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Agricultural Marketing Co-operative Societies' existing potential in adopting Climate Smart Agriculture among Smallholder Farmers in Bukoba District, Tanzania

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Abstract
Although the agriculture sector plays a crucial role in providing 90% of the world's food and employment opportunities, it is increasingly affected by climate change, resulting in decline in productivity and food insecurity. To address these challenges, Climate Smart Agriculture (CSA) has been adopted globally, with many places using co-operatives to assist smallholder farmers. However, there is a lack of scholarly research on the potential of Agricultural Marketing Co-operative Societies (AMCOS) to adopt CSA in Bukoba District, Tanzania. Therefore, this study aimed to investigate Agricultural Marketing Co-operative Societies' existing potential in adopting Climate Smart Agriculture (CSA) among smallholder farmers in Bukoba District-Tanzania. A total of 384 smallholder farmers members of co-operatives were used to collect using semi-structured questionnaires while personal interview was also used to collect qualitative data from key informants. The analysis involved both descriptive statistics for quantitative data and thematic analysis of qualitative data. The findings from the descriptive analysis showed that smallholder farmers were generally neutral and disagreed with the idea that AMCOS were instrumental in facilitating the adoption of these practices. Specifically, they expressed neutral and disagree views on access to agricultural credits, availability of training/ capacity building, access to extension services, and access to improved crop varieties through AMCOS. In particular, a total 362(94%) of the farmers disagreed and strongly disagreed with the assertion that they had access to fertilizer through AMCOS. However, it was noted that AMCOS primarily focused on collecting, storing, and selling smallholder farmers' produce, with more than 90% engagement in these activities. The study concludes that AMCOS in Bukoba have not

prioritized CSA, focusing mainly on marketing activities. It is recommended that AMCOS should integrate CSA into their operations and plans and commit resources, balancing production and marketing responsibilities. Additionally, the Ministry of Agriculture should guide AMCOS by providing clear policy directives, technical assistance, training, and monitoring to promote sustainable farming practices.

Keywords: Climate Smart Agriculture (CSA), Co-operative, Climate change, AMCOS existing potential

1.0 Introduction

Undoubtedly, agriculture remains a crucial sector for the majority of the population in developing countries, providing employment opportunities in production, marketing, and trading to more than 80% of people. In addition, it is responsible for over 90% of food and cash crop production and fosters rural and urban networks that promote crop production (Makate, 2017). However, despite its importance, the sector is currently experiencing low productivity due to global climate change. This has resulted in more than 800 million people in developing countries, who are mainly smallholder farmers, suffering from hunger and relying on agriculture for their livelihood (FAO, 2016).

Climate change is a global problem that presents challenges to the agricultural sector, caused mainly by the release of greenhouse gases from human activities such as burning of fossil fuels, deforestation, and land degradation. While the agricultural sector contributes a quarter of these emissions (Broeck, 2017), it is also highly vulnerable to the impacts of climate change, which can directly affect agricultural productivity and efficiency (Raghuvanshi & Ansari, 2017). Climate change can lead to food insecurity through rising temperatures, extended rainy seasons, or prolonged dry seasons, and can result in the eradication of crops, pests and diseases, reduced livestock production, and loss of arable land (Zighe, 2016). The consequences of climate change on the global population are severe, as food production needs to increase by at least 70% by 2050 to feed the projected 9 billion people. However, with such consequences 8.9% of the global population is already facing hunger and uncertainty about future food access (Wekesa, 2017; Wheeler & von Braun, 2013). Therefore, adoption of Climate Smart Agriculture is crucial to address the challenge of climate change in the agricultural sector (Mwinuka, 2018). Climate Smart Agriculture (CSA) is an approach that helps guide actions needed to transform and reorient agricultural systems to effectively support the development and ensure food security in a changing climate (Amadu, 2018). CSA aims to tackle three main objectives: sustainably increasing agricultural productivity and incomes; adapting and building resilience to climate change; and reducing greenhouse gas emissions. These objectives are also referred to as the three CSA pillars: food security, adaptation, and mitigation (Amadu, 2018). CSA provides the means to help stakeholders identify agricultural strategies suitable to their local conditions. Therefore, promoting and accelerating adoption and implementation of CSA practices among smallholder farmers, especially through collective efforts, can transform agriculture and increase productivity, wellbeing, ensure food security, mitigate and enhance resilience to climate change, as well as promote the performance of the farmers associations (Amadu, 2018).

In sub-Saharan Africa, climate change poses significant challenges to agriculture. The region has experienced negative climate change indicators such as extended rainy seasons, prolonged dry seasons, and temperature rise, which have negatively impacted agricultural production (Long, 2015; Thornton & Herrero, 2014). The effects of climate change on the agricultural sector in sub-Saharan Africa include low agricultural productivity, food insecurity and poor nutrition, eradication of some crops, occurrence of new pests and diseases, and loss of favorable weather conditions to cultivate crops. In Tanzania, for instance, there has been a decline in agricultural productivity leading to food insecurity, with crop yields declining by 84% in the Central Region, 22% in the Northern-Eastern Highland, 10-15% in the Southern

Highland, and 17% in the Lake Zone regions (URT, 2007). Moreover, projections indicate that temperatures in Tanzania are expected to increase by 2.1°C to 3.6°C by 2080, which will further challenge agricultural productivity (URT, 2015). This evidence underscores the need for the adoption of Climate Smart Agriculture (CSA) in the country. Substantial intervention and investment into modern agricultural practices, particularly through collective and joint efforts of smallholder farmers' associations, such as co-operatives, are necessary to enhance agricultural productivity and food security (Chandra, 2017; Dargush *et al.,* 2016; Branca *et al*., 2012).

While CSA is an important approach in the transformation of the agricultural sector, the role of co-operatives in the adoption of Climate Smart Agriculture (CSA) practices has been a subject of empirical investigation. Several studies have highlighted the impact of co-operative membership on the adoption of CSA practices and their subsequent effect on crop yields. Co-operatives can play a crucial role in climate change adaptation by improving farmers' knowledge about and access to climate-smart practices and technologies (Bizikova *et al*., 2020; Kahsay *et al*.,2022). Khanal *et al.* (2019) examined the role of community-based farmer organizations, found that members of farmer organizations were more likely to adopt different crop varieties and adjust the timing of their farm operations, which are key CSA practices. Similarly, Ombogoh *et al*. (2016) investigated the association between co-operative membership and climate adaptation among smallholder farmers in Kenya and Uganda. Their findings suggest that co-operative membership is important for farmers' adaptive capacity by improving their skills and sharing knowledge on agroforestry and soil and water conservation, which are also integral components of CSA. Additionally, co-operatives can facilitate the adoption of climate-smart agricultural practices by providing farmers with access to credits and insurances (Kahsay *et al*.,2022). The role of co-operatives in climate change adaptation is multifaceted. They can promote the adoption of climate-smart practices such as timely planting, crop diversification, and conservation agriculture (Kopytko, 2018). Co-operatives can also provide farmers with access to climate information and early warning systems, enabling them to make informed decisions about their agricultural activities (Kahsay *et al*., 2022). The factors influencing the adoption of CSA have been studied extensively. Government interventions, institutional factors, farm characteristics, farmer socioeconomic characteristics, and environmental constraints have all been identified as key determinants of CSA adoption (Wekesa, 2017; Zighe, 2016; Isaac *et al*., 2016; Karlsson *et al*., 2018; Gebremariam & Tesfaye, 2018; Jayne *et al*., 2018; Cordingley *et al*., 2015).

Several studies in Bukoba have primarily focused on climate change adaptation and the effect of climate change. However, there are limited empirical studies on AMCOS' potential in adopting CSA among smallholder farmers. For instance, the available studies such as that of Mgalla *et al*. (2023) and Luhunga and Songoro (2020) focused on the effects of climate change, but there is a lack of empirical evidence on the role of AMCOS in Bukoba District, particularly in the context of CSA adoption. Therefore, this study aims to fill this gap by investigating the existing potential of AMCOS in adopting CSA practices among smallholder farmers in Bukoba District, with the findings contributing to the existing literature by providing new insights into the role of AMCOS in promoting CSA adoption and highlighting the importance of strengthening their capacity to address climate change challenges.

To achieve the above objectives, the study adopted Random Utility Maximization Theory (RUMT) by McFadden, 1973. The RUMT assumes that farmers choose a particular climate change response strategy depending on the level of utility generated from the chosen strategy. However, the choice of a particular package of CSA will be guided by random factors. The utility of a choice is deterministic and an error component. The error component is independent of the deterministic part and follows a predetermined distribution. This shows that it is not usually possible to predict with certainty the alternative that the decision-maker will select. However, it is possible to express the probability that the perceived utility associated with a particular strategy is greater than other available alternatives (Cascetta, 2009). The utility that an individual will gain from the consumption of a good is made up of an observable deterministic component (the utility function) and a random component. This theory gives a picture that a rational farmer who aspires to maximize the present value of benefits (farm productivity) over a specified period of time must choose among a set of CSA strategies. The farmer will choose to adopt a CSA strategy if the perceived benefit from that strategy is greater than the utility from other strategies. It also explains that utility derived from any CSA strategy is assumed to depend on the attributes of the CSA strategy itself and the socio-economic characteristics of the farmer. The theory provides a framework to understand how the attributes of CSA strategies and the socio-economic characteristics of farmers influence their adoption decisions.

2.0 Methodology

This study used a cross-sectional research design consisting of survey. Survey research is a type of research which is favored when the purpose of the study is geared toward gathering large numerical and factual data relating to the characteristics, behaviour, expectations, personality, and knowledge of respondents (Creswell, 2013). Data was collected at one point in a time whereas a variety of data collection methods and analytical techniques including qualitative and quantitative were used. Although the cross-sectional design is cost effective in terms of time and other resources, however, it has some limitations such inability to establish causality between variables of interest. Adopting mixed approaches (qualitative and quantitative) enabled the researcher to rectify discrepancies in any method applied. Also, the use of this approach provided a wide range of describing and understanding of a research problem by having an extensive and critical perspective on practical issues related to CSA practices among co-operative small-scale farmers.

This study was conducted in Bukoba District, Kagera Region. The reasons for selection of the study areas include the evidence that the region is one among Lake Victoria regions reported with climate change that led to decline in crop yield by 17%. Moreover, other evidence includes the climate trend of monthly temperature across Tanzania which has increased by 1 °C over the past decades (URT, 2007). The unit of analysis involved smallholder farmers' cooperative members of AMCOS. Since the unit of enquires in the study areas are unknown, Cochran formula (1963) for infinity population was used to determine a minimum of 384 sample size as detailed below:

$$n = \frac{z^2pq}{e^2} =$$

$$n = \frac{(1.96)^2 x 0.5 x 0.5}{0.05^2} = 384 \text{ respondents (Members)}$$

Where n is the sample size, Z^2 is a confidence level of 1.96, p is the estimated proportion of 0.5, q is 1-p, and e is the level of precision which is 0.05. The Cochran method is used to calculate the minimum sample needed to achieve a desired level of precision, given a certain level of confidence and estimated proportion. In this study 5% level of confidence was chosen because is most commonly used in social studies. The confidence level represents how certain the researcher is that the mean of a sample will fall within the given margin of error from the true population mean. The choice of 50% (population proportion) is based on the ground that the exact number of smallholder farmers in the study is not known, what is known is the number of members in AMCOS.

Based on the sample size above, systematic sampling was used to select a total of 384 AMCOS smallholder farmers from the source list using an established interval. The random starting point was regenerated using a random number generator using Excel. The random starting point was the fourth observation from the list of co-operative members. After determining the random starting point and sampling interval (k=10), every kth observation was selected to be included in the study sample. The method was used so as to avoid researcher biases. Purposive sampling was also used to select 10 AMCOS Leaders out of 50 AMCOS in Bukoba Rural. Moreover, purposive sampling was used to select 10 Extension Officers for the selected AMCOS. The method was used to get valid information from experienced respondents who work daily with smallholder farmers in the district.

Semi-structured questionnaires have been used to collect responses from 384 respondents. The questionnaire was pre-tested to check of wording of the questions, interview time, and unit of measurement and to refine the survey instruments. A semi-structured questionnaire necessitates questions be developed, written, and arranged in a way that they are self-explanatory. This means that the researcher has little influence on the responses (Neuman, 2014). Efforts were made to avoid overlapping and unexhaustive responses. In this study, the use of a questionnaire was influenced by the need to record the demographics; socio-economic characteristics; and AMCOS existing potentials on the adoption CSA practices. Moreover, a semi-structured questionnaire is suitable because it is one of the survey instruments that ensures standardization of the questions and recording of answers which is fundamental in reducing errors that may result due interview variability and leads to data processing accuracy (Bryman, 2016). The data collected involved AMCOS existing potential among smallholder farmers in the district. Five Likert scales of responses were used to capture information namely: 1= strongly disagree; 2= disagree; 3=neutral; 4=agree; 5= strongly disagree. The semi-structured questionnaire was administered to enumerators. The enumerator had to read each of the item questions to respondents who supplied the information to each of the questions listed on the questionnaire. The method was used because it is a convenient method to collect detailed information from the respondents.

Personal interviews have been used to collect the data from key informants namely: 10 ward extension officers, one district extension officer, and 10 leaders of AMCOS. The interview was a semi-structured interview that involved a flexibility of change regarding the relevance of responses from the key informants. The data collected from the key informants involved AMCOS existing potential in CSA adoption. Their responses were collected using a smartphone, which were later retrieved for data analysis and discussion. The method was used because it enables the collection of data from experienced respondents who engage with the phenomenon in hand on a daily basis.

The analysis involved both qualitative and quantitative data analysis. Qualitative analysis involved data from semi-structured interviews collected from key informants in the study area. The qualitative analysis plan adopted five steps of Taylor-Powel, E. and Renner, M. (2003). Firstly, the researchers went through the collected information relating to AMCOS existing potential on adoption of CSA. The needed information was selected for analysis and the irrelevant information was ignored; secondly, the questions were formulated to be answered in relation to the underlying objective of the study in that case AMCOS-existing potentials on CSA adoption; thirdly, the researchers identified answers by looking at the source of data in that case recorded audio from smartphones. The identified answers were categorized based on sub-themes of AMCOS existing potentials on CSA adoption; fourthly, the researchers highlighted the sub-variations of the themes identified; lastly, the meanings were attached to the themes identified for further discussion. In case of quantitative analysis, the researchers used Statistical Package for Social Sciences (SPSS) for descriptive analysis of data. The descriptive analysis was used to analyse both socio-economic variables (see section 3.) and institutional variables (see section 3.2) from which percentages and frequencies has been presented as summary of outcome variables.

3.0 Results and Discussions

3.1 Socio-economic Variables

The study considered various demographic factors of smallholder farmers who are members of AMCOS, such as education level, age, farming experience, duration of cooperative membership, household size, farm characteristics, and type of crop cultivated. In terms of education, out of 384 participants under the study, the majority of respondents, 264(68.8%) had completed primary school, followed by 98 (25.5) % who had completed secondary school. Only 16(4.2%) of the respondents had a college education. These findings suggest that most of the respondents had received a formal education, enabling them to better understand and acquire the necessary information and skills related to CSA practices.

The researchers divided the respondents into different age groups, including 26-33 years, 34-41 years, 42-49yaers, and above. The majority, 270 (70.3%), were above 49 years old. The second largest age group was 42-49 years, with 59 (15.4%) respondents, followed by 34-41 years with 40 (10.4%) respondents. The youngest age group, 26-33 years, had the fewest respondents at 15 (3.9%). This suggests that age can impact the adoption of CSA practices, with older farmers facing a mix of obstacles and advantages. While age may impede labor-intensive practices, it also brings valuable experiences and skills that enhance understanding and adoption of CSA practices.

The social economic variables revealed that smallholder farmers had extensive experience in farming activities. Specifically, 315 respondents (82%) had 15 years or more of farming experience, while 48 (12.5%) reported 11-15 years of experience. This extensive experience may pose a challenge for the adoption of new Climate Smart Agriculture (CSA) practices, as farmers may be resistant to change due to their long-term familiarity with traditional practices. However, in terms of cooperative membership, the smallholder farmers had average membership duration of 18.92 years in the Agricultural Marketing Cooperative Societies (AMCOS). This long duration in co-operative membership indicates that farmers have gained experience in the operations, services, and potentials of AMCOS, which can facilitate the adoption of CSA practices. Cooperative membership also influences the adoption of CSA practices by facilitating knowledge sharing, collective action, improved market access, and risk resilience, ultimately enhancing farmers' ability and willingness to adopt CSA practices

According to the findings, the average household size was 5.74, with an average of 1.56 dependents per household. The size of the household can have both positive and negative effects on CSA adoption. A larger household size can lead to increased labor and financial resources for CSA adoption, but it can also pose challenges due to higher consumption needs and labor directed towards subsistence needs. Additionally, the findings revealed that 99.7% of the population owned land, with an average land size of 1.21 acres, of which 1.14 acres were cultivated during the 2020/2021 season. Only 0.35 acres of the land were granted, indicating that owned land is prevalent among smallholder farmers. This suggests that most of the respondents, given their ownership rights, were encouraged to adopt CSA practices, especially long-term recovery practices such as sustainable land management and agroforestry. Permanent land occupancy can be associated with higher adoption intensity and investment in long-term CSA practices.

In addition, various crops were found to be cultivated in the area, with coffee and banana being the most common, cultivated by 384 (100%) and 382 (99.5%) respondents, respectively. Beans ranked third, cultivated by 305 (79.4%) respondents, followed by maize, which was cultivated by 302 (78.6%). Other crops, such as vanilla, vegetables, and yams, were reported to be cultivated by fewer than 50% of the population in Bukoba District. These findings suggest that government interventions related to Climate Smart Agriculture (CSA) should focus on the main crops such as coffee, banana, beans, and maize to increase farm productivity.

Previous studies have suggested that background variables such as education level, age, farming experience, cooperative membership, household size, and farm size have both positively and negatively influenced the adoption of CSA (Climate-Smart Agriculture). These studies include Wekesa (2017), Karlsson *et al.* (2018), Li *et al*. (2023), and Saadu *et al*. (2024).

3.2 AMCOS Existing Potentials in Adoption of CSA

AMCOS existing potentials were measured in terms of AMCOS provision of smallholders' access to agriculture credits, access to training or capacity building, access to extension services, access to improved crop varieties, access to fertilizers and access to storage services. The responses were supplied using five likert scales of responses namely: 1= strongly disagree; 2= disagree; 3=neutral; 4=agree; 5= strongly disagree.

3.2.1 Access to Agricultural Credit

The responses indicated that AMCOS had not taken advantage of the opportunity to provide agricultural credits to cooperative smallholder farmers in the region. Out of 384 respondents, 376 (97%) strongly disagreed with this, while 8 (2.1%) disagreed with the assertion (see table 3.2.1).

Table 3.2.1 Access to Agricultural Credit

Response	Frequency	Percent	Valid Percent	Cumulative Percent
Strongly disagree	376	97.9	97.9	97.9
Disagree	8	2.1	2.1	100.0
Total	384	100.0	100.0	

The findings above imply that AMCOS in Bukoba District did not provide financial credits for smallholder farmers, which could be an institutional factor negatively influencing the adoption of CSA. The reason behind could be insufficient financial resources and prioritization of the activities in AMCOS. Without access to affordable credit, these farmers may struggle to afford essential CSA requirements such as seeds, fertilizers, and equipment. This can limit their ability to invest in and adopt CSA practices, which often require upfront investments. Other studies emphasize the importance of joint efforts through cooperative associations to access credit for implementing CSA practices such as fertilizer use, terracing, irrigation, hybrid plants, and planting trees. This highlights the need for AMCOS to provide financial support to smallholder farmers to enhance their adoption of CSA practices. (Karlsson, *et.al*., 2018).

3.2.2 Availability of Training/Capacity Building

In Table 3.2.2, the findings on the availability of training or capacity building provided by AMCOS to co-operative smallholder farmers in Bukoba District are presented. The results indicate that the majority of smallholder farmers were neutral about whether they had received training or capacity building on CSA adoption practices. Specifically, 257 respondents, or 66.7% of smallholder farmers, were neutral or unsure about access to training/capacity building on CSA. Out of 384 respondents, 56 smallholder farmers, equivalent to 14.6%, confirmed that they had received training or capacity building on CSA adoption practices from AMCOS. On average, 62 respondents, or 16.1% of the total, disagreed with the access to training from AMCOS.

Table 3.2.2 Availability of Training/Capacity Building

Response	Frequency	Percent	Valid Percent	Cumulative Percent
Strongly disagree	27	7.0	7.0	7.0
Disagree	35	9.1	9.1	16.1
Neutral	257	66.9	66.9	83.1
Agree	56	14.6	14.6	97.7
Strongly agree	9	2.3	2.3	100.0
Total	384	100.0	100.0	

The findings imply that the AMCOS in the region have not provided adequate training or capacity building to the cooperative smallholder farmers on the adoption of climate-smart agriculture (CSA) practices, which could hinder their ability to effectively implement these practices. Past studies emphasize that once the co-operative society, such as AMCOS, offers training on CSA adoption, it is likely that smallholder farmers will be informed on extension services and thus will have the civic education to withstand climate change, face future climate changes, and adopt best CSA practices in the region for improved soil fertility and increased food production. This highlights the importance of AMCOS providing training and capacity building to smallholder farmers to enhance their adoption of CSA practices (Zighe, 2016); Isaacs *et al.*, 2016; Nahayo*et al.,* 2016; Smit *et al*., 2006; Mariara& Karanja 2007).

3.2.3 Access Extension Services through AMCOS

In Table 3.2.3, access to extension services through AMCOS in Bukoba District is presented. The findings indicate that most smallholder farmers were neutral about whether they had received extension services on CSA adoption from AMCOS. Specifically, 277 (72.1%), smallholder farmers expressed neutrality. Out of 384 smallholder farmers, 67 (17.4%) disagreed, and 39 (10.2%) strongly disagreed with the access to extension services provided by AMCOS in the district.

Table 3.2.3 Access Extension Services through AMCOS

Response	Frequency	Percent	Valid Percent	Cumulative Percent
Strongly disagree	39	10.2	10.2	10.2
Disagree	67	17.4	17.4	27.6
Neutral	277	72.1	72.1	99.7
Agree	1	.3	.3	100.0
Total	384	100.0	100.0	

The findings imply that the AMCOS in the region had not provided extension services on CSA adoption, leading smallholder farmers to work independently to adapt to climate change. This situation could result in a decline in crop yields. This finding contradicts other studies in Kenya and Uganda, where farmers were encouraged to adopt CSA practices through joint efforts and government policies that facilitated access to extension services (Zighe, 2016 and Wekesa, 2017). The findings in this region indicate that farmers were not sufficiently supported in their efforts to adapt to climate change. This highlights the need for AMCOS to provide more support to smallholder farmers in adopting CSA practices, which are crucial for improving soil fertility and enhancing resilience to climate change.

3.2.4 Access to Improved Crop Varieties through AMCOS

In Table 3.2.4, the access to improved crop varieties through AMCOS in Bukoba District is displayed. The results show that majority of respondents were neutral regarding whether they received improved crop varieties from AMCOS. This was reflected in the responses of 222 smallholder farmers, equivalent to 57.8% of the total. Additionally, 94 respondents (24.5%) disagreed, and 48 (12.5%) strongly disagreed with this assertion.

Table 3.2.4 Access to Improved Crop Varieties through AMCOS

Response	Frequency	Percent	Valid Percent	Cumulative Percent
Strongly disagree	48	12.5	12.5	12.5
Disagree	94	24.5	24.5	37.0
Neutral	222	57.8	57.8	94.8
Agree	19	4.9	4.9	99.7
Strongly agree	1	.3	.3	100.0
Total	384	100.0	100.0	

The findings suggested that AMCOS may not have effectively provided improved crop varieties to farmers, which could be limiting their agricultural productivity and ability to adapt to climate change. Despite reported climate change indicators, local smallholder farmers still mainly rely on traditional crop varieties that are less resilient to changing climates. The limited new varieties introduced are primarily due to individual efforts. This contrasts with past studies, which emphasized the importance of planting hybrids and providing climate resistant seeds (Zighe, 2016; Isaacs *et al*., 2016; Nahayo *et al.,* 2016). These studies also highlighted that the government, through co-operatives, is usually responsible for introducing new hybrid plants, indicating government policies promoting the adoption of new crop varieties.

3.2.5 Access to Fertilizer through AMCOS

In Table 3.2.5, the results indicate the access to fertilizer through AMCOS in Bukoba District. The findings reveal that 236 smallholder farmers, which were 61.5%, strongly disagreed with the statement that they have been supplied with fertilizer by AMCOS. Additionally, 126 smallholder farmers, equivalent to 32.8%, disagree with this assertion. A total of 22 respondents (5.7%) were neutral regarding whether they were provided with fertilizer by AMCOS in the district.

Table 3.2.5 Access to Fertilizer Through AMCOS

Response	Frequency	Percent	Valid Percent	Cumulative Percent
Strongly disagree	236	61.5	61.5	61.5
Disagree	126	32.8	32.8	94.3
Neutral	22	5.7	5.7	100.0
Total	384	100.0	100.0	

The findings suggest that AMCOS were not effectively providing fertilizer to farmers, which hindered their agricultural productivity and resilience to climate change. This highlights the need for improved support mechanisms. The possible reasons for this could be limited resources, inefficient management, or misaligned priorities. These findings are contrary to other studies which found that fertilizer was provided through cooperatives to enhance soil fertility, increase crop yields, and improve soil fertility as in the case of Rwanda (Zighe, (2016); Isaacs *et al.*, 2016); Nahayo *et al.,* 2016).

3.2.6 AMCOS offers both Collection and selling farmers produced and Storage Services

Table 3.2.6, it is shown that AMCOS offers both the collection and selling of farmers' produce, as well as offering storage services. The findings indicate that more than half of the smallholder farmers agreed, to varying degrees, that they had received the collection and selling of farmers' produce and storage services for their farm products. This is supported by 228 respondents, equivalent to 59.4%, who strongly agree and 133 respondents, equivalent to 34.6%, who agree.

Table 3.2.6 AMCOS offers Both collection and selling farmers produced and Storage Services

Response	Frequency	Percent	Valid Percent	Cumulative Percent
Neutral	23	6.0	6.0	6.0
Agree	133	34.6	34.6	40.6
Strongly agree	228	59.4	59.4	100.0
Total	384	100.0	100.0	

The findings suggest that the AMCOS in Bukoba primarily focused their efforts on the collection, sale, and storage of farm products, rather than on improving the production efficiency of their members. Less attention paid to the adoption of Climate-Smart Agriculture (CSA) practices that could help ensure sustainable production in the long term. The core functions of AMCOS should encompass both the production and marketing aspects of their members' agricultural activities. By concentrating mainly on the marketing side (collecting, selling, and storing), the AMCOS may be neglecting the crucial role they could play in supporting their members to improve production methods and adopt more sustainable practices.

4.0 Conclusion and Recommendations

4.1 Conclusions

The research findings regarding the existing potential for AMCOS to promote the adoption of CSA practices among smallholder farmers in Bukoba District revealed that the farmers were generally neutral and disagreed with the idea that AMCOS were instrumental in facilitating the adoption of these practices. Specifically, they expressed neutral and disagree views on access to agricultural credits, availability of training/ capacity building, access to extension services, and access to improved crop varieties through AMCOS. In particular, a total 362(94%) of the farmers disagreed and strongly disagreed with the assertion that they had access to fertilizer through AMCOS. However, it was noted that AMCOS primarily focused on collecting, storing, and selling smallholder farmers' produce, with more than 90% engagement in these activities.

Based on the findings it can be concluded that AMCOS in Bukoba have not given due priority to Climate-Smart Agriculture (CSA) in their operations and plans. The core functions of the AMCOS primarily revolve around marketing activities, such as collecting, selling, and storing farm products, while overlooking the significant production support role they could play in promoting CSA practices among their farmer members. Given that AMCOS are responsible for production and marketing assistance, the neglect of the production function, including the adoption of CSA practices, raises concerns. By prioritizing CSA, AMCOS can effectively support their members in enhancing productivity, adapting to climate change, and improving soil health and ecosystem services, thus contributing to the overall sustainability of the agricultural sector in the Bukoba region.

4.2 Recommendations

The study recommends that AMCOS in Bukoba should make CSA a top priority their operations and future plans, allocating significant resources to promote sustainable farming practices that enhance productivity, adaptation, and mitigation. To fulfill their dual mandate, AMCOS should strike a balanced approach, equally supporting both production and marketing activities, with a strong emphasis on CSA integration, to ensure comprehensive and resilient assistance for their farmer members. Moreover, the Ministry of Agriculture should take a more proactive role in guiding the AMCOS in Bukoba to prioritize CSA practices within their operations and strategic plans. As the overseeing government body, the Ministry should develop and disseminate clear policy directives that mandate AMCOS to integrate CSA as a core component of their production support function, offer technical assistance and training programs to equip AMCOS staff with the knowledge and skills to effectively promote sustainable farming methods, and establish monitoring and evaluation mechanisms to track the progress of AMCOS in mainstreaming CSA practices. By taking these steps, the Ministry can catalyze a transformative shift in the agricultural sector, empowering smallholder farmers to enhance productivity, adapt to climate change, and contribute to the overall sustainability of the food system in the Bukoba region and beyond.

5.0 Suggestion for future research

Our study opens for future research on impact of AMCOS on adoption of Climate Smart Agriculture (CSA) and impact of Adoption of CSA on smallholder farmers productivity and household livelihoods using rigorous estimation techniques. Furthermore, future research should also consider the longitudinal data or panel data to establish for causality between variables of interest. Similar study can also be conducted on other districts to verify if the result is applicable in other contexts.

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