The Impact of Rice Commercialisation on Livelihoods in Kilombero Valley, Tanzania: Anybody Left Behind?

Mosha, D.B.[1]* and G. Boniface[2]

[1]Institute of Continuing Education, Sokoine University of Agriculture, Morogoro, Tanzania
[2]Indepenent researcher, Morogoro, Tanzania

*Corresponding author e-mail: *devotha@sua.ac.tz or devotha.kilave@gmail.com*

Abstract

Rice commercialisation is important in Kilombero valley because it is associated with agricultural intensification and escalation leading to increased productivity and subsequent income and livelihood improvement. However, the level of household engagement in rice commercialisation is highly dynamic depending on various factors including resource endowment, social, economic, cultural, institutional, and gender issues. Moreover, the mechanism by which different gender social groups are impacted by rice commercialisation is scantly documented. This paper, therefore, examined the impact of rice commercialisation on the livelihood of different farmers with respect to gender social groups. The empirical exercise uses a panel data set of the Agricultural Policy Research in Africa (APRA) collected in 2017 and 2019. The survey involved 537 and 801 rice farming households in the first and second wave of data collection. A mixed-methods approach involving household interviews, focused group discussion and key informant interviews (KIIs) of data collection were used. Descriptive and inferential statistical analysis were employed as tangible ways of presenting the findings. Quantitative and qualitative data were collected using a structured questionnaire, and Focus Group Discussions (FGDs). Descriptive and inferential statistical analyses were employed in the presentation of the finding. Female, youth, and small-scale farmers are the gender social groups negatively impacted with rice commercialisation compared to others, attributed by inadequate access to land and to improve agricultural inputs; reflecting that the gender gap remains a challenge in Kilombero valley. There is a need to develop friendly policy strategies that will provide equitable access to production resources and that the Ministry of Agriculture in collaboration with local government authority need to develop a new strategy that will guarantee cumulative and sound rice commercialisation improvement.

Keywords: rice commercialization, gender, livelihood, marginalized, social gender group

Introduction

Rice is among the most popular cereal crops grown next only to maize and largely produced by small-scale farmers in Tanzania. It is a crop that is more commercialised than any other staple crop in the country. According to FAO (2015), 42 percent of rice produced is sold compared with 28% and 18% of maize and sorghum respectively. Information from Tanzania's Agricultural Sector shows on the average annual rice production in Tanzania is 2.2 million metric tons and half of these are marketed (United Republic of Tanzania (URT), 2020).

During the past two decades, the demand for rice has increased steadily playing a major role in strategic food planning policies and income security in many developing countries (Achandi and Mujawamariya, 2016). In Tanzania, the Government has identified rice as a priority crop and developed the National Rice Development Strategy (NRDS) since 2009 (URT, 2019). Backed by international donors (DFID, USAID, UNDP, and FAO), the Government has made efforts to address critical constraints through an increased supply of agricultural inputs, capacity building on the use of a system of rice intensification (SRI), and installation of rural electrification all aiming at transforming rice crop from subsistence to commercialisation (Ngailo *et al.*, 2016; URT, 2019).

Rice commercialisation is associated with

agricultural intensification and productivity improvements (Poulton, 2017; Djurfeldt *et al.,* 2018), and farm expansion (Isinika *et al.,* 2020), both leading to a rising marketed volume of farm produce. However, the level of production varies, based on the use of recommended agricultural inputs and technologies. For example, rice farming households who were trained on the system of rice intensification (SRI) harvested about 2.9 tonnes/acre of rice from 2.3 tonnes per ha. This is an increase of more than 8.7 percent compared to those who did not attend the training. Currently, records show that Tanzania attained rice self-sufficiency in the 2017/18 cropping season, and in the 2019/20 season, the country exports about 25% of local production (Isinika *et al.,* 2021).

Despite impressive achievements over the last decade, evidence on the impacts of rice commercialisation on the household livelihood of different gender social groups is still under debate (Barret *et al.,* 2017; Isinika *et al.,* 2020). This is frequently attributed, among other things, to the generalisation approach in research works, forgetting that diversity among farming households, in terms of resource endowment, social, economic, policy, and institutional related factors may have an implication on engagement on agricultural commercialization (Barret *et al.,* 2017). These factors may have positive or negative effects on the livelihood of the households. Similarly, gender issues and cultural constraints are not often taken into consideration in development aspects (Mosha *et al.,* 2021). Under such scenarios, it is likely that rice commercialization will impact diverse gender social groups differently.

The perception that the system of rice intensification helps to raise productivity and production, and subsequently improve food availability to farmers and actors along the rice value chains is supported by much of the literature (Barrett *et al.,* 2012; Ngailo *et al.,* 2016; Nokona *et al.,* 2018 Isinika *et al.,* 2020; 2021). There is also positively associated rice commercialisation with poverty reduction in African cases of Madagascar (Maertens *et al.,* 2012) Senegal (Maertens and Swinnen, 2009), and Kenya (Fischer and Qaim, 2012). However, none of these studies have taken the gender lens on assessing the impact of rice commercialisation on the diversity of gender social groups. This paper, therefore, discusses the impact of rice commercialisation on household livelihood focusing on who is left behind among different gender social groups in Mngeta division, Kilombero district, Tanzania. The findings from this study contribute to the existing empirical literature on who are most affected by rising agricultural commercialisation, and therefore demand for a policy that ensures inclusion of marginalised gender social groups in Tanzania as well as similar countries in Sub Saharan Africa (SSA).

Research Methods
Study Area

The study was conducted in Mngeta division in Kilombero valley, Morogoro region. The valley is positioned at the foot of the Great Escarpment of East Africa in the Southern half of Tanzania, about 300 km from the coast (Nindi *et al.,* 2014) and lies between longitudes 34.563 and 37.797 E and latitudes 7.654 and 10.023 S (Wilson *et al.,* 2017). The study area was selected because it is part of the Southern Agricultural Growth Corridor of Tanzania (SAGCOT), an area earmarked for future investments in agriculture. According to the 2012 national census, the floodplain is home to more than 673 000 thousand people (National Bureau of Statistics (NBS), 2013), and approximately two-thirds of the population rely exclusively on smallholder farming for subsistence. The remainder supplement farming activities by raising animals for sale or weaving cloth as well as fishing. The sampling population was restricted to ten villages within a radius of 30 kilometers from Kilombero Plantation Limited (KPL) farm because it was likely that commercialisation impacts would differ across villages depending on their distance from KPL. The KPL was a large-scale rice investor who interacted with small and medium-scale farmers in their vicinity, trained them, and facilitated easy access to credits and some agricultural inputs. The selected ten villages were from three wards: (i) Mchombe (Njage, Mkusi, Ijia, Nakaguru); (ii) Mngeta (Mngeta, Itongowa, and Luvilikila: (iii) Chita (Chita and Makutano).

Sampling Procedure and Sample Size

The study used simple random sampling techniques to select the number of farming households to be interviewed. The data set used is a panel collected in 2016/2017 and 2018/2019. The first round of data collection covered 537 rice-producing households selected randomly from 10 villages in the Mngeta division; the sample consisted of 463 small-scale farmers (SSF) (86.2%) and 74 medium-scale farmers (MSF) (13.8%). Sexwise, the sample had 471 (87.7%) male headed households (MHH) and 66 (12.3%) female headed households (FHH). The second wave involved a total of 807 households comprising 438 (54.3%) new and 369 (45.7) old households. The decrease in the number in the second wave was due to old respondents attributed to the fact that some households migrated from the village, some were on a long journey outside their villages, and others died. The two data sets were compared in order to measure the impacts of rice commercialisation on livelihoods among different gender social groups. Table 1 provides a sample composition of the respondents.

household questionnaire was used to collect quantitative data, which captured a number of variables on rice production, processing, marketing, and related outcomes. The tool collects information on household demographic data, crops cultivated, the area cultivated, input use, agronomic practices, crop yield harvested, amount consumed, sold, and stored. Specific questions were included on a checklist of questions, which were used to guide FGD and key informant interviews conducted in each village. For this paper, both quantitative and qualitative information were used.

Data Analysis

To quantify the possible impact of rice commercialisation on the livelihood of rice farming households, we analyzed data based on three categories, namely sex of the household head (men and women); farmer categories (small-scale, medium, and SRI farmers), and age (either youth or the elderly). Data were analysed using a combination of descriptive and inferential methods including descriptive statistics. Descriptive statistics (mean, median,

Table 1: Sample composition of the respondents

Household Characteristic		Households 2017 number	%	2019 Panel	New	Total	%
Sex HH head	Female	66	12.3	59	70	129	16
	Male	471	87.7	310	368	678	84
	Whole sample	537	100	369	438	807	100
Farmer category	SSF	357	66.5	232	390	622	77.1
	MSF	74	13.8	46	48	94	11.6
	SRI	106	19.7	91	0	91	11.3
	Whole sample	537	100	369	438	807	100
Age of HH head	Youth farmer	131	24.4	66	77	143	17.7
	Older farmer	406	75.6	303	361	664	82.3
	Whole sample	537	100	369	438	807	100
	Percent	100	-	45.7	54.3		100

Source: APRA household data, 2017 and 2019

Data Collection Methods

The APRA study was undertaken using various research methods and techniques, including questionnaire surveys, stakeholder consultations, key informant interviews, focus group discussions, and literature reviews. A

and t-test) were used to compare different gender social category groups in terms of land ownership, acreage of rice planted, use of improved farming technology, and inputs and rice yields. Logit model to assess the influence of RCI and on the multi-dimensional poverty

index (MPI).

Measuring rice commercialisation index, livelihood, and its indicators

Rice commercialisation index (RCI) computed as a percentage of rice that was marketed out of what was produced. This methodological approach has been recommended by other scholars including (Muriithi and Matz, 2015; Von Braun 1994 cited by Cazzuffi *et al.,* 2018; Isinika *et al.,* 2020). The index varies from zero where nothing was sold to one where all rice produced was sold. The index is divided into four categories: zero, low, medium, and high sales levels. The quintiles were then used as explanatory variables versus livelihood indicators for the different gender groups. The study hypothesised that engagement in rice commercialisatin will result in improved livelihood and that it will vary with the level of participation.

The most common approach in the literature to measure the level of livelihood uses income, assets, food security, (Alkire *et al.* 2015). The livelihood indicators include income, food security, and subjective wellbeing, or multidimensional poverty measured by the multidimensional poverty index (MPI) as proposed by various authors (E.g. Alkire *et al.* 2015; Poulton, 2017). The MPI has advantageous as it captures a wider range of variables including assets, health, education, and nutrition

that reflect the quality of life within a household. The MPI, therefore, represents the proportion by which a household is deprived, with higher scores representing more deprivation and hence more poverty.

Results and Discussion
Trend in landholdings and land size under rice production by different gender social groups

Table 2 shows a decline in the mean land holdings and land under rice production among various gender social groups in the two cropping seasons. Female household heads and SSF had a higher (16%) decline in landholding than any other categories of gender social groups. There is also a decline in the mean area under rice cultivation. The SSF and female farmers had a more significant decline (by 14.3% and 7.7 %, respectively) than any other groups. These findings are in line with results from Focus Group Discussions (FGDs) in Mngeta, Chita, Ijia, and Makutano villages, which indicates that most of MHH had a larger land area planted with rice than FHH. The participants also reported that cultivating larger areas is important as it reduces the cost of production, calmest in farm management, hence subsequently more outputs and returns.

Surprisingly, SRI farmers had no change in the mean area under rice production, and MSF is the only group that experienced a

Table 2: Extent of landholding and size of land under rice production by different gender social groups in the Kilombero Valley (n=517 in each category)

Farmer Category		Mean land owned			Mean land under rice		
		2017	2019	% change	2017	2019	% change
Sex of HH head	Female	1.9	1.6	-16	1.3	1.2	-7.7
	Male	3.9	3.8	-2.5	2.9	2.8	-3.45
Farmer category	SSF	1.9	1.6	-16	1.4	1.2	-14.29
	MSF	11.7	12.9	-10.2	9.0	9.8	+8.89
	SRI	3.5	3.3	-5.7	2.6	2.6	0
Age of HH head	Youth farmer	2.3	1.7	-26.1	1.6	1.3	-18.8
	Older farmer	4.1	3.4	-17.1	3.1	2.6	-16.1
	Sample mean	3.64	2.98	-2.3	2.7	2.2	-19.3
	Significance of difference	**		***			

Source: APRA household data, 2017 and 2019

positive change on both landholdings and rice cultivation areas (Table 2). This implies, women and SSF were the group excluded in rice production in the study area due to limited access to land resources, and consequently less production and livelihood improvement. These findings corroborate those of Mdoe (2020) who found that households with more land have the capacity to cultivate more of the crop and expand their production to ensure adequate supply to the market. Farmers owning small farms may not be able to raise the necessary surplus to sell at the market. Likewise, Fischer and Qaim (2012) show women's involvement in the commercialisation process is affected by no or limited land holding capacity, and access to good quality seed and farm implement as a result no surplus for market.

Trend in use of farm inputs by gender social groups normalize per hectare

Table 3 shows variations in the use of inorganic fertiliser and herbicide across gender social groups. The panel sample data shows significant differences in the use of inorganic fertiliser between MHH and FHH and among farmer's categories. The decline was higher for FHH (29.4 %) compared to MHH (4.2 %); similar to MSF (48.7 %) compared to SSF (2.9 %). This is contrary to youth farmers who recorded a significant improvement (33.6 %) in the use of organic fertiliser compared to older farmers who had a decline by (5.7 %). In the farmer's category, SRI members recorded a minor (1.1 %) improvement. The high rate of decline among FHH members is likely to reflect their poor access to or exclusion in agricultural inputs, while the inertia in the use of inorganic fertiliser by SRI members could be associated with the termination of credit support following the end of KPL. Opinion from key informants shows an increase in the use of inorganic fertiliser in Kilombero valley. This was narrated by one of the key informants, he said :

Table 3: Changes in input use by gender social groups (normalized per hectare)

Farmer category		Whole sample			Panel sample			Percent change	
		2017	2019	Change	2017	2019	Change	Sample	Panel
Inorganic fertiliser (kg/ha)									
Sex of HH head	Female	103	61.1	-41.9	103	72.7	-30.3	-40.7	-29.4
	Male	67	69.3	2.3	67	64.2	-2.8	3.4	-4.2
Farmer category	SSF	73.3	66.7	-6.6	73.3	71.2	-2.1	-9.0	-2.9
	MSF	39.8	61.5	21.7	39.8	20.4	-19.4	54.5	-48.7
	SRI	73.0	73.8	0.8	73.0	73.8	0.8	1.1	1.1
Age of HH head	Youth	61.9	83.2	21.3	61.9	82.7	20.8	34.4	33.6
	Older farmer	71.4	63.4	-8	71.4	67.3	-4.1	-11.2	-5.7
Sample mean		**69.7**	**67.8**	-1.9	**69.7**	**70.2**	0.5	-2.7	0.7
F value		0.45			0.095				
Herbicides									
Sex of HH head	Female	3.2	4.21	1.01	3.2	3.8	0.6	31.6	18.8
	Male	3.7	4.1	0.4	3.3	4	0.7	10.8	21.2
Farmer category	SSF	3.3	4.2	0.9	3.3	4.1	0.8	27.3	24.2
	MSF	3.1	3.7	0.6	3.1	3.7	0.6	19.4	19.4
	SRI	3.6	3.6	0	3.6	3.6	0	0.0	0.0
Age of HH head	Youth farmer	3.5	6.2	2.7	3.5	7.2	3.7	77.1	105
	Older farmer	3.3	4.5	1.2	3.3	4.6	1.3	36.4	39.4
Sample mean		3.3	4.1	0.8	3.3	4	0.7	24.2	21.2
F value		24.8***			13.2***				

Source: APRA household data, 2017 and 2019

"... this was attributed to the support and/ or credits provided by the KPL potentially leads to the substantial increase in rice yield of SRI farmers...".

On the other hand, we tried to analyse the use of herbicides among farmers based on different gender social groups. The changes in relation to herbicides show a significant increase in the use among youth (105 %) and older farmers (39.4 %). The findings also show a definite increase in the use of herbicides across the other remaining gender social groups (Table 3). The increase was slightly higher for MHH than FHH and slightly higher for SSF than MSF (by 24.1 to 19.4 %). The findings are in line with that of Isinika *et al.* (2020) and Doss (2018) with the opinion that increased use of herbicides has a positive implication on rice productivity. It also increases farmers' opportunity to extensification as it reduces labour costs and increases the number of harvests. The study revealed that like what reported in the use of organic fertilisers, women and MSF were the most disadvantageous groups that harvest low and hence are less likely to engage in rice commercialisation.

Rice yield

Figure 1 shows the volume of rice yields in Mngeta division varied among gender social groups. The MHH and older farmers had a higher quantity of rice yield than FHH and youth farmers respectively. The FHH however, had the highest change compared to their counterpart. As indicated in section 4.1, FHH and youth farmers had less access to land, and use of agricultural inputs, the challenges which have also been reported to hinder the transformation of the agricultural sector toward commercialisation. The findings further show a decline in rice yield among most farmer categories except MSF. Unexpectedly, rice yield for the SRI farmers declined in 2019 compared to the 2017 cropping season. The plausible explanation for the decline is that in later cropping season SRI had a better chance to acquire agricultural inputs, which were provided by the KLP before the company ended.

Rice commercialisation by gender social groups

Table 4 presents Rice Commercialisation Index (RCI) for each gender social group in the study area. Generally, commercialisation declined across all gender social groups, the highest rate of decline being among SRI members (9.8 %) compared to SSF (4.5 %) and for MSF (3.8 %). In addition, FHH experienced a higher level of decline in commercialisation than their male counterparts as well as any other groups in the panel sample. This finding indicates both the amount harvested and sold declined with time, hence having a negative impact on people's well-being. Looking at these findings, women are the ones left behind in terms of enjoying
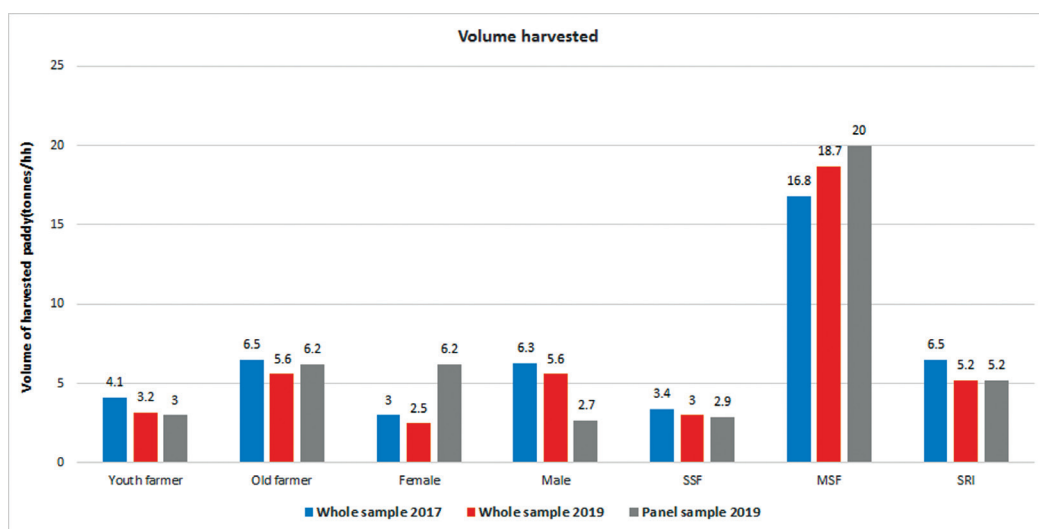

Figure 1: Percentage of the volume of paddy harvested at the household level

the benefits of rice commercialisation in the Kilombero valley.

The findings correlate with the qualitative findings reported during the FGD and stakeholder workshop in Kilombero district as the majority of the participants had a concern that improvement in rice farming is at a slow rate, and is unpredictable because of the change in the market price of the produce. Farmers' key concern was the unpredictability trend of rice prices in the local and national markets. Based on these findings, rice commercialisation has not yet sufficiently provided significant benefits to the majority of rice growers in Kilombero valley. The marginalised households particularly FHH, SSF, and SRI are excluded in the stream of the benefit of rice production and commercialisation. In view of these findings, there is a possibility that rice production and commercialisation in Kilombero valley is an unsustainable pathway to livelihood improvement.

The decline in the price in the current production year demoralizes farmers to produce more in the next cropping season, a challenge that needs the government of Tanzania to find the right solution, if we still need agriculture to continuously contribute to the Gross National Product. This is essential because the majority of the rural population still depend on agriculture for their economic growth, food and nutrition security.

Food security and MPI status by gender social groups

Food security is an important indicator of livelihood. The findings in Table 5 show a significant difference in food security among the gender social groups. Medium-scale and male, youth household heads were more food secure than their counterparts in female, SSF, and old households. This implies that attainment of food security is highly gender-dimension. The results further show a significant difference between food security and commercialization levels. Generally, households with low levels of rice commercialization were less food secure.

Using regression analysis of the determinants of livelihood outcomes – adopted from Isinika *el al.,* 2021 (Appendix 1), the findings indicated food security levels increase although at a marginal level of – 0.08 from 2017 to 2019, and this was influenced by the level of education and rice yields and commercialisation level. Food security declined for older household heads compared to youth, FHHs were food insured compared to their male counterparts and this was linked with cultural norms in relation to the land tenure system.

Figures 2a and 2b present findings on the mean MPI score and proportions of individuals with low MPI across various gender social groups. The relationship between RCI and MPI, shows that the MPI declined for all gender social

Table 4: Rice commercialisation index (RCI) by gender social groups

Farmer category		Whole sample			Panel sample			Percent change	
		2017	2019	Change	2017	2019	Change	Sample	Panel
Sex of HH head	Female	53.1	50.7	-2.4	53.1	49.4	-3.7	-4.5	-7
	Male	60	55.8	-4.2	60	56.7	-3.3	-7	-5.5
Farmer category	SSF	55.5	53	-2.5	55.5	51.7	-3.8	-4.5	-6.8
	MSF	65.4	62.9	-2.5	65.4	64.1	-1.3	-3.8	-2
	SRI	66.6	60.1	-6.5	66.6	61	-5.6	-9.8	-8.4
Age of HH head	Youth farmer	58.6	61.5	2.9	58.6	62.2	3.6	4.9	8.4
	Older farmer	59.4	53.7	-5.7	59.4	54.3	-5.1	- 9.6	-8.6
	Sample total/ mean	59.2	55.1	**-4.1**	**59.2**	**55.7**	**-3.5**	**-6.9**	**-5.9**
F value									

groups) from 2017 to 2019 cropping seasons with an exception for (RCI 20-40) which increased by about 12 %. This finding suggests that there is a fair livelihood improvement of most households in the study area, keeping other factors constant.

FHH. This means that FHH is less benefited from rice commercialisation, arguing more effort is needed to ensure their inclusion. On the other hand, the findings explained that despite SRI members having experienced relatively higher rates of decline in RCI, they still

Table 5: Percentage of households that are food-secure and insecure by farmer category

Farmer category	Food-secure	Food insecure	χ2
Farm size:			
SSF	42.6	57.4	37.290***
MSF	77.1	22.9	
Sex of household head:			
FHH	31.6	68.4	10.618***
MHH	51.8	48.2	
Age of farmer:			
Young	62.3	37.7	10.369***
Old	45.2	54.8	
Crop commercialisation level:			
Zero	32.6	67.4	
Low	46.6	53.4	
Median	58.4	41.6	16.0 **
High	53.2	46.8	
Whole sample	49.0	51.0	

Note: F = *; implies F value is significant at p<0.1. F = ***; implies F value is significant at p<0.01

Comparison by sex of household heads shows that MHHs experienced a higher level of MPI decline (-39.3 %) as well as the highest decline in the proportion of MPI poor. The decline in the levels of MPI means there is livelihood improvement. Likewise, the MHH had the highest decline in the proportion of MPI-poor households (28.1%) compared to

maintained the highest livelihood improvement, and the plausible explanation for this is that rural households are likely to have numerous ways of livelihood diversification. Looking at the evidence on income sources, sale of crops contributes (56.8%), while non-farm and livestock - (33.8%) and (11.2 %) respectively. This finding suggests that income from other

(a) MPI score
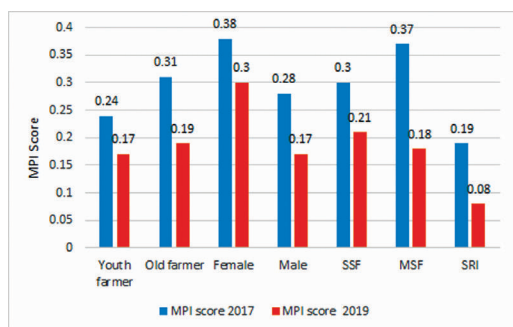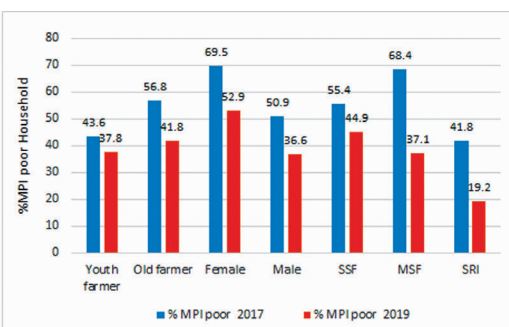
(b) Percent of MPI poor households

Figure 2: Multi-Poverty Index score and proportional of poor MPI poor households

crops (apart from rice) has a substantial contribution to livelihood improvement in the Kilombero valley.

Also, improvement in livelihoods is also linked to improving the house, the environment, infrastructures, and lifestyle. As noted in a recent study by Isinika *et al.* (2021), improvement in children's education level, improved house floor, walls, roofing, and sanitation, especially toilet has a significant role in livelihood improvement. All these values were higher in 2019 than in 2017 (Isinika *et al.,* 2021).

Conclusion and Recommendations

Rice is the most important cash and food crop in Kilombero valley, Tanzania. The study found that commercialisation varies across gender social groups, attributed to levels of access to agricultural inputs and markets. There is a decline in the RCI in 2019 compared to 2017, associated with a decline in land under rice cultivation. Despite this decline, there is still an increase in livelihoods improvement, which is associated with increased income accrued from other farm and non-farm activities. Generally, households headed by females, youth, and small-scale farmers are the gender social groups negatively impacted due to inadequate access to land and to improve agricultural inputs. The gender gap remains a challenge in Kilombero valley. Diversification to other crops and non-farm income contributes highly to livelihood improvement than rice alone. There is a need to develop friendly policy strategies that will provide equitable access to production resources especially; and that the Ministry of Agriculture in collaboration with local government authority need to develop a new strategy that will guarantee cumulative and sound rice commercialisation improvement.

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Conflict of Interest

The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

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Appendix

Determinants of Welfare outcomes – Pool Results – Marginal Effects

Variable	Type of Welfare outcome					
	MPI		Food security status		MDD	
	Coefficient	s.e	Coefficient	s.e	Coefficient	s.e
Year dummy (1=2020)	-0.1283***	0.0387	0.0758**	0.0330	-0.1299***	0.0362
Age of household head (years)	0.0019	0.0013	-0.0006	0.0011	-0.0012	0.0012
Years of schooling of household head	-0.0503***	0.0074	0.0230***	0.0058	0.0122**	0.0061
Sex of household head (1=female)	0.2014***	0.0482	-0.1219***	0.0379	-0.0619	0.0418
Household size (count)	0.0293***	0.0073	-0.0001	0.0064	-0.0000	-0.0000
Electricity status of village (1=yes)	-0.0834**	0.0411	-0.0357	0.0359	0.0617	0.0385
Rice area (ha)	-0.0020	0.0050	-.0004	0.0061	0.0009	0.0043
Rice yield (t.ha)	-0.0356***	0.0132	0.0258**	0.0130	0.0124	0.0089
Household income (Tsh '100000')	-0.0001	0.0003	0.0002	0.0003	-0.0003	0.0003
RCI quintile dummy 1 (1=Q2)	0.1244*	0.0674	-0.0382	0.0528	0.0065	0.0589
RCI quintile dummy 2 (1=Q3)	-0.0357	0.0591	0.0876	0.474	0.1186**	0.0525
RCI quintile dummy 3 (1=Q4)	-0.0659	0.0588	0.1336***	0.0475	0.1861***	0.0522
RCI quintile dummy 4 (1=Q5)	-0.1013	0.0662	0.0816	0.0541	0.0315	0.0578
Farmer type dummy 1 (1=MSF)	-0.1240*	0.0660	0.2057***	0.0681	0.1160*	0.0615
Farmer type dummy 2(1=RCI)	-0.1308***	0.0497	-0.0736*	0.0436	0.0388	0.0468

Source: Isinika *et al.,* 2021