

Full Length Research Paper

Constraints and opportunities to upgrading Uganda's rice markets: A value chain approach

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Received 23 February, 2015; Accepted 15 October, 2015

Most of Uganda's rice is produced by smallholder farmers with the purpose of marketing for family income. However, poorly developed market system is a major problem to rice producers. Based in Namutumba district (Eastern Uganda), the study involved both structured interviews with several stakeholders and focus group discussions with three farmers groups and three rice miller groups, each comprising of ten people. Using value chain approach, the study analyzes constraints and upgrading opportunities along the marketing channels. Low rice quality attributed to poor postharvest practices where foreign matter mixes with paddy during drying is a major challenge. High energy cost amounting to 69% of electricity operated and 89% of diesel operated machines during milling lowers farmers' income. Small volumes of rice supplied by individual farmers to the market also weaken their bargaining power. In addition, there is mistrust between farmers and millers since the latter can only recover up to 70% of financial credit advanced to the former. The above challenges are compounded by limited market support activities by the development partners. Strengthening group cohesion through horizontal coordination, improving relationships between chain actors at different chain nodes through vertical coordination and rural electrification are some of the possible considerations.

Key words: Uganda, rice market, upgrading, value chain, farmers, rice millers.

INTRODUCTION

Unlike most of the food crops grown to satisfy household consumption and food security requirements, rice is consumed more in urban areas, where it is one of the major foodstuffs at homes, schools, hospitals and prisons (Ahmed, 2012). Rice is grown almost throughout the country but mainly in the Eastern and Western Uganda due to availability of lowlands with high moisture contents throughout the growing season. However, these (Eastern and Western) regions' lack of market access is the most significant explanation to their food insecurity (McKinney,

2009). In the same regard, Odogola (2006) precisely observed that 70% of the rice farmers in Kamwenge district (Western Uganda) and 48% of their counterparts in Iganga district (Eastern Uganda) have poor marketing systems. The main problems cited as constituents of poor market access include: Lack of market information, poor road network, small paddy quantities, low quality paddy and inadequate postharvest handling skills (Odogola, 2006).

With the larger share of locally produced rice ending up

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in domestic markets, it is imperative that access to a well-functioning market will be required to improve the livelihood of smallholder farmers who are the majority rice producers in the country. There is need for an efficient and effective linkage between the rural producers and the urban consumers. This linkage can be well understood through the concept of value chain. Kaplinsky and Morris (2000) refers to value chain as a full range of activities required to bring a product or service from conception, through different stages of production, delivery to final consumers and final disposal after use. There are many rice value chain studies which have been conducted in Uganda by government agencies such as Ministry of Agriculture Animal Industry and Fisheries (MAAIF, 2009) and Plan for Modernization of Agriculture (PMA, 2009) plus several bilateral and donor organizations either directly or through consulting agencies (Trias, 2012; USAID, 2008; Kilimo Trust, 2012; ACF, 2014). In most of the above studies, the emphasis has been placed on market structure mapping and gross margin analysis with less focus on upgrading opportunities and yet it is mandatory for market access by rice producers. Mitchell et al. (2011) defines upgrading as a means of acquiring the technological, institutional and market capabilities that allow resource-poor rural communities to improve their competitiveness and move into higher-value activities.

The purpose of this study was to assess the rice value chains in Uganda in the context of upgrading by: (i) Studying various marketing channels; (ii) Identifying constraints and opportunities along the marketing channels, and (iii) Analyzing the upgrading strategies. Upgrading of rice value chains enables farmers earn higher prices as well as helping consumers access high quality rice at a relatively lower price (JICA, 2013).

The concept of value chain analysis

The concept of value chain can be traced back to the 1960s when French scientists developed the *filieri* approach for studying contract farming and vertical integration in agriculture (Mitchell et al., 2009; UNIDO, 2009). They later applied it on export commodity production of cotton, rubber, coffee and cocoa in France's former African colonies. The emphasis of this approach was analyzing how local production system was linked to processing industry, trade, export and final consumption (Nang'ole et al., 2011). At the time, the focus of *filieri* approach was on production and commercialization without the elements of governance, transformation and value addition (UNIDO, 2009).

In the 1970s a related concept 'sub-sector analysis' was developed which involved studying the networks and relationships linking suppliers, processors, transporters and traders in ways that connect

producers and enterprises to final consumers of goods and services (Nang'ole et al., 2011). A sub-sector thus involves a set of activities, actors and rules governing those activities.

The term value chain was first used and popularized by Michael Porter (1985) where he sought to assess the contributions of various primary and supportive firm activities to the overall added value of its business. The primary activities include inbound logistics, operations, out-bound logistics, marketing, sales and service which can directly add value to the production of goods and services (Nang'ole et al., 2009). On the other hand, support activities include procurement, human resources management, technology development and firm infrastructure which are necessary for the effectiveness and success of the firm (UNIDO, 2009). Porter's approach was aimed at highlighting actual and potential areas of competitive advantage and the interdependences and linkages between vertically arrayed actors in the creation of value for the firm (Rich et al., 2009). The weakness of Porter's approach to value chain is that it restricts analysis to firm level without considering upstream and downstream activities beyond the company (Fasse et al., 2009).

The concept of Global Commodity Chain was developed by Gereffi and Korzeniewicz (1994) who applied it to development issues. Whereas Porter's approach focused on within firm linkages of several activities, the Global Commodity Chain was modified and the focus was on inter-firm linkages while emphasizing the governance structure between several actors. Gereffi identified four elements: (i) Input-output structure; (ii) Territorial (international) structure; (iii) Institutional framework, and (iv) Governance structure (Nang'ole et al., 2009; Fasse et al., 2009).

Another modification of Global Commodity Chain, "Global Value Chain" was coined in the early 2000s by Kaplinsky and Morris (2002). They defined a value chain as a full range of activities required to bring a product or service from conception, through different stages of production, delivery to final consumers and final disposal after use. Kaplinsky and Morris (2002), distinguish the value chain from supply chain by emphasizing the relationships and linkages both within and between actors at each stage of production. According to Rich et al. (2009), this has considerable merit of highlighting the constraints and opportunities at and between stages of the chain and can thus be used to develop integrative policy recommendations that target chain inefficiencies and address distributional issues. More recently, the concept of value chain analysis seems to have become synonymous to market analysis as it involves the role of policies, institutions and laws in shaping markets (Nang'ole et al., 2011). However, the relevance of Global Value Chain approach in developing countries is questionable as it emphasizes vertical integration with emphasis on international markets leaving behind many

smallholder farmers who depend on local and regional markets (Riisgaard, 2009; Tran et al., 2013; Mitchell and Coles, 2011; Trienekens, 2011). Integrating horizontal and vertical coordination is a requirement for developing the value chains of rural farmers (Mitchell and Coles, 2011). Also, agricultural value chains are buyer-driven, meaning buyers have more powers in deciding what to produce (Mitchell et al., 2009). To reduce the power of buyers, developing country chain actors need to upgrade by building technological and managerial capacity that allows them to participate effectively in value chains (UNIDO, 2009). Value chain upgrading is therefore one of the main focus in developing countries (Trienekens, 2011).

Upgrading in value chains

Upgrading is a key contribution of value chain analysis with regard to understanding how incomes of poor people can be augmented. It refers to acquiring technological, institutional and market capabilities that allow firms or communities to improve their competitiveness and move into higher-value activities (Mitchell et al., 2009). The purpose of upgrading is to enhance the rewards and or reduce the risks to actors in production and marketing. If the anticipated rewards gain or risk reduction is not realized, the actor may choose to revert to previous or less functions. Such a scenario is referred to as downgrading and is the opposite of upgrading (Khiem et al., 2010). Different upgrading strategies have been suggested in various studies (Kaplinsky and Morris, 2002; Mitchell et al., 2009; Mitchell and Coles, 2011; Trienekens, 2011) to help in development of developing countries' value chains. Such strategies are briefly explained as follows:

Horizontal coordination

One of the main obstacles facing small-scale enterprises in developing countries is the very fact that they are small-scale. Horizontal coordination is the process of firms (which can be as small as individual actors) collaborating within a functional node (for example input supplies, production, processing, trading or retailing) to achieve a strategic balance between competition and collaboration (Mitchell and Coles, 2011). The purpose of horizontal coordination is to address shared constraints, interests and entry barriers associated with scale. These include high transaction costs, low and poor quality output, weak negotiating power and lack of capital and management of common property resources. According to Mitchell et al. (2009), horizontal coordination is often the first step in a sequence of interventions that ultimately result in access to the market, and is a prerequisite for other forms of upgrading. In developing countries,

horizontal coordination takes the form of producer associations or cooperatives (Trienekens, 2011).

Vertical coordination

The process of strengthening relationships between functional nodes of the value chain, involving the shift away from one-off spot transactions toward developing longer-term business connections for instance contract farming (Mitchell et al., 2009; Mitchell and Coles, 2011). In practice, vertical coordination is often a slow and difficult process because it involves the building of trust relations between the buyer and the seller. As such, it rarely takes place in isolation from other upgrading strategies. More formal contracts are often associated with higher performance requirements, such as higher-quality products, larger volumes and delivery schedules that are more frequent and reliable. Overcoming the barriers associated with these requirements may necessitate a preliminary step of horizontal coordination (Mitchell and Coles, 2011).

Functional upgrading

This is also referred to as vertical integration; it involves changing the mix of functions performed by actors in the value chain. This can be through adding new activities by an individual or firm, for instance agricultural producers starting to process some of their output to add value or starting to produce the inputs by themselves. In some instances, the individual or firm may decide to delete some activities (downgrading) if deemed necessary. The resulting distribution of functions among actors in the chain should maximize its efficiency and competitiveness by attaining the optimal level of specialization versus integration (Mitchell et al., 2009; Mitchell and Coles, 2011). Integrating functions vertically offers the possibility of transforming raw materials into new products and thereby increasing the proportion of value captured. Trienekens (2011) identifies functional upgrading as a key issue in developing country value chains as most exports in are raw material form.

Process upgrading

This involves improving value chain efficiency by increasing output volumes or reducing costs for a unit of output. Examples of this include improving agronomy to enhance yields that result in higher sales or own consumption, or both. This may be the result of improved planting techniques, planting materials or investments such as irrigation infrastructure and technologies which reduce postharvest losses (Mitchell et al., 2009). Process upgrading focuses on the one hand on upgrading the

product and on the other hand on optimization of production and distribution processes. The latter includes introduction of new technologies such as automated production and packaging lines, cooling installations and modern transportation technology as well as improved communication facilities in the supply chain such as internet connection, GPS systems or the intense use of mobile phones in production and transportation planning (Trienekens, 2011).

Product upgrading

This involves introducing new products or improving old products faster than rivals. This involves changing new product development processes both within individual links in the value chain and in the relationship between different chain links (Kaplinsky and Morris, 2000). Along the same line, Mitchell and Coles (2011) defines product upgrading as making better products that hold greater value and fetch higher prices. One of the most common and intransigent barriers for the rural poor is that their output fails to meet market specifications, both in terms of quality and volume. Raising product quality and increasing the efficiency of production are critical prerequisites to accessing and competing successfully and beneficially in markets (Mitchell and Coles, 2011). Process and product upgrading are closely related because improving product quality often involves improvements to the production process (Mitchell et al., 2009).

Inter-chain upgrading

This is where chain actors introduce value adding processes from other chains to offer new products or services, for instance a farmer who enters into tourism activities (Trienekens, 2011). The new value chain is usually more profitable than the previous one for example shifting from growing traditional commodities to high quality export horticulture. Unfortunately, the upgrading process often has significant barriers to entry for the poor and vulnerable to access the more lucrative value chain (Mitchell et al., 2009).

Upgrading of the enabling environment

Although not an upgrading strategy in a strict sense, competitiveness of the enabling environment for value chains is a major contributing factor in the success of the operations of a value chain. Improvements to the support services, institutional, legal and policy frameworks in which value chains operate are often a productive area in which development agencies can intervene to improve the functioning of a chain (Mitchell et al., 2009; Mitchell

and Coles, 2011). Such things as standards and certification, rules and regulations regarding contracts, etc. must be in place for successful upgrading in value chains to take place.

MATERIALS AND METHODS

The study was carried out in the eastern district of Namutumba. Carved out of Iganga district in 2006, Namutumba is located at coordinates 00 51N, 34 41E along Tirinyi road (Mbale-Iganga highway). It occupies a total area of 802 km² of which 138 km² is covered by water bodies. Administratively, the district is divided into six subcounties of: Namutumba, Magada, Bulange, Nsinze, Ivukula and Kibale. Given its abundant swamps and proximity to Lake Victoria, climate is tropical with small seasonal variations in temperature (22-27°C) and rainfall (900 to 1150 mm). As of 2011, the population estimate was 213,000 people of whom 51.5% were females. Smallholder subsistence farmers comprise 84% of the population. They engage in rearing livestock such as chicken, cattle, goats, etc and growing crops such as rice, cassava, groundnuts, millet and coffee. Namutumba, together with the nearby districts of Iganga, Pallisa, Tororo, Butaleja, Bugiri and Busia form the main rice growing region of Uganda. The district is easily accessible due to its location along the highway.

Nsinze subcounty was purposively selected since it has most of the rice value chain activities taking place there. It has many rice farmers and rural millers and the nearby Busembatya trading center has a lot of rice milling and trading transactions which makes it to act as a link between rice farmers and urban traders. The researchers first conducted a desktop research to have basic idea about rice farming as a business in the study area. This was followed by discussions with key informants who included the chairperson farmers' forum, representative from National Agricultural Advisory Services (NAADS), local council leaders and farmer group leaders. Focus group discussions were then carried out with 3 farmer groups each containing 10 people. Each group was a representative of a single parish. In addition, discussions with 3 groups of rice millers were conducted. One group of rice millers was in the rural farming area of Nsinze subcounty while the other two groups were in Busembatya trading center. This was necessary since millers from the rural village had different characteristics to those of town millers. For the purpose of cross checking the information got from group discussions, 15 farmers and 5 rice millers were selected for individual interviews. The major processing company in the region which is involved in purchasing the rice paddy from farmers and traders was interviewed to gather data on processing.

Analysis was done in the context of value chain upgrading as suggested by Trienekens (2011) with the help of descriptive statistics, tables, figures and gross margins.

RESULTS AND DISCUSSION

Overview of value chain actors

According to the group discussions, rice farmers own about 2 ha per household. Table 1 is a summary of landholding and land under rice cultivation which was captured from the individual household interviews.

The average land holding is 2.2 ha which is the same as reported in group discussions is. The actual landholding, however, varied significantly from 0.8 ha for

Table 1. Household landholding and rice cultivation.

Farmer	Total land owned (ha)	Total land cultivated (ha)	Land under rice (ha)	Rice area as % of cultivated	Yield (tons/ha)
1	0.8	0.8	0.3	40.0	1.6
2	1.2	0.8	0.4	50.0	2.5
3	1.2	1.0	0.4	40.0	3.0
4	1.4	1.4	0.4	28.6	3.3
5	1.6	1.4	0.8	57.1	3.8
6	1.6	1.4	0.6	42.9	3.0
7	1.6	1.6	0.6	37.5	2.0
8	2.0	2.0	0.6	30.0	2.5
9	2.0	2.0	0.8	40.0	2.5
10	2.4	1.6	0.8	50.0	2.8
11	2.4	2.4	0.6	25.0	3.8
12	2.4	2.4	0.4	16.7	1.5
13	4.0	3.2	0.8	25.0	2.5
14	4.0	3.6	1.0	27.8	3.3
15	4.0	4.0	1.6	40.0	3.0
Mean	2.2	2.0	0.7	36.7	2.7

Source: Survey interview (Sep-Oct, 2013)

the smallest farmer to 4.0 ha for the largest. In contrast, the average land holding in region as reported in the agricultural census of 2008 is about 0.8 ha per household. This implies that rice farmers own on average more land than their non-rice farming counterparts. Average cultivated land was 2.0 ha of which 36.7% was under rice. The average rice yield was 2.7 tons/ha. This yield was achieved using seed from the previous harvest and without fertilizer application or irrigation. Chemical herbicide for *striga* weed was however applied.

Rice millers in the survey area can be categorized into two: (i) Rural village millers (hereafter referred to as 'village millers') who are located in deeper villages where rice farming mostly takes place, and (ii) Rural town millers (hereafter referred to as 'town millers') who operate from the trading centers. Using the results of group discussion, Table 2 compares these two categories of rice millers. The village millers are relatively new (2 years old) in business and use diesel as power source. The milling capacity of their machines is low (3.2 tons/day).

Despite their proximity to farms, they receive relatively low volumes of paddy ranging from 0.3 tons/day to 1.3 tons/day depending on the season. Due to high diesel price, they charge a relatively higher milling fee (100000 Ush/ton). On the other hand, the town millers have accumulated relatively more experience as they have spent 5 years on average in milling business. They use electricity as a source of power and the milling capacity of their machines is quite large (18 tons/day). Although the quantity of paddy received is larger, it's well below the amount required by their milling machines. Because they

are far from farmers and electricity is cheaper than diesel, their milling charges are relatively low.

Interviews with the manager of processing company revealed that it was started by individual entrepreneur with the support of government and other donors in Jinja town (in 2006). The company has a large milling machine with a milling capacity of 2 tons per hour and a mechanical dryer with a capacity of 5 tons per hour. It currently supports 10000 clients across the country with some as far as Western Kenya. The clients are mainly smallholder farmers who bring paddy by themselves when from Busoga sub-region (where the company is located) or offered transport service (when from elsewhere). Besides farmers, there are some 300 traders who bring paddy.

At the company premises there are several services which include drying, milling, branding, storing and marketing. Milling is of high quality as all foreign matter and unfilled grains are separated from paddy before milling. Commission is charged for these services on the clients after selling milled rice.

Rice market structure

Figure 1 illustrates the rice market structure in the study area. Most of the dried paddy is taken by individual farmers to rural rice millers for milling. The remaining paddy is either taken by individual farmers to medium scale processor (Upland Rice Millers) or sold to paddy traders who in turn take it to the processing company. The processing company works with up to 300 traders

Table 2. Characteristics of rice millers.

Indicator	Rural village millers	Rural town millers
Power source	Diesel	Electricity
Years in business	2.0	5.0
Daily paddy supply (tons)- on-season	1.3	2.5
Daily paddy supply (tons)- off-season	0.3	0.5
Milling capacity (tons/day)	3.2	18.0
Milling fee (shillings/ton)	100000	80000

Source: Survey interview (Sep-Oct, 2013)

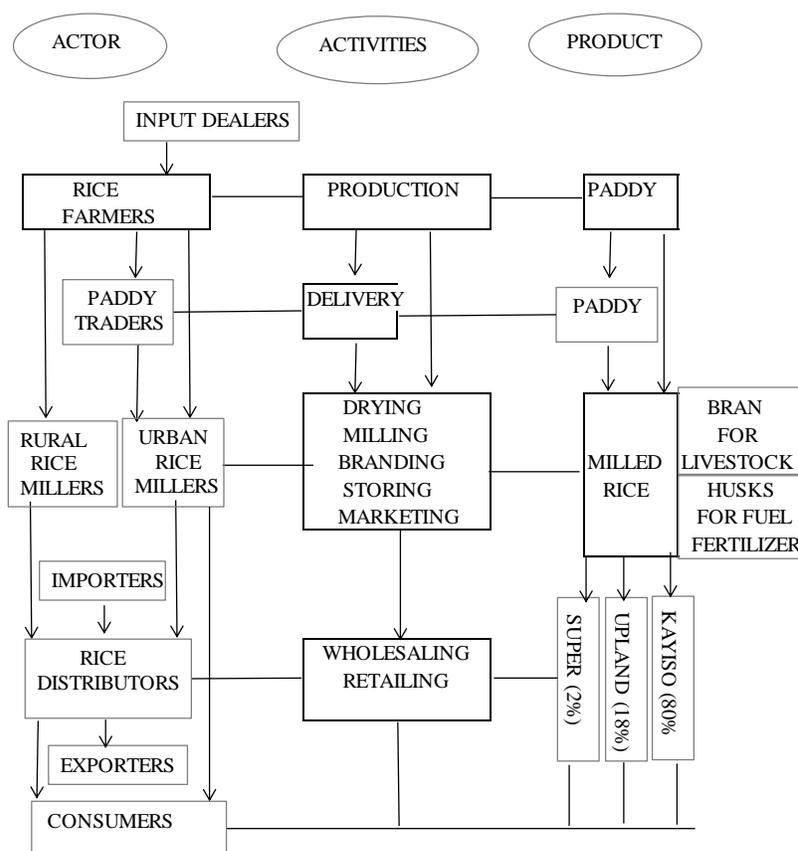


Figure 1. Structure of rice marketing. Source: Survey interview (September to October, 2013).

who source paddy from all parts of Uganda and other East African regions such as Western Kenya and Northern Tanzania. The paddy taken to the rural rice millers is sold immediately after milling to the waiting buyers. The buyers are mostly village assemblers who bulk the rice before selling to wholesaling traders from urban areas such as Iganga, Jinja and Kampala.

The paddy taken to processing company is dried to required standards (14% moisture content), milled, graded and branded before it is sold. Grading is based on the percentage of broken rice as all foreign matter is

removed by the machine during milling. The graded rice is then branded according to varietal features of milled rice: (i) ‘Kayiso’ for lowland long and narrow grains; (ii) ‘Upland’ for NERICA varieties, and (iii) ‘Super’ for lowland short, thick, sticky and aromatic grains. These brands have some meaning attached to them. For example ‘Kayiso’ literally means needle shaped and comes from indigenous Ugandan varieties. Due to their promotion since 2003, NERICA cultivars are the most popular upland rice varieties in Uganda. To this end, the words ‘NERICA’ and ‘Upland’ are often used interchangeably by

Table 3. Interventions by support organizations.

Organization	Support activity			
	Research	Inputs	Production	Marketing
Sasakawa Africa Association*	√	√	√	√
Africa 2000 Network			√	
NAADS		√	√	
NARO	√			
JICA	√	√	√	
Kilimo trust**				√

*Project activities in the survey area completed.. **Still in pilot phase. Source: Farmers survey (September to October, 2013).

farmers and consumers. 'Super' brand is associated with its superior cooking qualities. The branded rice is either sold to the distributors (wholesalers, retailers or exporters) or to final consumers (individuals, public and private institutions).

Besides rice, the processing company also produces other byproducts such as bran (for livestock and poultry feed) and husks which are currently being used as organic fertilizers in maize fields but plans are underway to be used for fuel supply.

Limited market support

Rice sector in Namutumba district boasts of a good network of governmental and non-governmental organizations. Table 3 indicates different organizations rendering support to farmers and the value chain activity supported. With the help from Japan International Cooperation Agency (JICA), the Uganda National Agricultural Research Organization (NARO) is constantly engaged in development of new rice cultivars and agricultural technologies. Organizations such as Sasakawa Africa Association (SAA), Africa 2000 Network (A2N) and National Agricultural Advisory Services (NAADS) are putting great efforts in rice farming technology dissemination and extension. The support however does not go beyond the farm level as shown by the interventions of various support organizations in the survey area. Besides the East African regional organization "Kilimo Trust", which supports marketing initiatives through its private partnerships, there is minimum assistance in the area. Through the program 'Development of Inclusive Markets in Agriculture and Trade (DIMAT)', which is a partnership with Upland RiceMillers Ltd, Kilimo Trust is expected to reach 3000 rice farmers in the area of rice marketing. The outcome of the aforementioned rice marketing partnership is yet to be seen, however, as the program is still new and not yet rolled out. Bulk marketing which was promoted by SAA could not be sustained after the closure of the project although it was positively viewed by farmers. During the

project period, farmers did not actively participate in the bulk marketing project. Instead, they would pack their rice and wait for the group leaders under SAA facilitation to come with the truck and take rice for milling. As a result there were no skills attained by participants during the project and this lead to the collapse of the initiative following the project closure. The rest of the organizations have concentrated on production with little assistance in postharvest handling and marketing. This is contributing to low quality rice produced by farmers. More support which is focused on quality improvement is required.

Mistrust between farmers and millers

In terms of financial credit, only one rice miller (former carpenter) was able to access credit from a microfinance institution (Pride Microfinance Ltd). Most millers used their own savings or borrowed from friends for their startup capital. Limited financial support is one of the reasons for low quality rice due to poor drying facilities. Efforts by millers to give financial credit to farmers have been futile due to failure in recovering. This has created mistrust between millers and farmers thereby derailing future hopes of credit offer.

Table 4 highlights credit recovery success by millers. All the millers who advanced financial credit to individual farmers recovered at most 70% of the total amount with the rest being defaulted. Since the buying and selling of rice takes place at the milling machine, informal agreement is formulated where farmers are supposed to mill their rice from the lender's premises and credit be repaid after milling either in cash or in-kind. If applied appropriately, this arrangement is fair to farmers since sometimes interest rates are not factored into the recovery amount as millers anticipate a steady supply of paddy for the smooth flow of their business.

Unfortunately, more often the farmers fail to honor the agreement after harvesting and mill their rice from elsewhere due to misallocation of credit funds. However, one miller who gave credit to a group of farmers was successful and recovered 100% of the amount. In

Table 4. Credit recovery by millers.

Miller	Credit to farmers*	Amount recovered*	Recovery rate (%)	Lending modality
1	500000	300000	60	Individual
2	300000	200000	67	Individual
3	1200000	1200000	100	Group
4	1000000	700000	70	Individual
5	0	N/A	N/A	N/A

*Unit of measurement is Uganda Shilling (1US\$= 2500 Ush, as of Oct, 2013). Source: Survey (September to October, 2013).

addition, this miller did not offer financial credit but rather provided tarpaulins in-kind which were valued in cash for the purpose of repayment. Based on this model, it is recommended that credit be offered in form of tarpaulins to farmer groups through their leaders.

Price formation mechanism

Figure 2 is a sketch of price forming mechanism. Through interactions with other farmers or rice millers over phone or face-to-face, farmers get to know the possible rice price range for a particular day before taking it for milling. On the other hand, village assemblers also come to the miller with fair knowledge of the prevailing price after consultations with other buyers through phone. Since most traders come from distant locations and are interested in large volumes, they do not directly purchase from farmers but buy from village assemblers who bulk the rice. Price is determined through negotiations between the farmer and the village assemblers. It depends on the perceived quality as determined by the amount of broken rice and presence of foreign matter. Since there are no quality standards, the perceptions are done in comparison to other available rice. Other factors which influence price on a given day include: Number of traders, volume of rice and bargaining power of a particular farmer.

Village assemblers hold the market power

Farmers in the survey area engage in growing various varieties of rice which can be branded either as Super, Kayiso or Upland in the wholesale and retail markets. Unfortunately, at farm gate it is sold as single category irrespective of how distinct it may appear. During drying, different varieties are usually mixed either voluntarily by farmers due to limited space or involuntarily by birds when spread separately but adjacent to each other. Because the rice offered by farmers to the market is mixed, village assemblers pay the price for the lowest quality brand even if it constitutes a minor share of the farmer's rice. Farmers in the survey area grow mainly NERICA as a result of previous assistance by Sasakawa Africa Association. However, their rice has been bought

at a price comparable to that of Kayiso instead of Upland which is the true brand for NERICA rice varieties. After reaching the wholesale market, traders sell it as Upland without adding any value. Given that prices for various brands are different, farmers lose money in this process.

Table 5 gives rice prices at different marketing levels. 'Kayiso rice' is the cheapest, followed by 'Upland rice' with Super brand being the most expensive at wholesale and retail price. This implies traders hold power and influence in rice markets at the expense of farmers. Farmers will need to be more coordinated and practice appropriate postharvest procedures if they are to benefit from high price of their rice. Worth noting however, whereas the wholesale and retail prices are quoted from the nearby market, it's important to note that most of rice produced in survey area is procured and taken by Kampala traders.

Market constraints to farmers

Striga weed is the most severe problem at the production stage. The weed causes many unfilled grains and consequently a low milling recovery. It also increases labor costs as it is cumbersome to eradicate and thus necessitates agricultural chemicals. The weed is more destructive to certain rice cultivars than to others. NERICA 4, the mostly grown cultivar in the survey area is so susceptible and can result into significant crop losses. However, NERICA 10, a newly introduced variety in Uganda is resistant to *striga* weed (Rodenburg et al., 2015). Given that it gives higher yields, switching from growing NERICA 4 to NERICA 10 is a viable consideration.

The most market related challenge to rice farmers is lack of drying facilities. Paddy is dried on bare ground and as a result it ends up mixing with a lot of foreign matter. Coupled with poor moisture control, this leads to low milling quality. Failure of farmers to dry different rice varieties separately lowers their potential income. There is need for post-harvest oriented training with emphasis on drying. Training alone without investment in basic drying facilities such as tarpaulins and moisture meters may not be of much help. Given that farmers do not have the financial ability for investing in the drying facilities, collaboration with other value chain actors mainly millers

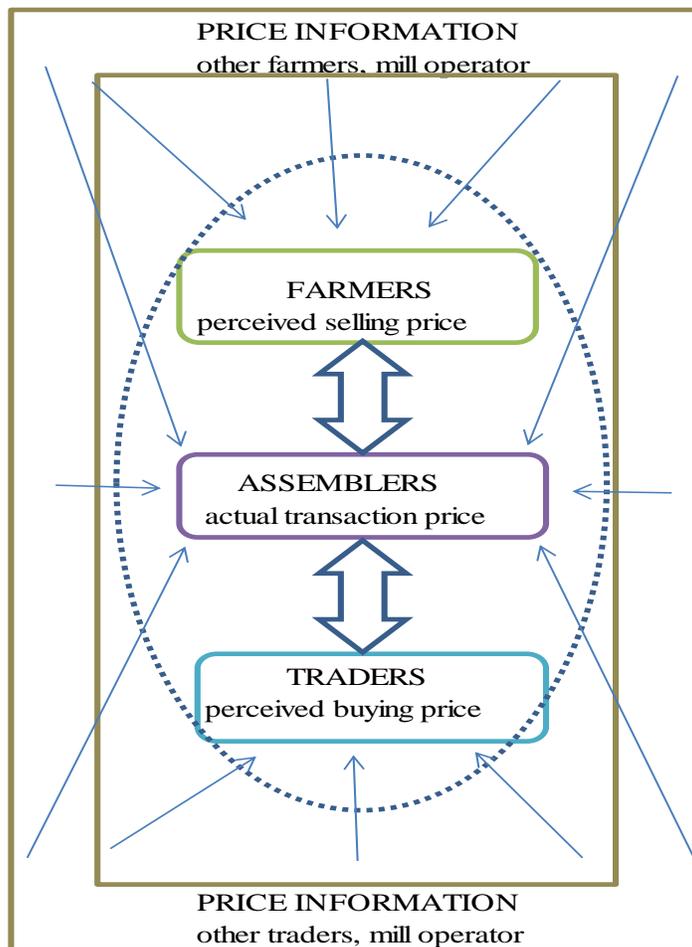


Figure 2. Price forming mechanism. Source: Survey interview (September to October, 2013).

Table 5. Monthly rice prices (Uganda shillings, Ush).

Distribution point	Brand	Average monthly price (Ush/kg)				
		Jun-13	Jul-13	Aug-13	Sep-13	Oct-13
Farm gate	Kayiso, Upland, Super	1700	1800	1900	1900	1800
	Kayiso	1750	2000	2050	2000	1950
	Upland	2400	2400	2400	2450	2450
Wholesale	Super	2850	2850	2850	2850	2750
	Kayiso	2100	2300	2300	2200	2200
Retail	Upland	2700	2700	2700	2700	2700
	Super	3200	3200	3200	3200	3000

Source: Survey (September to October, 2013), Infotrade Uganda database

for financing is essential. However, there is no trust between farmers and millers which hampers any financial credit advancement possibilities. Therefore, processes

aimed at building trust between various stakeholders such as horizontal and vertical coordination are encouraged.

Table 6. Constraints to rice milling.

General challenge	Specific problem	Possible solution
Cluster power supply	Frequent disconnection due to poor payment of bills by cluster members	Each individual should be allocated a separate meter
Low milling quality	Paddy usually contains foreign matters such as stones and dirt	Training of farmers in post harvest handling
Lack of trust between millers and farmers	Recovery of credit advanced to individual farmers by millers has been unsuccessful	Credit should be advanced to a group of farmers for easy monitoring should be emphasized
Unstable paddy supply	Available paddy is far below the milling capacity, this worsens during off-season	Productivity and market improvement

Source: Survey (September to October, 2013).

Table 7. Daily gross margin by rice millers.

Item	Rural village millers	Rural town millers
Revenue (Ush/day)	130000	-
1.3 tons at 100000	-	200000
2.5 tons at 80000	-	-
Total revenue-A	130000	200000
Operating costs (Ush/day)	-	-
Labor	7000	20000
Electricity	-	75000
Diesel	65000	-
Oil at 3200/L	3200	6400
Rent	-	8000
Total operating costs -B	75200	109400
Profit (A-B)	54800	90400

Source: Survey (September to October, 2013).

Challenges facing small scale millers

Small scale rice milling is done by diesel operated machines in villages and electricity operated machines in towns. To minimize on defaulters by the power company, rice millers were advised to form clusters through which they were to be connected to electricity. However, the initiative was not successful as several members were operating without paying the fees. The end result was frequent disconnection from the electric power grid due to defaulting cluster members. The faithful members who committed themselves to paying their fees have not been spared. They are suffering to service the debt of their defaulting counterparts so that they can sustain their business. Since clusters seem to have failed, allocating each miller individual electric meter is worth trying. The power cost is also high as it constitutes 69 and 86% of total costs to town millers and village millers respectively. Table 6 summarizes the challenges facing rural rice millers. Besides the aforementioned power related

challenges, the amount of paddy available keeps fluctuating. During off season this problem worsens forcing some millers out of business. Low paddy quality also affects the milling machine thereby necessitating frequent servicing.

With all the above challenges, small scale rice milling is still worth conducting due to its profitability. Table 7 shows daily profits accrued by village and town rural millers as calculated by the difference between income and operating costs. It is 54800 and 90400 Ush per day for village and town millers respectively. On monthly basis the average profit of village millers translates into 1.6 million Ush which is more than tenfold the average household income in Eastern Uganda (155500 Ush).

Constraints and coping strategies by the processing company

The company regularly evaluates its activities and

Table 8. Constraints to rice processing.

Value chain function	Previous challenge	solution/upgrading opportunity	New/potential challenge	planned solution/upgrading opportunity
Drying	Drying was mostly by sun on tarpaulines moisture content difficult to control, paddy spillage and some consumed by birds, crashed by workers during spreading, washed away by rains	High capacity mechanical dryer(5 tons/h) installed	Power shortage as a result of biweekly load shedding	Contemplating production of power from rice husks to avoid power disruptions
Storing	Limited storage space which encourage pests and diseases to emerge	Modern warehouse (3000 tons) has been constructed where farmers' rice is stored freely before and after milling	-	-
Milling	Unstable supply of paddy necessitating imports from Kenya	Partnership with other stakeholders to increase local production (e.g, 3000 new farmers will be supported by KILIMO TRUST)	Milling capacity of currently used machine (2 tons/h) may not be enough during peak hours	A higher capacity milling machine is in the plans of being installed
Sorting and grading	Four grades produced: A, B, C D. A (no broken), B (less broken), C (more broken) and D (all broken). C grade comprises highest proportion due to poor drying	Mixing grades B & C to allow farmers get high income	Quality compromised and consumer trust lost	Plans are underway to equip the laboratory with various testing capabilities to minimize broken and foreign matter
Branding and marketing	Three brands are produced: kayiso (80%), upland (18%)and super (2%).Super is highly demanded but low supply due to unsuitable soils	Paddy for super brand imported	Higher pricer (27%) compared to locally produced varieties	suitable soils have been identified in Soroti area and through several partnerships, local production is to be intensified

Source: Survey (September to October, 2013).

designs new strategies to overcome current and future challenges. Table 8 shows such innovations according to different processing functions. Originally paddy was sun dried on tarpaulins. Due to a number of challenges associated with sun drying, a high capacity mechanical dryer was purchased. Shortage of power supply due to load shedding, however, emerged as a fresh challenge. The company is now planning to start power generation from rice hulls as a backup source. Economic viability of such option needs to be assessed before the company starts the initiative. Since many sugar companies in the country are now producing their electricity from bagasse, there is genuine optimism. The increasing number of paddy supplying clients had put pressure on available storage place. This meant that many paddy and rice bags were crammed which in turn resulted into conducive environment for disease and pests outbreak. In response to this challenge, the company set up a modern and spacious (3000 tons) warehouse which has significantly improved storage quality. There is periodic shortage

(15%) in the amount of paddy received especially in period of February to May each year. The company tried to overcome this challenge by importing from Kenya for the short term. Partnerships with other organizations are being signed to increase local rice production to stop paddy importation. It is believed, such arrangement with no doubt will avail more paddy than the milling capacity of the current machine.

To prepare for this anticipated challenge, the plans are underway to install a higher capacity milling machine. Currently, milling results into four grades of rice: (i) A (100% wholly milled rice), (ii) B (up to 30% broken rice), (iii) C (31-70% broken rice) and (iv) D (more than 70% broken rice). Rice price decreases with grades from A to D, with A being the most expensive. Due to poor postharvest handling, farmers' rice is always dominated by grade C which commands lower price in the market and consequently low income. To help farmers earn more, the company has been marketing three grades (A, B-C and D) by mixing grades B and C. However, this has

been done at the compromise of product quality which deteriorates consumer trust.

The company is now encouraging farmers to bring freshly harvested paddy so that it can be dried from the premises. At the same time it is equipping the laboratory with chemicals and other instruments for various quality tests to reduce percentage of broken rice and improve milling quality. Super rice, is the most demanded brand, is in limited supply since its varieties do not grow well in most Uganda soils. Most of the paddy for Super rice is currently imported from Tanzania. This has resulted into higher prices which average consumers cannot sustain. Countrywide soil testing has been carried out and Soroti area soils been identified as ideal for Super rice cultivars. Through public-private partnerships, efforts to promote production of Super rice in Soroti are into consideration.

An appraisal of upgrading practices in the study area

Horizontal coordination

To a small extent the farmers were organized into farmers groups. In reality however the groups seemed non-existent as no activity was carried out in group apart from trainings. Initially, input purchase and paddy marketing were done collectively through groups with the help of Sasakawa Africa Association. Trucks, often coordinated by Sasakawa, would move from member to member gathering the paddy after weighing, take it for milling before selling to major buyers. Members would then be paid depending on the proportion of their paddy. This process ensured higher selling prices and lower marketing (mainly transportation) costs. In this way, farmers would earn more than if they sold individually. Since members played a passive role in marketing activities, they did not acquire the skills required for sustainability of the initiative. Consequently, collective marketing collapsed after the completion of Sasakawa project in the area. For the rural town millers, the only coordination they had was sharing the power through clusters. Failure by some members to meet their obligation of contributing to the utility charges has led to accumulated debt thereby resulting into frequent disconnection from the power grid. A lot of training on cluster benefits and management should be conducted by the electricity company. Meanwhile, downgrading to individual electricity meters in the short term is worth considering.

Vertical coordination

Even though there is no formal relationship between different chain actors, they occasionally coordinate. Rural rice millers have been trying to lend money to farmers to help in rice production. Because they do it in an informal way, recovery of credit has been difficult. As a result, they

have cut off such arrangements due to the loss of trust in farmers. The medium scale processing company has contracted traders to help in collecting paddy from farmers. In collaboration with other development partners, the company is also hiring agricultural specialists to train farmers in modern rice production and postharvest technologies. In addition, farmers are provided with drying and storage services on the company premises.

Functional upgrading

Previously farmers would sell their paddy to village collectors who would move from farmer to farmer. This trend has recently changed as most of the paddy is currently taken by farmers for milling before selling. This can be viewed as a form of functional upgrading as farmers are taking up the role of paddy traders. The processing company, which used to sell rice bran to livestock and poultry feed manufacturers, has started making feeds itself before selling. The company is also in the process of turning the rice husks into power supply source which will be used as a backup in case of electricity load shedding. Plans to add diversified products like chips, cakes, flour and wholegrain cereals are underway.

Process upgrading

To improve productivity in rain-fed rice farming system, farmers in the survey area adopted the cultivation of NERICA 4 which requires less amount of water. Unfortunately, the cultivar is susceptible to *striga* weed which is causing significant yield losses. Switching to NERICA 10 which is more yielding and resistant to the weed will be a worthwhile venture. Poor drying of paddy results into poor milling quality. Most rural millers have tarpaulins at their premises to help drying the rice to required moisture content before milling. However, they do not possess the moisture meters for observing the recommended moisture contents. To obtain optimally dried paddy, they will need to purchase moisture meters. The medium scale processing company has installed a mechanical drier which is more efficient in paddy drying.

Product upgrading

This form of upgrading is still the most challenging to rural farmers and millers. Paddy is usually sun dried on bare ground leading to quality deterioration of milled rice. In some cases paddy mixes with metals such as nails which keep damaging the milling machines. The viable solution is drying on tarpaulins but rural rice millers do not have enough financial credit to support the farmers. To dry 2.0 tons of paddy (average output per farmer), 4

pieces of tarpaulin worth 200000 Uganda shillings are required. This implies that rice millers would need considerable investment beyond their capability to support farmers. The medium scale processing company has a mechanical dryer which ensures optimum moisture content and minimizes foreign matter in the paddy. It also has a destoner incorporated into the milling machine which removes stones and other foreign matter from the paddy before milling. The newly constructed spacious warehouse provides good aeration which prevents diseases and pest infestation during storage. The quality standard of the rice, however, is still questionable as it is not yet certified by the national certification body.

Inter-chain upgrading

During paddy shortage, rural rice millers always divert to milling of maize into flour. In that way, they are able to smooth their income throughout the year. In the same way, paddy traders always venture into maize and coffee trading during paddy shortage.

Upgrading of business environment

This has been observed by agreements and partnerships between the processing company and other development agencies in the area. One such partner is Kilimo Trust which aims at improved market opportunities for smallholder farmers.

Conclusion

Ugandan rice value chain is long with many actors who hold varying degrees of power and influence. There are many smallholder farmers who produce rice either individually or in groups. However, marketing is mostly done on individual basis which significantly reduce the power of farmers. Given that most rice millers provide milling services at a commission rather than engaging in buying of rice, market power remains with rice assemblers who purchase rice from farmers and sale to wholesalers. Farmers tend to have low bargaining power due to the small volumes of rice they individually supply to the market. For farmers to raise their bargaining power there is need for horizontal coordination and aggregate their produce before selling. Currently, many farmers have joined groups aimed at joint production. Formation of these groups has been facilitated by several development organizations. However, marketing receives less attention and is supported by few agencies. More marketing support in terms of group formation, trust and management skills is required.

In liberalized rice sector of Uganda, bargaining power alone is not enough to improve the incomes of farmers.

The high rice milling costs will need to lower for farmers to improve the profitability of rice farming. Although both diesel and electricity costs are high, farmers can save significantly if they mill their rice using electricity operated machines. Similarly, rice millers make a better profit with electricity operated compared to a diesel operated machine. A program aimed at rural electrification is beneficial to all stakeholders and can play a major role in improving the competitiveness of rice produced by Ugandan farmers.

Lower cost contributes to competitiveness to a certain extent and the rest is covered by high quality. Unfortunately, the quality of Ugandan rice is still low due to poor postharvest handling and simple milling machines without cleaning and grading capabilities. The most critical stage of postharvest handling is drying where foreign matter mixes with paddy leading to further quality deterioration as paddy is spread on the bare ground. If farmers were trustworthy, they would get advance financial credit from millers to invest in basic drying equipment like moisture meters and tarpaulin to improve the quality of their rice. However, farmers' failure to repay the credit has led to mistrust between them and their lenders and as a result hampered any credit advancement. This necessitates strengthening of the linkages between different chain actors through vertical coordination. Vertical coordination is essential in building the relationship and trust between several actors across the chain which can result into a win-win scenario for all the participants.

Since the predominantly grown rice variety (NERICA 4) is susceptible to parasitic weeds, farmers lose potential income through yield losses and quality reduction. It is therefore advisable that various stakeholders involve in sensitization of farmers about available weed resistant and high yielding varieties such as NERICA 10.

Whereas this paper explores the challenges affecting Ugandan rice sector amore and highlights low rice quality as one of the major constraints. More research on how to improve the quality is recommended.

Conflict of interest

The authors have not declared any conflict of interest.

ACKNOWLEDGEMENT

The funding for this research was provided by the Society for Agricultural Education Research Development Abroad (SAEDA) and the Department of Agricultural Economics, Tokyo University of Agriculture. The authors acknowledge the academic staff of Department of Agricultural Economics, Tokyo University of Agriculture for the useful comments. Particular thanks to Professor Nagatada Takayanagi for the advice and proofreading.

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