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Smallholder Rice Farmers' Access to Information in Tanzania: Can Agricultural Marketing Co-operative Societies Provide Quality Information?

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Abstract

Access to quality information plays a crucial role in enhancing the competitiveness of smallholder rice farmers in Tanzania. Agricultural co-operatives have the potential to overcome smallholder farmers' information asymmetry. Yet, there is a lack of comprehensive understanding regarding the extent to which Agricultural Marketing Co-operative Societies (AMCOS) can effectively provide quality information to smallholder farmers as required by Co-operative Principle number five (Education, Training, and Information). This paper analyses the current level of access to information among smallholder rice farmers in AMCOS, evaluating the relevance, adequacy and reliability of information provided by AMCOS to its members and identifying the factors influencing the adequacy of the information provided by AMCOS. The study was conducted in Mvomero and Mbarali Districts. A cross-sectional research design was used and data were collected using a questionnaire that was administered to 382 randomly selected farmers based on registers availed by co-operative managers in three co-operatives. Data were analysed using Statistical Package for Social Sciences (SPSS) whereby ordinal logistic regression was used to estimate the influence of various factors on the adequacy of information obtained from AMCOS. The study found that 77.2% of farmers accessed information on rice agronomy. Smallholder rice farmers obtained adequate (52.6%), relevant (35.6%) and reliable (37.7%) information from their respective AMCOS. The adequacy of information was influenced by membership in social groups, access to rice agronomy information and financial information at $p<0.05$. It is concluded that agricultural co-operatives are potential platforms for providing quality information in enhancing smallholder rice farmers' informed decision-making. The study recommends that efforts should be made to strengthen AMCOS by providing them with resources, training, and support to enhance their capacity to deliver accurate and timely information to farmers. This include collaboration with agricultural extension service providers and leveraging their networks to access up-to-date information on agronomic practices, weather forecasts, and market trends to enhance farmers' competitiveness in rice farming.

Keywords: rice farming, adequacy, relevance, reliability and information access

1.0 Introduction

Smallholder agriculture contributes significantly to economic growth, job creation, and food self-sufficiency. Meeting farmers' information needs could help smallholder rice farmers increase agricultural productivity, and market accessibility as a key tool for rural development, poverty reduction, and food security. Different types of collective organisations including agricultural co-operatives have emerged and being recognised by academia, governments, and donors in the early years of the 21st century to improve the productivity and competitiveness of smallholder farmers (Tefera *et al.,* 2017). Smallholder farmers' challenges in farming include poor access to credit services (Deresse & Zerihun, 2018), shortage of training and low market access (Gashaw & Kibret, 2018), high transaction costs and information asymmetries (Cheng *et al.,* 2022), especially those living in rural remote areas.

In view of the above, one of the major issues impeding smallholder farmers' attempts to raise their output is access to relevant, timely and adequate agricultural information (Ndimbwa *et al.,* 2021). This may result in uninformed decisions on what to produce, when to produce, potential markets available, the quantities, and how to store produce (Singh *et al*., 2018). To limit the effect of such risks and doubts, smallholder farmers need to make well-versed decisions by having access and use of agricultural information that empowers them with the ability to plan and make informed decisions about farming activities (Ndimbwa *et al*., 2021). This is made possible when smallholder farmers have acceptable access to quality agricultural information. Mur *et al.* (2016) argue that the main criteria to assess the quality of information service to farmers include its relevance (being timely, addressing farmers' needs, affordable, applicable, tailored to farming and socioeconomic contexts), and reliability (being consistent, accurate, transparent, locally validated). To access the required type of information such as price and market information, post-harvest handling, rice agronomy information, and financial information, farmers must select pertinent and appropriate sources of agricultural information (Hilary *et al*., 2017; Mtega, 2021).

The mass media and mobile phones, fellow farmers, agricultural extension agents, and Agricultural Marketing Co-operative Societies (AMCOS) are the commonly used sources of agricultural information among smallholder farmers (Deresse & Zerihun, 2018; Mtega, 2021; Ndimbwa *et al.,* 2021; Nikam *et al*., 2022). However, co-operatives have gained attention as potential vehicles for the economic and social development of smallholder farmers, as they provide support for accessing information and advisory services through its operating principles. "Education, Training and Information" is one of the principle of cooperatives that requires AMCOS among other things to provide reliable and quality information to its members and general public (Cheng *et al.,* 2022; Mamo *et al.,* 2021; Muench *et al.,* 2021; Tumenta *et al.,* 2021).

It is well-established in the literature that AMCOS enhance farmers' access to information. For example FAO (2012), Deresse & Zerihun (2018), Liu *et al.*(2019), Bachke (2019), Achamyelh & Hailemariam (2020), Muench *et al.* (2021), Tuna & Karantininis (2021), Nikam *et al.* (2022) reported that agricultural co-operatives enhance smallholder farmers' access to information on markets, agronomy, credit, climate change and innovations. In particular, agricultural co-operatives serve as an information-exchange platforms where a farmer benefits from other farmers' experience, which helps them to implement the best agricultural practices to increase their productivity and livelihoods (Mahmood *et al*., 2021; Mamo *et al.,* 2021). It has been reported by Buadi *et al.* (2013), Jona & Terblanché (2015), Maake & Antwi (2022) and Sylla *et al.* (2019) that smallholder farmers receive relevant services from public and private agricultural extension service providers in various countries. However, farmers had mixed opinions concerning the services with respect to their adequacy, availability, effectiveness (Maake & Antwi, 2022) and timeliness of supply (Buadi *et al.,* 2013).

Studies such as those by Hilary *et al.* (2017) and Kassem *et al.* (2020) have reported on the quality of extension services provided through various communication channels in Uganda and Egypt. In their studies, extension services were perceived as relevant to farmer operations and needs. Studies have further reported the level of education, farm size, diversity of farming activities, annual incomes and participation in extension services as factors influencing farmers' satisfaction with the quality of extension services (Kassem *et al.,* 2021; Misozi & Chrispin, 2019). Evidence from

Hilary *et al.* (2017) on information quality in farmer organisations in Bugiri and Luwero districts of Uganda reported an exchange of quality and valuable information among farmer organisations, with information from government actors being the least reliable and that from the private actors being the most reliable.

In Tanzania, smallholder rice farmers face significant challenges in accessing quality information necessary for their agricultural practices. Despite the extensive literature on potential benefits of information dissemination through AMCOS, it remains unclear whether these co-operative societies can effectively provide smallholder rice farmers with the quality information basing on their needs. The lack of access to reliable and accurate information hampers the ability of smallholder rice farmers to make informed decisions regarding farm management and post-harvest practices. Therefore, it is essential to investigate whether AMCOS can fulfil the role of reliable information providers and address the information gap faced by smallholder rice farmers in Tanzania. This paper addresses this research gap by assessing the current level of access to information among smallholder rice farmers in AMCOS, evaluating the relevance, adequacy and reliability of information provided by AMCOS to smallholder rice farmers and identifying the factors influencing the adequacy of the information provided by AMCOS in Tanzania.

2.0 Methodology

The study was conducted in Mvomero and Mbarali districts of Morogoro and Mbeya regions, respectively in Tanzania. The districts were specifically chosen for the study because they are among the top rice-producing districts in Tanzania and include a significant number of rice value chain actors. The lack of access to reliable and accurate information in the study area hampers the farmers' ability to make informed decisions regarding crop management and post-harvest practices. The two districts also fall within acceptable agro-ecological zones for rice production in Tanzania (URT, 2017).

A cross-sectional research design was employed. A sample of 382 respondents was selected from the three registered co-operative societies; the sample size was estimated using Yamane's (2001) formula. Three AMCOS were purposefully chosen from the two districts namely; Kapunga smallholders and Madibira AMCOS in Mbarali District and UWAWAKUDA AMCOS in Mvomero District. This selection based on their functionality as well as information sharing with the farmers along the rice value chain and the period they have been engaged in rice farming activities. A simple random sampling procedure was used to select respondents from the list of smallholder farmers obtained from the AMCOS offices. A structured questionnaire was used to collect quantitative information from individual smallholder rice farmers. Focus Group Discussion (FGD) guide was used to gather information on the quality of agricultural information from farmers. Four FGDs were conducted and each comprised of eight participants purposively selected from smallholder farmers by the virtual of having high knowledge and experience in rice farming.

Data were analysed by using a computer based Statistical Package for Social Sciences (SPSS). Descriptive statistical analysis was computed to describe farmers' access to agricultural information in AMCOS, its adequacy, relevance and reliability. Three attributes of quality were measured on a three-point rating as follows: adequacy (inadequate, partially adequate and adequate), relevance (irrelevant, relevant and highly relevant) and reliability (not reliable, reliable, and highly reliable). The Kruskal-Wallis Test was employed to establish the variation of smallholder farmers' responses regarding adequacy, relevance and reliability between Kapunga, Madibira and UWAWAKUDA AMCOS.

The ordinal logistic regression analysis was used to determine influence of various factors on the adequacy of information received from AMCOS. In this model, the dependent variable (adequacy of information) was ranked as 0=Inadequate, 1=Partially Adequate and 2=Adequate. The ordinal logistic regression equation was specified as:

$$Y_{i1} = \lambda_j\left(\overset{x}{\rightarrow}\right) = \ln\left\{\frac{p}{1-p}\right\} = \alpha_j + \beta_1 X_1 + \beta_2 X_2 + \cdots + \beta_p X_p$$

Where:

Y_i = Dependent variable (Adequacy of information received from AMCOS)

$\lambda_j\left(\overset{x}{\rightarrow}\right)$ = Logit link function of explanatory variables
$\overset{x}{\rightarrow}$ = Vector of explanatory variables
$X_1 - X_p$ = Explanatory variables
α_j = j^{th} intercept estimate (Threshold).
$\beta_1 - \beta_p$ = Location parameter estimates or slopes of explanatory variables.
p =Probability that information received is adequate compared to partially adequate and inadequate.
$1 - p$ = Probability that information received is inadequate compared to partially adequate and adequate

Table 1: Variable specifications

Symbol	Variable	Explanation	Expected sign
y_i	Adequacy of information received from AMCOS	0=Inadequate, 1=Partially Adequate and 2=Adequate.	
x_1	Experience	Years in AMCOS (cont…)	-
x_2	Land size	Land size of respondents (cont...)	+
x_3	Smartphone ownership	0=No 1=Yes(dummy)	-
x_4	Membership in other social groups	0=No 1=Yes(dummy)	-
x_5	Information on rice agronomic practices	0=No 1=Yes(dummy)	+
x_6	Information on storage	0=No 1=Yes(dummy)	+
x_7	Information on value addition	0=No 1=Yes(dummy)	+
x_8	Information on marketing	0=No 1=Yes(dummy)	+
x_9	Financial information	0=No 1=Yes(dummy)	+
x_{10}	Education level	0=No formal education 1=Formal education (dummy)	+
x_{11}	Water distribution	0=Poor 1=Good(dummy)	+

The model validity was determined by considering parallel assumption which restricts using the model when it is violated. During the test of parallel line, once the P-value is less than 5% the null hypothesis was rejected. It was observed that the information comprising explanatory variables adequately fitted the model as the difference between -2 log-likelihood for the model with intercept only and the model with explanatory variables was positive and statistically significant at the p-value < 0.05 level. Also, there was a goodness of fit since both Pearson chi-square and Deviance test were not statistically significant (p-value>0.05); hence the model had no over-dispersion problem. The model agreed with parallel lines assumptions as the score test (Chi-square test) was not statistically significant (p-value>0.05); hence, the parameter estimates were the same across all categories of the dependent variable. Therefore, the fitted model was appropriate, and the selected explanatory variables were appropriate for discussion of the factors influencing the adequacy of information received from AMCOS.

Content analysis was employed to systematically organise, re-arrange and manage the qualitative data obtained through FGDs in order to derive meaningful insights and patterns. The qualitative information that was collected was mainly on the farmers' information accessibility and the quality of the information received from co-operative societies.

3.0 Findings and Discussion

3.1 Farmers' socio-demographic attributes

The findings in Table 2 show that 73.6% of the respondents had at least primary school education. Level of education is anticipated to be an important factor that would affect the quality of information in rice farming as educated farmers find it easier to comprehend information concerning production technologies and farming practices. Also, the study revealed that 70.7% of

the respondents were males while 29.3% of them were females. Men are dominant in rice production in the research area as shown in Table 2. This is because in many households, men often have greater power in decision-making and control over resources including land and agricultural activities. It implies further that extension services should mobilise women for more involvement in rice production and enable interventions tailored to their needs.

Likewise, 11.5% of farmers were recorded in all co-operatives having rice farming as their only economic activity. The study also found that the average household size was 5 people. This emphasizes the importance of considering the dynamics of household decision-making, information sharing, and resource allocation when designing strategies for information dissemination and support services targeted at smallholder rice farmers. The average number of years in AMCOS and experience in rice farming were 14.04 and 18.02 years respectively. Mean years were found highest at Madibira (15.21) and lowest at Kapunga (11.85). Experience in rice farming can affect smallholder farmers' access to agricultural information. Farmers with more experience may have already acquired knowledge and skills through trial and error or through interactions with other farmers, while less experienced farmers may have limited knowledge and may require more information and support.

Table 2: Socio-demographic characteristics among farmers (n=382)

Variable	Classes	AMCOS			Pooled statistics n=382
		Kapunga %	Madibira %	UWAWAKUDA %	
Sex	Male	74.2	72.6	62.80	70.7
	Female	25.8	27.4	37.2	29.3
Marital status	Single	11.3	10.3	7.1	9.7
	Married	88.7	89.7	92.9	90.3
Education level	Informal education	1.6	3.8	5.8	3.9
	Primary	69.4	71.4	82.6	73.6
	Secondary	4.8	19.2	7.0	14.1
	Tertiary	24.2	5.6	4.7	8.4
Economic activities	Farming (Other crops)	40.3	42.7	22.1	37.7
	Livestock	0.0	1.3	2.3	1.3
	Business	0.0	12.8	23.3	13.1
	Farming, livestock and business	46.8	34.6	33.7	36.4
	Rice farming only	12.9	8.5	18.6	11.5
			Mean		
Household size		5	5	5	5
Experience in rice farming		21.24	17.77	16.35	18.02
Years in AMCOS		11.85	15.21	12.43	14.04

3.2 Smallholder farmers access to information

The findings on smallholder rice farmers' information accessibility indicated that the majority of farmers obtained information on rice agronomic practices (77.2%) and marketing (75.1%) from AMCOS as shown in Figure 1. This means that these co-operative societies are playing a key role in disseminating information on rice agronomic practices and marketing to smallholder farmers. The agronomic practices include land preparation, seed selection and preparation, nutrient management, irrigation, weeding and pests/disease management in rice farming. Co-operative societies can leverage their network and resources to provide agricultural information to their members, which can be especially beneficial for smallholder farmers who may have limited access to other information sources. The fact that the majority of smallholder rice farmers obtained information on rice agronomy and marketing from their co-operative societies suggests that these societies are effective in disseminating information to their members. This can contribute to improving the productivity and income of smallholder farmers hence competitiveness in rice farming.

The findings are in line with those by Misozi & Chrispin (2019) and Phiri *et al.* (2019) who reported that the majority of co-operative farmers' information needs were in areas of agricultural

technology and agronomic practices in Chibombo District of Zambia and Malawi, respectively. On the other hand, only 43.7% of farmers obtained financial information from AMCOS as shown in Figure 1. This is due to the presence of a number of financial institutions in the study areas including the Mufindi Community Bank, Victoria Microfinance, Access Bank, and Savings and Credit Co-operative Societies where the majority of farmers obtained financial information about rice farming. These were the alternative sources of financial information to smallholder rice farmers in the study area.

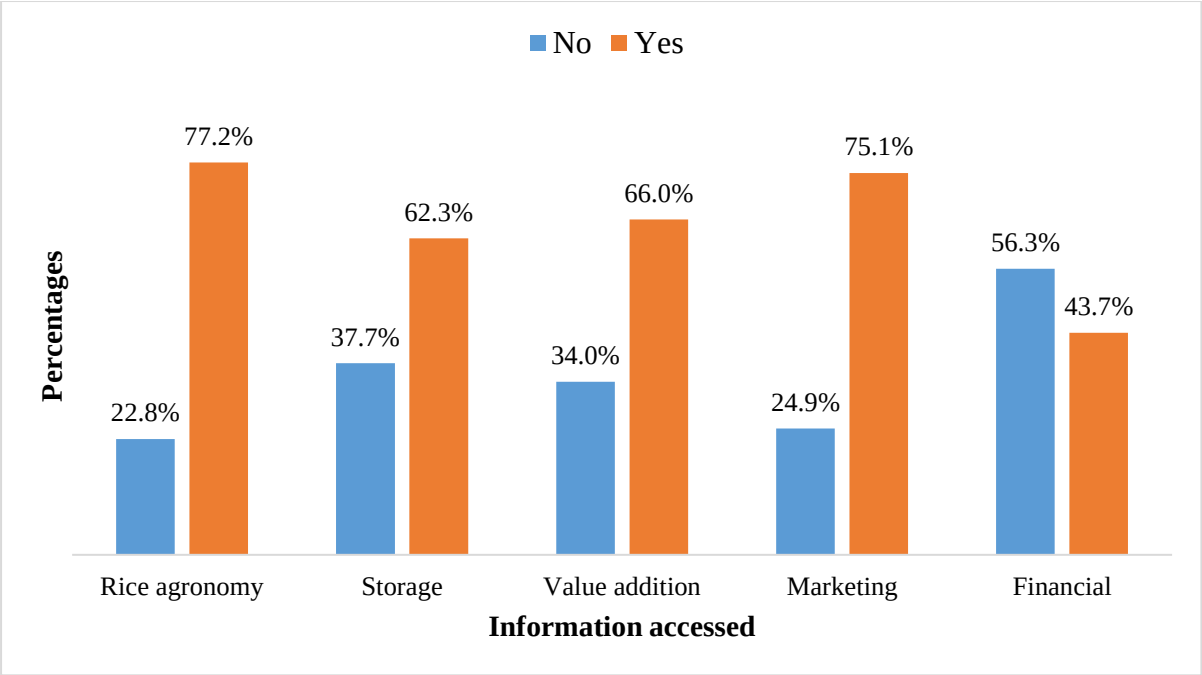

Figure 1: Information Accessibility among Smallholder Rice Farmers

Smallholder farmer reported having received no weather forecast information. Impliedly, the co-operatives societies had no expertise on information on weather condition. The results differ from those by Phiri *et al.* (2019) who found that 50% of smallholder farmers in Malawi obtained weather/ climate information from service providers co-operatives inclusive. Other sources of agricultural information for AMCOS members in the study area included input dealers, extension officers, research institutes, fellow farmers, mass media and traders. The rating on the quality of their information is as shown in Appendix 1.

3.3 Adequacy, relevance and reliability of information obtained from AMCOS

3.3.1 Adequacy

The majority of the respondents (52.6%) reported having received adequate information while 29.3% and 18.1% of them claimed to have received partially adequate and inadequate information respectively from their respective co-operative societies as shown in Table 3. This means that majority farmers feel the information provided is sufficient for their needs to some extent, but there may be some gaps or areas where more information is needed since farmers have different experiences in rice farming. This information can be helpful in identifying areas where additional information or support may be required to address the specific needs and challenges of smallholder farmers. The results on adequacy are well comparable with those by Buadi *et al.* (2013) who reported that farmers perceived agricultural information received to be adequate in the central region of Ghana. They are also comparable with findings by Jona and Terblanché (2015) who reported that farmer associations were ranked second after research institutes in the provision of adequate information to farmers in Namibia.

Table 3: Distribution of information adequacy among AMCOS members

Name of AMCOS	Adequate		Partially adequate		Inadequate	
	n	%	n	%	n	%
Kapunga	24	11.9	25	22.3	13	18.8
Madibira	140	69.7	67	59.8	27	39.1
UWAWAKUDA	37	18.4	20	17.9	29	42
Pooled	**201**	**52.6**	**112**	**29.3**	**69**	**18.1**

Among the three AMCOS considered, Madibira AMCOS had the highest proportion of farmers reporting adequate information (69.7%), followed by UWAWAKUDA AMCOS (18.4%) and Kapunga AMCOS (11.9%). These findings suggest that Madibira AMCOS has been more successful in providing agricultural information that meets the farmers' needs, while Kapunga AMCOS lags behind in terms of providing adequate information to their members. Agricultural information received from AMCOS was sufficient for the majority of farmers in making informed decisions on rice farming. However, within co-operatives, 42% of respondents in UWAWAKUDA reported having received inadequate information as shown in Table 3. Similarly, the results through FGDs revealed that majority of farmers in UWAWAKUDA had inadequate information from the AMCOS. One participant summarised the views of other respondents:

> *''....Our productivity and profitability in rice farming are directly impacted by the limited information flow that currently exists. Our co-operative society does not have a stationed extension officer; instead we rely on a government officer who has a large number of farmers to serve, and shortage of resources to facilitate him''* (FGD, Dakawa Village, March 2022).

A similar matter was raised by another FGD participant who enlightened that:

> *"... we need other actors to help us connect to the markets by providing us with enough information on rice farming and to connect our co-operative society to buyers, input suppliers, millers, exporters, and financial institutions, among others''*(FGD, Kapunga Village, February 2022).

Also, it was reported that:

> *"In the co-operative budget template, we have a section for farmers' capacity building every year, where farmers are trained and taken for study tours for adequate information on rice farming. In fact, Madibira has got a stationed extension staff; therefore, this co-operative society is providential and one step ahead when compared to Kapunga* (FGD, Charisuka Village, February 2022).

The study findings are supported by information from the FGDs that one of the reasons for inadequate information received in UWAWAKUDA, among others, could be absence of a stationed government extension officer for the irrigation scheme. The practice was different in the other co-operative societies such as Madibira. Additionally, availability of resources and connection with other actors like traders, input suppliers is vital for adequate information availability to smallholder rice farmers. In estimating the variations of smallholder farmers' responses regarding the adequacy of information in the three co-operative societies in the study area, the Kruskal-Wallis Test results show the significance (p=0.000) is less than the critical value of 0.05. This means that responses of farmers in the three co-operative societies differ significantly among AMCOS, where [H (2) = 0.639, p=0.000] were recorded. Further analysis was done to find out factors influencing the adequacy of information received from AMCOS.

3.3.2 Relevance

Assessment of the relevance of information received by farmers in terms of timeliness, addressing farmer's needs, and applicability in rice farming was done. An even distribution was revealed from the overall findings where 35.6%, 34.6% and 29.8% were observed in terms of highly relevant, relevant and irrelevant as shown in Table 4. The majority of farmers generally perceived the information to be highly relevant and relevant. When the majority of smallholder rice farmers rate

agricultural information as highly relevant and relevant, it indicates that the information provided is perceived to be useful and valuable to them. This means that the information meets their needs and expectations and can help them improve their farming practices, increase productivity, and potentially increase their incomes. This positive feedback from smallholder rice farmers is important because it suggests that the agricultural information is effective in addressing their specific needs and challenges. It also demonstrates that efforts to disseminate agricultural information to smallholder farmers are making a positive impact, which can ultimately contribute to smallholder farmers' competitiveness. The findings differ from those by Jona and Terblanché (2015) in Namibia who found that farmers were not satisfied with the relevance of information provided by farmer associations. Yet, the results support the findings by Alam and Guttormsen (2019) who reported that aquaculture farmers had received relevant financial information from co-operative organisations in Bangladesh.

Table 4: Distribution of information relevance among AMCOS members

Name of AMCOS	Highly relevant		Relevant		Irrelevant	
	n	%	n	%	n	%
Kapunga	16	11.8	27	20.5	19	16.7
Madibira	88	64.7	75	56.8	71	62.3
UWAWAKUDA	32	23.5	30	22.7	24	21.1
Pooled	**136**	**35.6**	**132**	**34.6**	**114**	**29.8**

Among the three AMCOS considered, Madibira AMCOS had the highest proportion of farmers reporting relevant information (64.7%), followed by UWAWAKUDA AMCOS (23.5%) and Kapunga AMCOS (11.8%). These findings suggest that Madibira AMCOS has been more successful in providing agricultural information that meets the farmers' needs, while Kapunga AMCOS lags behind in terms of providing relevant information to their members. In evaluating the variation of smallholder farmers' responses regarding the relevance of information between Kapunga, Madibira and UWAWAKUDA co-operative societies in the study area, Kruskal-Wallis Test findings revealed that, the significance ($p= 0.497$) is greater than the critical value of 0.05. This means that responses of farmers in the three co-operative societies did not differ significantly among AMCOS, where [$H (2) = 1.398$, $p= 0.497$] were recorded.

3.3.3 Reliability

The findings in Table 5 show that 37.7% of farmers argued that information obtained from AMCOS was reliable while 32.2% of farmers claimed that the information obtained was not reliable. When the majority of smallholder rice farmers rate agricultural information as highly reliable, it means that they trust the information and believe that it is accurate and trustworthy. This is important because reliable information can help farmers make informed decisions about their farming practices, such as when to plant, how much fertilizer to apply, and how to manage pests and diseases. When farmers have access to reliable agricultural information, they can increase their productivity and yields, reduce crop losses, and potentially increase their incomes. This, in turn, can contribute to improving food security and reducing poverty in rural areas. It is important to note that farmers may have different criteria for assessing the reliability of information and in this case, they trusted the source of information and the partnerships that exist between AMCOS and the research institutes. Therefore, it is important to understand the perspectives and needs of smallholder farmers when providing them with agricultural information to ensure that it is perceived as reliable and useful.

However, within co-operatives, the 19.5% respondents in Kapunga reported having received unreliable information from their co-operative society. The unreliable information was due to the lack of a stationed extension officer, less involvement of other actors in the rice value chain such as research institutes in Kapunga AMCOS. The study findings differ from those made by Jona and Terblanché (2015) who found that information provided by farmer associations in Namibia was not reliable, and hence farmers were not satisfied with its adequacy.

Table 5: Frequency distribution on the reliability of the information received

	Highly reliable		Reliable		Not reliable	
Name of AMCOS	**n**	**%**	**n**	**%**	**n**	**%**
Kapunga	19	16.5	19	13.2	24	19.5
Madibira	69	60	91	63.2	74	60.2
UWAWAKUDA	27	23.5	34	23.6	25	20.3
Pooled	**115**	**30.1**	**144**	**37.7**	**123**	**32.2**

In assessing the variation of smallholder farmers' responses regarding the reliability of information between Kapunga, Madibira and UWAWAKUDA co-operative societies in the study area, Kruskal-Wallis Test findings revealed that, the significance (p= 0.726) is greater than the critical value of 0.05. This means that there was no statistical difference between the mean scores in the three co-operatives, where [H (2) = 0.639, p= 0.726] were recorded.

3.4 Factors influencing adequacy of information accessed from AMCOS

Further analysis was done using ordinal logistic regression analysis to find influence of the factors listed in Table 6 on adequacy of information received from AMCOS. Membership in social groups, information on rice agronomic practices and information on finance had a positive and significant influence on adequacy at $p < 0.05$ while information on value addition negatively and significantly influenced adequacy as shown in Table 6. All other variables, except years in AMCOS, membership in social groups, information on value addition and marketing had their expected signs.

Table 6: Factors influencing adequacy of information received from AMCOS

		Estimate	Std. Error	Wald	df	Sig.	95% Confidence Interval	
							Lower Bound	Upper Bound
Threshold	[Inadequate = 0]	-0.424	0.490	0.747	1	0.387	-1.384	0.537
	[Partiallyadeq = 1]	1.636	0.500	10.689	1	0.001	0.655	2.616
Location	Years in AMCOS	0.028	0.018	2.466	1	0.116	-0.007	0.064
	Land size	-0.053	0.072	0.551	1	0.458	-0.194	0.087
	[Info on agronomy practices = 0]	1.532	0.342	20.048	1	0.000	0.861	2.202
	[Info on agronomy practices =1]	0a	.	.	0	.	.	.
	[Info on Storage=0]	-0.242	0.233	1.075	1	0.300	-0.699	0.215
	[Info on Storage=1]	0a	.	.	0	.	.	.
	[Info on Value addition=0]	-0.531	0.238	4.986	1	0.026	-0.997	-0.065
	[Info on Value addition =1]	0a	.	.	0	.	.	.
	[Info on Marketing=0]	-0.493	0.264	3.47	1	0.062	-1.011	0.026
	[Info on Marketing =1]	0a	.	.	0	.	.	.
	[Financial Information=0]	0.623	0.225	7.649	1	0.006	0.182	1.065
	[Financial Information =1]	0a	.	.	0	.	.	.
	[Membership in social groups=.00]	2.350	0.252	86.753	1	0.000	1.856	2.845
	[Membership in social groups=1.00]	0a	.	.	0	.	.	.
	[Education level=.00]	-0.159	0.54	0.087	1	0.768	-1.218	0.899
	[Education level =1.00]	0a	.	.	0	.	.	.
	[Water distribution=.00]	0.325	0.31	1.096	1	0.295	-0.283	0.932
	[Water distribution=1.00]	0a	.	.	0	.	.	.
	[Smartphone ownership=0]	-0.015	0.309	0.002	1	0.960	-0.621	0.59
	[Smartphone ownership=1]	0a	.	.	0	.	.	.

- Model fitting information: (Intercept only -2LL=742.887), (Final model -2LL=563.753, chi-square=179.134, df=11 and p-value = 0.000)
- Goodness of fit test: Pearson Chi-square=612.242, df = 667, P-value = 0.936 and Deviance = 540.395, df = 667, p-value = 1.000
- Coefficient of determination Pseudo R^2: Cox and Snell=37.5, Negelkerke = 43.2 and Mc Fadden = 23.3
- Test of Parallel lines: Null hypothesis -2LL=563.753, General -2LL=553.216, Chi-square=10.537, df=11, P-value = 0.483

Being part of other social networks demonstrate a strong positive and significant association with the adequacy of information received from AMCOS (coefficient estimate of 2.350, p-value of 0.000) as shown in Table 6. This shows that being a member of social groups tends to increase the adequacy of information compared to those who are not members. This means that members of social groups may access information from different angles but still rate information received from AMCOS as sufficient. This indicates that AMCOS is effectively meeting farmers' information needs, providing tailored and credible information that is valued and trusted by the members. It reflects the co-operative society's ability to understand and cater to the specific requirements of its members, ultimately contributing to their competitiveness in rice farming. The findings compare well with the findings by Petcho *et al.* (2019) in Thailand, who found that membership in other economic/social groups enhanced household members' knowledge and generated ideas related to production and marketing.

The variable information on agronomic practices shows a significant positive coefficient estimate (1.532) with a p-value of 0.000 which indicates a strong association between receiving information on agronomic practices and the perception of information adequacy among farmers. This suggest that farmers who receive information on agronomy practices are more likely to perceive the information as sufficient and satisfactory compared to those who do not receive such information. The increase in the frequency or extent of receiving agronomic information from AMCOS, increases farmers' likelihood to view that information as valuable and helpful in their farming practices. The results are in line with those by Frimpong-manso *et al.* (2022) in Ghana where active farmers who had received information on good agronomic practices for cocoa farming had a positive perception of co-operatives as a source of information.

The findings in Table 6 show that farmers who obtained financial information from AMCOS, their adequacy level increased by 0.623 logits at p-value of 0.006. This suggests that smallholder farmer who secured financial information from AMCOS are more likely to perceive the information received as adequate compared to their counterparts. The study results tend to reconcile with the findings by Alam and Guttormsen (2019) who found that farmers perceived co-operative organisations as a source of adequate farming information in Bangladesh. An increase in the provision of information concerning value addition decreased the adequacy of information by 0.623 units at p-value = 0.026. This means that the agricultural co-operatives either had insufficient information on value addition or had no expertise in the area and hence could not provide adequate information.

4.0 Conclusions and Recommendations

The highest information needs of smallholder rice farmers are in the areas of agronomic practices and marketing, and smallholder farmers reported no access to weather forecast information from AMCOS. Agricultural co-operatives are important platforms that provide quality information in enhancing smallholder farmers' informed decision-making. Financial and rice agronomy information are significant determinants of the adequacy of information received by smallholder farmers.

It is therefore recommended that, AMCOS should understand the specific information needs of smallholder farmers growing rice and tailor the information accordingly. This can be achieved through participatory approaches, such as farmer needs assessments and surveys, to identify the most relevant and useful information for farmers. Information should be provided in a format that is easily understood and accessible, taking into consideration the literacy levels and language preferences of the farmers. Collaborations with meteorological agencies and other relevant service providers should be established to ensure that farmers receive reliable and timely weather information. This can be achieved through the use of mobile technologies, such as SMS or smartphone applications to disseminate weather forecasts to farmers in a timely manner. Efforts should be made to strengthen AMCOS by providing them with resources, training, and support to enhance their capacity to deliver accurate and timely information to farmers. This can include collaboration with agricultural extension services and leveraging their networks to access up-to-date information on agronomic practices, weather forecasts, and market trends. Moreover, efforts should be made to improve farmers' access to financial and rice agronomy information, including information on good agronomic practices, accessing credit, savings, and investment opportunities.

This can be achieved through partnerships with financial institutions, training programs, and awareness campaigns on financial literacy tailored to the specific needs of smallholder farmers.

The Local Government Authority should put in place monitoring and evaluation mechanisms to assess the effectiveness of information dissemination strategies and interventions. This will help identify gaps and areas for improvement, allowing for adjustments and refinements in information delivery approaches. Feedback from farmers should be actively sought to ensure that the information provided is relevant, accurate, and meets their needs. To improve the smallholder rice farmer's competitiveness in rice farming, AMCOS and other stakeholders should enhance the information ecosystem for smallholder rice farmers, empower them with the knowledge and resources necessary to improve their agricultural practices, productivity, and livelihoods.

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Appendix: Agricultural Information Providers

SERVICE PROVIDER	VARIABLES		Kapunga		Madibira AMCOS		UWAWAKUDA			
			n	%	n	%	n	%	Total	%
AMCOS	ADEQUACY	Inadequate	13	18.80	27	39.10	29	42.00	69	18.06
		Partially adequate	25	22.30	67	59.80	20	17.90	112	29.32
		Adequate	24	11.90	140	69.70	37	18.40	201	52.62
		Total	62		234		86		382	100.00
	RELEVANCE	Irrelevant	19	16.70	71	62.30	24	21.10	114	29.84
		Relevant	27	20.50	75	56.80	30	22.70	132	34.55
		Highly relevant	16	11.80	88	64.70	32	23.50	136	35.60
		Total	62		234		86		382	100.00
	RELIABILITY	Not reliable	24	19.50	74	60.20	25	20.30	123	32.20
		Reliable	19	13.20	91	63.20	34	23.60	144	37.70
		Highly reliable	19	16.50	69	60.00	27	23.50	115	30.10
		Total	62		234		86		382	100.00
EXTENSION OFFICERS	ADEQUACY	Inadequate	20	29.90	24	35.80	23	34.30	67	17.54
		Partially adequate	20	13.10	106	69.30	27	17.60	153	40.05
		Adequate	22	13.60	104	64.20	36	22.20	162	42.41
		Total	62		234		86		382	100.00
	RELEVANCE	Irrelevant	9	60.00	3	20.00	3	20.00	15	3.93
		Relevant	51	16.70	183	59.80	72	23.50	306	80.10
		Highly relevant	2	3.30	48	78.70	11	18.00	61	15.97
		Total	62		234		86		382	100.00
	RELIABILITY	Not reliable	23	41.10	17	30.40	16	28.60	56	14.66
		Reliable	27	11.30	159	66.30	54	22.50	240	62.83
		Highly reliable	12	14.00	58	67.40	16	18.60	86	22.51
		Total	62		234		86		382	100.00
MASS MEDIA(TV,Radio,Mobile)	ADEQUACY	Inadequate	30	21.70	97	64.50	24	15.90	151	39.53
		Partially adequate	31	19.90	88	61.50	24	16.80	143	37.43
		Adequate	1	1.10	49	55.70	38	43.20	88	23.04
		Total	62		234		86		382	100.00
	RELEVANCE	Irrelevant	23	39.00	20	33.90	16	27.10	59	15.45
		Relevant	33	11.80	208	74.60	38	13.60	279	73.04
		Highly relevant	6	13.60	6	13.60	32	72.70	44	11.52
		Total	62		234		86		382	100.00
	RELIABILITY	Not reliable	28	29.80	46	48.90	20	21.30	94	24.61
		Reliable	25	12.80	143	73.30	27	13.80	195	51.05
		Highly reliable	9	9.70	45	48.40	39	41.90	93	24.35
		Total	62		234		86		382	100.00
INPUT DEALERS	ADEQUACY	Inadequate	12	17.10	75	50.00	33	32.90	120	31.41
		Partially adequate	24	15.40	99	68.60	25	16.00	148	38.74
		Adequate	26	16.70	60	59.00	28	24.40	114	29.84
		Total	62		234		86		382	100.00
	RELEVANCE	Irrelevant	10	35.70	15	53.60	3	10.70	28	7.33
		Relevant	50	15.40	194	59.90	80	24.70	324	84.82

SERVICE PROVIDER	VARIABLES		Kapunga		Madibira AMCOS		UWAWAKUDA			
			n	%	n	%	n	%	Total	%
		Highly relevant	2	6.70	25	83.30	3	10.00	30	7.85
		Total	62		234		86		382	100.00
	RELIABILITY	Not reliable	17	28.80	36	61.00	6	10.20	59	15.45
		Reliable	42	15.90	162	61.40	60	22.70	264	69.11
		Highly reliable	3	5.10	36	61.00	20	33.90	59	15.45
			62		234		86		382	100.00
RESEARCH INSTITUTES	ADEQUACY	Inadequate	43	25.90	106	63.90	17	10.20	166	43.46
		Partially adequate	16	11.20	82	57.30	45	31.50	143	37.43
		Adequate	3	4.10	46	63.00	24	32.90	73	19.11
		Total	62		234		86		382	100.00
	RELEVANCE	Irrelevant	29	63.00	13	28.30	4	8.70	46	12.04
		Relevant	32	10.90	202	68.70	60	20.40	294	76.96
		Highly relevant	1	2.40	19	45.20	22	52.40	42	10.99
		Total	62		234		86		382	100.00
	RELIABILITY	Not reliable	39	65.00	17	28.30	4	6.70	60	15.71
		Reliable	22	9.50	155	66.80	55	23.70	232	60.73
		Highly reliable	1	1.10	62	68.90	27	30.00	90	23.56
		Total	62		234		86		382	100.00
FELLOW FARMER	ADEQUACY	Inadequate	32	27.40	54	46.20	31	26.50	117	30.63
		Partially adequate	15	9.30	115	71.00	32	19.80	162	42.41
		Adequate	15	14.60	65	63.10	23	22.30	103	26.96
		Total	62		234		86		382	100.00
	RELEVANCE	Irrelevant	18	50.00	7	19.40	11	30.60	36	9.42
		Relevant	39	12.10	212	66.00	70	21.80	321	84.03
		Highly relevant	5	20.00	15	60.00	5	20.00	25	6.54
		Total	62		234		86		382	100.00
	RELIABILITY	Not reliable	14	15.10	63	67.70	16	17.20	93	24.35
		Reliable	43	16.70	148	57.60	66	25.70	257	67.28
		Highly reliable	5	15.60	23	71.90	4	12.50	32	8.38
		Total	62		234		86		382	100.00
TRADER (Including Millers and brokers)	ADEQUACY	Inadequate	39	18.70	110	52.60	60	28.70	209	54.71
		Partially adequate	22	13.40	117	71.30	25	15.20	164	42.93
		Adequate	1	11.10	7	77.80	1	11.10	9	2.36
		Total	62		234		86		382	100.00
	RELEVANCE	Irrelevant	41	12.50	202	61.80	84	25.70	327	85.60
		Relevant	21	38.20	32	58.20	2	3.60	55	14.40
		Highly relevant	0	0.00	0	0.00	0	0.00	0	0.00
		Total	62		234		86		382	100.00
	RELIABILITY	Not reliable	19	8.10	164	69.50	53	22.50	236	61.78
		Reliable	37	27.00	67	48.90	33	24.10	137	35.86
		Highly reliable	6	66.70	3	33.30	0	0.00	9	2.36
		Total	62		234		86		382	100.00