Contribution of Agricultural Marketing Co-operatives in Commercialisation Among Smallholder Maize Farmers in Mbozi District, Tanzania

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Abstract
Commercialisation of agricultural products is one of the key indicators of agricultural sector transformation and development of smallholder farmers. However, limited access to markets has remained one of the contemporary agendas that face smallholder farmers. This article addresses the role of Agricultural Marketing Co-operatives (AMCOS) in maize commercialisation among smallholder farmers using a cross-sectional research design. 374 households (203 AMCOS members, 171 non-members) maize growers were randomly sampled for analysis. Data were collected using survey and interview methods. To examine the level of commercialisation indexes between the two groups, Weighted Average Index and Propensity Score Matching were used. The results indicated that AMCOS members had 0.29-0.30 higher commercialisation index than their counterparts. Moreover, AMCOS members revealed strong marketing abilities in terms of bargaining power, access to market information and link to structured market and demand than non-members. The study concludes that AMCOS are important platform that support and enhance smallholders' ability towards maize commercialisation. The findings of this article are confined to maize crop, which has not been adequately researched. To smallholders, policymakers and scholars, the article informs on the perceived benefits of AMCOS and recommends the best steps toward smallholders' participation in AMCOS, improved market access and commercialisation.

Keywords: AMCOS, smallholder farmers, maize commercialisation, Mbozi-Tanzania

Introduction

Across Sub-Saharan Africa (SSA), about 75% of the population depends on agriculture to support their daily livelihood and generate income (World Bank, 2019; URT, 2018). More than 80% of these farmers are smallholders, owning and operating farmland of 0.5-2 hectares or 1-5 acres on average (Mchopa et al., 2020; ILO, 2017). In SSA, smallholder farmers generally involve in subsistence farming and experience limited access to agricultural inputs, agricultural technical incapability, low-value-added activities and access to reliable markets (Mmari, 2016; Rwekaza & Mhihi, 2016; Rashid et al., 2020). Smallholders find themselves locked out of local and regional value chains and lucrative markets, thus producing and trading

their products in a barter system and selling in local non-profitable markets. Bolton (2019), Rashid et al. (2020) and the ILO (2017) connected the barriers that hinder smallholder farmers towards market access and commercialisation of agricultural products to the absence of a formal market access platforms, low-value products, limited market and demand information and poor infrastructure which result in high transportation cost.

To uncover the challenges that hinder smallholders from market access and commercialisation of agricultural products, solid pathways, policies and strategies are needed. Among others, Agricultural Marketing Co-operatives (AMCOS) have been perceived as one of the commercialisation pathways that uphold smallholder's production, processing, distribution and marketing abilities (Rashid et al., 2020; Mmari, 2016; Mchopa et al., 2020). Through AMCOS, smallholders pull together their resources and overcome agricultural supply chain-related constraints, produce and process high-value products, share market and demand information and transportation facilities (Mojo et al., 2015; Mapunda et al., 2019). In Africa, the co-operative movement dates back to the 1920s when the emphasis was on producing and processing of cash crops to meet colonial demands (Mmari, 2016; Lyimo, 2012). The movement gained active momentum in 2018 after the establishment of the Alliance Africa Agricultural Co-operative Organisation (AAACO). The International Centre for Tropical Agriculture (ICTA) and the Technical Centre for Agricultural and Rural Co-operatives (TCARC) provide marketing platforms to smallholder farmers through shared market knowledge, expertise and coordination in Malawi, Ethiopia, Ghana, Senegal, Madagascar, Uganda, Tanzania and Rwanda.

As a part of co-operative movement, Kenya has achieved significant market access and commercialisation of agricultural products in dairy co-operatives (Bolton, 2019; Islam, 2015). Ethiopia and Mali have experienced sustainable production, processing and marketing of coffee and cotton products due to shared market information, high-quality products and marketing capacity building through co-operatives (Bolton, 2019; Mojo et al., 2015). In Tanzania, the express objectives of agriculture co-operatives are to increase crop productivity, increased farmers' access to support services, production of quality products and improve farmers' access to markets at better prices (URT, 2013; Ahmed & Mesfin, 2017). The Tanzanian Co-operative Development Commission (TCDC) is mandated to regulate, promote and develop co-operatives in the country (Lyimo, 2012; Mmari, 2016). To date, co-operatives movement have been shifting from cash crops co-operatives to food crops co-operatives. For instance, maize growers' co-operatives have recently emerged as one of the leading AMCOS in Tanzania, compared to the last decades when maize was primarily grown for home consumption. Maize is now grown as both food and cash crop among large, medium and smallholder farmers. The crop account for more than 70% of all cereal crops produced in Tanzania (URT, 2018; World Bank, 2019). The main buyers are local traders, millers, the National Food Reserve Agency (NFRA), the World Food Program (WFP), prisons, hospitals and schools that buy directly from farmers in rural areas and nearby the cities (Wilson and Lewis, 2015; URT, 2018). The pre-requisite condition for NFRA and the WFP is to buy maize from smallholder farmers through formal registered AMCOS.

Despite the government's express objectives for agricultural sector development, limited access to the markets for agricultural products among smallholder maize farmers has remained a contemporary issue. On average, only 35% of smallholder farmers have access to the markets for their agricultural products and 98% of all products are sold through informal market channels (URT, 2018; World Bank, 2019). Less than 5% of the agricultural products are sold through 4,115 actives registered AMCOS (Mapunda et al., 2019; URT, 2018). Existing studies examine socio-economic determinants of farmers' participation in AMCOS (Rwekaza & Mhihi, 2016; Mapunda et al., 2019), AMCOS success factors (Anania & Rwekaza; 2016), and the impact of farmers' participation in AMCOS with a focus in cash crops co-operatives (Islam et al., 2015; Abate et al., 2014). This study examines the role of AMCOS in enhancing smallholder farmers abilities to commercialisation of agricultural products, with a focus on cereal crops (Maize) based in Mbozi District, Tanzania.

Literature Reviews

Theoretical Perspectives

To capture the interdependence between AMCOS and commercialisation of maize product among smallholders, the collective action and social capital theories underpinned this study. AMCOS is regarded as an important platform that enhances smallholder farmers' abilities in accessing markets under the influence and role of collective action. The theory of collective action is built on principled assumptions with the need to achieve tangible rewards or benefits as the result of participating in socio-economic activities (Olson, 1971). However, the theory does not explicitly explain how collective action enhances a households' socio-economic benefits. To remain competitive in rapidly changing markets and pursue shared interests and benefits, smallholders require collective platforms (Ochieng et al., 2018). To understand how collective action results in tangible benefits between groups, the social capital theory tied well with this study. Social capital theory is the resources inherited from social relations which form a basis of trust, norms, networks, ultimate collective action and associations representing more or fewer groups with a common purpose (Pretty & Ward, 2001). Social capital theory provides a solid step on which the perceived collective interests and benefits are achieved through bonding, bridging and linking. AMCOS (as a collective aspect) offers socio-capital benefits such as access to market information, processing skills, marketing techniques and link smallholders to structured markets. Smallholders acting collectively minimises markets related challenges and risks, sell at better prices, have access to market information and transportation facilities. The benefits of AMCOS have been more evident in cash crops, with little attention to whether AMCOS makes sense in food crops. It is from this perspective, this study examines how the collective actions of AMCOS facilitate social capital benefits of AMCOS among smallholder maize farmers in Mbozi District, Tanzania.

Conceptual Framework

Figure 1 postulates a hypothetical relationship between smallholder maize farmers' participation in AMCOS and commercialisation. The framework is presented by a set of perceived benefits of AMCOS at the basic three nodes of agricultural supply chain [farm level, production level and marketing level].
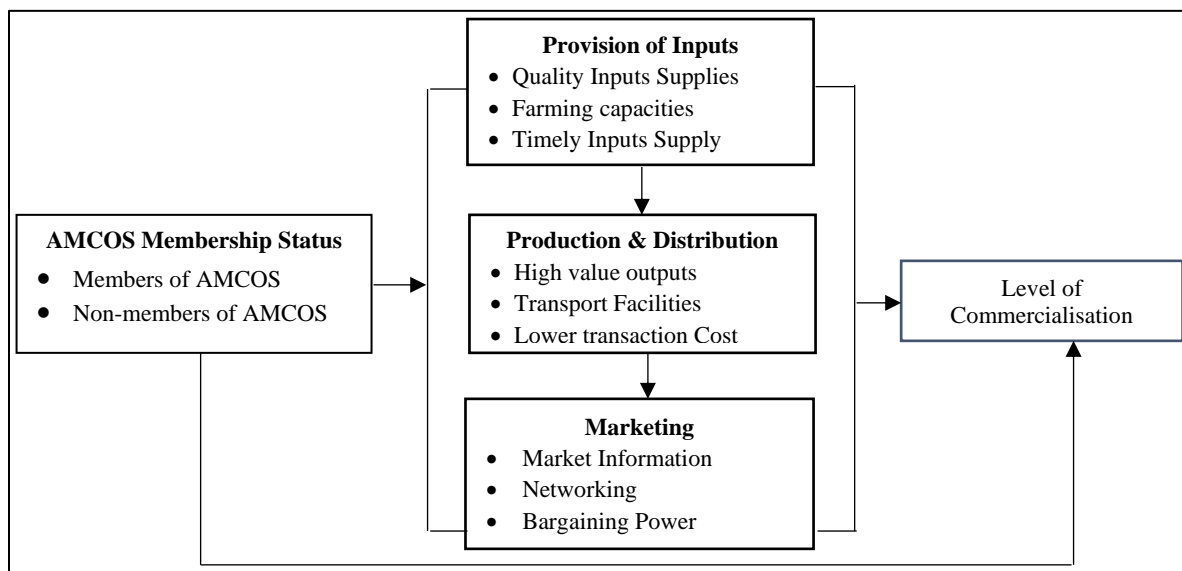

Figure 1: Conceptual Framework [Source: Researchers' Construct, 2022]

At a form level, AMCOS supplies better inputs to its members and offers extension services stemming from agricultural skills on a timely basis. At the processing level, smallholders can process high-value products

to meet market demand, offered with transport facilities due to technical and financial support offered through AMCOS (Anania & Rwekaza, 2016; Islam et al., 2015). The collective actions of AMCOS enhance smallholders' commercialisation abilities due to apparent high bargaining power, networking, shared resources and market demand information. AMCOS help in answering the "what to produce, where to sell, and at what price to sell" as the basic questions in production and marketing. The likelihood impact of AMCOS on smallholders is likely to differ depending on the membership status. AMCOS members are more likely to commercialise their agricultural products than non-members due to the perceived benefits accrued from AMCOS. However, the perceived benefits of AMCOS depend on the effectiveness of its formation, management and operation, keeping into account the clarity of management styles, rules, policies, strategic and operational goals of AMCOS (Ahmed & Mesfin, 2017; Abate et al., 2014).

Empirical Review and Hypothesis Development

There are inadequate empirical studies on the role of AMCOS in commercialisation of cereal crops in general. Previous literature captures the effects of AMCOS on the socio-economic well-being of households, the determinants and success of farmers' associations in local and global setting. AMCOS is the autonomous associations among farmers who voluntarily unite together to meet their socio-economic aspirations and goals (Islam et al., 2015; Mojo et al., 2015). In so doing, AMCOS members must set their own rules and policies from which a co-operative will be governed and managed towards socio-economic development. In Ethiopia, Ahmed & Mesfin (2017) and Abate et al. (2014) revealed a positive impact of AMCOS membership on the well-being of smallholder farmers in terms of an increased level of income and livelihood assets. In their studies, Mchopa et al. (2020) reported a positive and significant contribution of co-operatives towards improving food security in Tanzania. Increased food security through co-operatives is attributed to the fact that co-operatives offer quality agricultural inputs to their members, which in turn results in increased productivity. Examining the effects of farmer organisations on smallholder vegetable farmers, Aku et al. (2018) and Islam et al. (2015) reported substantial high income and access to market among co-operative members than non-members. AMCOS offer several benefits to their members including connecting and linking farmers to buyers, formal and structured markets. Connecting and linking smallholders to structured and formal markets is one of the pre-requisite requirements and the express objectives of AMCOS towards commercialisation of agricultural products and sustainable development of smallholders (Bolton, 2019; ILO, (2017).

Towards effective participation of smallholders in AMCOS, Anania & Rwekaza (2016) examined the determinants and success factors of AMCOS in Tanzania. In their studies, Anania & Rwekaza (2016) posted socio-economic factors such as age, marital status, level of education, family size, distance to co-operatives, off-farm income and co-operatives operational factors as the factors that influence smallholders toward participation in AMCOS. Mojo et al. (2015) and Rwekaza & Mhihi (2016) emphasised the need for clarity of the roles, policies and transparency in operation as the criteria for the success and sustainability of AMCOS. Departing from the determinants of smallholders' participation in AMCOS, Mojo et al., (2015) and Rashid et al. (2020) argued that smallholders who are more inclined to AMCOS, stand a better chance of being able to access the markets for their products. AMCOS provide a platform on which smallholder farmers share resources, have access to finance, link and network on market information towards commercialisation. The prime objectives of AMCOS are to increase members' production and incomes, create a better link with access to financial support, agricultural inputs, extension services and output markets. Indeed, the concern about the role of AMCOS in cereal crops has not been addressed. To fill this gap, this study provides evidence on the contribution of AMCOS in maize commercialisation among smallholder farmers in Tanzania's context.

H_0: AMCOS membership status has no significant impact on smallholders' maize commercialisation.

Materials and Methods

This study was conducted in Mbozi District, one of the five districts of Songwe region in Tanzania. The District has a remarkable record in maize production and AMCOS activities. In 2021, Mbozi District reported a total of 105 active registered maize AMCOS, being the appropriately large number of AMCOS compared to other districts of Songwe region: Momba (15), Ileje (8), Songwe (2) and Tunduma TC (8). A total of three wards from Mbozi district– Itaka, Isongole and Nambizo were selected for the study. It is from this criterion [large numbers of registered AMCOS], Mbozi District and its three wards were purposively considered for the study. The study used a cross-sectional research design to collect and analyse cross-sectional data [in a single period] from smallholder maize farmers who were members and non-members of AMCOS for 2020/2021 production year. For this study, the data collected were used to establish the likelihood level and differences in maize commercialisation between the members and non-members of AMCOS.

Simple random sampling was used to pool households for analysis. The analysis included households with at least a single agricultural plot of land who grows maize crop. A total of 374 households (203 members of AMCOS and 171 non-members) maize growers from the three wards were sampled, being estimated by Daniel's (2009) formula for infinite population. Due to infinite population size, smallholder maize farmers were drawn randomly at the same rate of 33.3% of the estimated sample size from each ward. Semi-structured questionnaires containing open-ended questions were used to collect quantitative data at a household level. Key Informant Interview (FII) was further administered to collect qualitative data from a total of four (4) key informants: district, ward, and village agricultural extension officers. The key informants were purposively selected based on their knowledge and understanding on smallholders' participation in AMCOS. The perceived benefits and outcomes of AMCOS membership are likely to differ significantly between the members and non-members. To address the apparent commercialisation and marketing capabilities among smallholder farmers, the Weighted Average Index (WAI) as proposed by Shivakoti et al. (2016) was employed expressed as follows: -

$$\text{WAI} = \frac{S_i f_i}{N} \dots\dots\dots\dots\dots\dots\dots\dots\dots[1]$$

From equation (1), S_i is the scale value from the responses collected using five-point scale where: 5 = To a very great extent, 4 = To a great extent, 3 = Moderate extent, 2 = Less extent, and 1 = Not at all. f_i denotes the frequency of responses, and N is the total number of all responses. The WAI ranges between $0 \leq \text{WAI} \leq 1$) and were computed from each response of a five-point scale with varying weights. The highest $0.8 \leq \text{WAI} \leq 1 = 5/5$ (Very Strong); $0.6 \leq \text{WAI} \leq 0.8 = 4/5$ (Strong), $0.4 \leq \text{WAI} \leq 0.6 = 3/5$ (Medium); $0.2 \leq \text{WAI} \leq 0.4 = 2/5$ (Weak); and $0.0 \leq \text{WAI} \leq 0.2 = 1/5$ (Very weak). To establish whether the perceived benefits of AMCOS have a significant role in enhancing smallholders' commercialisation ability, Chi-square test was used.

Since the estimated impact of smallholder maize farmers is likely to differ significantly between AMCOS members and non-members due to voluntary participation and potential selection bias. To make use of available sensitivity tests in examining the presence of available bias, Propensity Score Matching (PSM) fitted well with this study. PSM was used to estimate the contribution of AMCOS in enhancing smallholder farmers in maize commercialisation [proportional amount of maize sold] between the members and non-members of AMCOS for 2021/2022. PSM requires two groups [treated group and control group] of the same characteristics for both observed and unobserved variables for comparison. In this study, the treated group was AMCOS members and the control group was non-members of AMCOS. To allow adjustment for initial systematic heterogeneities through matching between the groups, the initial characteristics and the conditional probabilities of propensity scores (PS) were calculated using a Binary Logistic (BL) model [Equation 2].

$$P_i = \frac{e^{Z_i}}{1+e^{Z_i}} \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\text{ [2]}$$

Where P_i donates the probability of subscribing to AMCOS for the ith maize farmer, ranging from 0 to 1. e is a base of natural log and Z is observable characteristics defining the value of unobservable utility that farmer gets by subscribing into AMCOS expressed as:-

$$Z_i = \beta_0 + \sum_{i=1}^{n} \beta_i X_i + \varepsilon_i \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\text{ [3]}$$

In the context of this study Z_i is a binary independent variable [AMCOS membership status], X represents a set of observable characteristics, β is the estimated coefficients and ε is a disturbance term. After prediction of PS, the common support region was established, where observations with PS smaller than the minimum of the treated group and greater than the maximum of the control group were eliminated from estimating the overall average treatment effect on the treated (ATT). The focus of the study was to establish the average impact of AMCOS in commercialisation among smallholder maize farmers, that is the average treatment effect on the treated (ATT). At this step, the Nearest Neighbour Matching (NNM) algorithm was performed to establish the impact of AMCOS in maize commercialisation among smallholder farmers. NNM is the most straightforward estimator with the closest propensity scores (Dehejia & Wahba, 2002). From the propensity scores generated, the ATT was then captured to establish the average treatment effect on the treated individuals expressed as: -

$$ATT = E(Y_1 - Y_0|D = 1) = E(Y_1|D = 1) - E(Y_0|D = 1)\ldots\ldots\ldots\ldots\ldots\ldots\ldots\text{ [4]}$$

ATT is the average difference in the commercialisation index between smallholders who received the treatment and those who do not receive the treatment. Y_1 is the maize commercialisation index for the treated group (D=1) and Y_0 is the maize commercialisation index for the control group (D=0). Furthermore, Kernel Matching (KM) was used to estimate the quality of matches on fulfilment of the conditions of common support and balancing requirements under PSM. KM matches all treated units with a weighted average of all controls to construct the counterfactual outcome (Dehejia & Wahba, 2002; Li, 2013). For this study, commercialisation refers to farmers' ability to enter a market and be able to sell their crops. From this stance, the outputs commercialisation index was used to examine the proportional amount of maize sold between the control and treated groups using PSM. The index follows Von Braun's (1995) Commercialisation Index (CI) expressed as: -

$$CI = \frac{Grossvalue\ of\ all\ Maize\ Sold}{Grossvalue\ of\ all\ Maize\ Produced} * 100\%;\ 0 \le CI \le 100 \quad \ldots\ldots\ldots\text{ (5)}$$

Where CI = maize Commercialization Index for i^{th} household growing maize. A household with CI = 0.5 – 1.0 implies commercial oriented, CI = 0.25 – 0.49 transition and those with CI = 0 – 0.249 are subsistence-oriented (Von, 1995; FAO, 1989).

Results and Discussion

Characteristics of Sampled Respondents

Table 1 are the results of descriptive statistics on the socio-economic characteristics of smallholder maize farmers sampled from the study area. The results revealed that smallholder maize farmers who were members of AMCOS (the treated group) and non-members of AMCOS (the control group) were not significantly different in terms of socio-economic characteristics aspects, expect on the level of income generated from maize (t = 2.035; p = 0.001 < 0.1), proportional amount of maize sold (t = 3.185; p = 0.007

bachelor's< 0.01) and maize commercialisation index (t = 4.115; p = 0.005 < 0.05). The average age of both the treated group and the control group was almost the same (54 Years). Smallholder maize farmers who have obtained at least a bachelor degree were significantly many for AMCOS members by 3.8% than non-members. The majority of smallholder maize farmers were secondary school holders. The mean income generated from maize by AMCOS members was significantly higher by almost 121.67 USD from non-AMCOS members. These findings are in line with Rashid's et al. (2020) and Aku's et al. (2018) findings that being a member of farmers' association increases the likelihood impact towards increased market outputs, higher livelihood income and ultimate commercialisation among smallholders.

Table 1.
Sampled Household's Characteristics by AMCOS Membership Status

Households socio-economic characteristics	AMCOS Members (n = 203)		Non-members (n = 171)		t-Stat.	*p* -Value
	Mean	Std. Dev.	Mean	Std. Dev.		
Age	54.684	10.02	53.975	9.09	3.413	0.106
Sex of household head	0.646	0.31	0.654	0.33	2.987	0.205
Marital status	0.715	0.29	0.733	0.32	3.320	0.055
Family size	4.802	2.11	5.107	2.27	1.998	0.387
Level of Education (%):						
Illiteracy	27(13.3%)		22(12.9%)			
Primary education	61(30.1%)		48(28.1%)		4.018	0.061
Secondary school	94(46.4%)		77(37.9%)			
Bachelor degree +	21(10.3%)		24(14.1%)			
Maize farm size	3.352	2.78	3.594	2.47	3.912	0.103
Land ownership	0.709	0.065	0.763	0.096	1.053	0.017
Access to agricultural extension Service	0.428	0.198	0.380	0.097	2.095	0.003
Maize farming experience	32.053	13.07	34.082	13.13	3.834	0.101
Maize income (USD)	1,630.43	747.80	1,308.76	718.95	2.035	0.001*
Distance to the nearest market (Km)	19.979	7.64	20.468	13.45	2.837	0.321
Transportation cost (USD)	0.634	0.206	1.086	0.526	3.330	0.152
Level of maize productivity (T/ha)	101.502	30.965	98.812	21.085	4.083	0.409
Quantity of maize sold (Tons)	73.892	32.08	44.757	21.287	3.185	0.007**
Maize commercialisation index	0.728	0.087	0.4430	0.0763	4.115	0.005**

Note: **, and * Represent Significant Independent t-tests at 0.05 and 0.001

Marketing Capabilities and Maize Commercialisation Among Smallholders
This part presents and discusses the results of the perceived marketing and commercialisation capabilities of maize crop among smallholder maize farmers. Table 2 presents the results of the WAI on the perceived marketing and commercialisation abilities between the smallholders (Members and non-members of AMCOS maize growers). A total of seven marketing and commercialisation capabilities were weighted and indexed. To validate the results, Chi-square test was used to establish the strength of association between the perceived marketing capabilities and maize commercialisation. All the perceived marketing capabilities revealed a statistical and significant role in enhancing smallholders toward commercialisation of maize product (p < α). AMCOS members were rated with very strong ability (WAI = 0.89) in linking farmers to structured markets and demand compared to WI = 0.37 (weak) in non-members. This is an indication that

AMCOS members are more capable of accessing markets and demand for maize than non-members due to the perceived benefits of networking and information sharing. The finding concurs with Rwekaza & Mhihi's (2016) and Aku's et al. (2018) findings that farmers' association is a pivot point in linking smallholders to formal and structured markets. Bargaining power was 0.73 = "strong" among AMCOS members and 0.37 = "weak" among non-members. In line with this finding, Islam et al. (2015) and Mapunda et al. (2019) posited that smallholders' bargaining power tends to be strong when they act collectively than acting individually. The ability to link smallholders with buyers was 0.74 = "Strong" for AMCOS members and 0.43 = "medium" for non-members. This capability is associated with networking and collective benefits offered through AMCOS.

Table 2.
Smallholders' Marketing and Commercialisation Capabilities

Smallholder's Perceived Capabilities	AMCOS Members (n = 203)		Non-members (n = 171)		χ^2
	WAI	I	WAI	I	
Farmers bargaining power	0.73	S	0.37	W	0.341**
Cut-off marketing transaction costs	0.53	M	0.32	W	0.271**
Flows of market information	0.75	S	0.49	M	0.423*
Transportation facilities and Supports	0.68	S	0.46	M	0.280*
Process high-value crops for market	0.65	S	0.31	W	0.335**
Linkage to structured demand and Market	0.89	VS	0.37	W	0.267**
Linkage of farmers with buyers	0.74	S	0.43	M	0.405*

Legends: WAI = Weighted Average Index; I = Index; VS = Very strong; S = Strong; M = Medium; and W = Weak.

Notes: *, **, Represents Significant Chi-Square test at 0.1 and 0.05 respectively.

Through AMCOS, smallholders were revealed more capable of minimising marketing transaction costs (WAI = 0.53) than non-members (WAI = 0.32). AMCOS bring a sense of collective operations through sharing of resources, cost and risks which in turn minimises marking, transportation and transactional costs (Rwekaza & Mhihi, 2016; ILO, 2017). It is from the collective perspective of AMCOS, the ability to access transport facilities and support was 0.68 = "strong" among AMCOS members and 0.46 = "weak" among non-members. Nevertheless, AMCOS members revealed strong capability (WAI = 0.65) in processing high-value crops for markets and assurance of constant flows of market information (WAI = 0.75). These are perhaps due to the perceived support of AMCOS to smallholders in ensuring the quality of agricultural inputs, modernised processing and production control. These findings are in line with previous empirical studies by Islam et al. 92015), Ahmed & Mesfin (2017) and Rashid et al. (2020) that farmers' associations play a significant role in enhancing smallholders' marketing and commercialisation capabilities. The findings support the underlying assumptions of Collective Action Theory and Social Capital theories, which are built on the principled propositions that the participative behaviour of individuals in socio-economic groups is influenced by tangible and perceived rewards, benefits, penalties for participation or otherwise (Olson, 1971).

Smallholders' AMCOS Membership Status and Maize Commercialisation
A comparative analysis was conducted to examine the level of maize commercialisation between the treated group (members of AMCOS) and the control group (non-members of AMCOS) for 2020/2021 production season. PSM was used to compare and match the two groups and establish the conclusion on the contributions of AMCOS in maize commercialisation. Kernel Matching (KM) technique was used to

estimate the quality of matches on fulfilment of the conditions of common support and balancing requirements under PSM. The density distribution of estimated Propensity Scores (PS) and conditions of common support for the treated and control groups is presented in figure 1. The common support region for the treated and control groups was between 0.04565778 and 0.99219016. The estimate revealed Six (6) households [treated] being off-support region, thus were eliminated to ensure quality matching between the treated and control groups. It is from this stance, the common support region provided 368 as the adequate sample for estimating the PSM impact on commercialisation among smallholder maize farmers. ATT was therefore estimated for 368 households who were within the common support region $(0 < p(X) < 1)$. The PS estimated had 5 blocks, as the optimal number of blocks required. This was an indication that the mean PS was not different between treated and controls in each block (Dehejia & Wahba, 2002; Li, 2013). With the outputs of these tests, the balancing property of PSM was satisfied and the common support region was selected. Therefore, the tests revealed a considerable overlap of PS between the treated and control groups, which implies a good and balanced match (Dehejia & Wahba, 2002).
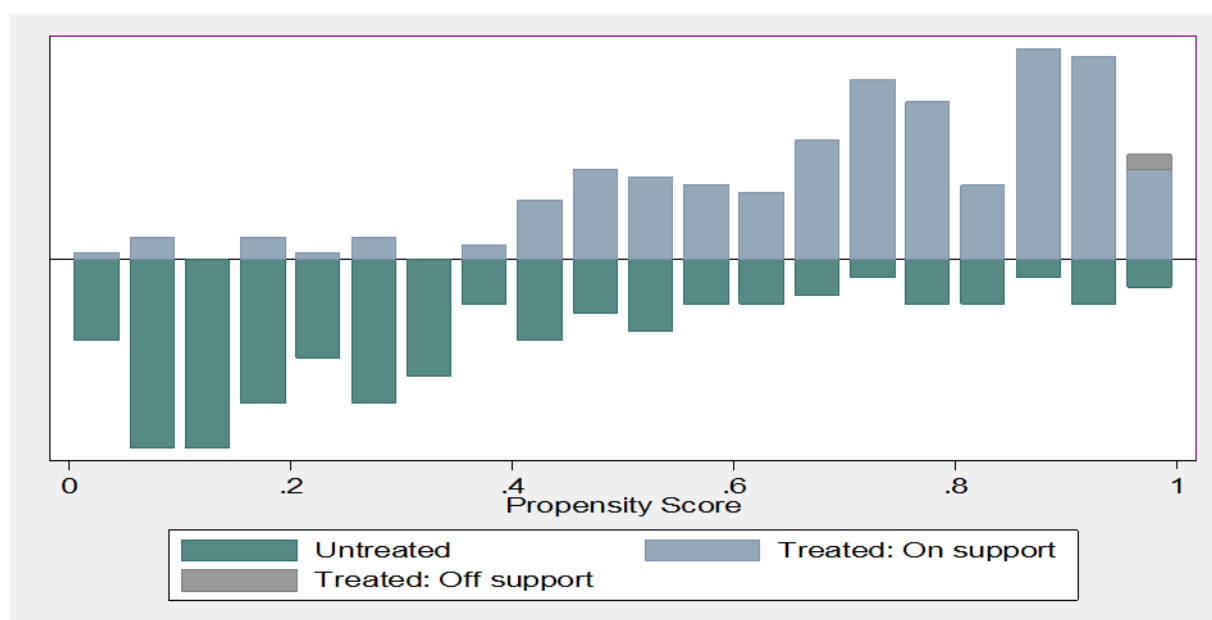

Figure 2. Distribution of Estimated PS and Common Support for the Treated and Control Group

A t-test was then employed to test the level of standardised bias and significant after matching the treated and control group. Equality of mean and significance difference before and after matching was established. Before thatching, the level of bias was between 33.7% and turned to 14.9% after matching. The revealed 14.9% after matching was below 20% of the recommended biasness (Rosenbaum & Rubin, 1983). BL model was used to adjust the initial systematic heterogeneous by matching the latent variables of the control and the treated groups under conditional probabilities of PS. Table 3 are the results of the BL model. Before matching, the χ2 was statistically significant $(p = 0.000 < \alpha)$ and turned to statistically insignificant after matching $(p = 0.080 > \alpha)$. The Pseudo R^2 decreased from 28.5% before matching to 4% after matching. The insignificant covariates (table 3) indicate that participation of smallholder maize farmers in AMCOS is influenced by the same factors [age, sex of household head, marital status, level of education, maize farm size, maize farming experience, distance to the nearest market, land ownership and access to agricultural extension service. Generally, the two groups were similar in all socio-economic aspects, hence worth comparing.

Table 3.
Households' Characteristics After Matching

Variables	AMCOS Membership Status [N = 374]
	Coefficients
Age	0.0126
	(0.0126)
Sex of Household head	0.542
	(0.299)
Marital Status (1 = Married, 0 = Single)	0.127
	(0.019)
Level of Education	-0.113
	(0.133)
Maize Farm size (Acres)	-0.00795
	(0.0894)
Maize farming experience (Years)	0.098
	(0.034)
Distance to the nearest Market (Km)	0.0456
	(0.115)
Land Ownership (1 = Yes, 0 = No)	-0.155
	(0.296)
Price of maize (USD)	0.715
	(0.048)
Gender (1 = Male, 0 = Female)	0.283
	(0.269)
Household size (Number of Family members)	0.117
	(0.0431)
Maize growers (Number of farmers who grows maize)	0.582
	(0.027)
Constant	-5.203***
	(1.114)

*** $p < 0.05$, Standard errors in parentheses

Sample	Pseudo R^2	LR Chi2	P>Chi2	Mean Bias
Unmatched	0.285	146.79	0.0000	33.7
Matched	0.040	22.21	0.080	14.9

Table 4 presents the results of PSM on a comparative analysis regarding maize commercialisation ability between the members and non-members of AMCOS smallholder farmers. The focus of this comparative analysis was to determine whether being a member of AMCOS plays a significant role in enhancing smallholders' marketing and commercialisation ability. The study defines commercialisation as the smallholders' ability to enter a particular market and be able to sell their crops. The contribution of AMCOS in maize commercialisation among smallholder maize farmers was estimated using ATT. The NNM matching algorithms technique as the most, straightforward and closest propensity scores estimator (Dehejia & Wahba, 2002) was used to estimate the ATT. Once the treated is matched with the control, the differences were obtained and used to qualify the contribution of AMCOS on the treated by averaging the differences. The contribution was captured by using indicators of the proportional amount of maize sold and the commercialisation index. The results of NNM revealed a significant difference (MD = 29.08; t =

4.259) in the overall propensity scores of the amount of maize sold between the treated (M = 73.89) and the control (M = 44.81). Through NMM, the findings also indicated a significant impact of AMCOS in maize commercialisation revealed by a significant mean difference (MD = 0.29; t = 2.625) in the commercialisation index, being M = 0.73 for the treated and M = 0.44 for control. Thus, AMCOS members revealed better commercialisation outputs than non-members.

Since NNM assumes high differences in PS for treated and its closest control neighbour, the KM was run as a supplementary matching algorithm technique to analyse the impact. KM revealed statistical and significant difference (MD = 29.20; t = 4.354) in the proportional amount of maize sold between the treated group (M = 73.89) and control group (M = 44.69). KM showed a considerable significant mean difference (MD = 0.30; t = 1.455) in commercialisation index between the treated (M = 0.73) and control (0.43). The results from the two matching algorithm techniques reveal that smallholders who are active members of AMCOS are more likely to commercialise maize product than non-members. Being a member of AMCOS increases the chance for smallholders to access markets for their crops due to perceived benefits (of AMCOS) that cannot be achieved by non-members who tend to produce, process and distribute their products individually. This finding was supported by a response from the District Agricultural Extension Officer, who argued that: -

> *"…Sometimes you may find a medium or large maize trader seeking for at least 50 tons of maize, and mostly prefers buying from AMCOS that collectively store and hold maize. It is not possible to get such amount of maize from individual smallholder…", "… further to that, the government through the National Food Reserve Agency (NFRA) buys maize every year, but only from formal and active registered AMCOS…" (District Agricultural Extension Officer, July 2021).*

AMCOS enhances smallholder farmers' capacity to compete and have access to national and international structured and formal markets, ensure efficient and sustainable production, processing of quality produces, and competitive marketing systems (Islam et al., 2015; Mojo et al., 2015). From these findings, the study rejected the null hypothesis and accepted the alternative hypothesis, that AMCOS play a significant role in enhancing smallholders' ability in accessing markets and commercialisation of maize product.

Table 4.
ATT for Smallholder Farmers Maize Commercialisation

Variables	Matching Algorithm	Sample	Treated	Control	Difference	Std. Error	t-stat.
Total Sales (Tons)	NNM	Unmatched	73.89	44.75	29.14	32.28	4.533*
		ATT	73.89	44.81	29.08	28.99	4.259*
	KM	Unmatched	73.89	44.75	29.14	32.28	4.533*
		ATT	73.89	44.69	29.20	29.01	4.354*
CI	NNM	Unmatched	0.73	0.45	0.28	0.025	1.982*
		ATT	0.73	0.44	0.29	0.024	2.625*
	KM	Unmatched	0.73	0.45	0.28	0.025	1.982*
		ATT	0.73	0.43	0.30	0.027	1.455*

CI = Commercialisation Index, NNM = Nearest Neighbour Matching; KM = Kernel Matching (KM): psmatch2 common support (n=368): off support (untreated 0; treated 6), on support (untreated 171; treated 197)

Conclusion, Implications and Future Research

Conclusion

This study empirically examined the contribution of AMCOS in enhancing smallholder farmers towards commercialisation of maize product. The study comparatively analysed the proportional quantity (mean) of maize sold and commercialisation index between the members and non-members of AMCOS. The results indicated significant mean differences in the amount of maize sold and the overall commercialisation index between the members and non-members of AMCOS. AMCOS members revealed 0.29-0.30 higher commercialisation index than non-members. Moreover, AMCOS members revealed strong marketing and commercialisation abilities in terms of bargaining power, flows of market information, link to structured market and demand than their counterparts. The study concludes that AMCOS are important platform that supports and enhances smallholders' ability to commercialisation of maize. AMCOS links farmers to formal and structured markets and demand, jointly searching and sharing market information for maize commercialisation.

Theoretical Implications

The findings under this study show how collective action theory and social capital theory can be applied to achieve contribution of AMCOS in commercialisation of agricultural products (maize). The deficiencies of smallholder farmers in accessing markets and commercialising maize product can be relieved through the collective action and socio-economic benefits of AMCOS. Collective action theory assumes sustainable development, improved socio-economic wellbeing and achievement of tangible benefits through participating in socio-economic activities (Olson, 1971). On the other hand, social capital theory provides a base on which smallholder farmers can achieve those tangle benefits and rewards by acting collectively, that is through AMCOS (Pretty & Ward, 2001). From collective action and social capital perspectives, the study regards market access and commercialisation of maize among smallholders as the ultimate impact of agricultural co-operatives. A collective perspective of AMCOS links smallholders to structured markets and formal demand access to agricultural technical know-how and quality inputs. Therefore, smallholders can choose to minimise market access-related deficiencies, improve their agricultural productivity and quality, have access to reliable, formal and structured markets by participating in AMCOS.

Managerial Implications and Future Research

Based on the perceived and signified potential benefits of AMCOS revealed under this study, the researcher recommends to smallholder farmers the need to consider being a member of farmers' associations as one of agricultural products commercialisation pathways. Being a member of AMCOS, smallholders will be more inclined to market access and be able to commercialise their agricultural products at a better price due to collective bargaining power, access to market information and opportunities. The TCDC through village agricultural extension officers should offer regular training to smallholder farmers, specifically on the perceived market access-related benefits of farmers' associations. This will create adequate awareness among smallholders on the express purposes, benefits and role of AMCOS. Moreover, the TCDC should establish useful mechanisms in which market information will be transparently shared among smallholder farmers. To scholars, the study highlights and informs on the perceived benefits and potential impact of AMCOS among smallholders of cereal crops, which have not been adequately addressed. The findings of this article are confined to cereal crops (maize crop), which have not been adequately researched and documented in Tanzanian context. Cash crops and other cereal crops than maize were not considered. Moreover, the challenges, determinants towards smallholders' participation and prospects of AMCOS in cereal crops were not accounted too. Therefore, future research should focus in addressing the challenges, determinants and prospects of AMCOS in cereal crops at local and global context.

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