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RICE VALUE CHAIN ANALYSIS IN TANZANIA: IDENTIFICATION OF CONSTRAINTS, OPPORTUNITIES AND UPGRADING STRATEGIES

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ABSTRACT

The importance of rice (*Oryza sativa* L.) as a food and cash crop in Eastern Africa, is increasing, but its value chain is becoming complex. In 2012/13, rice value chain analysis was conducted in rice farming systems of Lake, Eastern and Southern-Highlands zones of Tanzania. A sample of 240 producers, 60 traders and 30 processors was involved in the study. The aim of this study was to enhance rice actors with knowledge of the rice value chain, and identify feasible upgrading strategies. The study results revealed that rice was staple crop for more than 50% of the communities in Kilombero, Kyela and Mvomero districts; and less than 30% in Rorya, Mbarali and Maswa districts. It was also an important cash crop (79 - 100%) in all districts. About 44 and 61% of the total crop area cultivated per household, in lowland rainfed and irrigated ecosystems, respectively were under rice cultivation. SARO 5 was the only improved variety widely grown by 27% of farmers out of 32 varieties. Rice yield ranged from 1.5 to 4.3 t ha⁻¹ and varied greatly by ecosystem and variety. About 61-93% of farmers sold their rice paddy to collectors, used non-standard measurements. Farmers profits ranged from US \$ 206.63 to 994.85 per hectare. Producer's share of selling rice ranged from 34 to 40%. This implies that upgrading strategies are required that can increase producers' market share and improve competitiveness of rice value chain.

Key Words: Lowland rainfed, *Oryza sativa*

RÉSUMÉ

L'importance du riz (*Oryza sativa* L.) comme produit de consommation et de échanges commerciaux en Afrique de l'Est va grandissant, mais la chaîne de valeur du riz de plus en plus complexe. En 2012/13 l'analyse de la chaîne de valeur du riz a été conduite dans les systèmes de culture de riz dans la zone lacustre de l'Est et Sud de la Tanzanie. L'étude s'est servie d'un échantillon de 240 producteurs, 60 commerçants et 30 transformateurs de riz. L'objectif de l'étude était de doter les acteurs du riz de connaissances et informations sur la chaîne de valeur et identifier des stratégies possibles de modernisation. L'étude a révélé que le riz est un produit vivrier de grande consommation pour plus de 50% des populations des districts de Kilombero, Kyela et Mvomero et moins de 30% dans les districts de Rorya, Mbarali et Maswa. Le riz est aussi une culture de rente (79 - 100%) dans tous les districts de la zone d'étude. Environ 44 et 61% de la superficie totale dédiée à l'agriculture par chaque ménage est plantée en riz. Sur 32 variétés, SARO 5 était la seule variété améliorée largement cultivée par 27% des paysans. Le rendement en grain du riz variait de 1,5 t ha⁻¹ à 4,3 t ha⁻¹ ceci en fonction de l'écosystème et de la variété. Environ 61 - 93% des producteurs vendent leur riz paddy à des collectionneurs qui utilisent des outils de mesure non conventionnels. Les bénéfices des paysans varient de 206,63 \$ à 994,85 \$ par hectare. La part des

producteurs varient de 34 à 40%. Ceci indique que des stratégies de modernisation sont nécessaires et pourraient accroître le revenu des producteurs mais aussi améliorer la compétitivité de la filière.

Mots Cles: Plaine pluviale, *Oryza sativa*

INTRODUCTION

Of the four countries that participated in the Eastern Africa Agricultural Research Project (EAAPP), Tanzania is the Regional Rice Centre of Excellence with an estimated rice production of about 1.2 - 1.4 million tonnes per year of milled rice, of which 95% is under rainfed system. Other EAAPP countries are Kenya with rice production of 33,000 - 50,000 metric tonnes per year, of which 95% is under irrigation system; Uganda 165,000 and 334,000 metric tonnes, of which 71% is upland rice; and Ethiopia with 498,332 tonnes in 2009 estimated to reach 1.8 million tons in 2014 and 4 million tonnes in 2019. In Ethiopia, rice area increased by 156,000 ha in 2009 to 464,000 in 2014; and was estimated to reach 774,000 ha in 2019, from 20 million ha under rainfed system and only 3.7 million ha under irrigation (EG, 2009; Emong'or *et al.*, 2009; MAFC, 2009; UG, 2009). This rice value chain analysis was an entry point for rice value chain upgrading.

About 90% of the rice production in Tanzania is by smallholder subsistence farmers and production concentrated in Mbeya, Morogoro, Iringa, Mwanza, Shinyanga, Simiyu and Pwani Regions (ACT and TAP, 2010; EAAPP, 2011). Robust strategies in the value chain are needed to change the subsistence farmers into smallholder commercial farmers. The rice value chain is highly fragmented with millers and brokers playing a central role in the trading process, supply channels are generally long, whereby the produce changes many hands before reaching the final consumer (ACT and TAP, 2010). Although in the past there were attempts to eradicate the problem of poor market access by rice farmers, they mainly addressed the production segment of rice value chain (Meertens *et al.*, 1999; 2003; Ngailo *et al.*, 2007). Previous rice value chain analyses reported that actors had limited market access for both national and regional markets (Mafuru, 2007; MAFC, 2009; ACT and TAP, 2010). Most of rice actors had

limited information of key value chain segments that constrained the facilitation and establishment of upgrading strategies or interventions along the chain. Thus, little is known about the economics of production and marketing along the value chain. Information on prices, marketing margins, extent of competition, production costs is insufficient, making value chain upgrading recommendations challenging.

The objective of this study was to enhance knowledge and information of the rice value chain in Tanzania, with a view of proposing means by which fair returns to chain actors and the value added throughout the chain can be improved.

METHODOLOGY

The study was conducted in six sites located in Lake, Eastern and Southern highlands zones. In each zone, two districts were selected, one with irrigated ecosystem and the other with rainfed ecosystem. In the Lake zone, the two sites were Irienyi Irrigated ecosystem in Rorya district and Shishiyu, a rainfed ecosystem in Maswa district. The study areas in Eastern Zone were Komtonga rainfed ecosystem in Mvomero district and Mkula irrigated ecosystem in Kilombero district of Morogoro region; while in the Southern Highlands zone, the sites were Utulo irrigated ecosystem in Mbarali district and Mpunguti rainfed ecosystem in Kyela district.

Different survey instruments were administered for each key actor. Using the formal questionnaire, a total of 240 rice producers were interviewed. Information from traders, processors and other actors was collected using both key informants and focused group discussions.

The study adopted value chain principles to assess the rice value chain as way of gaining insights in potential productivity, competitiveness gains and improvements in supply chain efficiency. The study approach emphasized the five topics of relevance to value chain analysis, including trust and cooperation, governance,

market power, innovation and knowledge, and focus/intervention points (UNCTAD 2000; Kaplinsky *et al*, 2001; Sturgeon, 2001; Sharon 2006; Herr, 2007; GTZ, 2008; Webber and Labaste, 2010). Gross margins, net profits and returns to land and labour, received by actors were computed to measure the efficiency of existing rice marketing at each value chain segment.

Both qualitative and quantitative methods were employed and additional information from secondary sources and value chain actors' was collected through interviews. Value chain actors interviewed include input suppliers, rice producers, collectors, traders, processors, transporters, exporters, importers and consumers. Others interviewed included service providers and policymakers from local and central government authorities.

Data analysis was done using the Statistical Package for Social Sciences (SPSS) software. Descriptive analysis included cross tabulations of various variables, means, gross margins, marketing margins and proportions. Where applicable, a student's-test at 0.05 level of significance was performed to examine differences between variables.

RESULTS AND DISCUSSION

Mapping of rice value chain. The study identified key rice value chain actors at micro-, meso- and macro-levels (Fig. 1). At micro level the key actors were input suppliers (mainly of fertilisers, herbicides, seeds and implements), producers (small, medium and large farmers), collectors, processors, distributors (transporters, traders and wholesalers), retailers and consumers. These were key operators undertaking the marketing functions in a sequential manner (Fig. 2). Apart from the key actors, the rice value chain was insufficiently supported by farmer groups and associations, lending institutions, research and extension services, and other service providers at the *meso-level*. Nevertheless, they were key in supporting, facilitating, advising, promoting, training, technology development and financial services. Most of actors at micro- and meso-levels were operating in isolation and scattered, with minimal linkage mechanisms

between them, have limited business skills and low capital (Fig. 2).

At macro-level, the rice value chain was supported by local government authorities, central government and providers of utilities such as electricity, roads, irrigation infrastructures and storages facilities. The rice value chain was supposed to benefit from these institutions by getting the framework conditions for macroeconomic policy (such as subsidy and rice national development strategy), economic infrastructure (markets and communication), and administration including business establishment and enforcement. However, more supports were still needed to attain a strong and robust competitive rice value chain.

Rice producers. In Tanzania, there was an increasing number of smallholder rice farming households and by 2012, it was estimated at about 1.2-1.8 million, which was equivalent to 18% of farming households in the country. The number of large rice farmers was still small and increasing at a low pace. Rice smallholder farmers were scattered and had small rice farms of about 0.5 ha per household. They did variety choice based on their own preferences and less on attributes considered by traders and final consumers. Usually, they were constrained by limited market information and access to finance institutions.

Rice as staple and cash crop. Importance of rice crop varied across zones and ecosystems in the country. Rice was recorded as an important staple crop by 52 to 97% in Kilombero, Kyela and Mvomero districts; while it was less important staple crop by 3 to 29% in Rorya, Mbarali and Maswa districts (Fig. 3). However, the trend indicates that rice was increasingly becoming a staple food in both rural and urban areas.

Rice was regarded as an important cash crop by 79 to 100% of respondents in all project sites. About 70% of farmers' rice harvest was for sales. The difference across sites was due to differences in number of years in rice cultivation and type of staple crops in the respective community. Kyela, Kilombero and Mvomero districts were among of the old areas growing rice in the country since

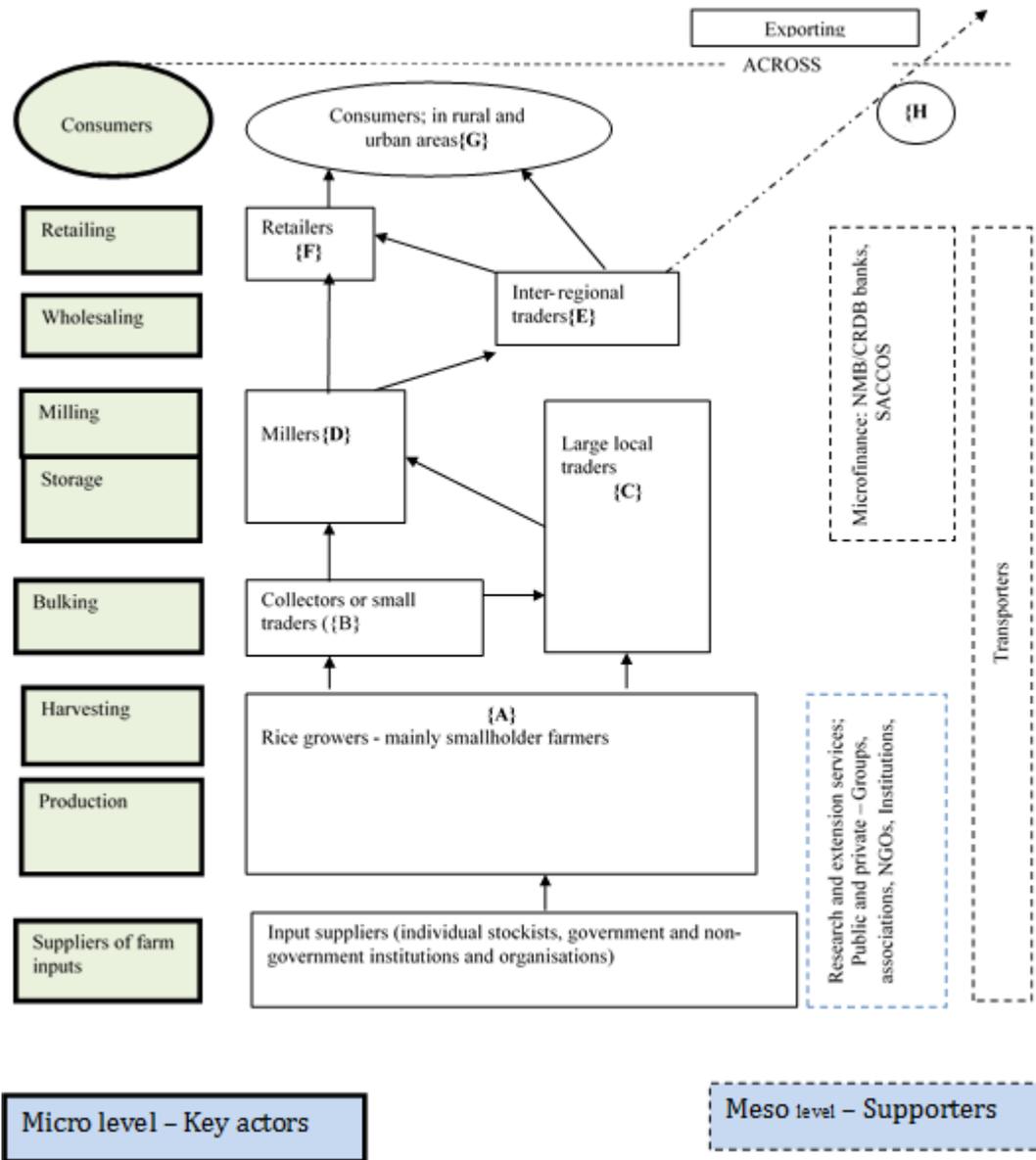


Figure 1. Typical mapping of rice sub-sector; functions and participants in Tanzania.

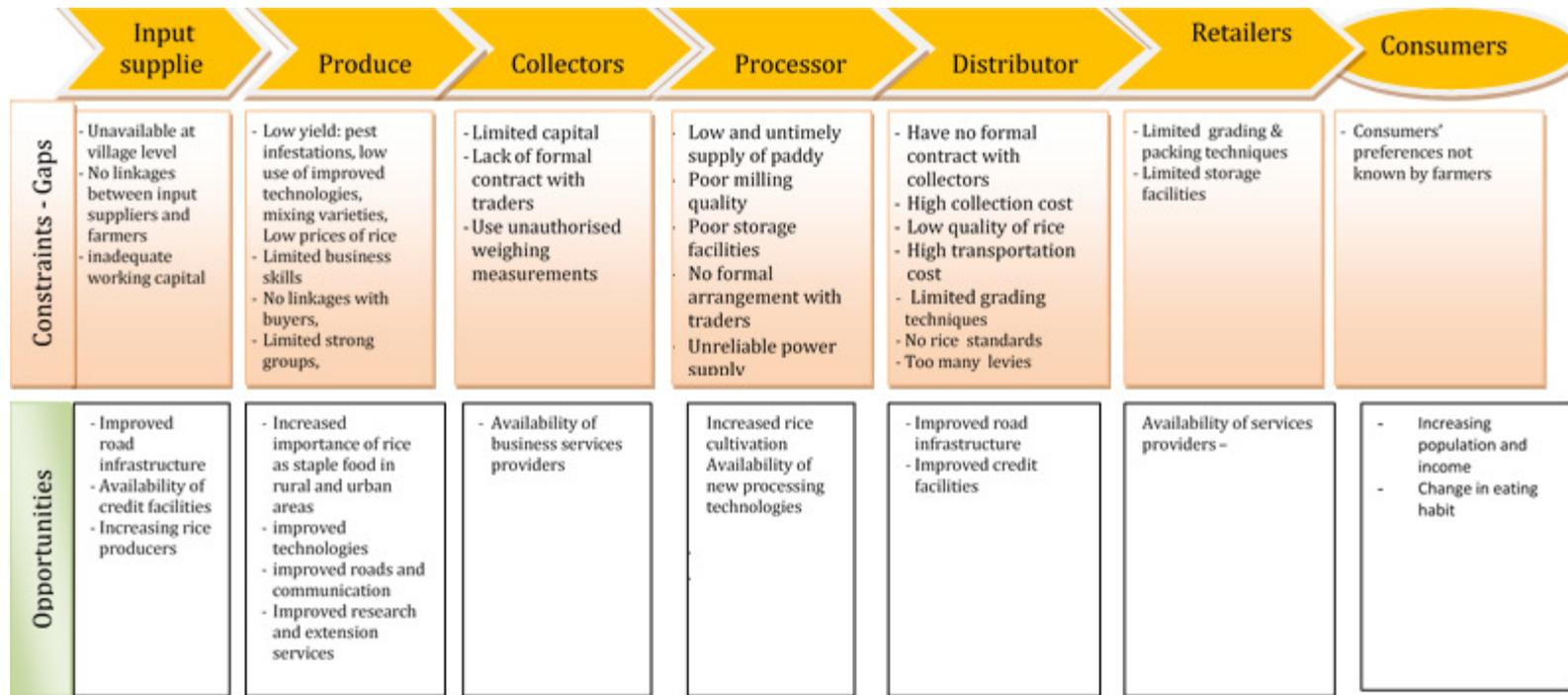


Figure 2. Constraints and opportunities of rice value chain actors in Tanzania.

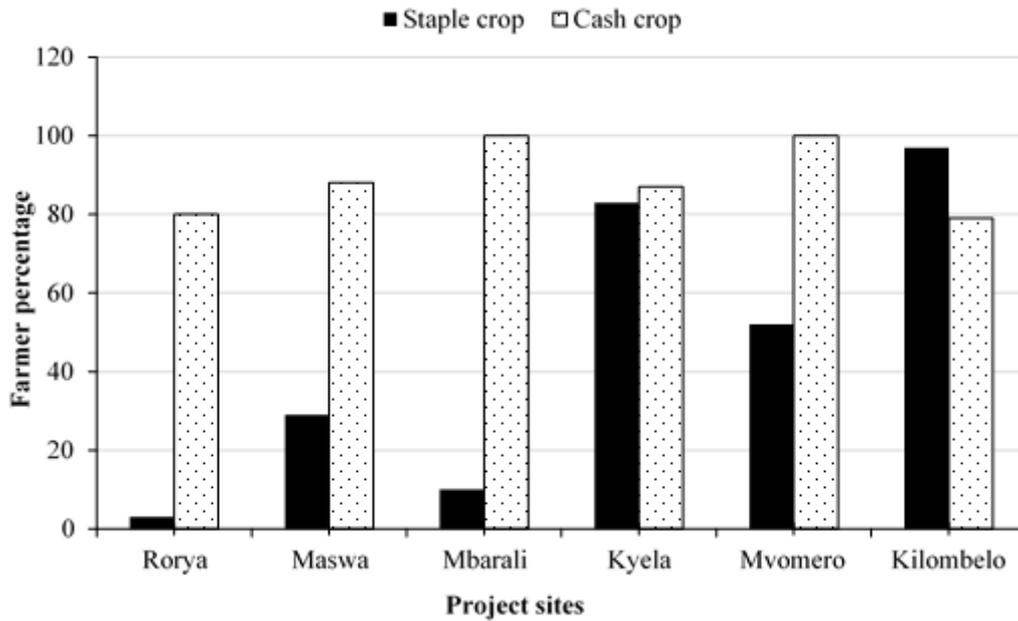


Figure 3. Importance of rice as staple and cash crop in Lake, Eastern and Southern Highlands zones of Tanzania.

1960s. While Rorya, Maswa and Mbarali districts started late in 1980s and 1990s to grow rice.

Farm size. On average, farm size owned per household was significantly different ($P < 0.05$) between zones and ecosystems. Farmers in rainfed rice ecosystems of Maswa, Kyela and Mvomero had 3.5, 1.8 and 1.5 ha, respectively; while in the rice irrigated ecosystems of Rorya, Mbarali and Kilombelo had 2.0, 2.4 and 1.7 ha, respectively. About 44 and 61% of the crop area cultivated in lowland rainfed and irrigated ecosystems, respectively, were under rice cultivation. It was expected that farm size (including rice farm) per household would continue declining until the diminishing limit would be reached. This proposition is supported by the fact that, despite increase in rice acreage in the country since 1970s (Fig. 4), rice area cultivated per household remained static or even declining (FAO, 2012). Expansion of rice acreage was achieved through new entrants in rice cultivation mainly in new areas.

Mechanisation of farm operations. Low level of mechanisation highly constrained timely farm operations in all rice ecosystems. In the Lake Zone,

the method of ploughing was 88.5% by ox-plough, 8.5% by hand hoe and only 3% by tractor. In the Southern Highlands Zone, ploughing was 73.8% by ox-plough and 8.8% by hand hoe. In the Eastern zone, the use of ox-plough in ploughing operation was minimal and use of hand hoe was relatively high at 69%, followed by use of tractor (23.8%) and by power tillers (7.1%). In Tanzania, about 64% of crop area was cultivated by hand hoe, 24% by ox-plough and 12% by tractor (MAFC, 2013).

In the Lake zone, weeding was entirely by hand hoe, while in the Southern Highlands, 55% used hand hoes, followed by a combination of hand hoe and herbicide (35%), Herbicides (6.2%), Push-weeder and herbicides (3.8%). In Eastern zone, weeding was 85.7% by hand hoe, 11.9% by herbicides and 2.4% by push-weeder. In the Lake zone, the use of power tillers, ox-cultivator, push-weeder and herbicides were not recorded, being neither owned nor used by farmers in the two sites. This implies that in the Lake zone, there is low mechanisation in planting and weeding operations compared to the other two zones. In all zones, the harvesting operation was done entirely by hand using sickles/slathers, knives and beating by poles.

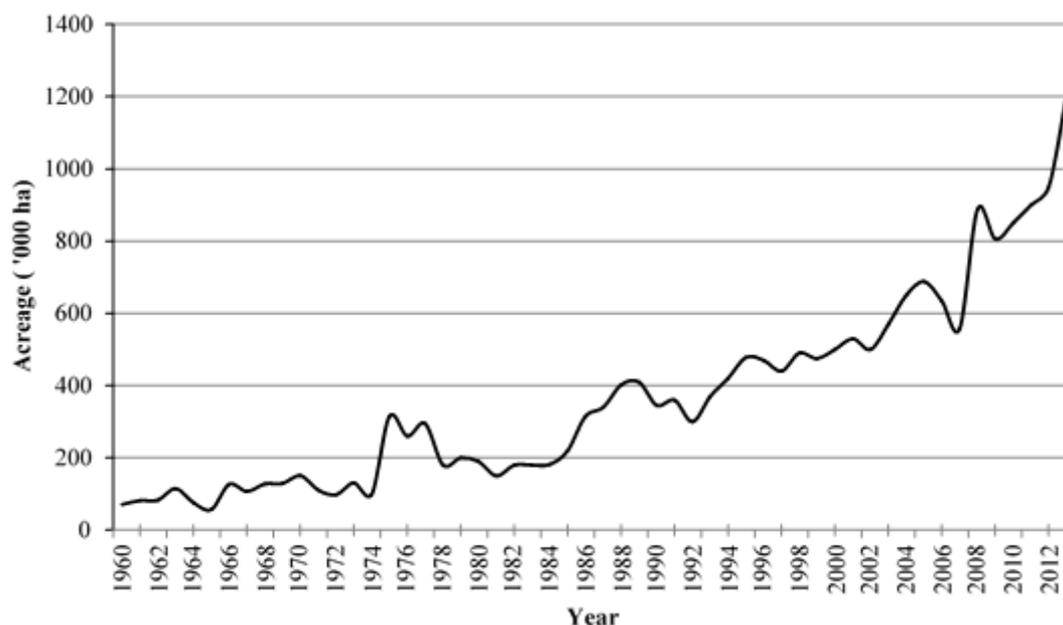


Figure 4. Trend of rice acreage from 1960 to 2011 in Tanzania. Source: FAO 2012.

Rice varieties grown by farmers. Nine rice varieties were planted by farmers in the Lake zone, ten in the Southern Highlands zone, and thirteen varieties in the Eastern zones. The rice varieties mostly cultivated by farmers in the Lake zone were SARO 5, Bulungwa, Sukari, Supa and Kalamata. Other varieties were Lubunatela, Lugata, Furaha and Sokotu. SARO 5 was the only improved variety planted by 27% farmers of Irienyi irrigation system. Farmers at Shishiyu did not prefer this variety due to its short height in the field, in case of floods, farmers disinterest of its taste. Also, in the Southern Highlands, SARO 5 was the only improved variety grown by 28 and 25% of farmers in Mbarali and Kyela respectively. The local varieties included Kilombero, Morogoro, Zambia, Indiarangimkia, Fayadume, Mwasungu, Supa, Mwendambio and a mixture of several varieties. Kilombero, India rangimkia and Zambia were the first top local varieties grown by majority of households from that zone.

In the Eastern zone, about 89 and 76% of the farmers in Mvomelo and Kilombero, respectively, used SARO 5 variety. This shows that the Eastern zone had the highest adoption of improved

varieties compared to other zones. The local rice varieties grown by farmers in Eastern zone were Kaulimawangu, Super Mbeya, Super Zanzibar, Super Shinyanga, Mbawambili, Udongowa Songea, Msukuma, Zambia, Jaribu, Kula na Bwana, India, Kalimata and Sengo. The first three were the most grown local varieties.

Rice productivity. In all sites, paddy yield greatly varied by rice ecosystem and variety. In the irrigated rice ecosystem of Erienyi in Rorya district, the average rice yield was 2.3 t ha⁻¹; while in the rainfed ecosystem of Maswa; was 1.8 t ha⁻¹. In the irrigated ecosystem of Mbarali, rice yield was relatively high at 4.05 t ha⁻¹. In the rainfed ecosystem of Kyela, the yield was much less at 1.6 t ha⁻¹, which was the same as that of Maswa rainfed ecosystem.

Rice varieties had significantly different yields in different ecosystems as estimated by farmers. For instance, India rangimbili had 3.8 t ha⁻¹, Faya 3.7 t ha⁻¹, Zambia 3.2 t ha⁻¹ and SARO 5 had 3.0 t ha⁻¹ under irrigated rice ecosystem of Mbarali; while under rainfed ecosystem, the average production of India rangimbili was 0.7 t ha⁻¹, Zambia 0.9 t ha⁻¹ and SARO 0.6 t ha⁻¹. Kilombero

and morogoro varieties, which were common grown under the rainfed ecosystem had average yield of 1.2 and 0.6 t ha⁻¹, respectively. In the Eastern zone, the irrigated ecosystem had a rice yield of 4.3 t ha⁻¹ and the rainfed ecosystem had 2.5 t ha⁻¹. Generally, results revealed that, rice yields of the irrigated ecosystem were two times or more than yields received under rainfed ecosystem.

Selling of rice. Most of the farmers sold unprocessed rice, i.e., paddy. In the Lake zone, for instance, about 61 and 47% of rice harvested in irrigated and rainfed systems, respectively was sold by farmers as rice paddy immediately after harvest. The same situation was observed in the Southern Highlands zone, whereby 60.4 and 38.5% of rice harvested by farmers in irrigated and rainfed ecosystems, respectively was sold immediately after harvest. Selling of paddy rice was higher in irrigated systems than in rainfed systems. In rare cases, selling of paddy rice could take place in fields (1 - 7%). The main market places for selling rice were at farmgate (home), village open market and urban markets (Fig. 5).

Most of the farmers in the Lake Zone (61%) and Eastern Zone (93%) sold their rice paddy at farmgate. Only small proportion sold their

produce in open village-markets. Rice smallholder farmers had limited linkages with urban markets due to limited marketing information, lack of transportation facilities and weak farmers' associations or organisations. Only 1% of farmers in the Eastern zone, and 11% in the Southern Highlands zone sold rice to urban markets. This made farmers sell rice in isolation; thereby lacking collective bargaining power. The main rice buyers at farmgate level were collectors (70 - 76%), who were often based within the community, traders (7- 14%) within or outside the community, and retailers (7.0%), processors who are also owners of rice milling machines (6%), and consumers (2 - 4%).

Source and means of acquisition of farm inputs.

The important farm inputs for rice cultivation included seeds, fertilisers, herbicides, insecticides and fungicides. In the six sites, there were no formal distribution channels for these farm inputs and, hence, not available at village level. Generally, farmers recycled seeds for several years. For instance, in the Lake zone, 4% of all farmers interviewed used recycled seeds of varieties acquired about 15 years previously; and 35% were using seeds that acquired about five years previously. About 78% of rice farmers used

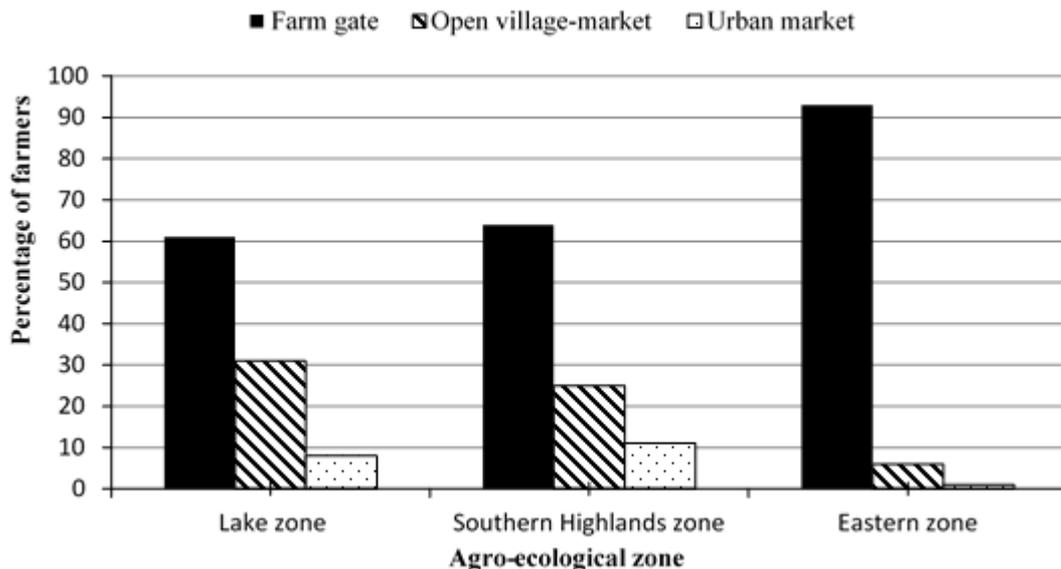


Figure 5. Farmers rice selling market places in Tanzania.

their own seeds from previous harvests. A similar situation was reported by farmers in Eastern zone, where about 10% of farmers used local seeds acquired about 15 years previously. In the Southern zone, about 42% of farmers obtained their seeds from neighbours, 32% their own seeds, 11% from seed multipliers who produce Quality Declared Seeds, 10% from SACCOS and 5% from the research institute (ARI Uyole). Sources of fertilisers, herbicides and insecticides were 76% from stockist, and 34% from local markets. In all sites, farmers claimed low quality of inputs supplied by stockists, and those obtained through local markets.

Farmers from the Lake Zone acquired seeds by buying (41%), got free (27%) and exchange of seeds (31%). The same trend was observed in the Southern zone, farmers obtained rice seed from neighbours (42%), own seeds (32%) and other sources (26%). Means of seed acquisition in all zones were through buying (34-60%), given free (8-25%), exchange seeds (10-18%) and own seeds (5-40%).

Fertilisers, herbicides and insecticides.

Unavailability of seeds, fertilisers, herbicides and insecticides at village level was the major constraint mentioned by farmers that, though this varied by zones. The use of fertilisers and herbicides in rice cultivation was relatively high in the Eastern zone. About 50 and 38% of farmers use fertilisers and herbicides, respectively. The use of herbicides and insecticides by farmers in the Lake zone was uncommon. Only two farmers were recorded to use herbicides for weeds control at Shishiyu. Farmers from the irrigated scheme of Erienyi applied urea fertiliser that was obtained at village level under input voucher system, or sometimes they got from extension agent, primary society or town markets of Tarime and Musoma. They used on average 36.2 kg of urea per household, with a 1 to 100 kg range. None of the farmers from the rainfed system applied chemical fertilisers for rice cultivation. Other constraints mentioned by farmers were high prices and low quality of seeds and other farm inputs.

Group membership. A number of rice farmers were not members of marketing groups,

cooperative societies, SACCOS or VICOBA. However, results show that 69, 61 and 41% of farmers were group members in the Southern Highlands, Lake and Eastern zones, respectively. In the Southern zone, the groups included SACCOS (38.2%), producer group (21.8%) and VICOBA (12.7%). In the Lake zone the groups included producer groups (45.1%), marketing groups (5.6%), Cooperative society (1.4%), SACCOS (2.8%) and VICOBA (5.6%); while in the Eastern zone, groups were producer group (59.4%), Cooperative societies (6.2%), SACCOS (6.2%), VICOBA (21.9%) and FINCA (6.2%). Participation of farmers in cooperative societies was low in all zones, mainly due to discouraging past records of cooperatives.

Extension services. Extension service was inadequate to farmers in all zones. In the Lake zone, about 80 and 14.6% of farmers interviewed from Irienyi irrigation scheme and Shishiyu rainfed ecosystems, received no extension services. In the Southern Highlands and Eastern zones, 51.2 and 62.7% of rice farmers interviewed reported to obtain advice on rice agronomic practices, of which 22.8% was irregular contact with extension agents, 22.5% once per year and 6% contact monthly, suggesting that extension services were irregular. Respondent sources of extension services were 45.7% research institutes, 42.9% local government extension staff and 11.4% NGOs and fellow farmers. However, extension services were relatively higher to farmers under irrigated systems than the under rainfed system.

Rice storage. A World Bank- FAO study revealed that 8 - 26% of rice was lost in developing nations due to post-harvest problems and poor infrastructure (FAO, 2012). This study indicated that 94 - 96% of farmers stored rice paddy in bags, 3% use vihenge and 3% own godown.

Mixing of varieties in storage of rice was highest in the Lake region, and lowest in the Eastern zone (Fig. 6), indicating that farmers were yet to realise the importance of maintaining quality by storing each variety separately. Grading before selling was done by 5, 20 and 30% of farmers in the Lake, Southern highlands

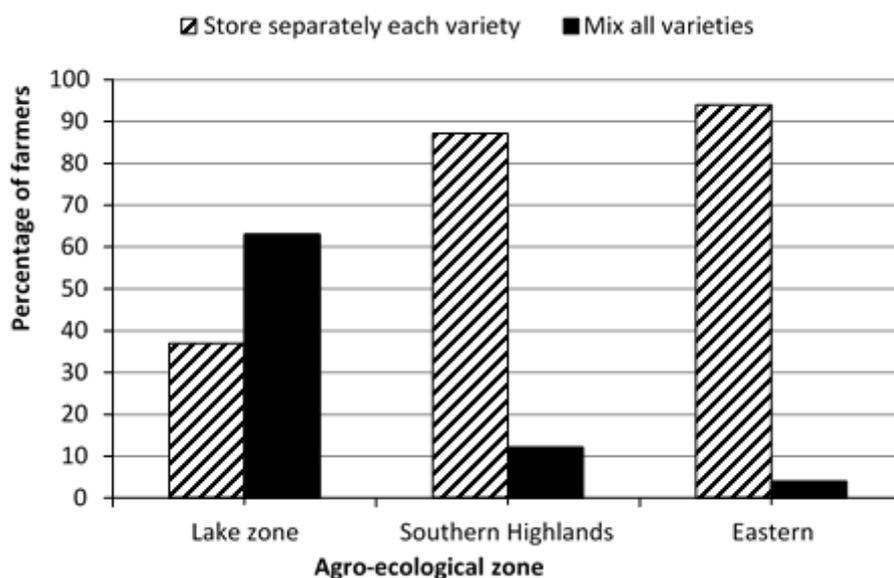


Figure 6. Means of storing rice; separate or mix varieties.

and Eastern zones, respectively. Access to marketing information ranged from 40 -54% of farmers.

In general, challenges faced by farmers in paddy production included:

- (i) small rice farms of about 0.5 ha and low rice yield (rainfed: 0.7 - 1.75 t ha⁻¹ and irrigated: 2.5 - 4.25 t ha⁻¹) due to low use of improved technologies, declining soil fertility, increasing pressure of pests and diseases (rice yellow mottle virus, stalk-borer), birds and climate change. Other causes were unavailability and high prices of inputs, and low level of mechanisation of farm operations (use of push-weeder was less than 5%) leading to high production costs and untimely weeding operation;
- (ii) limited access to micro-finance institutions for saving and credit services;
- (iii) limited market information leading to low market prices. In all sites, there was no mechanism for disseminating market information to farmers;

(iv) low use of appropriate pre and post harvest technologies, increasing rice loss from field through storage to processing;

(v) inadequate access to extension services (5-20%); and

(vi) farmers have no strong marketing groups, associations or cooperatives.

Rice traders. Three types of traders were identified; small traders (collectors), large traders including wholesalers and retailers. Collectors and traders were mainly dominated by men, but participation of women as rice retailers was observed in all sites. In the Lake zone, women participation was low 5% but high (70%) in Southern-Highlands.

Rice collectors were mainly based in their respective zone; 27 and 73% within and outside ward, respectively, in Lake zone; and 6.7 and 93.3% within and outside ward, respectively, in Southern zone. Collectors play the marketing function of bulking the produce at centres easily reached by traders. They preferred to buy paddy rice (83%) at farmgate, using their own

measurements such as tins and bags; while traders (60%) and retailers (75%) prefer to buy milled rice. Usually, collectors and traders had informal arrangement and were available at all times where more than 20 per village was common. Sometimes they gave loans to farmers and paid back in form of paddy rice at harvesting time. Challenges facing collectors were:

- (i) lack of storage facilities; all collectors use bags to store rice and had no storage godown;
- (ii) limited access to loans from institutions due to lack of collaterals;
- (iii) lack of contractual agreement with traders; and
- (iv) unfaithful farmers.

Large traders interviewed indicated buying paddy rice or milled rice in more than one production area or zone. They bought directly from producers or through collectors (75%), from collectors (18.8%) and from village open markets (6.2%). Usually, they hired transport to far markets and only 15% used own transport.

Factors considered by traders when buying rice included price, proximity to transportation service and quality of rice. Quality attributes were colour, size, aroma, origin, shape, proportion of impurities or broken grain, age and variety. Rice or paddy was bought through collectors. Large traders had more market information compared to producers and collectors. They stored before selling, using own or hired storage facilities, mill and transport to far markets. Constraints cited were low working capital, limited storage facilities, unreliable supply, price fluctuations and many market levies. They were also constrained by high transport costs to supply to demand areas.

Rice retailers were widely available both in rural and urban areas, but not organised in business sense. Their selling points were town markets and village centres. They operated on individual basis like farmers. In rural areas, retailers bought paddy or rice from farmers and sometimes from collectors. In urban areas, the

main supply of rice to retailers was from traders. Rice retailers' constraints were:

- (i) limited by capital and storage facilities;
- (ii) lack of market information on the supply side;
- (iii) frequent fluctuation in supply of rice from large traders of local and imported rice; and
- (iv) no formal associations or groups were registered.

Processors. Large traders stored paddy rice in godowns belonging to the owners of the milling machines and process when they had contacted traders in Dar es Salaam or Tanga, Mwanza, Mbeya and other towns. The owners of milling machines allowed collectors and traders to store their paddy for a few months, with an agreement that they would use milling machine. Godowns of millers visited had storage capacities of 100 to 300 tonnes at a time. The cost of milling paddy rice ranged from TSh 50 - 70 per kg of milled rice (equivalent to TS 35 - 49 per kg of rice paddy). There were few processing machines in all zones (2 to 3 milling machines per ward or located in one site due to limitation of electricity power supply). Available milling machines had 12 tonnes per day processing capacity. They were normally underutilised due to supply shortage of paddy rice. On average, a single rice miller processed only 225 tonnes of paddy rice per year.

Rice grading. Rice was graded as first grade (whole grain measuring 0.35 mm), second grade (half cut grains 0.28 mm) and third grade (several cuts measuring 0.24 mm). The by-products were the rice husks used as fuel for burning bricks and by breweries. Rice polish was also a by-product used as livestock feed.

Challenges faced by processors were:

- (i) irregular and unreliable supply of paddy rice due to fluctuation in production;
- (ii) unreliable markets where due to limited buyers, paddy is sold;

- (iii) product price fluctuations. Even with good quality and graded rice traders are not ready to purchase at high price; being stored, to the final consumer in the same markets, farmers' market share was computed as:
- $$\text{TGMM} = \frac{1700 - 900}{1700} \times 100 = 47.0\%$$
- (iv) high cost of equipments installation. Machines are old and efficiency low; Then, farmers' participation or farmers' market share was given by: $100 - 47 = 53\%$.
- (v) small working capital caused by inaccessibility to bank loans due to lack of collateral; Similarly, rice bought in Shishiyu or Irienyi and sold to the final consumer in urban markets of Mwanza was computed as:
- (vi) high taxes charged by local government; $\text{TGMM} = \frac{2000 - 750}{1700} \times 100 = 63\%$
- (vii) inadequate training on processing techniques; and Then, farmers' participation was given by: $100 - 66 = 37\%$
- (viii) unskilled labour in machine operation.

Returns to labour. Table 1 indicates that rice cultivation was profitable under both irrigation and rain-fed systems. Farmers could improve their profits by increasing rice yields and selling at competitive prices. Profits obtained under irrigation system were more than threefold that obtained under rainfed conditions.

Marketing margins by actors. A marketing margin measures the share of the final selling price that is captured by a particular actor in the value chain. The marketing margin was calculated by finding the price variations at different segments, and then comparing them with the final price to consumers (Table 2). The final consumer price was considered as the base or common denominator for all marketing margins computed. Thus, the total gross marketing margin (TGMM) was consumer price less farmer's price, divided by consumer price and expressed as percentage:

$$\text{TGMM} = \frac{\text{Consumer price} - \text{farmer's price}}{\text{Consumer price}} \times 100$$

Producer participation or producers gross marketing margin (GMM producer) was the portion of the price paid by the end consumer that belonged to the farmer as a producer (Mendoza, 1995). Therefore, producer's market share was given by: $100 - \text{TGMM}$. For example, rice bought in Shishiyu or Irienyi and sold after

If the rice producer in Maswa and Rorya sold their rice at TSh 750 per kg as an average price and consumer price was TSh 2000 per kg in Mwanza markets, then the producer's market share was 37% (Table 2.). Also, the producer's share or participation was 34% if rice sold to consumers in Dar es Salaam Markets. This implies that based on the local rice markets available in Maswa and Irienyi, rice producers got market share, which was less than the recommended farmers' market share of 60-70%. Thus, a large market share was absorbed by middlemen along the market value chain. Therefore, there is need to improve farmers' share to reach at least 60%. Likewise, farmer profits can also be improved by increasing rice productivity and reducing farm operation costs.

CONCLUSION AND RECOMMENDATIONS

Rice crop is considered by farmers as cash crop than staple crop. Rice production was profitable despite of low yields achieved by farmers. However, farmers' market share was less than 40% against the recommended market share of 60 - 70% of the consumer prices. Rice farmers can effectively participate in value chain in core marketing activities through vertical integration; and involvement of farmers in chain management

TABLE 1. Gross margins, net profits and returns to labour obtained by rice farmers in Tanzania

Criteria	Irrigated system			Rainfed system		
	Eastern zone (Kilombero)	Southern highlands (Mbarali)	Lake zone (Rorya)	Eastern zone (Mvomero)	Southern highlands (Kyela)	Lake zone (Maswa)
Yield (kg ha ⁻¹ of paddy)	4,000	4,000	2,300	2,500	2,241	1,800
Price kg ⁻¹ of paddy (TSh.) June - August 2013	800	760	1000	800	760	930
TR ha ⁻¹ (TSh.)	3,200,000	3,040,000	2,300,000	2,000,000	1,703,160	1,674
Mandays ha⁻¹ incurred in various farm operations (ploughing, planting, weeding, harvesting, transportation and selling)						
Mandays ha ⁻¹	185	118	223	190	191	200
Cost ha⁻¹ incurred in different farm operations (ploughing, planting, weeding, harvesting, transportation and selling)						
TC ha ⁻¹	1,616,000	1,802,000	929,000	1,216,000	1,374,374	736,600
Profit ha ⁻¹	1,584,000	1,138,000	1,371,000	784,000	328,786	937,400
Return to land labour	8,562	6,151	6,150	4,126	1,777	4,690

Assumption made is that farmers sell paddy just after harvesting and local buying units converted to price per kg of paddy rice; and yield per hectare

TABLE 2. Gross marketing margins by value chain actor in Tanzania

Marketing chain participant	Market share			
	Maswa and Rorya	Maswa and Rorya (after stored)	Mwanza	Dar es Salaam
TGMM for complete channel (%)	50.0	65.0	63.0	66.0
GMM for collector (%)	10.0	5.9	7.5	36.4
GMM for trader (%)	40.0	11.8	30.0	27.3
GMM for retailer (%)	26.7	41.2	25.0	22.7
Consumer (only buyer) (US \$)	1500	1700	2000	2200
GMM for producer participation (%)	50.0	35.0	37.0	34.0

activities or horizontal integration. Therefore, the following are suggested for up-grading of the value chain and increase farmers' competitiveness:

- (i) Increase productivity (Process upgrading) - Farmers in all sites need training on producing rice in more efficiently using Good Agricultural Practices (GAP). These include use of improved technologies such as improved varieties and fertilisers; water management practices; control of pests' attacks and save costs through integrated pest management and improved storage facilities.
- (ii) Functional upgrading or vertical integration - At present, farmers are just mere producer of rice paddy. They have minimal involvement in other marketing activities such as bulking and grading. Therefore, it is recommended that farmers be involved in collecting, bulking and grade before selling to traders and other middlemen. Farmers should be informed on the importance of linkages with other actors though value additional activities including bulking, storing, processing, grading and packaging.
- (iii) Strengthening of producer groups or associations- In order farmers to be fully and effective involved in chain management activities, the pre-condition is that they have to be organised in strong groups or cooperatives to acquire strong bargaining power in marketing decision making.

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