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Marketing efficiency and determinants of marketing channel choice by rice farmers in rural Tanzania: Evidence from Mbeya region, Tanzania*

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Rice production is 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 reduce poverty. This paper aims to determine the most efficient rice marketing channel and analyse the factors affecting marketing channel choices by smallholder rice farmers. Marketing efficiency was tested using Acharya and Aggarwal's composite index method. A multinomial logit model was used to analyse the marketing channel choices. The results showed that the miller–wholesaler marketing channel is the most efficient. The results show that most farmers in rural areas still sell their rice to local collectors because of failure, fear or inability by farmers to venture out of the farm gate into the markets. The findings suggest that there is a need to improve rural infrastructure, market information systems, smallholder access to productive assets, prudent use of credit and strengthening collective action through well-organised farmer groups in the country.

Key words: marketing channel choice, marketing efficiency, price spread, 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 occupies 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 source of income for smallholder farmers, who mostly produce cereals, roots and tuber, pulses, oilseeds and nuts, fruits and vegetables, and fibre crops and permanent crops (NBS 2012). About 28 per cent of the Tanzanian population lives with consumption levels below the poverty line, and nearly 75 per cent of the economically active population is directly or indirectly engaged in the

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agricultural sector (Wilson and Lewis 2015). In 2016/2017, the sector's share in Tanzania's GDP was 28.74 per cent, with rice accounting for about 19.5 per cent of annual cereal production (URT 2017a). The need for cereal crops, which continues to grow alongside the continued development of the food and feed industry, indicates the important role of cereals in the growth of the food crops subsector 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 implemented at the 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 farmer organisations and cooperatives, and 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 fertiliser and seed (Kuzilwa and Mpeti 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).

According to some 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). In addition, the literature on agricultural marketing has indicated that favourable marketing performance would encourage farmers 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 in 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 influence the livelihood of over two million people countrywide (Rugumamu 2014). URT (2017a) indicated that current total annual production averages about 2,194,750 million tonnes, of which smallholder farmers produce around 90 per cent under continuous flooding with average farm size and yield of 1.3 ha and 2.5 tonnes/ha, respectively. Rice consumption is on the rise, especially among urban and rural residents

due to improvement 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 urbanised (Rugumamu 2014; Lazaro *et al.* 2017). The increasing demand gives the smallholder rice producer more credibility to meet the growing demand by improving production (Africa Rice Center 2011). The growth potential of the rice sector shows great promise, and 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 are 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 analysing marketing channels in the Tanzania rice sector. It has two main objectives: (i) to evaluate the cost-benefit efficiency of rice marketing; and (ii) 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 policymakers to support smallholder farmers fully. The rest of the article is organised as follows: Part 2 describes the theoretical background and empirical evidence. Part 3 gives an overview of the rice marketing channel system in Tanzania. Part 4 describes the study area, data and methodology. Then, Part 5 presents the results of the quantitative analysis. Finally, the article closes with conclusions and implications for policymakers in developing countries regarding the improvement of agricultural market performance in rural areas.

2. Literature review

Marketing efficiency of agribusiness products (food and fibre) can be grouped into two types, namely operational efficiency and price efficiency (Kohls and Uhl 2002; Fafchamps *et al.* 2005). Operational efficiency is related to marketing activities that can increase or maximise the ratio of marketing output to input. 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, farmers share and profit-to-cost ratio (Kohls and Uhl 2002; Fafchamps *et al.* 2005). Instead, price efficiency emphasises the ability of the marketing system to allocate resources

and coordinate all agricultural production and marketing processes effectively to meet consumer demand and ensure satisfaction (Fafchamps *et al.* 2005). A market is therefore said to be efficient if there are indicators such as the creation of added value to agricultural products, the generation of profits for each marketing institutions involved, increasing consumer's satisfaction, and provision of a greater share of consumer prices to farmers to boost production (Kohls and Uhl 2002; Fafchamps *et al.* 2005; Panda and Sreekumar 2012). In this study, marketing efficiency analysis is analysed only through the operational efficiency approach.

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 broadest 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 out to evaluate the operational efficiency of agricultural markets and characterised the factors influencing farmers' choice of marketing channels (Rao and Qaim 2011; Panda and Sreekumar 2012; Shiimi *et al.* 2012; Xaba and Masuku 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 marketing 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 networks 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 Masuku (2013), Mmbando *et al.* (2015) and Pham *et al.* (2019) 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 the authors, farmers who have more education tend to be good negotiators and are risk-averse. Similar 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 increase smallholder farmers' market

participation. The studies also highlighted the role of marketing information, postharvest handling facilities and transportation infrastructures on marketing channel decisions (Barham and Chitemi 2009; Cazzuffi and McKay 2012; Tadesse and Kassie 2017; Pham *et al.* 2019).

3. Rice marketing channels and their characteristics

The traditional rice marketing channel in Tanzania is dominated by the private sector, comprised of smallholder rice farmers, rice millers, village rice collectors, wholesale traders, retailers and end consumers. Recently, new buyers such as large-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. Most of these buyers are large-scale farmers with equipment such as a four-wheel-tractor, trucks, motorbikes and a milling machine. They mostly offer a variety of services to smallholder farmers, such as supplying inputs, milling, buying paddy or providing credit.

The study identified four types of marketing linkages, which are analysed in detail below. The analysis focuses on the trading parties, the time of purchase as well as the type 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.

3.1 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 changes 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 organisations (FO's) for those under integrated schemes. However, 47.9 per cent of the 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.

3.2 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 available facilities, village collectors in the study area either sell directly to urban millers or dry and

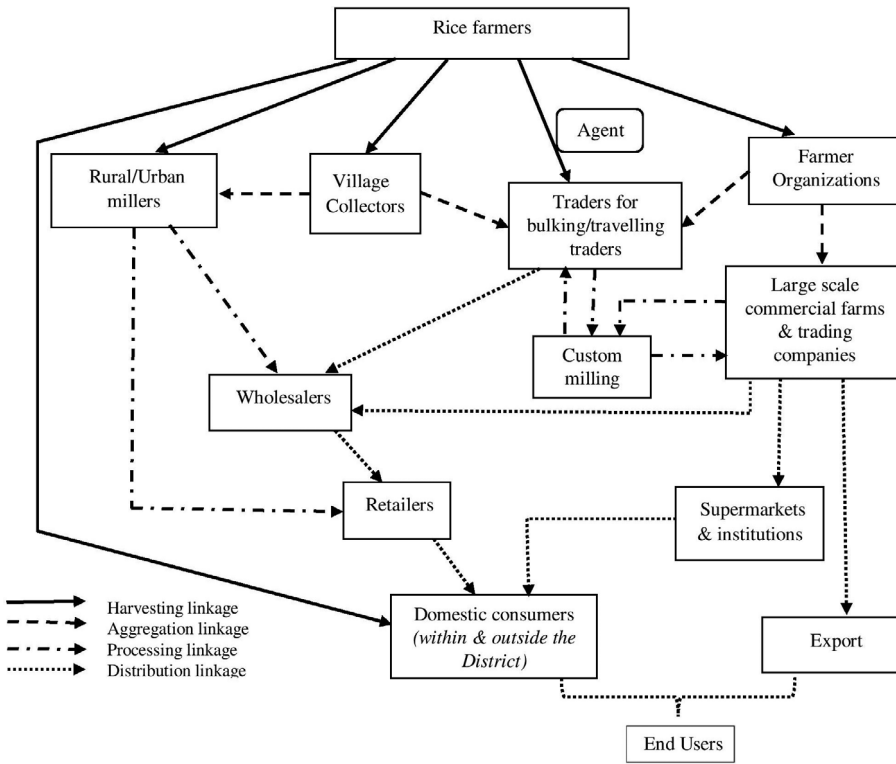


Figure 1 Structure of the rice supply chain relationship in the study area. Source: Own survey, 2019.

store the procured paddy before selling to millers or even large-scale traders who transport to deficit areas during the lean season.

3.3 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 large-scale wholesaling traders or companies as processing actors. In this 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 per cent 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 are mostly based on prevailing market prices. Large companies have business contracts with supermarkets, government institutions and sometimes export to neighbouring countries.

3.4 Distribution linkages

Distribution describes the step in the supply chain whereby 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 surrounding communities on a walk-in basis. Institutional buyers such as schools, restaurants and hospitals represent a different kind of customers who are characterised 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 produce to village collectors or assemblers. Produce 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 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. To succeed in this marketing channel, farmers generally have to rely on their urban networks. However, smallholder farmers can still face high transaction costs when selling a small amount of paddy/rice, so they end up selling their produce at a loss.

Due to the above challenges, a third marketing opportunity has emerged: the large-scale travelling traders and/or trading companies. By establishing farmer organisations or using agents, the large-scale traders have applied the strategy of buying directly from rice farmers and organising several processing steps such as milling, packaging and even branding products with their trademark. Then, products are delivered to urban consumers in deficit areas either through wholesalers, retailers or their retail outlet shops in urban areas.

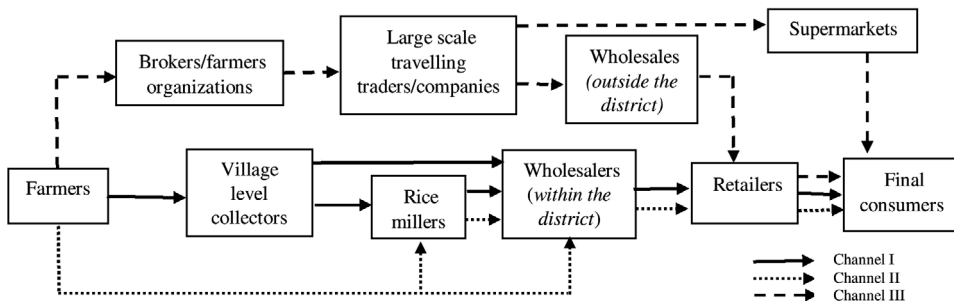


Figure 2 Rice marketing channel under study.
Source: Own survey, 2019.

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 is known to be among the key producing regions, accounting for over 17.8 per cent 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. The 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);

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

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

$$ME = \frac{NP_p}{TMC + TMM + TML}, \quad (3)$$

$$MEI = \frac{R_i}{N_i}, \quad (4)$$

where F_p is farmer price, C_p is consumer's price (value of goods purchased), F_s is the farmer share, and P_s is the price spread between farmers and final consumers. ME is marketing efficiency under Acharya's method, NP_p is the net selling price of farmers (selling price – marketing costs), TMC is total

marketing cost of intermediaries, TMM is the total marketing margin, and TML is total marketing loss. MEI is market efficiency index under the composite method, R_i is the sum of ranks in each channel, and N_i is the 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. The 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, the number of economic activities that take place during marketing activities and the amount of profits expected by each marketing institution involved. In addition, price spread was calculated by subtracting the net price received by farmers from the retail sale price/consumer's price (Wohlgenant and Mullen 1987). However, to ascertain the impact of marketing loss on marketing margins, the price of rice at a wholesale and retail level was adjusted to take into account the 35 per cent loss incurred during milling (Wilson and Lewis 2015).

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

$$y_i = \beta_0 + X'_{ij}\beta_j + \varepsilon_{ij}. \quad (5)$$

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 (MEs), according to Equation (6):

$$\frac{\partial P_{ij}}{\partial X_{ik}} = P_{ij} - \sum_{m=1}^{j-1} P_{im}\beta_{mk}; j = 1, \dots, j-1, \quad (6)$$

where each β_j represents the influence of selected independent variables 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 per cent of the respondents (114 farmers) sold their rice to the village collectors/assemblers, 28.6 per cent (61 farmers) to the miller–traders and nearly 17.9 per cent (38 farmers) to the large-scale travelling traders and trading companies outside the district. Even if for many variables, there are no significant differences between farmer groups. The significant differences in the mean values exist for the farm size cultivated and ownership of transport 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 selling in channel I (village collectors) and channel II (miller–wholesalers).

Furthermore, farmers participating in channel II face shorter distance to the next central market, receive more credit from traders and consider the rice market to be less risky 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 differences were found between the groups.

5.2 Price spread and marketing margins

The results presented in Table 2 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 costs 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 costs and prices are denominated in Tanzania shillings.¹

It can be seen from Table 2 that the highest marketing margin is in channel III, while the lowest marketing margin is in channel II. This shows that the longer the rice marketing channel, the higher the price paid by consumers.

Marketing costs incurred by the marketing agencies in each marketing channel shows that the largest share of costs is in channel III and lowest in

¹ Exchange rate: US\$1 = 2302 Tsh (at the time of survey conducted, May 2019).

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	6.73	–0.09	–0.21*
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)	17.95	15.41	15.23	3.54***	2.72***
Risk perception (1–5)	4.27	2.25	3.46	2.02***	0.81
Quality of roads to main market/district headquarter (1–5)	2.93	3.54	3.11	–0.61	–0.18
Owens transportation facility (cart/vehicle/power tiller)	0.33	0.45	0.68	–0.12	–0.35*
Owens storage facility	0.19	0.23	0.35	–0.04	–0.16
Observations	114	61	38	NA	NA

Note: * $P < 0.10$; ** $P < 0.05$; *** $P < 0.01$. Dummies for: access to credit (1 = yes); access to extension service (1 = yes); marketing information received (1 = farmer use marketing price information before the decision to sell (1 = yes)); dummies for owning a cart, harvesting machine and storage facility (1 = yes), scale for quality of infrastructures (1 = very poor, 5 = very good), scale for risk perception (1 = strongly disagree, 6 = strongly agree). The marketing channel was sorted mainly by (over 50% of the marketed surplus).

Source: Authors' calculations.

Table 2 Overview of price spread along rice marketing channels

	Channel I	Channel II	Channel III
Total marketing cost (TMC _I)	20,455	17,487	27,994
Total net marketing margin of intermediaries (TMM _I)	33,644	31,498	49,242
Farmer gross selling price (F_p)	45,147	55,059	69,276
Net price received by farmers (NP _p)	45,147	50,537	67,020
Retail sale price/consumer's price (C_p)	99,246	99,522	144,256
Price spread (P_s)	54,099	48,984	7,7235
Gross farmer share (F_s)	45	55	48

Note: Marketing costs = sum of all costs 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. Net prices received by farmers = subtracting farmers' marketing costs from the gross selling price (Acharya and Agarwal, 2016).

Source: Authors' calculations.

channel II. In channel III, the high marketing costs were due to a large number of marketing intermediaries involved, namely producers, brokers, millers, travelling traders or trading companies, wholesalers and retailers.

Marketing costs incurred are packaging, processing, storage, transportation, taxes/cess and fees. In this channel, large-scale traders bought rice locally from millers or farmer organisations and sold it to various retailers outside the region, which increased operating costs. The low-cost share in channel II was due to the small number of intermediaries. If the number of intermediaries increases, the total cost of marketing channel II would increase accordingly.

With regard to price spread, the results show that the highest spread is on channel III, which is the longest marketing channel. This means that the marketing intermediaries involved take advantage of the costs incurred to gain more of the profit share compared to other channels. While channel II is the channel with the lowest price spread, this is because in channel II, only a few intermediaries are involved. According to Wohlgenant and Mullen (1987), the lower the price spread of a marketing channel, the more efficient for producers and vice versa.

5.3 Marketing efficiency indicators

5.3.1 *Farmers' share in consumers' price*

Farmers' 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 2, marketing channel II has the highest efficiency value among the other two channels. The higher farmer share value in channel II reflects the increasing supply chain efficiency. Even though the price paid by final consumers in channels I and II is relatively the same, in channel II the price received by the producers is higher than that of channel I due to a lower number of intermediaries. Furthermore, marketing channel III is longer than channel II, that's why the producer share in this channel is the lowest.

5.3.2 *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 3 show that the highest efficiency value was in channel II (1.03), which means that channel II was the most effective channel, while the channel that has the lowest efficiency value was channel I (0.83), 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.

5.3.3 Marketing efficiency by the composite index method

In Table 4, 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 amounts 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 large-scale farmers also led to a higher price for the producers in channels II and III.

From the results, we can see that among the three channels where the producers sold paddy, channel II emerged as the most efficient channel. This is due to the lower 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 large-scale farmers had higher participation.

5.4 Factors influencing farmers' choice of marketing channels

Table 5 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 selecting channel III (large-scale trading companies) instead of channel I (village level collectors/assemblers). The ME illustrates that each unit increase in the selected independent variable increases or decreases the probability of choosing an alternative marketing channel.

Table 3 Marketing efficiency under Acharya and Aggarwal's method

	Channel 1	Channel 2	Channel 3
Net price received by farmers (NP _p)	45,147	50,537	67,020
Total marketing cost (TMC ₁)	20,455	17,487	27,993.51
Total net marketing margins of intermediaries (TMM ₁)	33,644	31,498	49,241.59
Marketing efficiency (ME ₁)	0.83	1.03	0.87
Marketing efficiency index (ME ₁ × 100)	83.45	103.17	86.77

Note: Net price received by farmers = subtracting farmers marketing cost from the gross selling price. Total marketing costs = summing up the cost from marketing activities carried out by each marketing agency in the rice distribution chain. Net marketing margin of intermediaries = subtracting selling price from cost price (buying price + marketing cost) (Acharya and Aggarwal 2016).

Source: Authors' calculations.

Table 4 Marketing efficiency under composite index method

	Score as performance indicators					Rank
	Net farmer share in consumer price (%)	Marketing cost share in consumer price (%)	Net marketing margin of intermediaries in consumer price (%)	Total score (R_i)	Mean score	
Channel 1 (Rank)	45.49 (3)	20.61 (3)	33.90 (2)	8	2.7	II
Channel 2 (Rank)	50.78 (1)	17.57 (1)	31.65 (1)	3	1	I
Channel 3 (Rank)	46.46 (2)	19.41 (2)	34.13 (3)	7	2.3	II

Note: Total number of performance indicators (N_i) = 3, mean score = (R_i/N_i).
 Source: Authors' calculations.

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 per cent. Our findings are in line with the results of Pham *et al.* (2019), who argue that increasing the level of education increases the likelihood of choosing the more profitable marketing channel. A possible explanation is that education enhances an individual's understanding and helps him make informed marketing decisions. On the other hand, if farmers tend to have more farming experience and produce more rice, they are more likely to choose travelling traders or trading companies outside the district and less likely to sell at the farm gate. More experienced farmers may be better connected with traders (i.e. have developed social capital) and may have more marketing experience. According to Shiimi *et al.* (2012), and Pingali *et al.* (2019), experience also reflects the ability to negotiate better marketing terms.

Concerning market information, the results show that if a farmer receives preliminary information on rice prices, the probability that farmers will choose channel II instead of the channel I increases by approximately 14 per cent. On the other hand, households unable to obtain pricing information were less likely to travel to the district centre to sell their produce to millers or wholesalers. They 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 marketing information (i.e. price, quantity to sell, where to sell or types of possible contractual arrangements) will give them more bargaining power and reduce their uncertainty when making trade deals with buyers. A similar result was obtained by Magesa *et al.* (2014), Fan and Salas Garcia (2018), and Pham *et al.* (2019) who argued that timely access to

Table 5 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 (0.1300)	-0.0002 (0.0029)	-0.0183 (0.0791)	-0.0023 (0.0102)
Education of household head	0.0409 (0.0374)	0.0028 (0.0044)	0.0575* (0.0368)	0.0184 (0.0059)
Experience in growing rice	0.0356 (0.0347)	0.0033 (0.0041)	0.0317* (0.0331)	0.0041 (0.0054)
Access to extension	-0.5714 (0.4191)	-0.0805 (0.0519)	0.1278 (0.3948)	0.0472 (0.0667)
Access to informal credits	0.0443* (0.3775)	0.1214 (0.0474)	-0.1633 (0.3174)	-0.0272 (0.0543)
Farm size	-0.4562 (0.3981)	0.0427 (0.0243)	0.9246 (0.3183)	0.1595 (0.0528)
Total paddy production	0.0015** (0.0008)	0.0002 (0.0001)	0.0002** (0.0002)	0.0001 (0.0001)
Membership to a farmers PMG	-0.6813 (0.8241)	-0.0197 (0.0152)	2.3264*** (0.4957)	0.2676 (0.0765)
Access to price information	1.8372*** (0.5745)	0.1409 (0.0537)	0.0132 (0.4664)	0.0291 (0.0723)
Distance to the market	-0.1865*** (0.0628)	-0.3531 (0.0019)	-0.0414 (0.0273)	-0.0048 (0.0036)
Risk perception	-0.9039*** (0.4353)	-0.4518 (0.1523)	-0.1756 (0.1704)	-0.0612 (0.0585)
Quality of roads to main market	0.0944 (0.3529)	0.0018 (0.0072)	0.0069 (0.2396)	0.0006 (0.0310)
Farmers' level of perceived trust in buyers	0.6981** (0.2775)	0.0384 (0.0197)	0.4584* (0.2177)	0.0662 (0.0365)
Own transport facility	1.4463** (0.6596)	0.1465 (0.0897)	-0.1984 (0.6467)	0.0621 (0.0854)
Owens storage facility	0.4636 (0.3835)	0.0436 (0.0481)	0.3875 (0.3347)	0.0487 (0.0571)
Observations	213			
Log likelihood	-135.47			
Pseudo R^2	0.4573			
Likelihood-ratio test $\chi^2(22)$ (significance level = 0.00)	169.25			

Note: * $P < 0.10$; ** $P < 0.05$; *** $P < 0.01$; standard errors in parentheses. ME, marginal effect; PMG, production and marketing group.
Source: Authors' calculations.

marketing information helps smallholder farmer to make informed decisions about what crops to produce, where to sell their product and buy inputs. According to Mmbando *et al.* (2015), access to reliable market information helps to reduce transaction costs associated with searching for trading partners, contracting and enforcing the contract.

Table 5 illustrates that farmers located a long distance from the market are less likely to sell their products to millers and travelling traders or companies than to village collectors. An increase in the distance increases the possibility of rice sales at the farm gate to village collectors by 35 per cent 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), Pingali *et al.* (2019), and Pham *et al.* (2019), who argued that, in most cases, farmers choose farm gate because it incurs no transaction cost. The results also show that farmers with a higher risk perception are most likely to sell at the farm gate compared to other channels. The negative, significant coefficient for risk perception confirms Kisaka-Lwayo and Obi (2012), Muthini *et al.* (2017), and Asravor (2018), who argued that in an information asymmetry environment like most agricultural markets in developing countries, it is difficult for risk-averse farmers to transport their products to the market. Faced with the choice between waiting for buyers at the farm gate or transporting produce to markets where they will get higher prices but will have to bear transaction costs; the former will be more likely.

Access to credit significantly increased the probability that a rice farmer will sell to millers relative to village collectors by 12.1 per cent. In the study area, rice growers usually borrow money from millers to buy inputs such as fertilisers and pesticides, where they often agree to pay through harvest rather than cash. This type of agreement prevents many farmers from choosing alternative marketing channels. Farmers' confidence in buyers also significantly increases the likelihood of rice producer selling to millers and large-scale travelling traders or trading companies relative to village collectors. A unit increase in perceived trust scores generates a 3.8 per cent and 6.6 per cent increase in the probability of selling to millers and large-scale 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 per cent. 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 centres 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 in a farmer production and marketing group (PMG) is associated with an increased likelihood of selling to the large-scale traders outside the district relative to the village collectors by up to 26.7 per cent. Most institutional economics authors have emphasised the importance of collective action (Barham and Chitemi 2009; Tadesse and Kassie 2017; Ochieng *et al.* 2018). Farmers in PMGs have the advantage of bulking hence gaining economies of scale. It is also cheaper and easier for the large-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 analysed the cost–benefit efficiency of rice marketing and the factors influencing marketing channel choice among smallholder rice farmers in Mbeya, Tanzania. The results revealed that among the three marketing channels studied, the miller–wholesaler channel was the most economically efficient marketing channel. This channel is characterised by low price spreads, low marketing costs, higher farmer share and lower marketing margins of intermediaries. It has also been observed that farmers who sell their produce directly to wholesale markets or processors get a higher price than those who sell at the farm gate. This suggests that shorter channels offer maximum benefits to producers and are more efficient than longer channels. However, most rural farmers in Tanzania continue to deliver their paddy to local collectors and assemblers at the farm gate.

Empirical results suggested that several farming and marketing characteristics play the most important role in the farmers' choice of a marketing channel. Specifically, access to appropriate marketing information sources has a highly significant influence on farmers' market participation choices. 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 strengthening the capacity of farmers' groups/associations and helping PMGs to build financial capital. This can act as platforms for smallholders' technology and information exchange, adding value and reducing postharvest losses (i.e. storage and processing facilities), improving bargaining capacity and trust between farmers and buyers, especially in areas where infrastructure is weak. In addition, policies aimed at improving market information systems and enabling farmers to access and use telecommunications technologies (such as mobile phones) for trade purposes should be supported.

The study findings further indicate that asset specificity plays an essential role in accessing distant and profitable market channels. This suggests that policies aimed at reducing transaction costs, such as increasing investment in rural infrastructure and farm households' access to assets, may be an important area of intervention to improve farmers' access to markets. 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 a profound 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 farm produce to a more profitable 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. As a result, intermediaries take advantage of the farmers' reluctance to venture into markets to exploit them. As stated 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.

Data availability statement

The data that support the findings of this study are available from the corresponding author upon reasonable request.

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Supporting Information

Additional Supporting Information may be found in the online version of this article:

Appendix S1. Cost and revenue of rice production per acre (2017–2018 season) – study area.

Appendix S2. Average marketing cost of rice for different intermediaries.

Appendix S3. Description of variables used in the MNL model.

Appendix S4. Rice production, productivity and consumption trend in Tanzania.

Appendix S5. Production areas and market routes of rice in Tanzania.