demonstrates that efforts to disseminate agricultural information to smallholder farmers are making a positive impact, which can ultimately contribute to smallholder farmers' competitiveness. The findings differ from those by Jona and Terblanché (2015) in Namibia who found that farmers were not satisfied with the relevance of information provided by farmer associations. Yet, the results support the findings by Alam and Guttormsen (2019) who reported that

aquaculture farmers had received relevant financial information from co-operative organisations in Bangladesh.

**Table 4.4: Distribution of information relevance among AMCOS members**

Name of AMCOS	Highly relevant		Relevant		Irrelevant	
	n	%	n	%	n	%
Kapunga	16	11.8	27	20.5	19	16.7
Madibira	88	64.7	75	56.8	71	62.3
UWAWAKUDA	32	23.5	30	22.7	24	21.1
<b>Pooled</b>	<b>136</b>	<b>35.6</b>	<b>132</b>	<b>34.6</b>	<b>114</b>	<b>29.8</b>

Among the three AMCOS considered, Madibira AMCOS had the highest proportion of farmers reporting relevant information (64.7%), followed by UWAWAKUDA AMCOS (23.5%) and Kapunga AMCOS (11.8%). These findings suggest that Madibira AMCOS had been more successful in providing agricultural information that met the farmers' needs, while Kapunga AMCOS lagged behind in terms of providing relevant information to their members. In evaluating the variation of smallholder farmers' responses regarding the relevance of information between Kapunga, Madibira and UWAWAKUDA co-operative societies in the study area, Kruskal-Wallis Test findings revealed that the significance ( $p = 0.497$ ) was greater than the critical value of 0.05. This means that responses of farmers in the three co-operative societies did not differ significantly among AMCOS [ $H_{(2)} = 1.398$ ,  $p = 0.497$ ].

#### 4.3.3.3 Reliability

The findings in Table 4.5 show that 37.7% of farmers argued that information obtained from AMCOS was reliable while 32.2% of farmers argued that the information obtained was not reliable. When the majority of smallholder rice farmers rate agricultural information as highly reliable, it means that they trust the information and believe that it is accurate and trustworthy. This is important because reliable information can help farmers make informed decisions about their

farming practices, such as when to plant, how much fertilizer to apply, and how to manage pests and diseases. When farmers have access to reliable agricultural information, they can increase their productivity and yields, reduce crop losses, and potentially increase their incomes. This, in turn, can contribute to improving food security and reducing poverty in rural areas. It is important to note that farmers may have different criteria for assessing the reliability of information and in this case, they trusted the source of information and the partnerships that exist between AMCOS and the research institutes. Therefore, it is important to understand the perspectives and needs of smallholder farmers when providing them with agricultural information to ensure that it is perceived as reliable and useful.

However, within co-operatives, the 19.5% respondents in Kapunga reported having received unreliable information from their co-operative society. The unreliable information was due to lack of a stationed extension officer, and less involvement of other actors in the rice value chain such as research institutes in Kapunga AMCOS. The study findings differ from those given by Jona and Terblanché (2015) who found that information provided by farmer associations in Namibia was not reliable, and hence farmers were not satisfied with its adequacy.

**Table 4.5: Frequency distribution on the reliability of the information received**

Name of AMCOS	Highly reliable		Reliable		Not reliable	
	n	%	n	%	n	%
Kapunga	19	16.5	19	13.2	24	19.5
Madibira	69	60	91	63.2	74	60.2
UWAWAKUDA	27	23.5	34	23.6	25	20.3
<b>Pooled</b>	<b>115</b>	<b>30.1</b>	<b>144</b>	<b>37.7</b>	<b>123</b>	<b>32.2</b>

In assessing variation of smallholder farmers' responses regarding the reliability of information between Kapunga, Madibira and

UWAWAKUDA co-operative societies in the study area, Kruskal-Wallis Test findings revealed that that the difference was not significant ( $p = 0.726$ ), as the p-value was greater than the critical value of 0.05. This means that there was no statistical difference between the median scores in the three co-operatives [ $H_{(2)} = 0.639$ ,  $p = 0.726$ ].

#### **4.3.4 Factors Influencing Adequacy of Information Accessed from AMCOS**

Further analysis was done using ordinal logistic regression analysis to find influence of the factors listed in Table 4.6 on adequacy of information received from AMCOS. Membership in social groups, information on rice agronomic practices and information on finance had a positive and significant influence on adequacy at  $p < 0.05$  while information on value addition negatively and significantly influenced adequacy as shown in Table 4.6. All other variables; except years in AMCOS, membership in social groups, information on value addition and marketing; had their expected signs.

**Table 4.6: Factors influencing adequacy of information received from AMCOS**

		Estimate	Std. Error	Wald	df	Sig.	95% Confidence Interval	
							Lower Bound	Upper Bound
Threshold	[Inadequate = 0]	-0.424	0.490	0.747	1	0.387	-1.384	0.537
	[Partiallyadequate = 1]	1.636	0.500	10.689	1	0.001	0.655	2.616
Location	Years in AMCOS	0.028	0.018	2.466	1	0.116	-0.007	0.064
	Land size	-0.053	0.072	0.551	1	0.458	-0.194	0.087
	[Info on agronomy practices = 0]	1.532	0.342	20.048	1	0.000	0.861	2.202
	[Info on agronomy practices =1]	0a	.	.	0	.	.	.
	[Info on Storage=0]	-0.242	0.233	1.075	1	0.300	-0.699	0.215
	[Info on Storage=1]	0a	.	.	0	.	.	.
	[Info on Value addition=0]	-0.531	0.238	4.986	1	0.026	-0.997	-0.065
	[Info on Value addition =1]	0a	.	.	0	.	.	.
	[Info on Marketing=0]	-0.493	0.264	3.47	1	0.062	-1.011	0.026
	[Info on Marketing =1]	0a	.	.	0	.	.	.
	[Financial Information=0]	0.623	0.225	7.649	1	0.006	0.182	1.065
	[Financial Information =1]	0a	.	.	0	.	.	.
	[Membership in social groups=.00]	2.350	0.252	86.753	1	0.000	1.856	2.845
	[Membership in social groups=1.00]	0a	.	.	0	.	.	.
	[Education level=.00]	-0.159	0.54	0.087	1	0.768	-1.218	0.899
	[Education level =1.00]	0a	.	.	0	.	.	.
	[Water distribution=.00]	0.325	0.31	1.096	1	0.295	-0.283	0.932
	[Water distribution=1.00]	0a	.	.	0	.	.	.
	[Smartphone ownership=0]	-0.015	0.309	0.002	1	0.960	-0.621	0.59
	[Smartphone ownership=1]	0a	.	.	0	.	.	.

- Model fitting information: (Intercept only -2LL=742.887), (Final model -2LL=563.753, chi-square=179.134, df=11 and p-value = 0.000)
- Goodness of fit test: Pearson Chi-square=612.242, df = 667, P-value = 0.936 and Deviance = 540.395, df = 667, p-value = 1.000
- Coefficient of determination Pseudo R<sup>2</sup>: Cox and Snell=37.5, Nagelkerke = 43.2 and Mc Fadden = 23.3
- Test of Parallel lines: Null hypothesis -2LL=563.753, General -2LL=553.216, Chi-square=10.537, df=11, P-value = 0.483

Being part of other social networks demonstrated a strong positive and significant association with the adequacy of information received from AMCOS (coefficient estimate of 2.350, p-value of 0.000) as shown in Table 4.6. This shows that being a member of social groups tends to increase the adequacy of information compared to those who are not members. This means that members of social groups may access information from different angles but still rate information received from AMCOS as sufficient. This indicates that AMCOS is effectively meeting farmers' information needs, providing tailored and credible information that is valued and trusted by the members. It reflects the co-operative society's ability to understand and cater to the specific requirements of its members, ultimately contributing to their competitiveness in rice farming. The findings compare well with the findings by Petcho *et al.* (2019) in Thailand, who found that membership in other economic/social groups enhanced household members' knowledge and generated ideas related to production and marketing.

The variable information on agronomic practices showed a significant positive coefficient estimate (1.532) with a p-value of 0.000 which indicates a strong association between receiving information on agronomic practices and the perception of information adequacy among farmers. This suggests that farmers who receive information on agronomy practices are more likely to perceive the information as sufficient and satisfactory compared to those who do not receive such information. The increase in the frequency or extent of receiving agronomic information from AMCOS, increased farmers' likelihood to view that information is valuable and helpful in their farming practices. The results are in line with those by Frimpong-manso *et al.* (2022) in Ghana where active farmers who had received information on good agronomic practices for cocoa farming had a positive perception of co-operatives as a source of information.

The findings in Table 4.6 show that farmers who had obtained financial information from AMCOS, their adequacy level increased by 0.623 logits at p-value of 0.006. This suggests that smallholder farmer who secure financial information from AMCOS are more likely to perceive the information received as adequate compared to their counterparts. The study results tend to reconcile with the findings by Alam and Guttormsen (2019) who found that farmers perceived co-operative organisations as a source of adequate farming information in Bangladesh. An increase in the provision of information concerning value addition decreased the adequacy of information by 0.623 units at p-value = 0.026. This means that the agricultural co-operatives either had insufficient information on value addition or had no expertise in the area and hence could not provide adequate information.

#### **4.4 Conclusions and Recommendations**

The highest information needs of smallholder rice farmers are in the areas of agronomic practices and marketing, and smallholder farmers reported no access to weather forecast information from AMCOS. Agricultural co-operatives are important platforms that provide quality information in enhancing smallholder farmers' informed decision-making. Financial and rice agronomy information are significant determinants of the adequacy of information received by smallholder farmers.

It is, therefore, recommended that AMCOS should understand the specific information needs of smallholder farmers growing rice and tailor the information accordingly. This can be achieved through participatory approaches, such as farmer needs assessments and surveys, to identify the most relevant and useful information for farmers. Information should be provided in a format that is easily understood and accessible, taking into consideration the literacy levels and language preferences of the farmers. Collaboration with meteorological agencies and other relevant service providers should be established to ensure that farmers receive reliable and timely

weather information. This can be achieved through the use of mobile technologies, such as SMS or smartphone applications to disseminate weather forecasts to farmers in a timely manner. Efforts should be made to strengthen AMCOS by providing them with resources, training, and support to enhance their capacity to deliver accurate and timely information to farmers. This can include collaboration with agricultural extension services and leveraging their networks to access up-to-date information on agronomic practices, weather forecasts, and market trends. Moreover, efforts should be made to improve farmers' access to financial and rice agronomy information, including information on good agronomic practices, accessing credit, savings, and investment opportunities. This can be achieved through partnerships with financial institutions, training programs, and awareness campaigns on financial literacy tailored to the specific needs of smallholder farmers.

The Local Government Authorities should put in place monitoring and evaluation mechanisms to assess the effectiveness of information dissemination strategies and interventions. This will help identify gaps and areas for improvement, allowing for adjustments and refinements in information delivery approaches. Feedback from farmers should be actively sought to ensure that the information provided is relevant, accurate, and meets their needs. To improve the smallholder rice farmers' competitiveness in rice farming, AMCOS and other stakeholders should enhance the information ecosystem for smallholder rice farmers, empower them with the knowledge and resources necessary to improve their agricultural practices, productivity, and livelihoods.

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**CHAPTER FIVE****5.0 DETERMINANTS OF SMALLHOLDER RICE FARMERS' MARKET OUTLET SELECTION IN MBARALI AND MVOMERO DISTRICTS, TANZANIA**

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**ABSTRACT**

Understanding smallholder farmers' market outlets has the potential to improve the productivity and incomes of smallholder farmers engaged in rice farming. Tanzania rice farmers select market outlets from a diverse spectrum. There is a scarcity of empirical information on the drivers of farmers' decision-making associated with market outlets in the context of Agricultural Marketing Co-operative Societies' marketing initiatives. This paper explores the smallholder rice farmers' drivers for the selection of market outlets. A cross-sectional research design was used. A sample of 382 smallholder rice farmers was selected from three co-operative societies selected from two districts in Morogoro and Mbeya Regions. Multivariate Probit regression was applied to examine the determinants of market outlet selection decisions. It was found that the market outlets were wholesale, retail, millers, middlemen and private buyers. The majority (65.7%) of farmers sold to more than one outlet. The quantity of paddy sold, access to market information, smartphone ownership, access to credit, the amount of rice sold and

frequency of extension visits were the important determinants of the selection of market outlets ( $p < 0.05$ ). It is concluded that the majority of farmers have access to multiple market outlets which contribute to livelihood improvement. To promote livelihood through agricultural transformation in Tanzania, policymakers should prioritize increasing smallholder rice farmers' access to market outlets through initiatives such as building rural infrastructures, improving market information systems, and promoting public-private partnerships.

**Keywords:** *Market outlets, smallholder farmers, decisions, co-operative societies*

## **5.1 Introduction**

Like many nations in sub-Saharan Africa, agriculture is a primary source of livelihood and income for over 70% of Tanzania's citizens, particularly those living in rural areas and peri-urban zones (REPOA, 2021). Rice is the second most produced food and commercial crop in Tanzania after maize, and about 90% of rice produced in Tanzania is under a smallholder system with sizes of rice farms ranging from 0.9 to 3 ha, with an average farm size of 1.3 ha (URT, 2019; Rugumamu, 2014). There are vast market opportunities for rice; yet, smallholder farmers' access to these markets remains a great challenge, and their participation remains low in African countries, including Tanzania (Donkor *et al.*, 2021). Smallholder farmers' access to market outlets improves productivity and profitability, and their participation is subject to the available markets that farmers can choose (Kangile *et al.*, 2020). However, the majority of smallholder rice farmers in the country are located in remote areas with numerous market challenges such as poor road infrastructures and limited market information; as a result, they often fail to access markets (Mgale & Yunxian, 2020). A market outlet is an organization that facilitates the flow of goods and services from producers to consumers (FAO, 2016). They include wholesalers, retailers, middlemen, processors, co-operative associations, and

other marketing agents who ensure that agricultural products get to the final consumer (Donkor *et al.*, 2021). Customers can get time and location of utilities from such outlets.

Mmbando *et al.* (2015), among others, contend that the commercialization of agriculture in developing countries such as Tanzania has the potential to promote economic growth and development of smallholder farmers' participation in markets. Hence, it is necessary to comprehend various rice marketing channels' features and improve farmers' skills to choose marketing channels wisely and correctly. It is, therefore, crucial to understand the variables that affect the selection of market outlets since the understanding can raise rice production and smallholder rice farmers' incomes. The information could also be used to design ways to lessen the impact of specific elements, improving smallholder rice farmers' access to markets and raising their chances of operating profitably. For smallholder farmers, choosing a market outlet can be a complicated decision and influenced by a variety of factors that should be taken into account such as the quantity of their outputs, their location, information, the nature of their commodity, and the prices offered (Tarekegn *et al.*, 2017; Kangile *et al.*, 2020). According to Dlamini-mazibuko *et al.* (2019), understanding the relationships between the market channels and the factors that determine the use of each market channel is beneficial to policymakers and smallholder producers who aim to access such market outlets.

Several studies have been carried out to characterize factors influencing farmers' choice of marketing outlets in Africa and other parts of the world (Adams *et al.*, 2019; Anthony *et al.*, 2021; Chekol & Mazengia, 2022; Degaga & Alamerie, 2020; Dlamini-mazibuko *et al.*, 2019; Donkor *et al.*, 2021; Geoffrey *et al.*, 2014; Jebesa, 2019; Thamthanakoon *et al.*, 2022; Yalew, 2022). Factors related to socio-demographics, access to credit, access to information, and asset ownership have been found to have significant effects on farmers'

market channel decisions. For instance, Anthony *et al.* (2021) found that socio-demographic characteristics, price information, market information and form of produce had significant effects on market channel choice among smallholder rice farmers in Nigeria. Also, Chekol & Mazengia (2022) and Dlamini-mazibuko *et al.* (2019) revealed that asset ownership, transaction costs, selling price, market attributes, and profit obtained were significant determinants of market channel choice by smallholder farmers in Ethiopia and Swaziland. Farmers with more education tend to be good negotiators and risk-averse (Mgale & Yunxian, 2021). Similar studies conducted in Ethiopia, Ghana and Kenya found that transport ownership, access to information, quantity sold, cost of labour, group marketing and contract farming can influence smallholder farmers' market outlet choice decisions (Adams *et al.*, 2019; Degaga & Alamerie, 2020; Geoffrey *et al.*, 2014).

Specifically, a study by Kangile *et al.* (2020) on sesame farming conducted in Mtwara and Lindi found that agricultural production services such as education and training, agricultural inputs, and access to credit were the factors driving farmers to choose a particular market to sell their produce. Similarly, a study by Mhagama & Mmasa (2022) on the choice of marketing outlets among smallholder farmers in staple foods in Dodoma (Chamwino District) and Morogoro (Kilosa District) identified factors related to age, education, membership in organizations, access to credit, contractual arrangements, and distance to markets as significant factors driving farmers to choose a particular market to sell their produce. Despite the extensive literature on smallholder farmers' market outlet choice decisions, there is a gap in understanding the determinants of smallholder farmers' market outlets in the context of Agricultural Marketing Co-operative Societies' (AMCOS) marketing initiatives in Tanzania. This paper addresses this research gap by assessing the existing marketing outlets and examining the drivers of smallholder farmers' market outlet selection in the context of AMCOS in Mvomero and Mbarali districts, Tanzania. This study

intends to assess the determinants of smallholder rice farmers' choice of a particular market outlet for their competitiveness in rice farming.

## 5.2 Methodology

The study was conducted in the Morogoro and Mbeya Regions, which are among the major rice-producing regions in Tanzania. Purposive sampling technique was used to select two districts, namely Mvomero and Mbarali, from Morogoro and Mbeya regions, respectively. These districts were purposively selected because they contribute a larger proportion to the total rice output of the regions (URT, 2017). Based on their functioning and the length of time they had been involved in rice farming activities, three AMCOS were purposively selected from the two districts namely UWAWAKUDA, Kapunga, and Madibira. The target population for the study encompassed all smallholder rice farmers who were members of the three AMCOS.

The study employed a cross-sectional research design. A sample of 369 respondents from the three registered co-operative societies was estimated using Yamane (2001) formula.

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

Where:

n = sample size

N = population size = 4749

e =level of precision (Sampling error) = 5% or 0.05

Interviews were conducted with a total of 382 smallholder rice farmers, surpassing the initially calculated sample size to account for any unforeseen circumstances and ensure comprehensive data collection. Proportionate stratified sampling technique was used to select farmers from the three co-operatives giving a sample size of



$i = 1, 2, 3 \dots \dots 382$  observations

$j$  represent rice market outlet (Wholesale( $Y_{i1}$ ), Retail( $Y_{i2}$ ), Miller( $Y_{i3}$ ), Middlemen( $Y_{i4}$ ) and Private buyers( $Y_{i5}$ ))

$\beta_0 - \beta_8$  Represent parameter estimates/ slope coefficients

$X_{i1} - X_{i8}$  Represent observed independent variables selected for this study

$\varepsilon_i$  Represent other factors that were held constant (residuals)

The main equation 1 above can be categorized into simultaneous equations as follows;

$$Y_{i1} = \beta_0 + \beta_1 X_{i1} + \beta_2 X_{i2} + \dots + \beta_8 X_{i8} + \varepsilon_i \dots \dots \dots (3)$$

$$Y_{i2} = \beta_0 + \beta_1 X_{i1} + \beta_2 X_{i2} + \dots + \beta_8 X_{i8} + \varepsilon_i \dots \dots \dots (4)$$

$$Y_{i3} = \beta_0 + \beta_1 X_{i1} + \beta_2 X_{i2} + \dots + \beta_8 X_{i8} + \varepsilon_i \dots \dots \dots (5)$$

$$Y_{i4} = \beta_0 + \beta_1 X_{i1} + \beta_2 X_{i2} + \dots + \beta_8 X_{i8} + \varepsilon_i \dots \dots \dots (6)$$

$$Y_{i5} = \beta_0 + \beta_1 X_{i1} + \beta_2 X_{i2} + \dots + \beta_8 X_{i8} + \varepsilon_i \dots \dots \dots (7)$$

The key variables that were included in the Multivariate probit regression model are specified in Table 5.1.

**Table 5.1: Summary of variables that were used in the MVP model**

	Variable(unit)	Measurement	Expected hypothesis on market outlets				
			Wholes	Ret	Mil	Middlemen	P/buyer
$x_1$	Experience in rice farming	Continuous (In years)	-	+	+	-	+
$x_2$	Owning a smartphone	Dummy (1=owned smartphone, 0=otherwise)	+	+	+	+	+
$x_3$	Access to credit	Dummy (1=accessed credit, 0=otherwise)	+	+	+	-	-
$x_4$	Access to training	Dummy (1=accessed training, 0=otherwise)	+	+	+	-	+
$x_5$	Quantity of paddy sold(kg)	Continuous (In kg per smallholder farmer)	+	-	+	-	+
$x_6$	Quantity of rice sold (kg)	Continuous (In kg per smallholder farmer)	+	-	-	-	+
$x_7$	Marketing information	Dummy (1=accessed mark information, 0=otherwise)	+	+	+	-	+
$x_8$	Frequency of Extension Contact	Categorical (0=rarely, 1=on event, 2=frequently)	+	+	-	+	+

## 5.3 Results and Discussion

### 5.3.1 Socio-demographic characteristics

Out of 382 smallholder rice farmers interviewed, the majority (73.6%) had at least a primary education as shown in Table 5.2. While educated farmers find it simpler to understand information

about production and marketing, the degree of education is projected to be a significant element that would affect the choice of market outlet in the rice farming industry. Also, the study revealed that the majority (70.7%) of the respondents were males, which shows male dominance in rice production in the study area.

The findings in Table 5.2 also show that 11.5% of farmers in all co-operatives engaged in rice growing as their sole source of income and had no other economic activity in the area. As rice production takes up the majority of their time and resources, it may reduce their ability to select appropriate market outlets. The study also established that the mean household size was 5 members. The average number of years the respondents had been associated with the AMCOS were 14.0. The mean years of membership were found highest in Madibira (15.2) and lowest in Kapunga (11.8). This denotes that Madibira had extra experience in dealing with rice farmers and was thus perhaps more able to deal with members' pressing issues, compared to Kapunga and UWAWAKUDA. Farmers had 18.0 average years in rice farming; with this experience, they were more likely to choose wholesale trading companies and less likely to sell to middlemen and village collectors as they might have more market connections (Mgale & Yunxian, 2020).

**Table 5.2: Socio-demographic Characteristics of the sampled respondents in the study area (n=382)**

Variable	Classes	AMCOS (%)			Overall statistics (%) n=382
		Kapunga n=(62)	Madibira n=234	UWAWAKUDA n=86	
Sex	Male	17.0	63.0	20.0	70.7
	Female	14.3	57.1	28.6	29.3
Marital status	Single	18.4	63.2	18.4	9.9
	Married	16.0	61.0	23.0	90.1
Education level	Not educated	6.7	60.0	33.3	3.9
	Primary	15.3	59.4	25.3	73.6
	Secondary	5.6	83.3	11.1	14.1
	Tertiary	46.9	40.6	12.5	8.4
Economic activities	Farming	17.4	69.4	13.2	37.7
	(Other crops)				
	Livestock	0.0	60.0	40.0	1.3
	Business	0.0	60.0	40.0	13.1
	Farming, livestock & business	20.9	58.3	20.9	36.4
	None	18.2	45.5	36.4	11.5
Household size	Mean	5.5	5.5	5.4	5.4
	Max	9	14	15	15
	Min	2	1	1	1
Experience in rice farming	Mean	21.2	17.7	16.4	18.0
	Max	50	41	50	50
	Min	3	2	3	2
Years in AMCOS	Mean	11.8	15.2	12.4	14.0
	Max	22	33	19	33
	Min	2	2	3	2

### 5.3.2 Smallholder Rice Farmers Market outlets

Rice farmers reported that they used different rice market outlets to sell their produce in the form of paddy and milled rice. These rice market outlets include wholesale, retailers, millers, middlemen and private buyers. The outlets were typically selected in combination with one another. Table 5.3 shows the different rice market outlets used by smallholder farmers when selling their produce.

The results show that the commonly used market outlet for both paddy and milled rice was multiple outlets, followed by private buyers and middlemen (15.2%) for paddy and both wholesale and retail for milled rice as shown in Table 5.3. This finding shows that about two-thirds of the farmers depended on multiple market outlets to perform their marketing functions. By selling to multiple outlets, farmers could spread their risks, compare offers and negotiate for better prices or terms. Also, smallholder farmers might sell to multiple outlets to diversify their customer base and maintain good relationships with different buyers so as to avoid becoming too reliant on a single buyer or market, which could be risky if that market suddenly declined or disappeared.

The majority of smallholder farmers sold rice through multiple outlets (75.8%), followed by 18.2% selling to private buyers with the remaining selling outlets (wholesale and retail) accounting for only a small proportion. Similar results on small proportions of farmers selling to wholesale have also been reported by Mgale and Yunxian (2020) in their study on the rice market channels in Tanzania. A small proportion of farmers sold to wholesale and retail markets because it requires more resources and infrastructures; also farmers might not have the expertise to negotiate with wholesalers and retailers who often demand high-quality products and consistent supply. However, there are opportunities for smallholder farmers to improve their access to these markets through targeted investments in infrastructure, marketing, and capacity building. Overall, multiple outlets were found to be a dominant selling outlet for smallholder farmers accounting for 65.7% of sales, followed by private buyers (17.0%) and middlemen (12.0%). This suggests that multiple outlets and private buyers are important selling outlets for both types of produce, while wholesale and retail outlets are less commonly used. The results differ from those by Mgale and Yunxian (2020) who found that approximately 53.5% of farmers sold to middlemen, 28.6% to millers and nearly 17.9% to wholesale in Tanzania. The difference is because the previous study did not consider multiple

outlets used by rice farmers in the study area. In addition, the results in Table 5.3 show a statistically significant association between the types of produce and the selling outlet category ( $p < 0.01$ ).

**Table 5.3: Tabulation of Multiple responses on Produce sold and Market outlets**

Produce sold	Selling outlets						Total
	Wholesale	Retail	Miller	Middlemen	Private buyer	Multiple	
Paddy	6(2.08)	5(1.73)	2(0.69)	44(15.22)	45(15.57)	187(64.71)	289(100.00)
Milled rice	1(3.03)	1(3.03)	0(0.00)	0(0.00)	6(18.18)	25(75.76)	33(100.00)
Both	0(0.00)	1(1.67)	4(6.67)	2(3.33)	14(23.33)	39(65.00)	60(100.00)
<b>Total</b>	<b>7(1.83)</b>	<b>7(1.83)</b>	<b>6(1.57)</b>	<b>46(12.04)</b>	<b>65(17.02)</b>	<b>251(65.71)</b>	<b>382(100.00)</b>

Pearson  $\chi^2 = 26.12$ , Prob = 0.0036. The first row has *frequencies* and the second row has *row percentages*

### 5.3.3 Descriptive Statistics of Variables used in the Model (continuous and dummy variables)

The results in Table 5.4 show that the majority of smallholder rice farmers surveyed did not access credit (65.7%). The findings are similar to those by Dessie *et al.* (2018); Yalew (2022) who found that the majority of smallholder farmers had no access to credit in Ethiopia and differ from the findings by Apind (2015) who found that the majority of farmers had access to credit for rice farming in Kenya. Farmers' access to credit minimizes financial constraints and enhances their participation in direct market outlets and selection of market outlets (Donkor *et al.*, 2021; Haile *et al.*, 2022; Mgale and Yunxian, 2020; Mmbando *et al.*, 2015; Yalew, 2022). Moreover, the majority (83.3%) of the respondents did not own a smartphone. The fact that a good number of respondents did not own smartphones suggests that they might have limited access to information and technology. This could affect their ability to access market-related information, prices, weather forecasts, and other data that could influence their market outlet selection.

On the other hand, the fact that at least 20.9% of the respondents had attended training suggests that there were opportunities to increase access to training and capacity-building programmes for

smallholder farmers. The high percentage of respondents who did not attend training on rice farming indicates a significant gap in knowledge and skills among smallholder rice farmers which could have implications for their farming practices and, subsequently, their choices regarding market outlet selection. Most respondents were contacted by extension officers on events (56.3%). The findings are similar to those by Apind (2015) who reported that 81.9% of rice farmers were contacted by extension staff in Kenya.

The findings in Table 5.4 show that 75.13% of respondents received market information suggesting that there were already some outreach efforts in marketing. The findings support those by Yalew (2022) in Ethiopia but differ from those by Apind (2015) who found that the minority (33.7%) of rice farmers obtained market information in Kenya. It is through access to information that farmers can make informed market decisions (Dlamini-mazibuko *et al.*, 2019). The results also provide some insight into the quantity of rice and paddy sold by the farmers. The average quantity of paddy sold was 7703.793 kg, which is a significant amount, but the standard deviation of 5334.369 kg suggests a wide variation in sales volume. Similarly, the average quantity of rice sold was 1008.068 kg, with a large standard deviation of 2610.749 kg. This may suggest that the smallholder rice farmers had some difficulty in achieving consistent sales volumes, which could affect their incomes.

**Table 5.4: Descriptive Statistics of Variables Used in the Model  
(n=382)**

<b>Categorical Variables</b>	<b>Observation</b>	<b>Frequencies(n)</b>	<b>Per cent (%)</b>
Owning a smartphone	No	318	83.25
	Yes	64	16.75
Access to credit	No	251	65.71
	Yes	131	34.29
Attended training	No	302	79.06
	Yes	80	20.94
Marketing information	No	95	24.87
	Yes	287	75.13
Frequency of Extension	On event	215	56.28
	Frequently	162	42.41
Contact from AMCOS	Rarely	5	1.31
<b>Continuous Variables</b>		<b>Mean</b>	<b>Std. Dev.</b>
Experience in rice farming		18.016	9.434
Quantity of paddy sold(kg)		7703.793	5334.369
Quantity of rice sold(kg)		1008.068	2610.749

### **5.3.4 Determinants of farmer participation in market outlet selection**

Presented in Table 5.5 are the determinants of rice farmers' decision to select a certain market outlet. The results show that some variables were significant at more than one market outlet while one variable was significant in only one market outlet. Out of eight expounding variables included in the MVP model, five variables significantly affected wholesale market outlet; three variables significantly affected retail outlet; four variables significantly influenced miller outlet; one variable significantly affected middlemen market outlet choice and two variables influenced private buyer outlet at different probability levels.

The results in Table 5.5 indicate that quantity of rice sold/supplied had positive significant correlation with all market outlets, except middleman which had strong negative significant correlation at < 5% (0.05) significant level. The implication is that smallholder farmers with large volumes of rice were more likely to sell to wholesale, millers and retailers, compared to middlemen. This is because

wholesalers can purchase a large quantity of rice and provide fair prices. The result compares well with those reported by Adams *et al.* (2019), Chekol & Mazengia (2022) for tomato and garlic farmers in Ghana and Northwest Ethiopia.

Concerning the frequency of extension contact from co-operative society, the variable had a positive and significant influence on wholesale, retail and miller outlet choice decisions at the 1% significance level. Extension services increase the ability of farmers to acquire important market information as well as enable them to improve production methods, hence leading to more output which in turn increases producers' ability to choose the best market outlet for their product. Thus, households who were visited more by extension agents were more likely to deliver rice to wholesale, retail and miller. Similar findings were also reported in studies by Chekol and Mazengia (2022) and Tarekegn *et al.* (2017) that confirmed that consistent contact with extension had positive effects on the likelihood of selection of retail and wholesale outlets by honey and garlic producers in Ethiopia, respectively, but differ from findings of a study by Degaga and Alamerie (2020) who found a negative influence on the choice of middlemen outlet by coffee producers in Ethiopia.

A positive and significant relationship was found between access to market information and the likelihood of choosing a private buyer at a 5% level of significance. Farmers that have access to financing are more likely to participate in the wholesale market channel, whereas middlemen and private buyer outlets are less likely to do so. Farmers that have access to market information are more likely to participate in the private buyer outlet. Market information makes it easier for farmers to communicate the pricing differences between their area and the adjacent main market, which enhances the likelihood that they will choose a private buyer outlet that gives a relatively higher price to farmers. The results differ from those by Tarekegn *et al.* (2017) who reported a positive association between

this variable and the likelihood of choosing retailer and consumer outlets among honey producers in Ethiopia.

Access to credit also had a positive and negative impact on the likelihood of choosing a wholesale and miller and private buyer outlet at the  $p < 5\%$  level of significance. Farmers that have access to finance are more likely to participate in the wholesale market channel, whereas it decreases for middlemen and private buyer outlets. Impliedly, farmers who accessed credit had a higher level of commercialization. Farmers can obtain the operating capital needed for intensive rice farming from credit. This shows the importance of credit in the rice commercialization process for agricultural transformation. The outcome is similar to one from a study by Chekol and Mazengia (2022) on garlic producers in Northwest Ethiopia, but differs from those of Mgale and Yunxian (2020) who reported a positive influence of access to credit in rice farming on miller outlet in Tanzania.

Ownership of a mobile phone had a positive significant effect on the wholesale outlet which was statistically significant at the 1% level and negatively associated with the intensity of participation in the miller outlet at the 5% level. Ownership of communication resources upsurses the probability of smallholder farmers' market participation and increases access to information and market participation (Mmbando *et al.*, 2015). This result implies that ownership of a mobile phone decreases farmers' intensity of participation in the miller while it increases the capability of smallholder farmers to select a wholesale outlet. This is because whole selling requires consistent farmers who can easily be contacted and communicate easily with buyers. The results support those by Donkor *et al.* (2021) who found a negative and positive influence of mobile phone ownership by rice farmers and the likelihood of choosing a miller and a direct market outlet in Ghana respectively.

**Table 5.5: Multivariate Probit Estimations for smallholder rice farmers market outlet selection**

Variables	Wholesale Coeff (Se)	Retail Coeff(Se)	Miller Coeff(Se)	Middlemen Coeff(Se)	Private buyer Coeff(Se)
Experience in rice farming	-0.018*(0.010)	0.013*(0.007)	-0.011(0.01)	0.009(0.007)	0.001(0.007)
Owning a smartphone	0.587***(0.199)	-0.232(0.182)	-0.911**(0.382)	0.182(0.189)	-0.282(0.177)
Access to credit	0.826***(0.169)	0.100(0.145)	-0.828***(0.288)	-0.180(0.146)	-0.325**(0.144)
Access to training	-0.12(0.195)	0.031(0.17)	-0.286(0.27)	-0.168(0.167)	0.091(0.169)
Quantity of paddy sold(kg)	0.069***(0.017)	0.034**(0.014)	0.032(0.021)	-0.001(0.014)	-0.004(0.014)
Quantity of rice sold (kg)	0.188***(0.035)	0.068**(0.03)	0.175***(0.04)	-0.098***(0.032)	0.006(0.031)
Marketing information	-0.098(0.188)	0.083(0.154)	-0.027(0.238)	-0.188(0.157)	0.380**(0.154)
Frequency of Extension Contact	0.431***(0.165)	0.495***(0.125)	0.792***(0.185)	0.241*(0.126)	0.049(0.128)
Constant	-2.304***(0.38)	-1.358***(0.277)	-2.348***(0.441)	0.061(0.277)	0.17(0.27)
Predicted Probabilities:	0.204	0.497	0.115	0.602	0.643
Multivariate probit (SML, # draws = 5)		382			
Number of obs		382			
Wald chi <sup>2</sup> (40)		178.50			
Log-likelihood		-953.25394			
Prob > chi <sup>2</sup>		0.0000			
Correlation matrix(estimates)	Wholesale ( $\rho_1$ )	Retail ( $\rho_2$ )	Miller ( $\rho_3$ )	Middlemen ( $\rho_4$ )	Private buyer( $\rho_5$ )
Wholesale ( $\rho_1$ )	1.000				
Retail ( $\rho_2$ )	0.003(0.959)	1.000			
Miller ( $\rho_3$ )	-0.101(0.048)	0.035(0.499)	1.000		
Middlemen ( $\rho_4$ )	-0.185(0.000)	0.135(0.008)	0.076(0.141)	1.000	
Private buyer( $\rho_5$ )	-0.152(0.003)	0.007(0.891)	0.011(0.824)	-0.348(0.000)	1.000

Likelihood ratio test of  $\rho_{12} = \rho_{13} = \rho_{14} = \rho_{15} = \rho_{23} = \rho_{24} = \rho_{25} = \rho_{34} = \rho_{35} = \rho_{45} = 0$ :  $\chi^2(10) = 85.9303$  Prob >  $\chi^2 = 0.0000$

**Key:** \*\*\* = significant at 1%, \*\* = significant at 5%

#### **5.4 Conclusions and Recommendations**

It was found that the existing market outlets in the study area were wholesalers, retailers, millers, middlemen and private buyers. However, the majority of farmers chose to sell to multiple outlets. The most common produce sold in the study area was paddy. The smallholder rice farmers select multiple market outlets as an approach to safeguard their rice farm investment and maximize their profits in the long term. The choice of the selling outlets influences farmers' profitability and livelihood improvement; therefore, when smallholder rice farmers have access to additional market outlets, they must choose the best mix to maximize their long-term earnings. The selection of market outlets of rice producers in the study area is associated with the quantity of paddy sold, market information, smartphone ownership, access to credit, the quantity of rice sold and frequency of extension services.

To promote livelihood through agricultural transformation in Tanzania, policymakers should prioritize increasing smallholder rice farmers' access to market outlets through initiatives such as building rural infrastructures, improving market information systems, and promoting public-private partnerships. Local government Authorities and AMCOS should ensure that technical as well as organizational assistance is provided to smallholder rice farmers and that farmer choices are reinforced through access to market information, credit and extension services. This will help the smallholder farmers realize the benefits associated with rice marketing. It is also recommended that the existing AMCOS should be capacitated on market information, increase frequencies of extension contact to farmers, and organize more farmers into co-operatives since the two attributes influence farmers' market outlet choices. Further, the existing AMCOS should establish a Warehouse Receipt System (WHRS) so that it can be one of the market outlets in the study area to enhance value chain development. If well managed, they will be able to purchase large volumes of rice at reasonable prices, providing technical support and capacity building to their members.

To enrich the existing literature, the study recommends further research to investigate the marketing and transaction costs associated with different market outlets.

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## CHAPTER SIX

### **6.0 SUMMARY, CONCLUSIONS AND RECOMMENDATIONS**

This chapter presents a summary of conclusions based on the major findings of the study. The chapter also presents the study's recommendations specifying actions to be taken at policy-making level and various points by different actors including the Local Government Authorities, TCDC, AMCOS, traders, other rice value chain actors and other stakeholders engaged with rice farming for the purpose of enhancing smallholder rice farmers competitiveness in the study area.

#### **6.1 Summary of Major Findings and Conclusions**

Various efforts have been made by the GoT to increase technical efficiency, productivity and profitability along rice value chain for several years. Given the importance of rice farming among smallholder farmers in Tanzania, there is still limited empirical information available on the potential of AMCOS on the competitiveness of smallholder farmers in terms of technical efficiency, profitability, information access and market outlets. This study assessed the competitiveness of smallholder rice farmers in AMCOS in terms of technical efficiency, profitability, agricultural information access and market outlet selection. To achieve this, the study resided on four specific objectives whose major findings and conclusions are summarized in sub-sections 6.1.1, 6.1.2, 6.1.3, and 6.1.4.

##### **6.1.1 Smallholder rice farmers' productivity and TE in rice farming**

The first specific objective of this study was to analyse the productivity and TE of smallholder rice farmers. The first paper investigated the competitiveness of smallholder rice farmers in Mbarali and Mvomero Districts in terms of productivity and TE. The findings presented in the paper show that the overall mean TE for the whole sample was 83.8%, suggesting that rice farming was on

average about 16.2% below the potential due to the specific inefficiencies connected to farming. The rice farms in the study area have been operating below the maximum level of production frontier. The result suggests that there is room for improvement in rice farming practices. The gap between the actual level of technical efficiency and the potential indicates that farmers could achieve higher levels of productivity and output if they addressed the identified inefficiencies. Factors that positively influence smallholder rice farmers' TE are access to training, water distribution, ploughing time and planting systems. Access to credit negatively influenced farmers' TE. Smallholder rice farmers in Madibira AMCOS are more competitive compared to Kapunga and UWAWAKUDA due to their high productivity, slightly higher TE than the average, and a good number of members in the high-level TE. The findings provide evidence that AMCOS has affected the TE of smallholder farmers through coordinated training, the use of water-saving irrigation technologies, water infrastructures and access to credit.

### **6.1.2 Profitability among smallholder rice farmers**

The second specific objective of this study was to analyse the profitability of smallholder rice farmers. The study found an average Return on Investment of 0.42, Benefit Cost Ratio of 1.42 and Profit Margin of 24%. The level of profitability differed among co-operatives where UWAWAKUDA had the highest return per acre followed by Kapunga and Madibira. Alongside profitability, smallholder rice farming was sensitive to changes in total variable costs, yield and output price as shown in the Sensitivity Analysis results. This led to the conclusion that smallholder rice farming under irrigation schemes managed by AMCOS is a profitable business which should be promoted considering the changing consumer preferences in Tanzania. Mvomero and Mbarali Districts are well-known strategic areas for rice production; therefore, if farmers get good technical and financial support, rice farming in those districts can be competitive and profitable to create job opportunities and reduce poverty. Farmers in UWAWAKUDA had

been able to realize higher profits more than the rest of the farmers due to their close collaboration with a research institute and proximity to input suppliers and traders. Rice production could enhance self-sufficiency and foreign exchange earnings in Tanzania.

### **6.1.3 Smallholder rice farmers' agricultural information**

The third specific objective of this study was to assess the smallholder rice farmers' access to agricultural information. The highest information needs of smallholder rice farmers were in the areas of agronomy and marketing, followed by finance, storage and value addition. Agricultural co-operatives were not able to address all the needs on their own; yet, they provided adequate, relevant and reliable information to smallholder farmers covering almost all aspects of rice farming. However, within co-operatives, UWAWAKUDA reported having received inadequate information due to the unavailability of resources and expertise. No information was provided on weather conditions. The study concludes that agricultural co-operatives are important platforms that provide quality information in enhancing smallholder farmers' informed decision-making, suggesting an improvement in the reliability of the most pressing information needs.

### **6.1.4 Market outlet selection**

The fourth specific objective of this study was to assess the smallholder rice farmers' market outlet selection. It was found that the existing market outlets in the study area were wholesalers, retailers, millers, middlemen and private buyers; however, the majority of farmers chose to sell to more than one outlet. On this aspect, the smallholder rice farmers selected multiple market outlets as an approach to safeguard their rice farm investment and maximize their profits in the long term. The study concludes that the choice of the selling outlets influences farmers' profitability; therefore when smallholder rice farmers have access to additional market outlets, they must choose the best mix to maximize their long-term earnings. The selection of market outlets of rice producers in the

study area is associated with the quantity of paddy sold, market information, smartphone ownership, access to credit, the quantity of rice sold and frequency of extension services.

## **6.2 Recommendations**

### **6.2.1 Smallholder rice farmers' agricultural practices**

- (i) To improve productivity and TE, AMCOS in the irrigation schemes should consider proper water distribution in the rice plots, planting in rows and providing training on rice farming best practices to increase smallholder farmers' TE. Moreover, smallholder rice farmers should adhere to the rice farming best practices to improve their competitiveness in rice farming.
- (ii) Since smallholder farmers in Madibira were more competitive in terms of TE, their practices should be a derivative of other co-operatives especially in farmer training through co-operative extension sourcing seeds from research institutes at low costs.
- (iii) To improve the smallholder rice farmer's competitiveness in rice farming, AMCOS and other stakeholders should enhance the information ecosystem for smallholder rice farmers, empower them with the knowledge and resources necessary to improve their agricultural practices, productivity, and livelihoods.

### **6.2.2 Policy implications**

The findings from this study inform policy formulation and implementation. For example, policymakers can use these findings to design targeted interventions aimed at improving productivity and profitability, enhancing technical efficiency, facilitating access to quality agricultural information, and diversifying market outlet selection for smallholder rice farmers. This can contribute to food security, poverty reduction, and overall agricultural development for improved livelihood. Policy makers should address the need for infrastructure development in rural areas, such as roads and

irrigation systems within schemes. This will ensure high productivity due to good water supply in rice plots and easy access to multiple market outlets. To enhance smallholder rice farmers' competitiveness, Local Government Authorities in collaboration with AMCOS should implement policies and programmes that protect the rights and interests of smallholder farmers such as ensuring fair and stable prices for inputs and outputs so that smallholder rice farmers can earn more profit from rice and invest in other economic activities for improved livelihood.

### **6.2.3 Capacity building initiatives**

- (i) The Local Government Authority and development partners responsible for improving smallholder farmers' livelihoods should make sure that farming credits provided to farmers are properly channelled to rice farming and be given to farmers who exhibit the need for them and show commitment to improve their production through external funds.
- (ii) AMCOS should design training on the proper use of inputs such as fertilisers and herbicides to reduce the costs of production per acre. A well-managed programme or mechanism that aims at increasing rice yield per area, and organising markets and value addition should be introduced. This can be implemented through bulk procurement of quality inputs by the co-operative society or by organising for the suppliers. A good practice of organising input suppliers for easy access was observed in UWAWAKUDA, and hence it can be a derivative of other co-operatives.
- (iii) Efforts should be made by TCDC to strengthen AMCOS by providing them with resources, training, and support to enhance their capacity to deliver accurate and timely information to farmers; and collectively represent the interest of farmers.

#### **6.2.4 Marketing strategies**

- (i) The existing AMCOS should establish a Warehouse Receipt System (WHRS) so that it can be one of the market outlets in the study area in order to enhance value chain development. If well managed, they will be able to purchase large volumes of rice at a reasonable price, providing technical support and capacity building to its members.
- (ii) AMCOS should organise group marketing for smallholder rice as it offers smallholder rice farmers benefits such as collective bargaining power, improved market access, reduced transaction costs, risk management, and social support. By joining forces, smallholder farmers can enhance their market competitiveness, profitability, and resilience, ultimately improving their livelihoods.
- (iii) Local Government Authorities should improve rural infrastructures, including roads, irrigation systems, and storage facilities, to reduce transportation costs, enhance market access, and minimize post-harvest losses. This will enable smallholder farmers to connect to larger markets more efficiently and improve the overall competitiveness of their rice produce.

#### **6.2.5 Collaborations with other stakeholders**

- (i) Collaborations with meteorological agencies and other relevant service providers should be established to ensure that farmers receive reliable and timely weather information. This can be achieved through the use of mobile technologies, such as SMS or smartphone applications to disseminate weather forecasts to farmers in a timely manner.
- (ii) AMCOS should collaborate with financial and agricultural extension service providers and leverage their networks to access up-to-date information on agronomic practices, affordable credits. This can include low-interest loans, microfinance schemes, and crop insurance programmes to

help farmers manage risks and invest in technology and inputs to improve productivity and competitiveness.

### **6.3 Contribution of the Study**

#### **6.3.1 Contribution to theory**

The study was guided by a model and a theory which complement each other to explain the relationships between variables in this study. Based on the Porter's Diamond Model of Competitiveness (Porter, 1998), in his study on competitive advantage, identified six (6) factors as determinants of the competitiveness of firms. Porter's Diamond Model of Competitiveness explains the determinants of competitiveness of firms and contends that a firm is likely to succeed in a particular industry because of certain attributes such as factor conditions, related and supporting industries, strategy, structure and rivalry, government-supportive policy and the role of chance. These attributes have the potential to contribute to their competitiveness. The study recognizes the role of government which is well viewed by considering the availability of extension officers in the irrigation schemes and its impact on other determinants of competitiveness rather than a separate determinant. The integral measure of being competitive belongs to smallholder farmers; government only offers the atmosphere for businesses to succeed. This study has found that access to information that enables smallholder farmers to meet the needs and wishes of the consumers which was used as a proxy indicator for demand conditions was associated with smallholder rice farmers' competitiveness. The findings of this study offer some empirical explanation of the way financial institutions support access to credit among smallholder rice farmers in improving their competitiveness. The arguments for this model are limited to research and financial institutions as supporting industries on firm competitiveness, while in reality AMCOS have roles to play in smallholder farmers' competitiveness in rice farming.

On the other hand, according to the Transaction Cost Theory, if transaction costs are not reduced to the barest minimum,

smallholder farmers won't be motivated to actively participate in the market which has an implication on the competitiveness in terms of profit levels. The findings are informed by the TCT that smallholder farmers made informed decisions and actively participated in the market due to the minimum transaction costs involved. UWAWAKUDA was found in high profit levels as a result of lowest transaction costs in terms of transport which supports the TCT which explains the effect of transaction costs on profit levels. The findings of this study offer some empirical explanation of the way transaction costs influences profitability. This integrated approach provides valuable insights into the specific barriers and opportunities for smallholder farmers in improving their competitiveness in the rice sector

### **6.3.2 Contribution to literature**

With a special focus on irrigation schemes managed by AMCOS, the study offers real-world insights into the factors affecting smallholder rice farmers' competitiveness in terms of technical efficiency, profitability, access to agricultural information, and market outlet choices. This empirical evidence adds to the body of existing literature. Policymakers, researchers, and practitioners need this kind of knowledge in order to develop policies and interventions that will increase the competitiveness of smallholder farmers. The study fills a gap in the literature by concentrating on AMCOS rice farmers in the low land irrigated farming system and enhancing the understanding of competitiveness within this particular agricultural context. This narrow focus makes it possible to comprehend smallholder farmers' chances and challenges in low land irrigated areas better. Such findings may not be the same as those among farmers in other farming systems.

### **6.4 Areas for Further Research**

- (i) Since the study considered AMCOS members only, further studies should be done to compare AMCOS which are in the irrigation schemes and those outside irrigation schemes in

enhancing smallholder farmers' competitiveness in terms of productivity, profitability and access to markets and agricultural information.

- (ii) This study did not measure NPV and IRR as profit indicators since information collected covered only one crop season in 2021. To accurately reflect long-term profitability in smallholder rice farming, further studies should be done to evaluate smallholder rice farmers' profitability in terms of NPV and IRR.
- (iii) To enrich the existing literature, the study recommends a further research to investigate the marketing and transaction costs associated with different market outlets.

## APPENDICES

### **Appendix 1: A copy of smallholder farmers' questionnaire for research on: "Smallholder farmers' competitiveness in rice farming within Agricultural Marketing Co-operative Societies in selected districts, Tanzania".**

#### **Introduction**

Dear respondents,

Good morning/afternoon, My name is **Consesa Richard Mauki**, a PhD student at Sokoine **University of Agriculture (SUA)**. **This research is part of my study, designed to assess smallholder farmers' competitiveness in rice farming within Agricultural Marketing Co-operative Societies in Selected Districts, Tanzania.** Your participation is entirely voluntary. The interview will take about 50-60 minutes to complete. Your answers will be anonymous and confidential and only used for the purpose of this PhD thesis. Therefore, feel free to give your views and opinions.

#### **Objectives**

- i. Determine smallholder rice farmers' productivity and technical efficiency in rice farming in the study area
- ii. Estimate profitability of smallholder rice farmers.
- iii. Evaluate AMCOS in agricultural information access by smallholder rice farmers' in the rice farming.
- iv. Assess the drivers of market outlet selection among smallholder rice farmers

#### **SECTION 1: Identification**

- a) Questionnaire number:** .....
- b) Name of District:** .....
- c) Name of village/ward:**.....

- c) Name of Co-operative Society .....
- e) Date of contact: .....
- f) Name of respondent.....

### SECTION2: Socio-Demographic Characteristics

SN	Question	Response
1	Sex of household head (Male = 1, Female = 2)	
2	Marital status (Married=1, Single=2, Divorced=3, Separated=4)	
3	Age of respondent	
4	Education level of Respondent	
5	Economic activity (rice farming only=0, rice farming+other crops=1, rice +Livestock=2, rice+Business=3, rice+Farming and business=4)	

### SECTION 3: Background Characteristics

SN	Question	Response
6	Household land size under rice farming (acres) during previous season	
7	Plot location (1=lowland, 2=upland)	
8	Number of years in rice farming	
9	Number of years in AMCOS	
10	Land ownership (Titled=1, rented=2, borrowed=3)	
11	If rented, what cost do you pay for rent	
12	Household size	

**SECTION 4: Rice Production**

## 14. Inputs used for rice in the previous crop season

Inputs	Variety/type	Source (1=own saved seeds; 2= farmer/relative; 3= research institution; 4= farmer groups 7= other-specify)	Form(1=credit, 2=cash)
<b>Seeds</b>	1=SARO 5		
	2=Others (specify)		
<b>Fertilisers</b>	1=DAP		
	2=NPK		
	3=UREA		
	4=CAN		
	5=BOOSTER		
	6=Others (specify)		
<b>Pesticides</b>			
<b>Herbicides</b>	1=Round up		
	2= 2-4-D		
	3= RIRO		
	4=Others (specify)		

15 Do you often use other type of fertilizers [ ] (1=Yes 2=No)

16. If yes, state the type and amount

.....  
 .....

17. Which method of crop establishment do you use? [ ]

(Transplanting=1, Direct sowing=2)

18. Condition of water distribution in your plot? (1=good, 2=fair 3=poor)
19. Which method of planting system do you use (1=Raw planting, 2=Zigzag planting)
20. How do you harvest your field? [ ] 1=Manual, 2=cutters and slashes, 3=Combined harvester
21. What is the source of labour in your rice field? [ ] 1=Family, 2=Hired, 3=both

## 22. Mechanisation

Operation	Timing of operation	Mechanisation type (1=Hand hoe, 2=Animal Traction, 3=Tractor, 4= Power tiller )	Service provider (1=Govt, 2=Private, 3=AMCOS, 4=fellow farmer 5=own)
Ploughing			
Harrowing			
Levelling			

22. Do you encounter any challenges on rice production? 1=Yes, 2=No

23. If yes, what are the most important challenges?

SN	Production problem	1=yes 2=no
1	Inadequate capital	
2	High cost of inputs	
3	Incidence of pests and diseases	
4	Inadequate extension services	
5	Flooding	
6	Drought	
7	Water infrastructures	
8	Access to information	
9	Other (specify)	

24. What kind of material do you use on packaging your produce?  
(1=sacks 2=plastic bags, 3=plastic containers)
25. Where do you store paddy before selling? 1=Home, 2=AMCOS, 3=Milling machine, 4=Private warehouse
26. Do you pay any storage costs? 1= Yes, 2= No
27. If yes, how much do you pay per month for the rent? .....
28. What preservation measures are done before crop storage?  
1=sun drying, 2=fungicides, 3=others
29. Do you encounter any problems on storage of your produce?  
1=Yes, 2=No
30. If yes, what are the most important problems on storage of your produce?

SN	Storage problem	1=yes 2=no
1	Inadequate space	
2	Old warehouses	
3	Poor storage materials	
4	Pests and rodents	
5	Theft	
6	Storage costs	
7	Warehouse management	

31. Did you sell harvested paddy during 2020/2021 cropping season  
1=Yes 2=No
32. If yes, which product did you sell?

Product	Quantity produced	Quantity sold	Selling location 1=Farm gate, 2=market, 3=AMCOS warehouse 4=Private warehouse	To whom do you sell 1=wholesale 2=Retail 3=Millers 4=Middlemen	Distance to the main market(km)
Paddy					
Rice					
Rice Bran					

33. If No, what was the reason for not selling your crop? (1= Low price, 2= Low production, 3= High transport cost, 4= Cumbersome procedures, 5= Others (specify))
34. I would like to conduct a rice farm budget with you to find out costs of production and revenues.

### 35. Rice Farm Budget for Previous Season

Method of production					Rain fed	Irrigated
Item	Unit	Quantity	Price(ts h/unit)	Quant* price		
<b>A. Revenue</b>						
Output 1-Paddy(kg)						
Output 2- Milled rice(kg)						
Output 3-Rice bran(kg)						
Output 4-Specify						
<b>Farm size (acre)</b>						
<b>B. Intermediate Costs(per acre)</b>						
Seed purchase						
Planting fertilisers						
Top dressing fertilisers purchase						
Insecticides purchase						
Herbicides purchase						
Pesticides purchase						
Sacks purchase						
Ploughing cost						
Harrowing cost						
Cost of borrowing land						
Harvest						
Transport						
Storage						
Other(specify)						

TOTAL(B)						
<b>C. Labour Costs (per acre)</b>						
Average cost of nursery preparation						
Ploughing labour cost						
Harrowing/level labour cost						
Transplanting labour cost						
Planting fertiliser labour cost						
Top dressing fertiliser application labour						
Herbicides application labour						
Pesticides application labour						
Insecticides application labour						
Weeding labour						
Bird scaring labour						
Irrigation labour						
Harvesting labour						
Shelling/threshing/winnowing labour						
On-farm loading and off-loading						
Transport cost						
Labour costs for drying						
Labour costs for storage						
Other (specify)						
Cost or renting land-paid to coop						
Cost of irrigation-paid to coop						

**SECTION 5: Relationship with other Actors**

36. Which services do you receive from various actors along the rice value chain?

<b>SN</b>	<b>Name of actor (main and supportive)</b>	<b>Type of service</b>	<b>Duration of relationships –in yrs</b>	<b>How often 1=on event, 2=frequently3=rarely</b>
1	Research institutions			
2	Input supplier			
3	Transporter			
4	Trader			
5	Miller			
6	Fellow farmers			
7	AMCOS			
8	Financial institutions			

37. What type of information do you need for your effective rice farming?

<b>SN</b>	<b>Source</b>	<b>Type of Information (multiple response)</b>
1	AMCOS	1. Land preparation 2. Seeds selection 3. Fertilizer application 4. Weeds control 5. Herbicides control 6. Harvesting and storage 7. Marketing 8. Others (specify)
2	Extension	
3	Newspapers /radio/TV	
4	Input supplier	
5	Research institute	
6	Fellow farmer	
7	Trader	

38. What challenges do you encounter in accessing above information?

- 1.....
- 2.....
- 3.....

39. Do you read agriculture bulletins, newsletters or magazines?

1=Yes, 2=No

40. Do you listen to agricultural programmes aired in radio or TV?

1=Yes, 2=No

41. Do you own a smart phone? (1=yes, 2=no)

42. Which farming information do you obtain through your phone?

.....

43. Are you a member of any other group or association? 1=Yes,

2=No

44. How do you rate the quality of information received from the following channels

<b>Channels of marketing information</b>	<b>Adequacy 3=Adequate 2=Partial 1=Inadequate</b>	<b>Relevancy 3=Highly relevant 2=Relevant 1=Irrelevant</b>	<b>Reliability 3=Highly reliable 2=Reliable 1=Not reliable</b>
AMCOS			
Extension			
News papers			
Radio			
TV			
Fellow farmer			
Trader			

45. In which markets do you sell your produce?

Market	Location	Distance to the main market (km)

46. What are the most important problems do you encounter in marketing your produce?

SN	Problem	1=yes 2=no
1	Poor output prices	
2	Distance to the markets	
3	Access to market information	
4		
5		

47. Access to credit last season

Did you request credit (1=Yes,2=No)	If yes, What was the source 1.SACCOS 2.Commercial banks 3.Microfinance 4.Neighbour, friends, relatives 5.Other (specify)...	What was amount of credit obtained	What was the collateral?	What was the use of credit: 1= rice farming, 2= other agricultural activities , 3= other uses)	How did you pay back the loan? 1=cash, 2=in kind

<b>If in cash how much did you pay back</b>	<b>If in kind, what quantity used to repay</b>	<b>Value of this quantity (Tsh)</b>	<b>Repayment period (months)</b>

48. If No, what are your main reason(s) for being unable to access credit from credit sources?

<b>Reasons</b>	<b>Rank</b>
1. Could not fulfil loan conditions	
2. Procedure is too complicated	
3. Interest rate is too high	
4. No need, enough private money	
5. Lack of information	
6. Others restrictive conditions (specify)	

49. Training on rice farming

<b>Have you attended any training course 1=yes, 2=No</b>	<b>If yes, what was the training about?</b>	<b>Who provided the training</b>	<b>Kind of training 1=free, 2=paid</b>

50. Has any other member of the household attended any agricultural training course? [ ] 1=Yes 0=No.

51. Has any other member of the household attended rice farming training course? [ ] 1=Yes 0=No

**Appendix 2: Key Informants Guide for Research on:  
 “Smallholder farmers' competitiveness in rice  
 farming within Agricultural Marketing Co-operative  
 Societies in selected districts, Tanzania”**

**1. CO-OPERATIVE MANAGER**

**Section1: General Information**

1.	Name of the respondent:	
2.	Name of Co-operative:	
3.	Job title:	
4.	Location	Region; District; Ward;

**Section 2: Issues on rice farming in the co-operatives Society**

5. Registration and total number of beneficiaries of the co-operative society
6. Genesis of your Co-operative Society
7. Government and non-government institutions support to your Co-operative-System of Rice Intensification
8. What are the costs associated with joining in the co-operative society?
9. What are the key issues considered during the preparation of the AMCOS budget?
10. The expected roles of co-operative society during registration
11. The actual roles performed by the co-operative society on enhancing smallholder rice farmers competitiveness
12. Which market outlets exist in for farmers in your AMCOS? Which is the most preferred outlet by smallholder rice farmers and why?
13. How does the irrigation scheme co-operative facilitate the availability of production inputs, credit, information, markets and capacity building to ensure members competitiveness (productivity, profitability and efficiency) in rice farming?

14. Water use permit, cropping calendar and Soil report of the area under rice production in your scheme.
15. How do you rate the quality of information received by your members from the AMCOS in terms of adequacy, relevancy and reliability

### **Section 3: Challenges and the way forward**

16. What challenges do you encounter as you work with small holder rice farmers?
17. In your opinion, what can be done to address these challenges?
18. Any other information you would like to share?

## **2. WARD EXTENSION OFFICER**

### **Section1: General Information**

1.	Name of the respondent:	
2.	Job title:	
3.	Location	Region; District; Ward;

### **Section 2: Issues on rice farming**

4. What are the actual roles performed by the co-operative society on enhancing smallholder rice farmers competitiveness
5. How do you rate the information provided to AMCOS members in terms of quality, relevance and adequacy?
6. How do you rate the quality of information received by farmers from the AMCOS and other actors in terms of adequacy, relevancy and reliability?
7. Which market outlets exist in this area? Which is the most preferred outlet by smallholder rice farmers and why?
8. How does the AMCOS assist you in facilitating the availability of inputs, credit, information, markets and capacity building to

ensure smallholder rice farmers competitiveness (productivity, profitability and efficiency) in rice farming?

9. What challenges do you encounter as you work with small holder rice farmers?
10. In your opinion, what can be done to address these challenges?
11. Any other information you would like to share?

### 3. INPUT SUPPLIERS

#### Section 1: Identification

1	Name/Contacts of Interviewer	
2	Date/time of interview	
3	Name of Input supplier/business name	
4	Name of respondent	
5	Position of respondent in the business	
6	Mobile number of respondent(optional)	
7	Location of the business	Region: District: Ward:

#### Section 2: Input supply

8. How long have you been supplying inputs to rice farmers?
9. Why did you decide to venture in this business?
10. Which inputs did you sell to rice farmers in the previous season?

Input type	Source	Average Transport cost	Average Buying price/unit	Average Selling price/unit
Seeds				

Fertilisers				
Pesticides/Herbicides				

11. How do you sell inputs to farmers? [ ] 1=on cash basis, 2=on credit, 3=both
12. If on credit, what are the conditions?
13. What other services do you provide to smallholder rice farmers?

### **Section 3: Operating costs**

13. How many employees do you have? (Permanent/ casual)
14. How much do you pay as salaries per month?
15. What other costs do you incur in this business (probe for electricity, rent etc)

### **Section 3: Financing**

16. How do you finance your operations? (own saving, credit from financial institutions)
17. What challenges do you encounter in securing finance for the business?

### **Section 4: Challenges and the way forward**

18. What challenges do you encounter as an input supplier to smallholder rice farmers?
19. In your opinion, what can be done to address the challenges?
20. What is your role in improving smallholder rice farmers' competitiveness? (in terms of productivity, profitability and efficiency)
21. Any other information you would like to share?

#### 4. TRADERS

##### Section 1: Identification

1.	Name/Contacts of Interviewer	
2.	Date/time of interview	
3.	Name of Trader/business name	
4.	Name of respondent	
5.	Position of respondent in the business	
6.	Mobile number of respondent(optional)	
7.	Location of the business	Region: District: Ward:

##### Section 2: Traders Information

8. Category of trader 1=broker, 2= whole seller, 3=retailer
9. How long have you been in the rice trading business?
10. Why did you decide to venture in this business?
11. How many employees do you have? (permanent/casual)

##### Section 3: Trade quantities and sources

12. Which type of produce do you buy? 1=paddy 2= milled rice 3= both
13. How much do you incur in Milling, grading and polishing?
14. What is the source of your rice? Who are the main suppliers?
15. What varieties do you buy and why do you prefer them?

Variety	Reasons for preference

16. What quality standards do you consider while buying rice? (moisture, aroma, physical appearance etc)
17. Do you offer any services/incentives to your suppliers-smallholder rice farmers?
18. What services do you offer to your suppliers (including farmers) to incentivize to supply rice to you/your business?
19. How often do you buy rice/ what are the major buying months? Which quantities do you buy per month or per season?

Month	Total quantity purchased monthly

20. What is the annual quantity and the purchase price for rice?(/kg) by variety

Variety	Quantity purchased/month	Number of months of purchase in a year	Average price/kg

21. What are the storage costs?

#### **Section 4: Rice Marketing**

22. In what form do you sell your rice (1=paddy, 2=milled rice, 3= both)
23. If you sell milled rice, do you pack, brand and grade? What are the costs?
- Package units (1kg, 5kg, 10kg, 50kg,bulk)
  - Package costs
  - Grades (Grade 1,2,3 etc)

- Grading costs

24. Who are your main customers/outlets for rice that you sell?

Market outlet	Rice grade	Quantity sold(kg)	Price/kg

### Section 6: Rice marketing costs

25. What are the **monthly** costs of the listed items in your operations and management?

Operation	Number	Cost/Unit	Monthly costs
Milling/grading/polishing			
Transport			
Loading and off-loading			
Storage/rent			
Materials and supplies			
Preservatives(storage chemicals)			
Electricity			
Water			
Communication(airtime)			
Labour(permanent/casual)			
Packaging(materials and labour)			
Insurance			
Licence and levies			
Others (specify)			

26. How do you finance the above operations (own saving, credit)

27. What do you do to minimise costs of operation so as to increase profit?
28. What is your role in improving smallholder rice farmers competitiveness (productivity, profitability and efficiency)

### **Section 7: Challenges and the way forward**

29. What challenges do you encounter as you trade with small scale rice farmers?
30. In your opinion, what can be done to address these challenges?
31. Any other information you would like to share?

## **5. RICE MILLERS**

### **Section 1: Identification**

1.	Name/Contacts of Interviewer	
2.	Date/time of interview	
3.	Name of Rice miller/business name	
4.	Name of respondent	
5.	Position of respondent in the business	
6.	Mobile number of respondent	
7.	Location of the rice mill	Region: District: Ward:

### **Section 2: Millers Information**

8. When was this rice mill established?
9. What is the ownership status of the mill? (Sole proprietorship, government entity, co-operative etc specify)
10. How many employees do you have? (permanent/casual)
11. What is the capacity of your machine?(metric tonnes/day or /hour)

### **Section 3: Rice sourcing and milling**

12. Do you grow or buy rice for milling? 1=Yes, 2= No (If NO SKIP TO 3.8; If YES continue to 3.2)

13. If you grow your own rice, what is the size of your land? (area under production )
14. If you buy paddy rice for milling, who are your main suppliers
15. What services do you offer to your suppliers (including smallholder farmers) to incentivize them to supply rice to your milling plant?
16. Which varieties do you mostly buy and why do you prefer them?
17. What quality standards do you consider while buying paddy for milling? (moisture, physical appearance)
18. How often do you purchase paddy rice for milling? Which are the major buying months? Which quantities do you buy per month/season and prices?

<b>Month</b>	<b>Total quantity purchased(monthly)</b>	<b>Average price per kg</b>

19. In the event you offer milling services, what is the fee levied per kg?

<b>Rice variety</b>	<b>Milling levy per kg</b>	<b>Additional services(grading, polishing, packaging)</b>	<b>Average quantity milled per month</b>	<b>Number of months with active milling</b>

20. Who are your customers for milling services? What is the nature of engagement with these customers (probe for cash/credit terms of service, contracts etc)
21. What is your daily processing capacity?
22. What is the average conversion factor from paddy to milled rice?
23. How much does it cost to mill a kg of paddy?

**Section 4: Rice marketing.**

24. What market channels do you use to sell your rice? At what price? what grades? (probe for distribution chain)

Market outlet	Quantity sold	Price per kg

25. Total quantity of rice sold seasonally

Season	Quantity of rice sold(tonnes or kg)

26. What other products do you process and sell?

Product	Buyers	Quantity sold	Price/unit (kg)
Rice bran			
Rice cake			
Starch			
Others (specify)			

**Section 5: Operations and maintenance**

27. What are your major cost centres? (Utilities, labour, maintenance, materials, sales etc)

28. What are the **monthly** costs of the listed items in your operations and management?

<b>Operation</b>	<b>Number</b>	<b>Cost per unit</b>	<b>Amount</b>
Transport			
Storage			
Materials and supplies			
Electricity			
Water			
Labour (permanent/casual)			
Branding			
Packaging			
Insurance			
Security			
Others (specify)			

29. How do you finance the above operations? (own saving, credit)

30. What challenges do you encounter in trying to secure finance for your operations?

### **Section 6: Challenges and the way forward**

31. What challenges do you encounter as you do business with small scale rice farmers?

32. In your opinion, what can be done to address these challenges?

33. What is your role in improving smallholder rice farmers competitiveness (productivity, profitability and efficiency)

34. Any other information you would like to share?

## 6. TRANSPORTERS

### Section 1: Identification

1.	Name/Contacts of Interviewer	
2.	Date/time of interview	
3.	Name of Transporter/business name	
4.	Name of respondent	
5.	Position of respondent in the business	
6.	Mobile number of respondent	
7.	Location of the business	Region: District: Ward:

### Section 2: Transporter Information

8. How long have you been in the transport business?
9. What form of transport do you own/operate?
  - a) Motorbike b) Pickup c) Canter d) Lorry e) Trailer
10. What is the capacity of the form of transport you operate?
11. Who are your target clients?
  - a) Farmers b) Millers c) Wholesalers d) Retailers
12. At what point do you offer transport services
  - a) From farm to store b) From farm to miller c) From miller to trader d) From input supplier to farmers
13. How do you charge your clients for transporting rice?(per bag/per tonne/per km)
14. What volume of rice do you transport per season?

Rice type	Volume/quantity transported per season	Price per unit	Total income
Paddy rice			
Milled rice			

15. What is the nature of engagement and terms with your clients? (contract, credit, cash on delivery)
16. What services do you provide to smallholder farmers?
17. What are the costs of the listed items in your operations and management?

Operation	Number(quantity)	Cost/unit	Total cost
Maintenance			
Fuel			
Labour(casual/permanent)			
Insurance			
Others (specify)			

18. What is your role in improving smallholder rice farmers' competitiveness in rice value chain (productivity, profitability and efficiency)

### **Section 3: Challenges and the way forward**

19. What challenges do you encounter as you do transport business with small scale rice farmers?
20. In your opinion, what can be done to address these challenges?
21. Any other information you would like to share?

**Appendix 3: Focus Group Discussion Guide for Research on:  
 “Smallholder farmers' competitiveness in rice  
 farming within Agricultural Marketing Co-  
 operative Societies in selected districts,  
 Tanzania”**

Name/contact of Interviewer	
Date/time of discussion	
Location/ward	
Number/name of FGD	

1. Which inputs did you use for rice in the previous crop season? and why do you prefer them?
2. What costs did you incur on average in rice farming in the previous season?
3. What is the main source of labour in your rice field?
4. How do you harvest your rice?
5. On average, how much do you harvest per acre? How does the yield vary per seasons?
6. What was the average price per kg last season.( probe for paddy, milled rice, rice bran and broken rice)
7. In the event farmers do not sell their produce, what was the reason for not selling?
8. Who are the other rice value chain actors working with rice farmers in Mbarali and Mvomero?
9. How do you access agricultural information in rice farming? (sources, adequacy, relevancy, reliability)
10. Out of what is harvested, how much is consumed at home and how much is sold? (probe for %)
11. Paddy storage after harvesting.
12. What are your major selling location/market outlets? Which is the most preferred outlet by smallholder rice farmers and why?
13. What are your sources of credit (probe for source and terms/conditions)

14. Training programs in rice production
15. What are the major challenges in production, storage and marketing your produce?
16. What possible improvements can you recommend to address these challenges?
17. What are the roles of AMCOS in improving your productivity and profitability?
18. How can you relate the use of ICT and competitiveness in smallholder rice producers in your area?

## Appendix 4: Agricultural Information Providers

SERVICE PROVIDER	VARIABLES	Kapunga		Madibira AMCOS		UWAWAKUDA				
		n	%	n	%	n	%	Total	%	
AMCOS	ADEQUACY	Inadequate	13	18.80	27	39.10	29	42.00	69	18.06
		Partially adequate	25	22.30	67	59.80	20	17.90	112	29.32
		Adequate	24	11.90	140	69.70	37	18.40	201	52.62
		<b>Total</b>	62		234		86		382	100.00
	RELEVANCE	Irrelevant	19	16.70	71	62.30	24	21.10	114	29.84
		Relevant	27	20.50	75	56.80	30	22.70	132	34.55
		Highly relevant	16	11.80	88	64.70	32	23.50	136	35.60
		<b>Total</b>	62		234		86		382	100.00
	RELIABILITY	Not reliable	24	19.50	74	60.20	25	20.30	123	32.20
		Reliable	19	13.20	91	63.20	34	23.60	144	37.70
		Highly reliable	19	16.50	69	60.00	27	23.50	115	30.10
		<b>Total</b>	62		234		86		382	100.00
EXTENSION OFFICERS	ADEQUACY	Inadequate	20	29.90	24	35.80	23	34.30	67	17.54
		Partially adequate	20	13.10	106	69.30	27	17.60	153	40.05
		Adequate	22	13.60	104	64.20	36	22.20	162	42.41
		<b>Total</b>	62		234		86		382	100.00
	RELEVANCE	Irrelevant	9	60.00	3	20.00	3	20.00	15	3.93
		Relevant	51	16.70	183	59.80	72	23.50	306	80.10
		Highly relevant	2	3.30	48	78.70	11	18.00	61	15.97
		<b>Total</b>	62		234		86		382	100.00
	RELIABILITY	Not reliable	23	41.10	17	30.40	16	28.60	56	14.66
		Reliable	27	11.30	159	66.30	54	22.50	240	62.83
		Highly reliable	12	14.00	58	67.40	16	18.60	86	22.51
		<b>Total</b>	62		234		86		382	100.00
MASS MEDIA(TV,Ra)	ADEQUACY	Inadequate	30	21.70	97	64.50	24	15.90	151	39.53

SERVICE PROVIDER	VARIABLES	Kapunga		Madibira AMCOS		UWAWAKUDA				
		n	%	n	%	n	%	Total	%	
dio,Mobile)	RELEVANCE	Partially adequate	31	19.90	88	61.50	24	16.80	143	37.43
		Adequate	1	1.10	49	55.70	38	43.20	88	23.04
		<b>Total</b>	62		234		86		382	100.00
	RELIABILITY	Irrelevant	23	39.00	20	33.90	16	27.10	59	15.45
		Relevant	33	11.80	208	74.60	38	13.60	279	73.04
		Highly relevant	6	13.60	6	13.60	32	72.70	44	11.52
	INPUT DEALERS	<b>Total</b>	62		234		86		382	100.00
		Not reliable	28	29.80	46	48.90	20	21.30	94	24.61
		Reliable	25	12.80	143	73.30	27	13.80	195	51.05
	RELEVANCE	Highly reliable	9	9.70	45	48.40	39	41.90	93	24.35
		<b>Total</b>	62		234		86		382	100.00
		Inadequate	12	17.10	75	50.00	33	32.90	120	31.41
RELIABILITY	Partially adequate	24	15.40	99	68.60	25	16.00	148	38.74	
	Adequate	26	16.70	60	59.00	28	24.40	114	29.84	
	<b>Total</b>	62		234		86		382	100.00	
RESEARCH INSTITUTES	Irrelevant	10	35.70	15	53.60	3	10.70	28	7.33	
	Relevant	50	15.40	194	59.90	80	24.70	324	84.82	
	Highly relevant	2	6.70	25	83.30	3	10.00	30	7.85	
ADEQUACY	<b>Total</b>	62		234		86		382	100.00	
	Not reliable	17	28.80	36	61.00	6	10.20	59	15.45	
	Reliable	42	15.90	162	61.40	60	22.70	264	69.11	
ADEQUACY	Highly reliable	3	5.10	36	61.00	20	33.90	59	15.45	
	<b>Total</b>	62		234		86		382	100.00	
	Inadequate	43	25.90	106	63.90	17	10.20	166	43.46	
ADEQUACY	Partially adequate	16	11.20	82	57.30	45	31.50	143	37.43	

SERVICE PROVIDER	VARIABLES	Kapunga		Madibira AMCOS		UWAWAKUDA					
		n	%	n	%	n	%	Total	%		
FELLOW FARMER	RELEVANCE	Adequate	3	4.10	46	63.00	24	32.90	73	19.11	
		<b>Total</b>	62		234		86		382	100.00	
		Irrelevant	29	63.00	13	28.30	4	8.70	46	12.04	
	RELIABILITY	Relevant	32	10.90	202	68.70	60	20.40	294	76.96	
		Highly relevant	1	2.40	19	45.20	22	52.40	42	10.99	
		<b>Total</b>	62		234		86		382	100.00	
	ADEQUACY	Not reliable	39	65.00	17	28.30	4	6.70	60	15.71	
		Reliable	22	9.50	155	66.80	55	23.70	232	60.73	
		Highly reliable	1	1.10	62	68.90	27	30.00	90	23.56	
	TRADER(Including Millers and brokers)	RELEVANCE	<b>Total</b>	62		234		86		382	100.00
			Inadequate	32	27.40	54	46.20	31	26.50	117	30.63
			Partially adequate	15	9.30	115	71.00	32	19.80	162	42.41
		RELIABILITY	Adequate	15	14.60	65	63.10	23	22.30	103	26.96
			<b>Total</b>	62		234		86		382	100.00
			Irrelevant	18	50.00	7	19.40	11	30.60	36	9.42
		ADEQUACY	Relevant	39	12.10	212	66.00	70	21.80	321	84.03
			Highly relevant	5	20.00	15	60.00	5	20.00	25	6.54
			<b>Total</b>	62		234		86		382	100.00
RELIABILITY		Not reliable	14	15.10	63	67.70	16	17.20	93	24.35	
		Reliable	43	16.70	148	57.60	66	25.70	257	67.28	
		Highly reliable	5	15.60	23	71.90	4	12.50	32	8.38	
ADEQUACY	<b>Total</b>	62		234		86		382	100.00		
	Inadequate	39	18.70	110	52.60	60	28.70	209	54.71		
	Partially adequate	22	13.40	117	71.30	25	15.20	164	42.93		
	Adequate	1	11.10	7	77.80	1	11.10	9	2.36		

SERVICE PROVIDER	VARIABLES	Kapunga		Madibira AMCOS		UWAWAKUDA			
		n	%	n	%	n	%	Total	%
	<b>Total</b>	62		234		86		382	100.00
RELEVANCE	Irrelevant	41	12.50	202	61.80	84	25.70	327	85.60
	Relevant	21	38.20	32	58.20	2	3.60	55	14.40
	Highly relevant	0	0.00	0	0.00	0	0.00	0	0.00
	<b>Total</b>	62		234		86		382	100.00
RELIABILITY	Not reliable	19	8.10	164	69.50	53	22.50	236	61.78
	Reliable	37	27.00	67	48.90	33	24.10	137	35.86
	Highly reliable	6	66.70	3	33.30	0	0.00	9	2.36
	<b>Total</b>	62		234		86		382	100.00



### **Kuhusu Tasnifu Hii**

Vyama vya Ushirika wa Masoko ya Mazao ya Kilimo vina uwezo wa kuboresha ushindani wa wakulima wadogo kwa kushirikiana katika utumiaji wa rasilimali na maarifa. Hata hivyo, ushindani wa wakulima wadogo katika vyama hivyo haujachunguzwa vya kutosha nchini Tanzania. Utafiti ulifanyika kutathmini ufanisi wa kiufundi, faida, upatikanaji wa taarifa na masoko kwa wakulima wadogo wa mpunga. Utafiti ulihusisha eneo la wilaya za Mbarali na Mvomero. Uchanganuzi wa kitaamuli kwa kompyuta ulitumia kielelezo cha mpaka cha 'Cobb-Douglas' na mbinu ya bajeti ya biashara 'FBT'. Matokeo yalibainisha kuwa, kwa wastani ufanisi wa kiufundi ulikuwa 83.8%, kiwango cha faida cha 24%, huku taarifa kuhusu shughuli za shambani zikiwafikia wakulima wengi (77.2%) na wakulima (65.71%) wakiuza mazao kwa zaidi ya soko moja. Mamlaka za Serikali za Mitaa, Vyama vya Ushirika na wadau wengine wanapaswa kuendelea kuboresha miundombinu ya maji, kuandaa masoko na programu za mafunzo ili kuongeza ushindani wa wakulima wadogo wa mpunga.