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Full Length Research Paper

Is Agricultural commercialisation sufficient for poverty reduction? Lessons from rice commercialisation in Kilombero, Tanzania

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Agricultural commercialisation is widely promoted as a solution for poverty alleviation among smallholder farmers because it has been associated with rising cash income, improved nutrition and living standards. In Tanzania, agricultural commercialization is an important component for agricultural transformation to meet national goals and achieve global sustainable development goals. This paper uses data from Mngeta division in Kilombero district, a major rice-producing area in Tanzania, to demonstrate that attaining higher commercialisation may not be enough to ensure poverty reduction among small-scale farmers and medium-scale farmers. The findings show that rice commercialisation in the study area was driven by intensification and extensification through sustainable rice intensification technologies and animal-drawn technologies, respectively. Nonetheless, the majority of medium-scale farmers who employed animal drawn technology for area expansion and scored the highest rice commercialisation index, surprisingly, scored the highest multidimensional poverty index, representing a higher poverty level than small-scale farmers. This demonstrates that while increased cash income through commercialisation is necessary, it is not sufficient to ensure poverty reduction. Hence more needs to be done to address institutional and cultural factors that impede initiatives to translate higher income to livelihood improvement and facilitate inclusive poverty reduction.

Keywords: Commercialization, Rice, Productivity, Livelihood, Kilombero, Tanzania

INTRODUCTION

Agricultural commercialization is a process that involves agricultural transformation where farmers increasingly depend on markets to sell their products, but also for the acquisition of inputs including labour (Poulton and Chinsinga, 2018; Poulton, 2017). It is the aggregate pursuit of many actors (farmers, input suppliers, transporters, millers) who choose different pathways in response to existing opportunities to increase the value of marketed farm produce. Agricultural commercialization has also contributed to diversification into non-farm activities (Cazzuffi et al., 2020). At the farm level agricultural commercialization is associated with increased productivity of land and labour, as farmers produce greater surpluses for the market, thereby increasing their market participation, with subsequent higher incomes and living standards (Jayne *et al.,* 2019;

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Abbreviations: ADT: Animal drawn technology, **APRA**: Agricultural policy research in Africa, **FHH**: Female headed household, **HCI**, Household commercialisation index, **MHH**: Male headed household, **MSF(s)**: Medium scale farmer(s), **MPI**: Multi-dimensional poverty index, **RCI**: Rice commercialisation index, **SDG(s)**: Sustainable development goal(s), **SRI**: Sustainable rice intensification, **SSF(s)** Small scale farmer(s)

Neme and Tefera, 2021). Agricultural commercialization occurs as an incremental process driven by growing market demand, but it may be accelerated by external facilitation through public investment or institutional changes by governments and other development agencies or social actors (Wiggins *et al.,* 2013; Poulton, 2017).

In many countries across Sub-Saharan Africa, the commercialization of smallholder agriculture has been considered a key strategy for sustainably reducing poverty and achieving equitable growth (Kirsten et al. 2013). Agricultural commercialization is therefore now widely sought by governments and development agents because it is associated with agricultural intensification and productivity improvement (Djurfeldt et al., 2019) and/or farm expansion, both leading to rising marketed volume of farm produce. Rising income from such processes may contribute to livelihood improvement, measured in terms of household assets, food security and hence poverty reduction (Poulton, 2017; Neme and Tefera, 2021). At the national level agricultural commercialization is desirable for multiple reasons. Foremost, it contributes to the food supply, keeping food prices down for growing urban demand. Moreover, for tradable commodities such as rice, commercialization generates foreign currency and at advanced levels, a commercialized agricultural sector releases labour for employment in other sectors of the economy (Poulton and Chinsinga, 2018).

The commercialization process may however lead to undesirable outcomes, especially for small scale farmers (SSF), whose risk-bearing threshold is very low. Price volatility in markets may expose them to more risk, and so do contractual arrangements that link SSF with medium and large-scale farmers (Khamaldin et al., 2013). Moreover, household food security may be compromised where farmers expand their share of land for commercial crops or they increase the share of stable crops sold (Langat *et al.,* 2011; Ochieng *et al.,* 2015). Other studies have however found inconclusive results regarding the impact of agricultural commercialisation on food security since they vary depending on the region (Linderhof et al., 2019). When agricultural commercialisation comes from area expansion by medium scale farmers (MSF) and large-scale farmers, SSF may be squeezed out to near landlessness and destitution (Khamaldin et al., 2013). Furthermore, a strong market demand-pull for agricultural commodities may accelerate farm expansion into marginal and protected areas, with negative environmental outcomes.

All these point to the fact that agricultural commercialization may have different impacts on different people within an area depending on the underlying factors, including their ability to respond to commercialization opportunities around them. These may include rising demand for agricultural commodities, supply and demand for inputs and services, reduced cost of production due to infrastructure improvement among others. In Tanzania, linking farmers to markets is pursued as an important strategy towards commercialization and agricultural transformation under the Five-year Development Plan for the period 2016 – 2021 guided by the national vision up to 2025 (URT, 2006; 2016).

This paper uses data from Mngeta division, Kilombero District in Tanzania, where rice is the most important cash crop, to assess the extent of rice commercialization and examine whether or not the process is contributing to poverty reduction for all categories of farmers. Rice is Tanzania's third most important staple crop after maize and cassava (Wilson and Lewis, 2015). Rice is produced by more than one million households and it involves many more actors and service providers along the value chain, having strong employment effects on-farm and at post-harvest nodes. Tanzania is second after Madagascar for rice production in East, Central and Southern Africa. Exports to neighbouring countries bring foreign currency and further employment creation related to transportation and storage. Rice commercialisation is therefore expected to be associated with rising income and declining poverty among participating farmers. This may however not always be the case because in all rice producing areas it also serves as the main food crop. About 30% of the rice produced is consumed by the producing households (Kilimo Trust, 2014). Thus, for some farmers, excessive sales may have negative effects on food and nutrition security

Rice production in Tanzania has been increasing in recent years, by up to 7.3% per year between 2001 – 2011), and the country attained rice self-sufficiency in 2018 (URT, 2019). Nonetheless, supply remains susceptible to vagaries of nature since traditional rainfed production is predominant, accounting for about 74% of the area under rice production in the country (Wilson and Lewis, 2015). The supply gap presents a huge opportunity for rice commercialisation among farmers.

Rice commercialisation has been ongoing in Kilombero valley since the 1970s, attributed to the interaction of several drivers including; infrastructure development, migration of people and cattle, which had been going on since 2000 but accelerated after 2008, following the eviction of agro-pastoralists from Ihefu wetland in Mbeya Region (Isinika, *et al.,* 2020). Since 2009 the government of Tanzania identified rice as a priority crop, undertaking several national and regional initiatives to promote rice commercialisation. Kilombero Valley, where the study area (Mngeta Division) is located, is one of the leading rice-producing areas in Tanzania. Rice in this area is grown by over 95% of the households, covering over 90% of the area planted with crops (Kato, 2007; Msuya et al., 2018).

The ongoing infrastructure and institutional changes have accelerated opportunities for farmers to increase production by area expansion and productivity improvement. This paper addresses three basic questions regarding rice commercialisation and its impact in the study area: (i) What is the level of rice commercialisation attained by different categories of farmers in the study area? (ii) Has rice commercialisation resulted in different levels of poverty reduction? (iii) Has rice commercialisation and its impact on poverty reduction been inclusive? Equally important but not directly addressed in the paper are the environmental sustainability concerns; What is the potential impact of the commercial rice production system given the current technologies and farm management practices?

MATERIAL AND METHODS

The paper used baseline data from the Agricultural Policy Research Programme (APRA), involving six African countries (Tanzania, Ethiopia, Ghana, Nigeria, Malawi and Zimbabwe). The research programme responds to Africa's Malabo challenge to support the process of accelerating agricultural transformation and growth for shared prosperity and improved livelihoods, consistent with the Global Sustainable Development Goals (SDGs). This paper narrows the focus by addressing three specific questions, (i) Has rice commercialisation in the study area been significant? (ii) Has commercialisation resulted in poverty reduction? Has rice commercialisation been inclusive, attaining equal commercialisation and poverty reduction levels for all categories of the farmer? These questions are important because the findings will inform policymakers and other stakeholders at the local and national levels regarding barriers to inclusive and sustainable commercialisation that need to be addressed. For this study, the typologies of farmers were identified to include; male headed households (MHH) compared to female headed households (FHH); MSF compared to SSF and farmers using sustainable rice intensification (SRI) technologies; and farmers in villages with electricity compared to villages without electricity.

Determinants of commercialisation

In this study agricultural commercialisation is measured using the rice commercialisation index (RCI), a share of rice that is sold out of the total volume of harvested paddy. The RCI is used instead of the conventional household commercialisation index (HCI) as employed by Bernard et al., (2007), due to the dominance of rice in the study area, being produced by 95% of the households, covering 92% of the farm plots and accounting for 96% if the household income (Isinika et al. 2020). The HCI excludes income from livestock (Dube and Guveya, 2016), which is its main weakness.

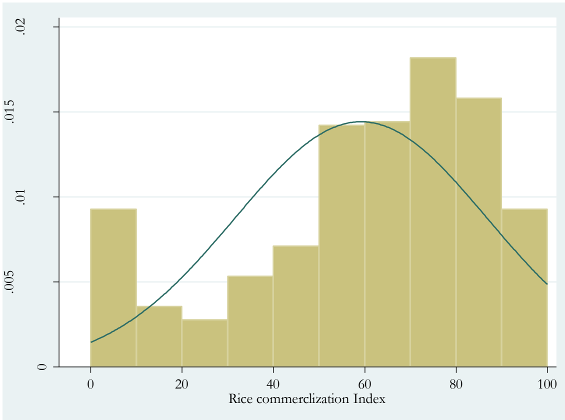
The analysis employed a three-step process. First, the RCI for each farmer was computed as well as mean and median values for each farmer category. The key drivers of rice commercialisation were then determined using regression analysis based on commercialisation levels attained by each household. In the third steps the influence of rice commercialisation and other factors on livelihood outcomes was determined by regression analysis. Hence, a two-limit Tobit model was used to determine the drivers of rice commercialisation, reflecting corner solutions at RCI=0 where no rice is sold and RCI=1 where all rice is sold (Figures 1a and 1b). A similar model has been used by Kirui and Njiraini (2013); Bekele and Alemu (2015) and Dube and Guveya (2016).

Electrification assumed an important role when defining the sampling frame because of the observed immediate effect to improve milling services. However, its effect on commercialisation is not direct. Rather, the relationship between electrification and commercialisation is mediated by intensification and extensification controlling for other key household factors such as age and education (Isinika et al. 2020). The same authors argue that a household's distance to the nearest large electric mill captures the relationships with rice production incentives via access to output market opportunities from farm intensification or extensification. We therefore, estimate the following specification:

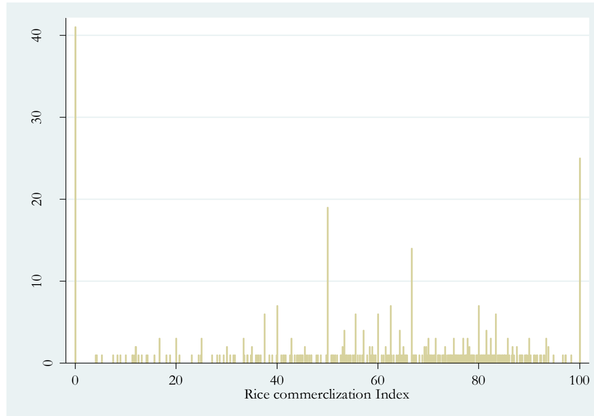
$$RCI_i^* = \gamma_1 Marketaccess_i + \gamma_2 Intensification_i + \rho X_i + \varepsilon_i, \dots \dots \dots \dots \dots \dots \dots \dots \dots \dots \dots \dots \dots \dots \dots [1]$$

The nature of the underlying latent variable RCI_i^* implies that censoring occurs naturally over the unit interval. Hence, equation [1] is estimated with two-sided censoring using heteroscedasticity robust standard errors clustered at the village level. The coefficients γ_1 and γ_2 are the parameters of interest while ρ is a vector of parameters for the control variables. The error term ε_i is normally distributed. Our main variables of interest include:

- $MarketAccess_i$–represented by a proxy (distance to the nearest large rice mill) at the household level (i). This variable also serves as a proxy for a village's electricity status since all large mills use electricity.
- $Intensification_i$– farmers' response to commercialisation opportunities (extent of rice intensification), constructed as an additive score (0-4) using data on improved seeds, organic fertilisers, inorganic fertilisers, and pesticides, where each technology caries a score of 1 or zero or one for use or non-use by a farmer, and X is a vector of control



Panel A: RCI and Density



Panel B: Frequency and RCI

Figure 1. Examining the distribution of RCI

variables, namely:

- household level attributes (farm size, household size, level of education of household head, sex of household head, household total non-farm income, and access to extension services).
- The number of medium scale farmers in the village (MSF) serves as a village level control factor, representing the potential for extensification. The proportion of MSF is higher in villages where land is still available for agricultural expansion including opening new paddy farms (Isinika et al. 2020).

The determinants of rice commercialisation and expected sign of coefficients are presented in Annex 1.

Measuring poverty

The immediate contribution of commercialisation at the household level is often measured in terms of income (Ogutu and Quam, 2018; Dube and Guveya, 2016; Zhou et al., 2013) or the value of sales (Cazzuffi et al., 2020). However, using income as a proxy for livelihood status has been strongly criticized (Ogutu and Quam, 2018; Kirui and Njiraini, 2013) since it has been argued that household income only reflects the potential of livelihood improvement. Depending on intra-household relations and who controls the income, it may not be spent to improve nutrition and/or increase household assets that improve the quality of life in terms of education, health, and household assets. Moreover, depending on both on individual attributes and the availability of services in a locality, the cost of translating income into wellbeing can vary considerably across households (Sen, 1999).

Poverty may also be measured using different indicators including consumption-based indicators such as the sum of household consumption expenditure, income-based indicators such as total net income, subjective indicators based on self-assessment such as the subjective ladder. Others are asset-based indicators, which include the type of housing, asset indices and inequality-based indicators such as the Lorenz curve and the Gini coefficient (Chirwa et al., 2017). The multidimensional poverty index (MPI) as proposed by Alkire and Santos (2014) and Alkire et al. (2016) provides a better alternative since it captures a wider range of variables including assets, health, education and nutrition that reflect the quality of life within a household.

The MPI uses a set of vulnerability indicators to determine the incidence of poverty (headcount) and the intensity of poverty (degree of deprivation). At the population level, these two indicators are combined to compute the MPI. A poverty cut-off point of 33.3% (approximately 33%) ranks as multidimensionally poor, those people whose deprivation score exceeds this threshold (Alkire et al., 2016). Hence, the overall MPI represents a proportion of the sample which is poor, being representative of the population from which the sample is drawn. Scores above 33% (or 0.33%) represent more deprivation, hence deeper poverty. The entire list of indicators that are used to compute the MPI is summarized in Annex 2.

Determinants of poverty status

The third part of the analysis uses a logit model to identify factors determining the likelihood of a household to be poor based on several poverty indicators. In this study, we consider the following; (i) poverty incidence (headcount), (ii) intensity of poverty, (iii) MPI deprivation score and (iv) subjective poverty. Descriptive analysis and the logit model are used, the latter being chosen because it avoids the problem of endogeneity, since a farmer's poverty status most likely influences their RCI level and vice versa (Alkire et al., 2016; Ogutu and Quaim, 2018). To study the relationship between MPI and commercialization, we estimate the following baseline specification [equation 2]:

$$MPI_i^* = \beta_i RCI_i + \delta_{ij} Electrification_j + \gamma_i X_i + \varepsilon_i, \quad \text{...[2]}$$

Where MPI_i^* represents a household dummy taking a value of 1 if a household is MPI poor and zero otherwise
RCI_i represents the RCI for i^{th} household.
$Electrification_j$ represents electrification status of j^{th} village taking a value of 1 if a village is electrified and zero otherwise

X is a vector of control variables as previously defined under equation 1 but the number of MSF representing the potential for extensification is replaced by MSF as a dummy, being 1 if a farmer is a medium scale and zero otherwise.

As defined earlier, a cut-off point of 33% distinguishes households that are MPI poor from others that are not. Using the logit model where a household's MPI score is the dependent variable, the analysis addresses the question, what is the probability of a household being multidimensionally poor? The expected relationship between the MPI and explanatory variables is briefly described in Annex 3. The estimated change (increase/decrease) in the probability or likelihood of a household being classified as poor when a quantitative variable increases by one unit is the increase/decrease in the mean probability of being classified poor when comparing two classes of a qualitative variable such as one level of RCI compared to farmers who are less commercialized. Explanatory variables for determinants of a household's multidimensional poverty status are presented in Annex 3.

RESULTS AND DISCUSSION

For the rice harvest of 2017, the mean RCI for the whole sample was 59.2%, being significantly higher (p<0.01) for SRI farmers followed by MSF, and lowest for SSF (Table 2). All median values were higher than the corresponding mean values, implying that more than half of the sample in each stratum scored an RCI value above the mean – an indication that rice commercialisation was happening. The RCI mean score for MHHs was also significantly higher (p<0.1) an indication of less inclusion for FHH. Lower inclusion was also reported for women in male headed households as they experience less influence in making farm and expenditure decisions (Jeckoniah et al., 2020). Farmers in villages with electricity essentially scored higher mean RCI value but it was not significantly different from villages without electricity because the effect of electricity on rice commercialisation is indirect, manifesting through other variables such as distance from the nearest electric-powered milling centres and the price of milled rice. All farmers respond to such opportunities (Isinika et al. 2020).

The findings also showed that MSF and SRI households each achieved a higher mean RCI value in villages with electricity, where access to output markets through modern processing facilities was easier. Surprisingly, however, the opposite was true for SSFs, who within our sample were found predominantly in villages without electricity. We acknowledge that farmers respond to improved milling options following electrification within their own, or in neighbouring villages. We also hypothesise that there are technological and knowledge spill-overs from MSFs to SSFs and that these occur primarily in villages without electricity, where there is room for farm area expansion and the majority of MSFs (81% in our sample) have settled there.

Rice commercialisation by area expansion

As more recent immigrants into villages, MSFs acquired land in villages that were less densely populated, further from the main road where electricity has not yet been connected. They brought with them oxen and ox ploughs (Mdoe et al., 2020). Consequently, findings in Table 2 showed that MSF had a significantly larger mean area under rice (11.6 ha) compared to only 1.9 ha and 3.5 ha for SSF and SRI farmers respectively. The maximum area for SSF at 4.9 ha was lower than the minimum for MSF at 5.2 ha whose maximum holding was 50.6 ha. The median values followed the same pattern. These differences partly account for why MSF harvested significantly more rice (Table 2) compared to SSF and SRI members. A higher proportion of MSF, therefore, scored RCI values above 60% (Isinika et al., 2020).

Comparison by sex of the household head similarly showed that MHH planted rice on significantly more land (3.8 ha) compared to their female counterparts (1.8 ha), hence representing a higher proportion of farmers at RCI values above 60% who were therefore more commercialized. Likewise, comparison of mean, median, minimum and maximum farm size by village electricity status clearly showed that farmers in villages without electricity had significantly more land under rice compared to those in villages with electricity. Even among SSF, the mean area under rice was significantly higher in villages without electricity compared to those with electricity (Isinika et al., 2020).

Rice commercialisation by farm intensification

Yield response is the aggregate effect of all the inputs

Table 1. Rice Commercialization Index (RCI) by farmer category (%)

Category	Farmer characteristic	Mean RCI	Median RCI	Significance of difference (for RCI mean)
Farmer category	SSF	55.5	60.0	F = 8.78 p = 0.00
	MSF	65.3	70.8	
	SRI	66.6	74.1	
Head of household	Female	53.1	59.0	F = 3.462 p = 0.06
	Male	60.0	66.7	
Electricity status	With electricity	60.2	67.0	F = 0.55 p = 0.5
	Without electricity	58.5	64.3	
Sample mean		**59.2**	**65.2**	

Source: APRA Tanzania survey (2017)

Table 2. Mean and Median land holdings and harvested rice (by farmer category)

Category	Farmer characteristic	Total rice harvested (Kg)	Mean area (Ha)	Median area (Ha)	Significance of difference (for area mean)
Farmer category	SSF	3,358.5	1.9	1.6	
	MSF	16,786.2	11.6	8.7	F = 220.44***
	SRI	6,683.4	3.5	2.0	
Head of household	Female	6,365.6	1.8	1.4	F = 9.17***
	Male	3,037.9	3.8	2.0	
Electricity status	With electricity	5,145.9	2.8	2.0	F = 7.03***
	Without electricity	6,539.8	4.0	2.0	
Sample mean		**5,956.3**	**3.5**	**2.0**	

Source: APRA Tanzania survey (2017)

used by a farmer to attain higher yields and total output for food security and cash income to acquire assets for production and livelihood improvement. The findings showed that there was no significant difference in yield between farmers who used purchased seed, but yields were significantly higher for farmers who used pesticides, herbicides and organic manure (Isinika et al., 2020).

The SRI farmers — who scored the highest yield (Table 3) — also scored the highest mean RCI Table 1), which reflects the positive correlation between intensification and commercialisation. In terms of gender, male headed households attained higher yield and RCI values. Likewise, villages with electricity attained higher mean RCI score and yield. But, not all high RCI values reflected agricultural intensification. For instance, MSF who scored the second highest RCI obtained the lowest mean yield, their high RCI score being attributed to extensification as discussed earlier.

Determinants of rice commercialisation

Results of the regression analysis [equations 1] are given in Table 4, representing a good fit for the data based on the pseudo log likelihood ratio and F-value of the Chi square likelihood ratio ($p<0.00$). As stated earlier, a household's distance to the nearest mill was used as a proxy for the effect of electricity on rice commercialisation. The distance captures the interaction between electrification with rice production incentives via ready access to output market opportunities as rice processing capacity and quality improves after electrification. The coefficient for this variable was negative (-0.012) and highly significant ($p<0.05$), consistent with our hypothesis that electrification is correlated with increasing rice commercialisation through various opportunities, including selling rice at a higher price and using storage facilities at installed mills to sell at a higher price later during the year. Farmers who had more surplus to sell would benefit more from such services.

Our interpretation is that everybody responds to electrification at different speeds, both within a village and across neighbouring villages. Electrification immediately improved milling and storage services.

Table 3. Mean and median yield levels

Category	Farmer characteristic	Yield Mean	Median	Significance of difference
Farmer category	SSF	2,476.5	2,409	
	MSF	2,071.1	1,853	F = 6.96***
	SRI	2,841.5	2,630	
Sex	Female	2,424.0	2,372	F = 0.17
	Male	2,501.1	2,426	
Electricity	With electricity	2,675.2	2,595	F = 6.51***
	Without electricity	2,360.4	2,224	
	Sample mean	**2,491.7**	**2,409**	

Source: APRA Tanzania survey data (2017)

Table 4. Factors influencing RCI

Variable	Coefficient	Standard error	Marginal effects	Standard error
Distance to nearest mill	-0.012**	0.005	-0.0117**	0.005
Intensification score				
1	0.055	0.039	0.0546	0.039
2	0.023	0.054	0.226	0.051
3	0.149**	0.062	0.149**	0.062
Control variables				
Age of household head	-0.001	0.001	-0.001	0.001
Education of household head	0.012*	0.006	0.012*	0.007
Female headed household	-0.030	0.046	-0.030	0.046
Household size	-0.016**	0.009	-0.016**	0.007
Farm size (ha)	0.016***	0.004	0.016	0.004
Total non-farm income	0.000	0.000	0.000	0.000
Extension services	0.093***	0.031	0.093***	0.031
Number of MSF in a village	0.002**	0.001	0.002**	0.001
Constant	0.540***	0.100		
Dependent variable = RCI				
Observations	401			
Uncensored	344			
Censored (left)	35			
Censored (right)	22			
Log pseudo-likelihood ratio	-141.03			
F-Value	5.61			
Pseudo R-Square	0.185			

* Significant at 10% level. ** Significant at 5% level. *** Significant at 1% level.
Source: APRA Tanzania survey data (2017)

Subsequently, farmers received higher prices as they sold rice instead of paddy. Farmers responded to such higher prices via intensification, area expansion, or both, but it seems that area expansion responses are more immediate, and more feasible in remote villages — these are not yet electrified. Moreover, it seems that the electrification dummy was picking up some of the spill-over effects from MSFs to SSFs, that occurred primarily in villages without electricity (Isinika et al., 2020). This finding is supported by the coefficient for the number of MSFs, which was positive and highly significant ($p<0.01$) as expected, reflecting the positive influence of area expansion on commercialisation. In the model, all three coefficients for intensification were positive but significant only at the score of 3, representing three intensification technologies being adopted (Isinika et al., 2020). Hence, the relationship between electricity and rice commercialisation depends on the intensification level attained by farmers and room for farm expansion.

Out of seven household control variables education of the household head, farm size and extension services had a significant positive influence on rice commercialisation ($p< 0.05$). The household size had a

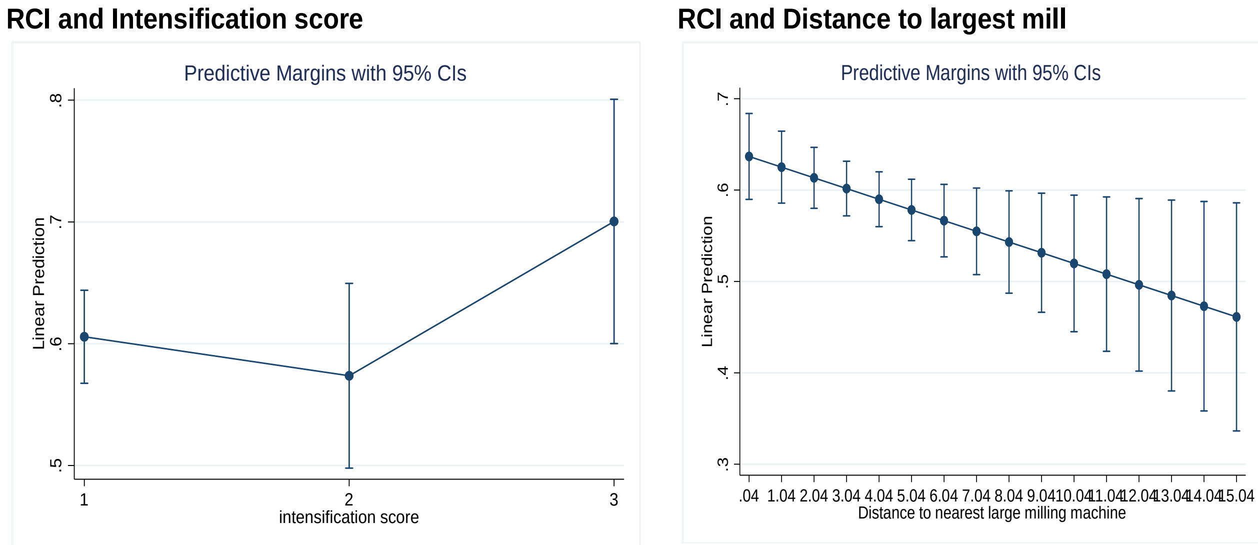


Figure 2. Linear prediction of intensification score and distance to large mill

significant negative influence on commercialisation (p<0.1). Also, negative but not significant was the influence of age of the household head and FHH implying that younger farmers were more likely to score higher RCI levels, representing more commercialisation, probably because they had a higher tendency to adopt SRI technologies that required more labour and obtained higher yields (Isinika et al., 2020).

We found no clear relationship between non-farm income and commercialisation — the coefficient is positive but close to zero and insignificant. The arrival of electricity was expected to stimulate non-farm activities, including income generated from enterprises such as shops, guest houses, mobile money services and charging mobile phones. However, *a priori*, non-farm income could have either a positive or negative influence on rice commercialisation. Increased incomes from non-farm sources could be reinvested to increase rice production for the market (Djurfeldt et al. 2019) or access to income from non-farm sources could substitute income from rice marketing and so reduce the pressure to sell rice.

Overall, our findings are as follows: First, farmers responded to increased market opportunities either by intensifying or extensification positioning to increase farm production. The choice depended on the balance of factors of production (land, labour, capital and information) at their disposal. In recent years, opportunities for rice marketing have been increasing throughout Kilombero valley, but more rapidly in villages reached by electricity than in villages without. In villages reached by electricity, where land is typically scarce, a subset of farmers successfully responded by intensifying their production. This requires, *inter alia*, some capital and some knowledge. At least some of the farmers that have joined SRI groups appear to have been well-positioned to respond to the increased market opportunities that came with electrification, primarily via intensification since SRI members recorded the highest mean and median yield (Table 3). About 71% of the SRI members came from villages with electricity.

Second, in more remote villages that had not yet received electricity, there had been an influx of MSFs, who produced higher volumes of rice (Table 3) and therefore also sold higher volumes. This represented an extensification response to the general improvement in rice market conditions in Kilombero valley. Moreover, we hypothesise that these farmers encouraged nearby SSFs (both existing and new) to expand their rice production, *inter alia* through the adoption of animal traction, a presumed extensification response in this context.

Figure 2 depicts the average marginal effects at different levels of the primary variables of interest. Holding all covariates at their respective mean, we note higher predicted RCI values at higher levels of the interaction between RCI values and the intensification score (Panel a). There is a clear jump in the marginal effect of RCI when the intensification score rose to 3, the response being stronger in villages with electricity (Isinika et al., 2020). In panel (b) there are lower predicted marginal effects on RCI with increasing distance from mills. Other studies have reported that rising income from commercialisation will reduce poverty (Ogut and Quam, 2018, Dube and Guveya, 2016). We consequently

Table 5. MPI score by farmer category

Category		Incidence (%)	Intensity (%)	MPI	% MPI poor households	Difference (χ^2)
Farmer type	SSF	61	49	0.30	55.4	
	MSF	75	50	0.37	68.4	11.8***
	SRI	44	43	0.19	41.8	
Sex of household head	MHH	58	48	0.28	69.5	
	FHH	78	49	0.38	50.9	7.1***
Village electricity status	With electricity	47	46	0.22	44.4	
	Without electricity	68	49	0.34	61.3	11.8***
	Sample	**61**	**48**	**0.29**	**62.5**	

Source: APRA Tanzania survey data (2017)

addressed the pertinent question, is rice commercialisation in the study area associated with reduced poverty for all farmer categories?

Determinants of poverty in relation to rice commercialisation

The whole purpose of promoting agricultural commercialisation is to achieve livelihood improvements among farmers and other rural residents. Concern about reducing poverty has always been on the global agenda, especially since 1995 when the Global Summit on Social Development adopted a declaration and programme of action to eradicate absolute poverty and reduce overall poverty (Gordon, 2006). Absolute poverty is characterised by severe deprivation of basic needs including food, safe drinking water, sanitation facilities, health and education, and information. While income plays an important role in reducing poverty (Jayne et al., 2019; Poulton 2017) access to services may also be a limiting factor. In this study, the MPI of the whole sample, as well as sub-components, were computed according to Santos and Alkire (2016).

The results in Table 5 present the incidence of multidimensional poverty, also referred to as the headcount ratio. The sample mean is 61% presenting the proportion of multidimensionally poor households. This headcount is higher than the average for Tanzania mainland at 26.4%, and 31.3% for rural areas by 2018 (World Bank Group, 2019). The mean intensity of poverty is 48%, which implies on average the multidimensional poor households in the sample are deprived in 48% of the weighted indicators (Annex 2). The overall MPI score (0.29) is a product of the headcount and the intensity score. This value is higher than the mean of 0.275 for Tanzania (UNDP, 2019) but lies below the cut-off point of 0.33 which implies that on average, by 2017, when the data was collected, farmers in the study area were poorer than the national mean score but they were above the poverty line.

Perhaps surprising, the MSFs who scored the second highest RCI (Table 1) also scored the highest MPI and the second highest incidence of poverty (Table 5) and therefore representing high levels of commercialisation and poverty as well. This means commercialisation did not guarantee attainment of lower poverty levels. Both the MPI and the proportion of MPI poor households were significantly higher in villages without electricity where about 81% of the MSF resided, compared to farmers in villages with electricity, even though the latter harvested significantly more rice (Table 2). The MSF households appear particularly deprived when one looks at health indicators including nutrition, sanitation, safe drinking water, deaths in the family, and poor school attendance among children (Isinika et al., 2020; Isinika et al., 2021). The sick, especially children, are sometimes not taken to formal health services soon enough resorting to alternative traditional medicine as the first option, which sometimes results in death.

Some of the MSFs may also represent newly settled residents, yet to establish permanent houses and other amenities. All these factors raised their MPI scores placing them at lower livelihood categories (Isinika et al., 2020). The MPI score for FHHs was also significantly higher than that of MHHs but, the latter recorded the highest proportion of MPI poor households. The incidence of poverty was highest among MSFs who also recorded the second highest proportion of MPI poor households (68.4%) and was significantly higher for FHHs than MHHs. These findings therefore point out to lack of electricity and some negative cultural norms as exclusion barriers for poverty reduction and livelihood improvement.

These assertions were tested using regression analysis (Equation 2) to establish the determinants of being classified as MPI poor among respondents (Table 6). The

Table 6. Determinants of MPI

Variable	MPI Coefficient	Standard error	Marginal effects	Standard error
RCI	-0.0078*	0.004	0.0077*	0.0042
Age household head (years)	0.0221**	0.009	-0.0091	0.0087
Education (years of school)	-0.1588***	0.487	0.0360	0.0445
Female household head (dummy)	1.0551***	0.356	-0.6643**	0.3143
Household size (number)	0.2906***	0.061	-0.1213**	0.05371
Farm size (hectares rice area)	-0.0902**	0.041	0.2981***	0.0890
SRI member (dummy)	-0.1869	0.307	-0.0405	0.3168
MSF (dummy)	0.4796	0.539	-0.8440	0.6516
Non-farm income (100,000 TShs)	0.0000	0.000	0.0000	0.0000
Electrification (village dummy)	-0.4977**	0.251	0.1314	0.2520
Constant	-0.6123	0.672	0.5587	0.6458
Dependent variable = MPI				
Observations	411			
Log likelihood	-231.13			
Log likelihood Chi2 (10)	105.46***			
Pseudo R2	0.186			

* Significant at 10% level. ** Significant at 5% level. *** Significant at 1% level.
Source: APRA Tanzania survey data (2017)

predictive power of the model is highly significant with a Log likelihood ratio of–231.13. All the variables have expected signs, where negative coefficients mean the variable is poverty reducing.

According to these results, rice commercialisation (RCI) had significant poverty-reducing effect ($p<0.1$). Some household control variables including education of the household head, farm size and village electrification also had significant negative coefficients ($p<0.05$) implying highly significant poverty reducing effects. The coefficient for SRI group membership was also negative but not significant, reflecting the positive influence of rice intensification on livelihood improvement. Meanwhile, the age of the household head had significant poverty increasing influence ($p<0.05$) whereas the coefficient for the MSF dummy was positive but not significant, implying that MSFs were more likely to be MPI poor, not because they had low cash income, rather due to other underlying factors (low education, health and livelihood assents), which place them in lower livelihood ranks according to official livelihood indicators.

However, the MSF self-perception of poverty, measured using several subjective instruments revealed that they did not perceive themselves as poor. About 84.3% rated their households as being above average compared to 54.5% and 64.7% among SSF and SRI members respectively. This apparent contradiction arises because the asset-based indicator used by farmers in their poverty self-assessment ranks lowest (seventh) among components of the MPI, which is commonly used by governments and development agents (Isinika et al., 2020). Discussion with key informants revealed that most farmers place a higher value on to own productive assets (land, oxen and ploughs) than health, nutrition and education indicators.

CONCLUSION

This paper addressed three basic questions; (i) What is the level of rice commercialisation attained by different categories of farmers in the study area? (ii) Has rice commercialisation resulted in different levels of poverty reduction among rice farmers? (iii) Have commercialisation and livelihood improvement been inclusive? According to the findings, we establish that yes, commercialisation has been happening in Mngeta Division, a reflection of the ongoing commercialisation process in the entire Kilombero Valley. On average, our sample farmers sold about two-thirds of the rice they produced, with a median of 65.2%. Higher commercialisation levels have been associated with land intensification in villages with electricity and extensification in villages without electricity, where land is still available for farm expansion especially using oxen in marshy areas. For these reasons, SRI members who opted for the intensification pathway and MSFs who pursued extensification both scored higher RCI values than SSF and also sold more rice. Nonetheless, women, especially in FHHs faced resource access constraints including land such that they had significantly less land planted with rice, used less productivity-improving inputs and they often faced labour constraints.

The second question addressed in this paper relates to whether or not rice commercialisation has resulted in different levels of poverty reduction. The findings clearly show that rice commercialisation has reduced poverty among the sample farmers but with differential impact. Farmers especially MSFs, farmers living in villages without electricity, female farmers and farmers with small farm holdings — less than 2ha — are more likely to be more impoverished i.e. MPI poor for various reasons. The MSFs face higher levels of deprivation since they live in more remote villages where access to education and health services is lower. This requires the district authorities to work with local institutions and community members to reverse this unlikely nexus of high commercialisation amid rampant poverty due to institutional and cultural constraints. Besides the government's efforts to improve amenities (education, water and health facilities), vulnerability can also be reduced by using existing by-laws coupled with effective methods of raising awareness to accelerate the pace of constructing and using improved toilets.

On whether commercialisation and livelihood improvement have been inclusive or not, FHHs scored significantly lower RCI and higher MPI scores due to resource constraints as alluded to earlier. Women within MHH also face exclusion in decision making, including the decision to use income accruing from rice commercialisation. Resource constraints notwithstanding, younger farmers were less likely to be poor probably because they have younger and smaller families hence lower dependency ratios. Moreover, younger farmers were more likely to adopt SRI technologies, thereby obtaining higher yields. The lower performance of both FHHs and women in general during commercialisation and subsequent livelihood improvement show a clear need for deliberate steps to address their exclusion in order to arrest the gender gap. The low RCI among FHHs is largely due to lower yield because they cannot afford productivity-improving technologies up to optimum levels. These farmers require additional support to raise yields in order to achieve higher commercialisation levels, thereby reducing their poverty levels. Encouraging more women and youths to join SRI groups and supporting other intensification commercialisation pathways is likely to bring more inclusion dividends in the form of, poverty reduction and food security. It is also important to use affective training approaches to change the farmers' mindset and address embedded cultural constraints that promote gender imbalance, especially women's participation in decision making so that rice commercialisation is more equitable and inclusive.

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REFERENCES

Alkire S, Santos ME (2014). Acute Multidimensional Poverty: A New Index for Developing Countries. World Dev., 59: 251–274.

Alkire S, Conconi A, Robles G, Roche JM, Santos ME, Seth S, Vax A (2016). The Global Multidimensional Poverty Index (MPI): 5-year Methodological Note, OPHI Briefing Note 38. London: University of Oxford, https://www.ophi.org.uk/wp-content/uploads/ OPHIBrief_38.pdf.

Bekele A, and Alemu D (2015). Farm level determinants of output commercialization: In Haricot bean-based farming systems. Ethiopian J. of Agri. Sciences. 25: 61–69.

Bernard T, Gabre-Madhin E, Alemayehu ST (2007). Smallholders' Commercialization through Cooperatives A Diagnostic for Ethiopia. IFPRI Discussion Paper 00722 October 2007.https://citeseerx.ist.psu.edu/viewdoc/download?doi=10.1.1.81.5105&rep=rep1&type=pdf.

Cazzuffi C, Mackay A, Perge E (2020). The impact of agricultural commercialisation on household welfare in rural Vietnam. Food Policy. 94: 1-13.

Chirwa E, Sabates-Wheeler R, Saha A (2017). Poverty and Inequality Indicators. in Authors (ed.), *APRA* Outcome Indicators. Brighton: Future Agricultures Consortium. https://www.future-agricultures.org/wp-content/uploads/2018/07/APRA-Outcome-Indicators-Paper.pdf.

Djurfeldt AA, Djurfeldt G, Hillbom E, Isinika AC, Dalitso M, Joshua K, Kaleng'a WC, Kalindi A, Msuya E, Mulwafu W, Wamulume M (2019). Is There Such a Thing as Sustainable Agricultural Intensification in Smallholder-based Farming in Sub-Saharan Africa? Understanding Yield Differences in Relation to Gender in Malawi, Tanzania and Zambia. Dev. Studies Res. 6(1): 62–75, https://doi.org/10.1080/21665095.2019.1593048.

Dube L, Guveya E (2016). Determinants of Agricultural Commercialisation Among Smallholder Farmers in Manicaland and Masvingo Provinces of Zimbabwe. Agric. Sc. Res. J. 6(8): 182-190.

Gordon D (2006). The concept and measurement of poverty. From Pantanzis C, Gordon D. Levitas R (Editors) Poverty and Social Exclusion in Britain, Bristol, The Policy Press. ISBN 978-1861343734.

Isinika A, Mlay G, Boniface B, Mdoe N, Poulton C, Saha A (2020). Does Rice Commercialisation impact on Livelihoods? Experience from Mngeta in Kilombero District, Tanzania. APRA WP 30. https://www.future-agricultures.org/publications/working-papers-document/

Isinika A, Mlay G, Mdoe N, Magomba C, Kilave D (2021). Rice commercialisation effects in Mngeta Kilombero district: Identifying underlying factors. APRA working paper 63, https://www.future-agricultures.org/publications/working-papers-document/

Jayne TS, Haggblade S, Minot N, Rashid S (2019). Agricultural commercialization, Rural Transformation and Poverty Reduction: What have We Learned about How to Achieve This? https://doi.org/10.21955/gatesopenres.1115440.1.

Jeckoniah J, Mosha DB, Boniface B (2020). Does rice commercialisation empower women? Experience from Mngeta division in Kilombero district, Tanzania. APRA working paper 34. https://www.future-agricultures.org/publications/working-papers-document/

Khamaldin M, Wiggins S, Mdoe N (2013). Commercialisation of African Smallholder Farming: The Case of Smallholder Farmers in Central Tanzania, APRA Working Paper 072, Brighton: Futures Agriculture Consortium, https://www.future-agricultures.org.

Kato F (2007). Development of a Major Rice Producing Area in Kilombero Valley, Tanzania. African Study Monographs, Suppl. 36:3-18, March 2007

Kilimo Trust (2014). Expanding Markets for Rice in the East African Community (EAC) Region, Uganda: Kilimo Trust https://www.kilimotrust.org/documents/2018/Expanding_Rice_Markets_in_East_Africa.pdf.

Kirsten J, Mapila M, Okello J, Sourovi De (2013). Managing agricultural commercialisation for inclusive growth in Sub-Saharan Africa. Global Development Network Working Paper Series. SP No. 60. http://www.gdn.int/sites/default/files/WP60-SSA-Agriculture-Commercialization_d6d.pdf.

Kirui OI, Njiraini GW (2013). Determinants of Agricultural Commercialization Among the Rural Poor: Role of ICT and Collective Action Initiatives and Gender Perspective in Kenya, paper presented at 4th Conference of Afr. Assoc. of Agric. Econ., (AAAE), Diar Lemdina Hotel – Hammamet, Tunisia 22–25 September 2013, https://ageconsearch.umn.edu/bitstream/161618/2/Oliver%20K.%20Kirui%20et%20al.pdf.

Langat BK, Ngéno VK, Sulo TK, Nyangweso PM, Korir MK, Kipsat MJ, Kebenei JS (2011). Household food security in a commercialized subsistence economy: A case of smallholder tea famers in Nandi south district, Kenya. J. Dev., Agric. Econ., Vol. 3(5), pp. 201-209, May 2011.

Linderhof V, JanssenV, Achterbosch T (2019). Does Agricultural Commercialization Affect Food Security: The Case of Crop-Producing Households in the Regions of Post-Reform Vietnam. Sustainability 11.5: 1263, doi:10.3390/su11051263.

Mdoe N, Mlay G, Isinika A, Boniface G, Magomba C (2020). Effect of choice of tillage technology on commercialisation and livelihood of smallholder farmers in Mngeta division, Kilombero district, Tanzania. APRA WP 37. https://www.future-agricultures.org/publications/working-papers-document/

Msuya E, Isinika AC, Dzanku FM (2018). ‘Agricultural Intensification Response to Agricultural Input Subsidies in Tanzania: A Spatial-Temporal and Gender Perspective, 2002–15’, in Djurfeldt, AA, Dzanku FM, Isinika AC (ed.), Agriculture, Diversification, and Gender in Rural Africa: A Longitudinal Perspective from Six Countries. Oxford: Oxford University Press.

Neme AA, Tefera TL (2021). A review of commercialization of smallholder agricultural producers and its impacts on household livelihoods. Evidence from Ethiopia context. J. Agribus. Rural Dev., 1(59): 69-75.

Ochieng J, Knerr B, Owuor G, Ouma E (2016). Commercialisation of Food Crops and Farm Productivity: Evidence from Smallholders in Central Africa. Agrekon. 55(4):458–482.

Ogutu SO, Quaim M (2018). Commercialization of the Small Farm Sector and Multidimensional Poverty. Global Food Discussion Papers No. 117, Universität Göttingen, Research Training Group (RTG) 1666: Global Food - Transformation of Global Agri-Food Systems, University of Göttingen. https://www.econstor.eu/bitstream/10419/175889/1/1016121555.pdf.

Poulton C, Chinsinga C (2018). The Political Economy of Agricultural Commercialisation in Africa, APRA Working Paper 16, Brighton: Future Agricultures Consortium, https://www.future-agricultures.orghttps://www.future-agricultures.org.

Poulton C (2017). What is Agricultural Commercialisation? And How Do We Measure It? APRA Working Paper 6, Brighton: Future Agricultures Consortium, https://www.future-agricultures.org

Sen A (1999). The possibility of choice. *Am. Econ. Rev.,* 89 (3): 349-378.

United Republic of Tanzania (URT) (2006). National Sample Census of Agriculture (2002/03): Small holder agriculture, Volume II: Crop Sector – National Report. National Bureau of Statistics.

United Republic of Tanzania (URT) (2016). The United Republic of Tanzania: 2014/15 Annual Agricultural Sample Survey. Dar Es Salaam. Retrieved from http://www.nbs.go.tz/nbs/takwimu/Agriculture/Annual_Agricultural_Sample_Survey_Report2014_15.pdf.

United Republic of Tanzania (URT) (2019). National Rice Development Strategy Phase II (NRDS II 2019 – 2030). Ministry of Agriculture. https://www.kilimo.go.tz/index.php/en/resources/view/national-rice-development-strategy-phase-ii.

Wiggins S, Argwings-Kodhek G, Gebreselassie S, Asuming-Brempong S, Chirwa E, Matita MM, Mdoe N, Mutabazi K (2013). *Cautious Commercialisation.* Findings from Village Studies in Ethiopia, Ghana, Kenya, Malawi and Tanzania. FAC Working Paper 82, Brighton: Future Agricultures Consortium, https://www.future-agricultures.org/.

Wilson RT, Lewis I (2015). The rice value chain in Tanzania: A report from The Southern Highlands Food Systems Programme. http://www.fao.org/fileadmin/user_upload/ivc/PDF/SFVC/Tanzania_ rice.pdf.

World Bank Group (2019). Tanzania Economic Update, Transforming Agriculture: Realizing the Potential of Agriculture for Inclusive Growth and Poverty Reduction. Africa Region Macroeconomics, Trade and Investment Global Practice. December 2019 Issue 13.

Zhou S, Minde IJ, Mtigwe B (2013). Smallholder agriculture commercialization for income growth and poverty alleviation: A Review. African. J. Agric. Res., 22 (8): 2599-2608.

Annex 1. Determinants of RCI

Variable	Specification	Expected sign
Age of household head (HH attribute)	Years	positive or negative
Level of education of of household head (HH attribute)	Years of formal education	Positive
Sex of household head (HH attribute)	Coded as a dummy – assigned a value of 1 if HH is a female and 0 if HH is a male	Negative
Household size (HH attribute)	Number of household members	Negative
Plot size (HH attribute)	Total holding size hectares	Positive
Access to extension services (HH attribute)	Coded as a dummy – assigned a value of 1 if a farmer had access to extension services and 0 otherwise	positive: In this model, used as a HH attribute since, famers' access to extension services is limited by availability of staff. SRI members, MHHs and famers in villages with electricity having more access
Total HH non-farm income	Value of total non-farm income earned by the household	positive
Distance to nearest mill (market access attribute)	Radial distance from the household to the nearest large rice mill, calculated using GPS coordinates (in km)	negative
Intensification score (HH attribute)	Defined as a sum of scores associated with use (1) and non-use (0), of yield increasing inputs or services (purchased seed), chemical fertiliser, organic fertiliser, and pesticides. Minimum score 0 and maximum score 6 Score 1 = 1 technology adopted Score 2 = 2 technologies adopted Score 3 = 3 technologies adopted Score 4 ≥ 4 technologies adopted	positive
Number of MSFs in a village	Number of MSFs in a village, derived from initial construction of survey sampling frame	positive: More MSFs are found in villages where there is land for expansion. Their presence is expected to have a positive effect on rice commercialisation through a larger volume of marketed surplus

Annex 2. Components of Multi Poverty Index (MPI)

Years of schooling (given 1 for a household that did not have any member who has at least five years of schooling)
School attendance (given 1 fora school-age child out of school, and 0 otherwise).
Child mortality (given 1 for a household that reported a death of a child in the household during the past ten years, and 0 for a household that had not).
Nutrition (used the Food Insecurity Experience Scale with a cut-off point of five, where those scoring five and above out of nine were considered to be deprived nutritionally).
Living standards:
- **Electricity** (given 1 for a household that did not have electricity, and 0 for one that had electricity).
- **Drinking water** (given 1 for a household that did not have access to clean water, i.e. use unprotected sources, and 0 for a household that had access to clean drinking water).
- **Sanitation** (given 1 for a household that did not have adequate sanitation (i.e. no toilet facility, go to bush or field, use pan or bucket, use traditional pit latrine), and 0 for a household that had a ventilated improved pit latrine and a flush toilet).
- **Flooring** (given 1 for a household that had dirty, earth, dung floor etc, and 0 to a household that had a tiled, cemented, concrete floor).
- **Cooking fuel** (given 1 for a household that cooked with wood, charcoal or dung, and 0 was given to a household that used gas, electricity or paraffin as the main source of cooking energy).
- **Asset ownership** (given 1 for a household that did not own did not own a car or tractor, or more than one of the following: radio, TV, telephone, bicycle, motorcycle, or refrigerator; the value of 0 was given to a household that owned more than one of the listed assets).

Annex 3. Determinants of MPI

Variable	**Definition**	**Expected sign (MPI)**
Age of household head	Age of household head in years	positive
Education of household head	Year of schooling for household head	negative
Female headed household	Sex of household head: 1 if female, 0 if male	positive
Household size	Number of people in a household	positive
% of land under rice	Total area of farm plots in hectares	negative
Total household non-farm income	Value of total non-farm income earned by the household	negative
Electricity status	1 if village has electricity, 0 otherwise	Negative
SRI dummy	1 if farmer practices SRI, 0 otherwise	Negative
MSF dummy	1 if farmer is a MSF, 0 otherwise	Negative
RCI	Used as a continuous variable	Negative