[ARTIGO RETRATADO] Cost-benefit efficiency and determinants of marketing channel choice by rice farmers in rural Tanzania: evidence from Mbeya Region, Tanzania

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Abstract

Rice production is considered an increasing source of income and food security for smallholder farmers in many parts of Tanzania. Improving market access for rice farmers is essential to raise rural incomes and reducing poverty. This study aims to determine the cost-benefit efficiency of different rice marketing channels and factors affecting marketing channel choices of smallholder rice farmers. The analysis has been conducted using various efficiency indicators and Multinomial Logit Model on quantitative data collected from 213 rice farmers in Mbeya, one of the main rice production regions in Tanzania. The results showed that out of the studied channels, the miller-wholesale marketing channel is the most efficient market. Regarding the factors, the results show that although most farmers in rural areas still sell their produce to local collectors, favorable prices and reduced transaction cost due to ownership of transportation and storage facilities, access to market information, credit access, transportation infrastructure improvement, and collective action through associations influences farmers to choose better marketing channels. The findings suggest that policies aimed at improving extension services, access to productive assets, access to formal credit, improvement of rural infrastructure and post-harvest facilities, reducing transaction costs, promoting the use of farmers' production and marketing groups to access appropriate marketing information could enhance marketing efficiency and inclusion of smallholder farmers in markets.

Keywords: Cost. Profitability. Efficiency. Marketing channel. Rice supply chain. Smallholder.

1. Introduction

The availability of sufficient and sustainable food is the foremost pillar in various aspects of human life (Taylor, 2016; Rajaram and van Ginkel, 2019). In Tanzania, the agriculture sector has a strategic position in the supply of main national staple food, employment, raw materials for industries and foreign exchange earnings (Lyatuu *et al.,* 2016; Mkonda and He, 2016; Kuzilwa and Mpeta, 2017). It is also the main income source, which is largely conducted by smallholder farmers, most of whom produce maize and rice (NBS, 2012c). Approximately 28% of the Tanzanian population lives with consumption levels below the poverty line, and almost 75% of the economically active population is directly or indirectly engaged in the agricultural sector (Wilson and Lewis, 2015). In 2016/2017, the sector's share in Tanzania's GDP was 28.74%, with rice accounting for about 19.5% of annual cereal production (URT, 2017a). The need for cereal crops, which continues to increase in line with the continued development of the food and feed industry, indicates the significant role of grains in the growth of the food crops sub-sector in the country.

The Tanzanian government and its partners have adopted several policies and interventions geared to enhance the productive capacity of farmers to maintain the stability of domestic supplies and meet the basic food needs of the communities (Fang *et al.,* 2017). The Agricultural Sector Development Programme among others, implemented at district level under the District Agricultural Development Plan has focused on increasing agricultural productivity through efficient use of improved technologies, rehabilitating irrigation infrastructures, strengthening management capacities of existing farmers organizations and cooperatives, promoting marketing and value addition linkages (URT, 2017b). The sector also enjoys tax exemptions on the import of agricultural machinery, and subsidies on agricultural inputs such as fertilizer and seed (Kuzilwa and Mpeta, 2017; Kweka and Mboya, 2017). Through these supportive initiatives, crop production in the country has been gradually improved (Brentrup *et al.,* 2016). Serious concerns remain for the exiting levels of marketing, and value chain linkage (Kissoly *et al.,* 2017).

Among researchers, access to efficient markets is considered an essential tool for lifting farmers out of poverty and enhancing food security in developing countries (Fafchamps *et al.,* 2005; Panda and Sreekumar, 2012). Additionally, the literature on agricultural marketing indicated that a conducive marketing performance will provide farmers with incentives to produce, adopt improved technologies, and increase the share of prices received by the farmer (Zeller *et al.,* 1998; Barrett, 2008). Nevertheless, smallholder farmers

can still face various barriers to participate into markets (e.g., high transaction costs and inefficient information flows), leading to limited bargaining power and channel choices for farm households (Omiti *et al.*, 2009). As a result, farm gate prices are depressed, and production incentives are distorted (Mmbando *et al.*, 2015). The successful increase in productivity and profitability largely depends on the potential of a marketing system to support such an improvement.

In Tanzania, rice cultivation, trade, and value addition have been a significant contributor to food security and nutrition, socio-economic development, and sometimes foreign exchange earnings and trade balance (Wilson and Lewis, 2015; Nkuba *et al.*, 2016). The crop production and marketing activities directly influences the livelihood of over two million people countrywide (Rugumamu, 2014). Official data indicate that current total annual production averages about 2,194,750 million tonnes, of which smallholder farmers produce around 90 percent under continuous flooding with an average farm size and yield of 1.3 hectares and 2.5tonnes/ha respectively (URT, 2017a). Rice consumption is on the rise, especially among urban and rural residents due to an increase in people's income, change in lifestyle, and dietary habits (Lazaro *et al.*, 2017). Demand for Tanzanian rice is projected to increase threefold in the next decade as the population increases and becomes more urbanized (Rugumamu, 2014; Lazaro *et al.*, 2017). The increasing demand gives the smallholder rice producer more credibility to meet this growing demand by improving production (Center, 2011). The growth potential of the rice sector shows a great promise, and hence it is considered to be a viable economic activity that can effectively tackle the problem of low income-earning for smallholder farmers (Kangile and Mpenda, 2016). In harnessing this potential, the issue of improving efficiency in marketing and the choice of the right marketing channel with the consideration of increasing profit to farmers is particularly important. Nevertheless, the literature on whether or not Tanzania's smallholder rice farmers can obtain potential financial benefits from participating in domestic non-traditional marketing channels is still limited (Achandi and Mujawamariya, 2016). Considering the importance of the sector from a development economics perspective, this represents a considerable research gap.

This study seeks to close this gap by analyzing marketing channels in the Tanzania rice sector. It has two main objectives: (1) to evaluate the cost-benefit efficiency of rice marketing, and (2) to explore the determinants influencing rice farmers' choice of marketing channels. This study uses data from 213 smallholder rice farmers in Tanzania and applies both descriptive qualitative and quantitative methods. The results are of particular interest for producers and traders of agricultural products in developing countries as well as policy

makers to fully support smallholder farmers. The rest of the article is organized as follows: Part 2 gives an overview of the study area and rice marketing channel system in Tanzania. Part 3 describes the data and methodology. Then part 4 presents the results of the quantitative analysis. Finally, the article closes with conclusions and implications for policy-makers in developing countries regarding the improvement of agricultural market performance in rural areas.

2. Literature Review

Cost-benefit efficiency of agricultural markets is related to marketing activities that can increase or maximize the ratio of marketing output to input (Kohls and Uhl, 2002; Fafchamps *et al.*, 2005). It measures the efficiency of profit earned by marketing institutions (traders, factories, or processors) as a function of operating costs (Kohls and Uhl, 2002). The analysis that is often done in operational efficiency studies is the analysis of marketing margins, farmer's share, and profit to cost ratio (Kohls and Uhl, 2002; Fafchamps *et al.*, 2005). A market is said to be cost efficient if there are indicators such as: creating or increasing the added value to agribusiness products, generating profits for each marketing institution involved per cost incurred, increases consumers satisfaction relatively to the marketing margins, and provide farmer's share which will moderately stimulate production (Kohls and Uhl, 2002; Fafchamps *et al.*, 2005; Panda and Sreekumar, 2012).

Marketing channel selection is a vital farm household decision and has a significant impact on household income (Mmbando *et al.*, 2015). Before choosing a marketing channel, farmers consider the costs associated with transportation, returns, the ability of the channel to capture the widest range of target markets, level of trust among the available channels and familiarity of the markets, among other factors (Magesa *et al.*, 2014). In some other cases, farmers market their products through channels offering low prices because they either lack market knowledge or have difficulties in accessing more rewarding markets (Romero and Wollni, 2018). The choice of the marketing channel to use is a fundamental decision for the smallholder farmers where several factors have to be considered as a basis for such a decision. Farmers need a clear understanding of market characteristics before starting a channel selection.

Several studies have been carried to evaluate the cost-benefit efficiency of agricultural markets and characterized the factors influencing farmers' choice of marketing channels (Rao and Qaim, 2011; Shiimi et al., 2012; Panda and Sreekumar, 2012; Xaba and Masuka, 2013;

Mmbando *et al.,* 2015; Soe et al., 2015; Romero and Wollni, 2018; Safi *et al.,* 2018). The studies used various indicators and ratios to examine cost-benefit efficiency such as; marketing cost, marketing margins, farmers share, price spread, profit to cost ratio, and marketing efficiency index. Regarding farmers' choice of a marketing channel, studies have identified factors related to transaction costs, farm household characteristics, product characteristics, access to assets, and social capital, such as collective action to have significant effects on farmers' market channel decisions. For instance, in Kenya, Rao and Qaim (2011) found that transaction costs in the form of information costs, negotiation costs as well as monitoring and enforcement costs have a significant impact on market channel choice by banana smallholder farmers. Also in the assessment done by Xaba and Masuka, (2013) and Mmbando *et al.* (2015) revealed that level of education and age of household head were significant determinants of market channel choice by smallholder farmers in Swaziland and Tanzania, respectively. According to authors, farmers who have more education tend to be good negotiators and are risk-averse. Studies conducted in Tanzania, Vietnam and Ethiopia respectively found that social network variables, such as membership in local associations and networks or participation in collective action, can improve the market participation of small-scale farmers (Barham and Chitemi, 2009; Cazzuffi and McKay, 2012; Tadesse and Kassie, 2017).

3. Rice Marketing Channels and their Characteristics

The traditional rice marketing channel in Tanzania is dominated by the private sector, including rice farmers (most of them smallholder), rice millers, village rice collectors, wholesale traders, retailers, and end consumers. Recently, new buyers such as larger-scale farms and food companies, farmer associations, and supermarkets have entered the domestic as well as the export rice markets. Of these, collectors, miller-traders, and wholesalers are the farmers' preferred trading partners and, therefore, the most common in villages. In each ward, there is at least one buyer with full equipment such as a four-wheel-tractor, motorbikes, and a resident milling machine, who can offer a variety of services to smallholder farmers: supplying inputs, milling, buying paddy or providing informal credit.

The study identified four types of marketing linkages, which are analyzed in detail below. The analysis focuses on the trading parties, the time of purchase as well as the kind of arrangement, and the relationship between the trading parties. The linkages are differentiated by the traded commodity (paddy or milled rice) and the actors involved.

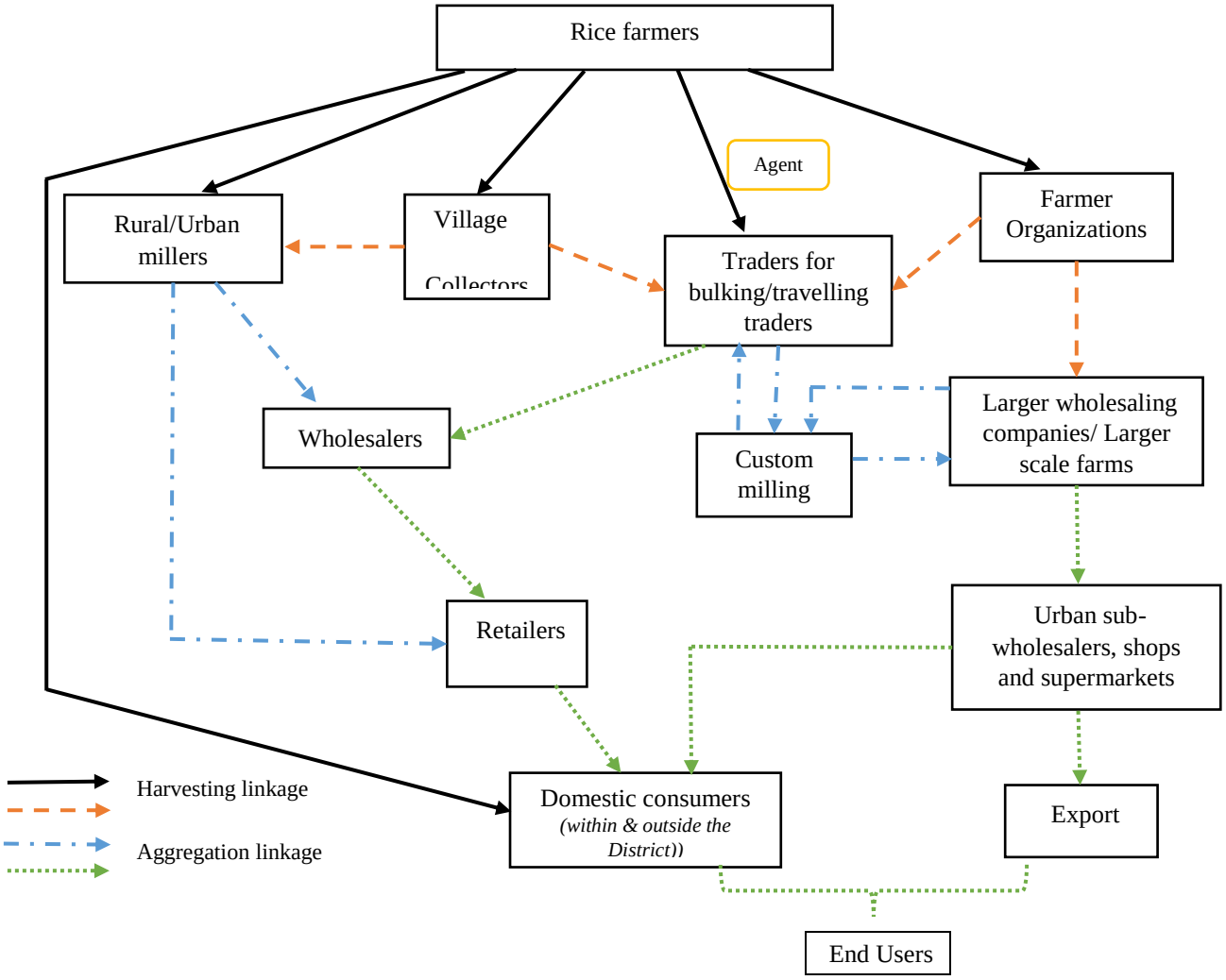

Figure 1: Structure of rice supply chain relationship in the study area

Harvest linkages. Harvest linkages refer to the marketing of paddy by the farmer to other actors of the supply chain, such as local collectors/brokers, traders, or millers. In most cases, paddy change hands immediately or shortly after harvest where these buyers are based in the same or adjacent villages. According to Figure 1, there is a range of marketing channels available to farmers, including millers, local collectors, wholesalers, and their respective agents or farmer organizations (FO's) for those under integrated schemes. However, many interviewed farmers depend on one specific marketing channel due to production financing agreements, family ties, or relationships. Some farmers can choose their customers freely, based on the highest price offered. Buyers, however, actively search for farmers who want to sell to them, frequently hiring agents to establish the contact.

Aggregation linkages. Aggregation describes the step in the value chain where paddy has been collected by local collectors/agents, but not yet processed. It mostly takes place immediately after harvest. Depending on their facilities, village collectors in the study area

either sell directly to millers and traveling traders, or they dry and store the procured paddy themselves and sell it to millers or larger scale traders, especially those who transport to deficit regions during the lean season.

Processing linkages. The processing linkage refers to the sale of husked rice to wholesalers and retailers. These transactions take place throughout the year and involve rice millers, traders, and larger-scale wholesaling traders or companies as processing actors. In either case, the buyers can be located within the district or adjacent districts/regions to the selling party. Depending on the volume handled, some millers and traders have business contacts in other areas within the country, such as Dar es Salaam (the principal end-market for about 60 percent of consumption), Iringa, Njombe, Ruvuma, and Dodoma regions. The volume of the rice purchased depends upon the demand by wholesalers or retailers, while prices are negotiated between business partners but regions on prevailing market prices. Larger companies have business contracts with supermarkets and sometimes tend to export to neighboring countries.

Distribution linkages. Distribution describes the step in the supply chain where milled rice is sold to the end consumer. Besides retailers and wholesalers, there are several supply chain actors, such as traders, millers, and supermarkets, who are mainly engaged in other supply chain activities, but who also run retail outlets and sell milled rice to consumers. Most retailing actors sell to private customers on a walk-in basis. Institutional buyers such as schools, restaurants, and hospitals represent a different kind of customers, which are characterized by high buying volumes.

Figure 2 shows the three rice marketing channels targeted in the present study. The first channel of the system is referred to as a traditional marketing channel, whereby farmers sell their products to village collectors or assemblers. Products are then resold before milling to urban millers or bulking traders, who after milling sell to wholesalers, food companies, shop retailers, and finally to the end consumers. In this channel, most of the farmers choose to sell their paddy at the farm gate and know at least one collector or agent in their village. The main disadvantage for farmers is that they must rely on their buyers for marketing information (e.g., prices) and have limited bargaining power. As a result, some farmers in the study area tend to deliver their paddy to the second marketing channel in the system: miller-traders or wholesalers in urban areas. For transport, bus services or trucks are often used to deliver paddy to urban millers. For success in this marketing channel, farmers usually need to rely on their urban networks. However, smallholder farmers might still face challenges when selling small quantities of paddy, also have to incur some additional transport costs.

Due to these challenges, a third marketing opportunity has emerged: the traveling traders (traders outside the district). By establishing farmer organizations or using agents, the larger-scale traders have applied the strategy of buying directly from rice farmers and organizing several processing steps such as milling, packaging, and even branding products with their trademark. Then, products are delivered to urban consumers in deficit regions either through wholesalers, retailers, or their retail outlet shops in urban areas.

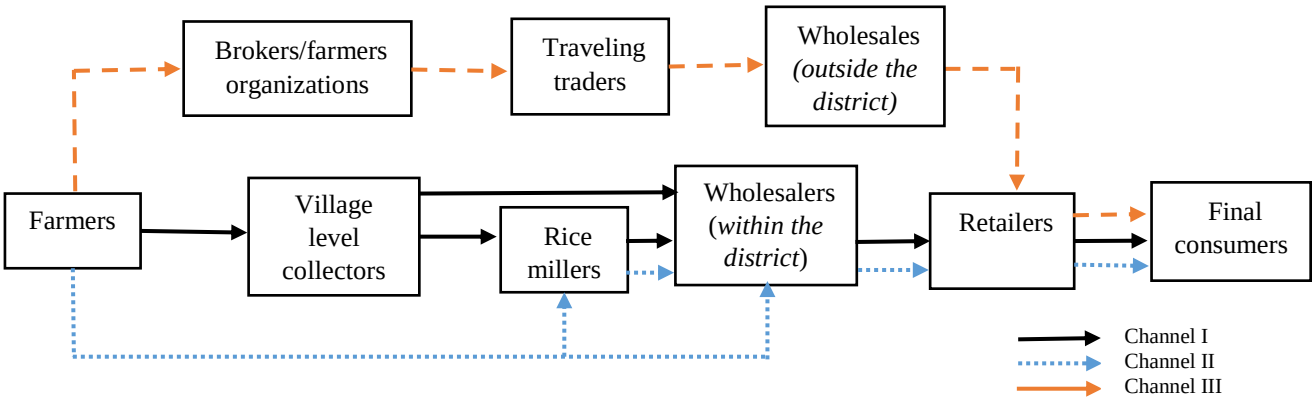

Figure 2: Rice marketing channel under study

4. Materials and Methods

4.1. Data sources

The study was conducted in Mbeya, located in the southern part of Tanzania mainland. Three factors influenced the selection of the study area. First, the area falls within a suitable agro-ecological zone for rice production (SAGCOT, 2011). Secondly, it's known to be among the key producing regions, accounting for over 17.8 percent of total rice production in Tanzania at an average yield of 2.2 tonnes/ha (URT, 2017a). Third, there is potential demand for rice produced in this region due to accessibility by road network and rail linking Tanzania to Zambia; this means that rice from this area can be easily transported to other domestic markets and nearby countries as export products. To this end, three wards of the Mbarali District in Mbeya region were selected for the study.

Farmers who participated in rice marketing in the 2017/2018 crop season were the sampling frame of the research, from which a random sample of 213 individuals was extracted. Multistage sampling procedure was employed to construct the sample. Additionally, twenty representatives of marketing intermediaries were purposively interviewed. Data related to marketing costs, average prices, and marketing margins were collected to evaluate the cost-benefit efficiency of various rice marketing channels. While

data on farm household characteristics, product characteristics, access to assets, trust, and social capital, such as farmer association, were collected to assess their significant effects on farmers' market channel decisions.

4.2. Analytical framework and empirical model

The following efficiency indicators were used to evaluate the cost-benefit efficiency of different rice marketing channels (Acharya and Agarwal, 2016);

$$F_s = \frac{F_p}{C_p} \times 100 \quad (1)$$

$$P_s = C_p - F_p \quad (2)$$

$$ME_1 = \frac{C_p}{TMC_I} \quad (3)$$

$$ME_2 = \frac{NP_p}{TMC_I + TMM_I} \quad (4)$$

$$MEI_1 = \frac{R_i}{N_i} \quad (5)$$

Where F_p is farmer's price, C_p is consumer's price (value of goods purchased), F_s is farmer's share, and P_s is the price spread between farmers and final consumers. ME_1 denotes efficiency under Shepherd's method, ME_2 marketing efficiency under Acharya's method, NP_p is the net selling price of farmers (price received - marketing costs), TMC_I is total marketing cost of intermediaries, and TMM_I is total marketing margin. MEI_1 is market efficiency index under the composite method, R_i is sum of ranks in each channel, and N_i is total number of performance indicators.

Marketing costs were obtained by summing up the cost from marketing activities carried out by each marketing agency in the rice distribution chain. The amount of marketing costs differ from one channel to another due to the type of commodity (paddy or rice), marketing location, types of marketing institutions, and marketing activities (Acharya and Agarwal, 2016). The marketing cost of intermediaries included transportation cost, loading and unloading, taxes and fees, bags, threads, processing charges like drying, husking, etc. Marketing margin was obtained by subtracting cost price (purchase price and marketing cost) from the selling price of rice/paddy by a market agent. The size of marketing margins in various rice marketing channels depends on its length, number of economic activities that take place during marketing activities, as well as the amount of profits expected by each marketing

institution involved. Whereas, price spread was calculated by subtracting the net price received by farmers from the retail sale price/consumer's price (Acharya and Agarwal, 2016).

To analyze the causality behind smallholders' choice of rice marketing channels, we chose a multinomial logit regression model. This model is suitable for analyzing unordered responses with more than two options (Wooldridge, 2010). Thus, farmers' selection of marketing channels can be examined, as shown below:

$$y_i = \beta_0 + X'_{ij}\beta_j + \varepsilon_{ij} \quad (6)$$

In this model, y_i represents the vector of the dependent variable describing the farmers' marketing channel choice, and X'_{ij} the vector of independent variables measuring farm characteristics, asset-specific, network parameters, and farmers' socio-demographics.

Impacts of the explanatory variables were measured by their marginal effects, according to Equation (7).

$$\frac{\partial P_{ij}}{\partial X_{ik}} = P_{ij} - \sum_{m=1}^{j-1} P_{im}\beta_{mk}\,; j = 1, \ldots\ldots, j-1 \quad (7)$$

Where each β_j represents the influence of selected independent variable on the chosen alternatives j to m.

5. Results and Discussions

5.1. Socio-economic characteristics

The socio-economic characteristics of the rice-producing households presented in Table 1 indicate that, approximately 53.5% of the respondents (114 farmers) sold their rice to the village collectors/assemblers, 28.6% (61 farmers) to the miller-traders, and nearly 17.9% (38 farmers) to the larger scale traveling traders (traders outside the district). Thus, selling to village collectors who are mostly moving from house to house collecting small lots until they assemble the required amount was the most common marketing channel for rice farmers in the study area.

Table 1 presents the mean values and T-tests of mean differences between the variables used in the multinomial regression analyses. Even though for many of the variables, there are no significant differences between the groups, significant differences in the mean values exist for the farm size cultivated and ownership of transport-related facilities, which indicates that farmers selling to traders outside the district (channel III) are more extensive / wealthier than those taking part in the other two channels. Additionally, farmers participating

in channel III had significantly more years of formal schooling, a higher volume of marketed outputs and more sources of marketing information than farmers who sell to channel I (village collectors) and II (miller-wholesalers).

Also, farmers participating in channel II face longer distances to the next central market and receive more credits from traders than farmers participating in channel I. However, for other variables related to socio-demographic characteristics (e.g., age, household size, access to extension services, experience, membership in farmer groups, and quality of infrastructures) no significant difference between groups was found.

Table 1: Household characteristics of the study sample by choice of marketing channel

Variables	Channel I	Channel II	Channel III	Mean difference (I – II)	Mean difference (I – III)
Age of household head (years)	48.51	47.64	48.13	0.87	0.38
Education of household head (years)	6.52	6.61	6.74	-0.09	-0.22*
Household size	5.46	5.12	5.38	0.34	0.08
Experience in growing rice (years)	23.02	22.94	23.15	0.08	-0.13
Access to Extension	0.58	0.46	0.41	0.12	0.17
Access to Credit	0.17	0.46	0.21	-0.29*	-0.04
Farm size (ha)	1.93	3.75	7.14	-1.5	-4.2*
Annual total paddy production (tonnes/farmer)	4.38	8.14	16.25	-3.76	-11.87*
Membership in farmers groups	0.42	0.27	0.11	0.15	0.31
Uses of market price information before decision to sell	0.31	0.44	0.49	-0.13*	-0.18*
Distance to the market (Km)	2.3	17.9	15.4	-15.6**	-13.1**
Quality of roads to main market/District headquarter (1-5)	2.93	3.54	3.11	-0.61	-0.18
Owns transportation facility (cart/vehicle/power tiller)	0.33	0.45	0.68	-0.12	-0.35*
Owns storage facility	0.19	0.23	0.35	-0.04	-0.16
Observations	114	61	38		

Note: *$p < 0.10$, **$p < 0.05$, *** $p < 0.01$

Source: Authors' calculations

Note: Dummies for: access to credit (1=yes); access to extension service (1=yes); marketing information received (1=farmer use marketing price information before decision to sell (1=yes); experience with any shock (1=yes); Dummies for owning a cart, harvesting machine, and storage facility (1=yes), Scale for quality of infrastructures (1=very poor, 2=poor, 3=average, 4=good, 5=very good). The marketing channel was sorted mainly by (over 50% of the marketed surplus).

5.2. Profit Analysis of rice production

The average return realized by rice farmers are presented in Table 2 below. The net profit margin of the rice farmers both at farm gate and market place was calculated on an acre basis. Results shows that, at farm-gate, farmers sold paddy at Tshs 54920.74/= per 100 kg bag

on average. However, the farm-gate price ranged between Tshs 40000 and 100000/= per bag depending on the variety and season.

The profitability analysis of rice production shows an average profit of 47.8 percent for every Tanzania shilling invested. However, farmers selling their produce at farm gate received less profit than those bypassing local buyers due to price differences. According to the results, farmers participating in market receive an additional 45.96% profit per 100 kg bag of rice as compared to those selling at farm gate.

Table 2: Cost and revenue of rice production per acre (2017-2018 season)

Item	Value
Revenue	
Average total output in bags (TQ) (1 bag =100 kg)	27.00
Average selling price (SP)	54920.74
Gross revenue per acre (TQ*SP) (TR)	1482860.06
Cost	
Hiring land cost per acre (opportunity cost of land)	176100.63
Ploughing	66037.74
Seed	37735.85
Rotavation	108490.57
Transplanting	87735.85
Spraying herbscides	24528.30
Weeding	33018.87
Bird scaring	40833.94
Fertilizers	216981.13
Fertilizer application	1415.09
Harvesting	127358.49
Cost of bags	18160.38
Transport costs	12971.70
Storage	51886.79
Total cost per acre (TC)	1003255.32
Total cost per bag of paddy	37157.60
Return at farm level (TR-TC)	479604.74
Return per bag of paddy harvested (farmgate)	17763.14
Return per shilling invested [(TR-TC)/TC)]	0.4780
Marketing cost	
Transportation	2038.83
Load/Unload	922.33
Levies	1165.05
Information search	19.42
Personal expenses	106.80
Total marketing cost	4252.43
Total Cost per bag of paddy (Marketing + Production)	41410.03
Selling price at the market (miller/traders)	74285.96
Return at the market per bag of paddy	32875.93
Additional profit per bag of paddy (Market- farm gate)	15112.79

Source: Authors' calculations
Note: All the cost and price are denominated in Tanzania shillings.

5.3. Price spread and marketing margins

The results presented in Table 3 and 4 show the marketing costs, farmers' shares in the consumers' prices, and margins accruing to the three rice marketing channels. All the calculations were based on the information on prices and operational cost obtained from farmers and traders. For 100 kg of paddy, farmers/traders obtained 65 kg of husked rice. Thus, a simple conversion factor of 0.65 (i.e. 65/100) was used to convert the amount and value of paddy to rice. However, the rice marketing channels presented were not the only ways used to sell rice. The analysis presents the majority of actors in Mbeya from rural to urban markets. All the cost and price are denominated in Tanzania shillings.

Table 3: Marketing cost of rice for different intermediaries

	Village colectors	Millers-traders	Wholesalers	Retailers	Total	
					Cost	Percentage
Transportation	2038.83		7864.08	1270.36	11173.27	31.29
Market Fee			495.15	1045.60	1540.75	4.31
Taxes/levies	1533.98	582.52	1941.75		4058.25	11.36
Empty bag/Sack	485.44	497.02	315.53		1297.99	3.63
Load/Unload	970.87	504.85	1165.05	1006.51	3647.29	10.21
Assembling cost	485.44				485.44	1.36
Information search	48.54	29.13	194.17		271.84	0.76
Personal Travel costs	103.88		436.89		540.78	1.51
Security costs	19.42	106.80	97.09	127.04	350.34	0.98
Drying		388.35			388.35	1.09
Processing/Husking		5825.24			5825.24	16.31
Storage		1019.42			1019.42	2.85
Labour charges			582.52	1172.64	1755.16	4.91
Rent market place			1456.31	1319.22	2775.53	7.77
Miscellaneous			291.26	293.16	584.42	1.64
Total	5686.41	8953.33	14839.81	6234.53	35714.07	100.00
Percentage	15.92	25.07	41.55	17.46		

Source: Authors' calculations

From the Table 3, it is clear that, cost of marketing for wholesalers was the highest among all intermediaries due to high transportation cost, storage, taxes/levies and packaging cost; and the lowest for village collectors. Besides, the wholesalers bought rice from millers-traders and sold it to different retailers in and out of the region that resulted in higher operational costs than those of others.

Table 4: Price spread along rice marketing channels

	Channel I	Channel II	Channel III
Total Marketing cost	20455.18	17486.60	27993.51
Total net Marketing margin of intermediaries	33643.64	31497.72	49241.59
Farmer's gross selling price	50102.77	59738.71	76275.97
Net price received by farmers	50102.77	55217.28	72020.45
Retail sale price/Consumer's price	104201.60	104201.60	149255.55
Price spread	54098.82	48984.32	77235.10
Producer's share	48.08	57.33	51.10

Source: Authors' calculations

Note: Marketing costs = summing up the cost from marketing activities carried out by each marketing agency in the rice distribution chain. Marketing margin = subtracting purchase price and marketing cost from the selling price of rice/paddy (Acharya and Agarwal, 2016).

According to the results in Table 4, the highest cost share was in channel III and lowest in channel II. In channel III, the high marketing costs were due to the large number of marketing institutions involved, namely producers, brokers, traveling traders, wholesalers, and retailers as well as the more number of activities performed in the process of purchasing, transporting and selling rice out of the district which obviously adds packaging, storage and transportation costs. The low-cost share in channel II was due to the producers' sale of rice directly to millers or wholesalers so that the lowest costs were incurred. If the number of intermediaries increases, the total marketing cost of channel II would increase accordingly.

Table 4 shows that the highest marketing margin is in channel III. This implies that the longer the channel, the more the number of marketing functions which results in the higher price received by consumers, hence marketing inefficiency. Although the level of farmers profit in channel II is greater, but in this area more farmers sell to village collectors, with the reason that farmers do not want to bother, do not want to pay too much, and most of the time wants to get money faster so that it is better to sell at farm gate.

5.3. Marketing efficiency indicators

5.3.1 Farmers' share in consumers' price

Farmer's share is also one of the quantitative measurement tools for assessing marketing efficiency which indicates that the greater the share, the higher the efficiency of the channel from the farmers' point of view. Although in reality, farmers do not care about the portion of the price they receive for the price paid by consumers. Farmers are only oriented to high or low prices. According to the findings in Table 4, marketing channel II has the highest efficiency value among the other two channels. The higher farmer share value reflects the increasing supply chain efficient. Even though the price paid by final consumers in channel I

and II is the same, in channel II the price received by the producers is higher than that of the channel I due to less number of intermediaries. Furthermore, marketing channel III is longest than channel II, that's why the producer share in this channel is the lowest.

5.3.2. Marketing efficiency by Shepherd's method

The operational efficiency of rice marketing channels was also calculated using the Shepherd Method. According to the method, the greater the ratio, the higher the efficiency and vice versa. From the calculation results in Table 5, it can be concluded that by using the Shepherd method, the most efficient rice marketing channel was channel II with the highest efficiency value, while the inefficient channel was channel I. Low marketing cost at channel II due to decrease in number of intermediaries made it more efficient than the other channels. But it should be kept in mind that the producers in channel II sell directly to millers or wholesalers, while in others, it is the village collectors or brokers who buy from the farmers.

Table 5: Marketing efficiency under shepherd's method

	Channel I	Channel II	Channel III
Consumers' purchase price	104201.60	104201.60	149255.55
Total Marketing cost	20455.18	17486.60	27993.51
Marketing efficiency	5.09	5.96	5.33

Source: Authors' calculations

5.3.3. Marketing efficiency by Acharya and Aggarwal's method

Acharya's approach was used to estimate the cost-benefit efficiency of rice marketing channels with the ratio of farmers' selling price apart from the marketing costs and marketing margins. As per this method, a higher value denotes a higher level of marketing efficiency and vice versa. The findings in Table 6 show that the highest efficiency value was in channel II (1.13), which means that channel II was the most effective channel. While the channel that has the lowest efficiency value was channel I (0.926), which means it was not effective. The higher efficiency of channel II may be mainly due to the higher prices received by farmers and the low marketing cost of intermediaries unlike the case of channel III.

Table 6: Marketing efficiency under Acharya and Aggarwal's method

	Channel I	Channel II	Channel III
Net price received by producers	50102.77	55217.28	72020.45
Total marketing cost	20455.18	17486.60	27993.51
Total net margins of intermediaries	33643.64	31497.72	49241.59
Marketing efficiency (E)	0.93	1.13	0.93
Marketing efficiency index (E x100)	92.61	112.72	93.25

Source: Authors' calculations

5.3.4. Marketing efficiency by composite index method

In Tables 7, we have made a comparative study by computing the composite index of the marketing channels of paddy/rice. The ranks were assigned by the following criteria: higher rank (highest rank being 1) for the higher value of producers' share value in the final price and lower rank for higher values of marketing cost and marketing margin. The composite index was computed from individual indicators. Channel II ranked first for the producers' share of the final price, marketing margin, and marketing cost. Less number of intermediaries in channel II led to a lower marketing margin in this channel. The convenience of bulk purchasing from larger farmers also led to a higher price for the producers in channel II and III.

Table 7: Marketing efficiency under composite index method

Channel	**Score as performance indicators**					
	Net Producer's share in Consumer Price (%)	Marketing cost share in Consumer Price (%)	Net Marketing Margin of intermediaries in Consumer Price (%)	Total score	Mean score	Rank
Channel 1	48.08	19.63	32.29	8	2.7	II
(Rank)	(3)	(3)	(2)			
Channel 2	52.99	16.78	30.23	3	1	I
(Rank)	(1)	(1)	(1)			
Channel 3	48.25	18.76	32.99	7	2.3	II
(Rank)	(2)	(2)	(3)			

Source: Authors' calculations

From the results, we can see that among the three channels where the producers sold paddy, channel two emerged as the most efficient channel. This is due to the less number of intermediaries involved in this channel. But most of the marginal and small farmers did not participate in this efficient channel. The next most profitable channel is channel III. Here again, the larger farmers had higher participation.

5.4 Factors influencing farmers' choice of marketing channels

Table 8 presents the empirical results of the multinomial logistic analysis of farmers' marketing decisions through the three rice marketing channels. To run the model, we chose channel I (village level collectors) as the base option to compare it with the two other marketing channels. The coefficients shown in the first and second columns represent the coefficients and probabilities of choosing channel II (miller-traders) instead of channel I (village level collectors/assemblers). The third and fourth column interprets the coefficients and the probability of substituting either Channel III (traveling traders/traders outside the district) or channel (village level collectors/assemblers). The marginal effect (ME) illustrates that each unit increase in the selected independent variable increases or decreases the probability of choosing an alternative marketing channel.

Among the household demographic variables, the education level of household head positively and significantly influences the decision to sell rice to millers in urban areas relative to local traders. If a rice farmer spends one additional year on education, then the probability of selling to millers' increases by 1.8%. Also, if farmers tend to produce more rice, they are more likely to choose traveling traders outside the district and less likely to select miller traders. However, the magnitude of this effect is still limited.

Regarding marketing information, if a farmer receives preliminary information on rice prices, the probability that farmers will choose channel II instead of the channel I, increase by approximately 14%. On the other hand, households that were unable to obtain pricing information were less likely to travel to the district center to sell their produce to millers and would prefer to sell to village collectors at the farm gate level. This is a significant result since rice farmers often lack access to marketing information before making their decision to sell their paddy-rice. Providing them with price information's will give them more bargaining power and reduce their uncertainty when making deals with local traders. A similar result was obtained by Benard *et al.* (2014), Magesa *et al.* (2014), Fan and Salas Garcia (2018) who argued that, timely access to marketing information helps smallholder farmer to make informed decisions about what crops to produce, where to sell their product and buy inputs.

Table 8: MNL estimation results for sample smallholder rice farmers, Mbeya region

Variables	$ln(P_2/P_1)$ Channel II vs. Channel I		$ln(P_3/P_1)$ Channel III vs. Channel I	
	Coef	ME (dy/dx)	Coef	ME (dy/dx)
Age of household head	-0.0142	-0.0002	-0.0183	-0.0023
	(0.1300)	(0.0029)	(0.0791)	(0.0102)
Education of household head	0.0409	0.0028	0.0575*	0.0184
	(0.0374)	(0.0044)	(0.0368)	(0.0059)
Experience in growing rice	0.0356	0.0033	0.0317*	0.0041
	(0.0347)	(0.0041)	(0.0331)	(0.0054)
Access to extension	-0.5714	-0.0805	0.1278	0.0472
	(0.4191)	(0.0519)	(0.3948)	(0.0667)
Access to informal credits	0.0443*	0.1214	-0.1633	-0.0272
	(0.3775)	(0.0474)	(0.3174)	(0.0543)
Farm size	-0.4562	0.0427	0.9246	0.1595
	(0.3981)	(0.0243)	(0.3183)	(0.0528)
Total paddy production	0.0015**	0.0002	0.0002**	0.0001
	(0.0008)	(0.0001)	(0.0002)	(0.0001)
Group membership	-0.6813	-0.0197	2.3264***	0.2676
	(0.8241)	(0.0152)	(0.4957)	(0.0765)
Access to price information	1.8372***	0.1409	0.0132	0.0291
	(0.5745)	0.0537	0.4664	0.0723
Distance to the market	-0.1865***	-0.3531	-0.0414	-0.0048
	(0.0628)	(0.0019)	(0.0273)	(0.0036)
Quality of roads to main market	0.0944	0.0018	0.0069	0.0006
	(0.3529)	(0.0072)	(0.2396)	(0.0310)
Farmers' level of perceived trust in buyers	0.6981**	0.0384	0.4584*	0.0662
	(0.2775)	(0.0197)	(0.2177)	(0.0365)
Own transport facility	1.4463**	0.1465	-0.1984	0.0621
	(0.6596)	(0.0897)	(0.6467)	(0.0854)
Owns storage facility	0.4636	0.0436	0.3875	0.0487
	(0.3835)	(0.0481)	(0.3347)	(0.0571)
Observations	213			
Log likelihood	-146.89			
Pseudo R^2	0.3752			
Likelihood ratio test $X^2(22)$ (significance level =0.00)	178.36			

*Note: * p < 0.10, ** p < 0.05, *** p < 0.01; Standard errors in parentheses*
Source: Authors' calculations

Table 8 illustrates that farmers located a long distance from the market are less likely to sell their products to millers and traveling traders than to village collectors. An increase in the distance, increases the possibility of rice sales at farm gate to village collectors by 35% relative to millers (Channel II). Market distances can be a barrier for farmers to access better markets. This situation was similar to Okoye *et al.* (2016), Romero and Wollni (2018), and Pingali *et al.* (2019), who argued that, in most cases, farmers choose farm gate because it incurs no transaction cost.

Access to credit significantly increased the probability that a rice farmer will sell to millers relative to village collectors by 12.1%. In the study area, rice growers usually borrow money from millers to buy inputs such as fertilizers and pesticides and pay it back after

harvesting their paddy. Because of this, many farmers cannot choose other marketing channels. Farmers' confidence in buyers also significantly increases the likelihood of rice producer selling to millers and larger scale traveling traders relative to village collectors. A unit increase in trust scores generates a 6.6% and 3.8% increase in the probability of selling to millers and larger scale traveling traders, respectively. Higher levels of trust may reduce transaction costs for screening and the risk of default in business relationships.

Ownership of transportation facilities is significantly associated with a higher probability of selling to the millers in urban areas relative to village collectors by up to 15 %. As noted from discussions with farmers, lack of transport means to the market was among the main challenges for accessing urban markets. Hiring means of transportation were too expensive and risky for most of the farmers, considering that they had no information on the market. Further, as explained by Bathla (2016), ownership of transport means allow farmers to access marketing centers that are located far away at a lower cost and in a short time compared to their counterparts who did not have the means of transport.

Finally, membership to a farmer' s production and marketing group (PMG) is associated with an increased likelihood of selling to the larger-scale traders outside the district relative to the village collectors by up to 26.7 %. Most institutional economics authors have emphasized the importance of collective action (Barham and Chitemi, 2009; Tadesse and Kassie 2017; Ochieng *et al.,* 2018). Farmers in production and marketing groups have the advantage of bulking hence gaining economies of scale. It is also cheaper and easier for the larger-scale traders to enforce grade and quality requirements of the niche markets through reaching farmers in PMG's rather than individually.

6. Conclusions and Suggestions

In this study, we analyzed the cost-benefit efficiency of rice marketing and the factors influencing marketing channel choice among smallholder rice farmers in Mbeya, Tanzania. The results reveal that the rice marketing is not yet efficient with an uneven margin share in the three rice marketing channels. The values of the marketing indexes show that intermediaries are making more profit than the investment value, which is contrary different to farmers, while the value of farmer's share shows that rice farmers get a better price share in the second channel compared to the other two marketing channels. Therefore according to the findings, the miller-wholesale market channel was the most economically efficient channel of

the three studied channels even though farmers in rural areas most commonly deliver paddy to local collectors and assemblers.

The study found that several factors influenced the farmer's choice of rice marketing channels. Specifically, access to appropriate marketing information sources has a highly significant influence on farmers' participation in the miller-wholesaler marketing channel. Even though farmers evaluated farmer groups and extension agents as among the most important sources of marketing information, the availability of these sources is still limited at the farm level. In this regard, we recommend building capacity in farmers already in groups and assisting PMGs to build financial capital; this would help them to overcome the lack of marketing information and other risk associated with marketing, add value to their produce, and probably build storage facilities like warehouses to reduce post-harvest losses. Furthermore, asset specificity plays an essential role in accessing better markets since the distance to the district headquarters (main market area) has a negative influence on farmers' choice of millers and traveling traders' channels. Facilitating rice farmers to obtain means of transport or storage facilities would help in reducing reliance on village collectors and assemblers, but these are strictly related to credit access. Despite the existence of inadequate formal credit programs in rural areas, informal credits exert profoundly influence on the choice of marketing channels as many farmers agree with traders to pay the harvest as part of the loan repayment they took during the farming season. In addition to transaction cost related influences, socio-demographic characteristics of the farmer, such as education level, also have a significant impact on selling rice to the high-value marketing channel since better-educated farmers are more successful in bargaining with trading partners.

Contrary to the perception that farmers are making losses because of low prices for agricultural produce caused by oversupply in production areas, this study finds that low return in production is caused by failure, fear or inability by farmers to venture out of the farm-gate and into the markets. Farmers are not willing to venture out for fear of the unknown; they lack information on markets and do not actively look for it either. Even farmers with access to improved transport infrastructure and facilities are not willing to venture out of the farm-gate to market their produce. Intermediaries take advantage of the farmers' unwillingness to venture into markets to exploit them. As put earlier in the study, when there is oversupply in the production areas, there is a scarcity elsewhere.

The study also reinforces the importance of institutional economics in understanding how agricultural product markets operate in developing countries. Results show that assumptions of perfect markets by classical and neo-classical economics are not applicable in

most agricultural markets in developing countries. Information is not accurate, and there is no trust between buyers and sellers; hence market forces of supply and demand are not used to determine prices. Instead, the price that a farmer gets is determined by majorly institutional factors such as collective action, transaction costs and information access. Thus, local authorities need to encourage rice production and marketing by improving rural infrastructure, providing better marketing information, enhancing the extension services, focusing more on credit policy and enhancing the capacity of farmer groups in the rural areas.

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