



The Role of Agricultural Social Enterprise to Smallholder Farmers' Adaptive Capacity to Climatic Stresses in Tanzania

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Abstract

This paper intended to ascertain the implications of agricultural social enterprise on the adaptive capacity of smallholder farmers to climatic stresses in the Kilolo District, Tanzania. The study used a sample of 90 households. Household questionnaires, focus group discussions (FGD), and key informant interviews were used to collect primary data for this study. Secondary data were collected through a review of literature relevant to this study. The content analysis was used to analyse qualitative data, whereas quantitative data were subjected to Statistical Product and Service Solution (SPSS) version 20 for analysis. Microsoft Excel 2007 was used to analyse rainfall and temperature data trends of the study area. Findings revealed that the agricultural social enterprise found in the study area (i.e. One Acre Fund-OAF) enhanced the adaptive capacity of smallholder farmers since the services it provided to its clients positively influenced the functioning of the determinants of adaptive capacity and consequently led to the increase of average maize production per acre by 54.5%. This study concludes that agricultural social enterprises such as OAF have the potential to enhance smallholder farmers' adaptive capacity to climatic stresses, however other stakeholders should come together to support this cause.

Keywords Climatic stresses; Adaptive capacity; Social enterprises; Social entrepreneurship

Introduction

Climate change and variability are at the core of the serious threats and challenges to agriculture and food security in the 21st century, mainly to poor and agricultural-based countries (Njenga et al. 2012). Almost 80% of the total agricultural area of the world practice rain-fed agriculture producing about 62% of the world's staple food; thus, climatic stresses put agriculture sustainability at a major risk (Mongi et al. 2010). Climatic stress refers to the condition, trend, or event related to climate change and variability that can exacerbate hazards (US Climate Resilient Toolkit 2020) such as floods, recurring

droughts, temperature raising, and erratic rainfall (Kosmowski et al. 2012). Due to climatic stresses, serious concerns have been raised in Africa, where agriculture contributes about 35% of the total GDP (FAO 2019). Studies show that African farmers are losing about US\$ 28 per hectare per year for each 1 °C temperature rise (Kumsa and Jones 2010), and it is estimated that there will be a decline of about 50% of crop yields from rain-fed agriculture in some African countries by 2020 due to climatic stresses (Matata and Adan 2018). Generally, climate change is anticipated to have repercussions on Africa's economy, whereby sub-Saharan Africa is

expected to lose about US\$ 26 million by 2060 due to climatic stresses (Gemedu and Sima 2015).

East African countries, the agricultural-based countries, experience the adverse effects of climatic stresses, which have ultimately resulted in the decline of crop production (Awojobi and Tetteh 2017). In the same light, Tanzania has also been experiencing the effects of climatic stresses. For instance, since the 1960s, there has been an increase in annual temperature by 1.0 °C, while rainfall has been decreasing by 2.8 mm per month per decade since the same particular year (McSweeney et al. 2010). Furthermore, recurring droughts, floods, increasing crop pests and diseases, and seasonal shifts are other notable climatic stresses that have been experienced in the country (Mongi et al. 2010). Similarly, studies by Pauline et al. (2017) and Pauline and Grab (2018) found that dry spells during the rainy season, excessive rainfall during the rainy season, variability in terms of onset and cessation, and change in rainfall patterns are some of the climatic stresses that have been observed in the Kilolo District, Tanzania. According to the authors, the above-mentioned climatic stresses have disrupted farming activities which have ultimately resulted in crop failures in the district.

A study by Shirima et al. (2016) established that smallholder farmers in many developing countries, such as Tanzania, are highly vulnerable to the adverse effects of climatic stresses because they engage in climate-sensitive activities with limited access to resources to invest in appropriate adaptation strategies. In addition to that, a study by Pauline (2015) reported that non-climatic stresses such as lack of capital, limited access to agricultural extension services, lack of farm implements/assets, limited access to agricultural inputs, and limited access to credits are barriers that constrain smallholder farmers' adaptation strategies. Generally, different studies have concluded that smallholder farmers have the least capacity to adapt to climatic stresses (e.g., Shirima et al. 2016). It is for this reason that various studies have recommended

different stakeholders and actors to support smallholder farmers to address these challenges to enhance farmers' adaptive capacity (e.g., Mupenzi et al. 2011). Thus, agricultural social enterprises have emerged and continue to do a lot to improve the effectiveness of smallholder farmers in East Africa (Chepkwony 2018).

Social entrepreneurship has come into view as an answer to social exclusion and to provide needs left unfulfilled by traditional support systems (Thompson et al. 2000). Drayton (2006) defines social entrepreneurship as a business aimed at addressing social exclusion and empowering specific target groups or disadvantaged communities. In the context of this study, smallholder farmers are a disadvantaged group targeted by social entrepreneurs. A social enterprise does not focus on profit maximization, but rather it focuses on empowering social and economic development (Mohapatra et al. 2018). Social enterprises have gained attraction in East Africa whereby more than 400 social enterprises have been working in the agricultural sector (Raikundalia 2017), such as One Acre Fund (OAF), E-soko, Kilimo Salama and Kick Start (Smith and Darko 2014). Agricultural social enterprises aggregate farmers into cooperatives to reduce the cost of production, reduce price uncertainties, increase crop production, and eradicate needless intermediaries (An et al. 2015).

The agricultural social enterprise operating in the study area is called the One Acre Fund (OAF). The OAF started its work in Tanzania, especially in the regions of Iringa and Mbeya in 2013, by supporting smallholder farmers to cultivate maize over one growing season per year. In terms of the mode of operation of the OAF, the enterprise provides the input-extension services such as improved maize seeds, storage facilities, and fertilizers to smallholder farmers, and then the farmers will be paying the cost of the services provided in installments in any amount until they cover the whole costs/loan. These payments should be completed within one growing season, i.e., from November to

July/August. The mode of operation adopted by the OAF is similar to the “*pay-as-you-go model*”, also known as the “*rent-to-own model*” described by Raikundalia (2017). According to the author, the “*pay-as-you-go model*” enables clients (i.e. farmers) to pay an opening deposit for a service or product (e.g., farm inputs) and continue to pay in instalments regularly until the balance costs are covered. Furthermore, out of the six types of the agricultural social enterprise described by LEAP (2014) in the Agricultural Social Enterprise Framework, i.e., input innovator, producer group, a local processor, producer processor, contract processor, and social enterprise retailer, OAF belongs to agricultural social enterprise type one, i.e., the “*Input innovator*” whereby the enterprise (i.e. OAF in this context) provides the necessary farm inputs such as seeds, fertilizers, storage facilities, and the extension services to its clients (i.e. the farmers). Thus, this study sought to uncover the implications of the agricultural social enterprise (i.e. OAF) on the adaptive capacity of smallholder farmers to climatic stresses in the Kilolo District, Tanzania. In so doing, smallholder farmers both engaged and those who did not engage with agricultural social enterprise were involved in this study to capture differences in their adaptive capacities.

The conceptual framework

The conceptual framework for this study was modified from the *Agricultural Social*

Enterprise Framework developed by LEAP (2014). The framework involves key players within the agriculture value chain such as input providers, producers, processors, and retailers. According to the author, a social enterprise within the agriculture sector operates in all stages of the value chain. The operation of the afore-mentioned key players is facilitated by three major factors, namely finance, knowledge (technical know-how on production and processing), and infrastructure (e.g., irrigation, storage, and transportation). From the framework, the author further identified six types/categories of agriculture sector social enterprises as indicated in Figure 1. These categories may stand alone in each stage/player of the value chain, or in some cases, they may operate as a hybrid of several categories, whereby one stage/player of the agriculture value chain (e.g., input providers) can be served by more than one type/category of the agricultural social enterprise. This framework was used to determine the type of the enterprise (out of the six identified by the Agricultural Social Enterprise Framework) operating in the study area, the mode of operation of the enterprise, the kind of support/services it provided to smallholder farmers, and how it facilitated the functioning of the determinants of adaptive capacity as the central objective of this study.

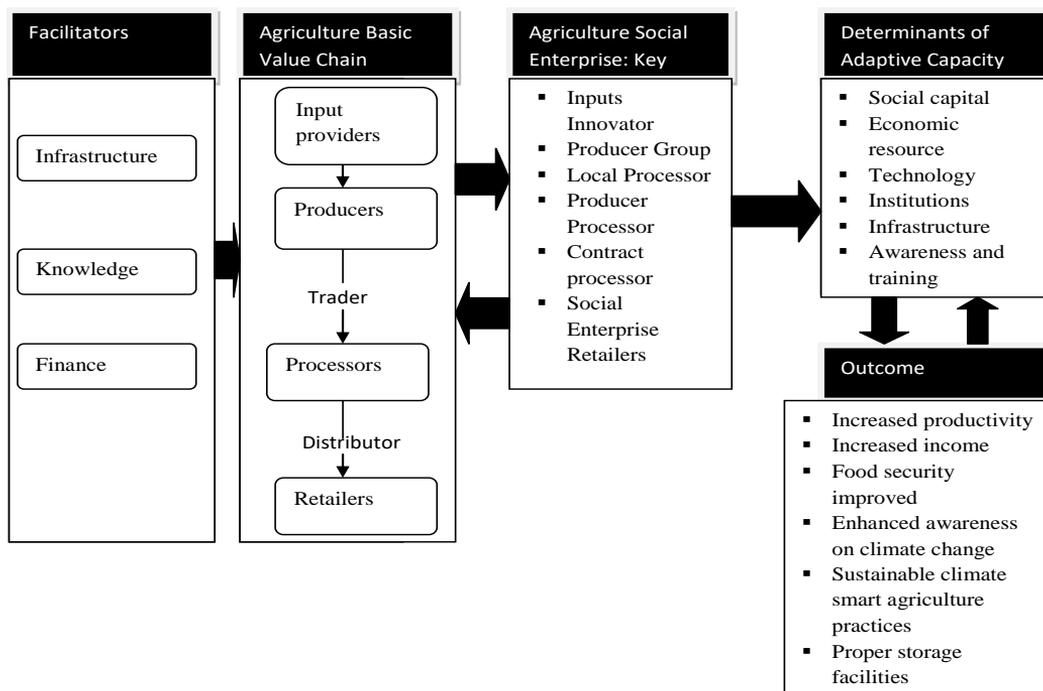


Figure 1: Conceptual framework. **Source:** Modified from LEAP (2014).

Methodology

The study area

This study was conducted in two villages of the Kilolo District in the Iringa region (Figure 2). Kilolo District occupies an area of about 7,881 km², whereby 86.32% of the total area, which is equivalent to 6,803.2 km², is suitable for farming. The district is located between latitude 7° and 8° S and longitude 34° and 37° E. The district is bordered to the south by Mufindi District, to the North and East is bordered by Morogoro region, and to the west is bordered by Iringa rural District (KDC 2019). According to the national census of 2012, the district has a population of 218,130, whereby 105,856 (48.5%) are males, while 112,274 (51.5%) are females (NBS 2013, KDC 2019).

As a whole, the district experiences a unimodal type of rainfall, whereby in many areas, rain starts in November to May with an amount ranging between 500–2,700 mm per

annum. In higher areas, the mean temperature is about 15 °C, while in lowlands temperature may range between 15 °C to 30 °C, especially in June and July. The major economic activities carried out in the district are crop farming and livestock keeping. The food crops grown in the district include maize, wheat, paddy, Irish and sweet potatoes, fruits, and vegetables, while the cash crops grown in the district range from tomatoes, onions, tea, tobacco to coffee (Pauline 2015).

The study area was selected based on the available information from previous studies on the effects of climatic stresses on agriculture in the Kilolo District (e.g. Pauline 2015, Pauline et al. 2017, Pauline and Grab 2018) and the presence of agricultural social enterprise (e.g., One Acre Fund) which is working closely with the smallholder farmers, hence making it possible to achieve the intended objective of this study.

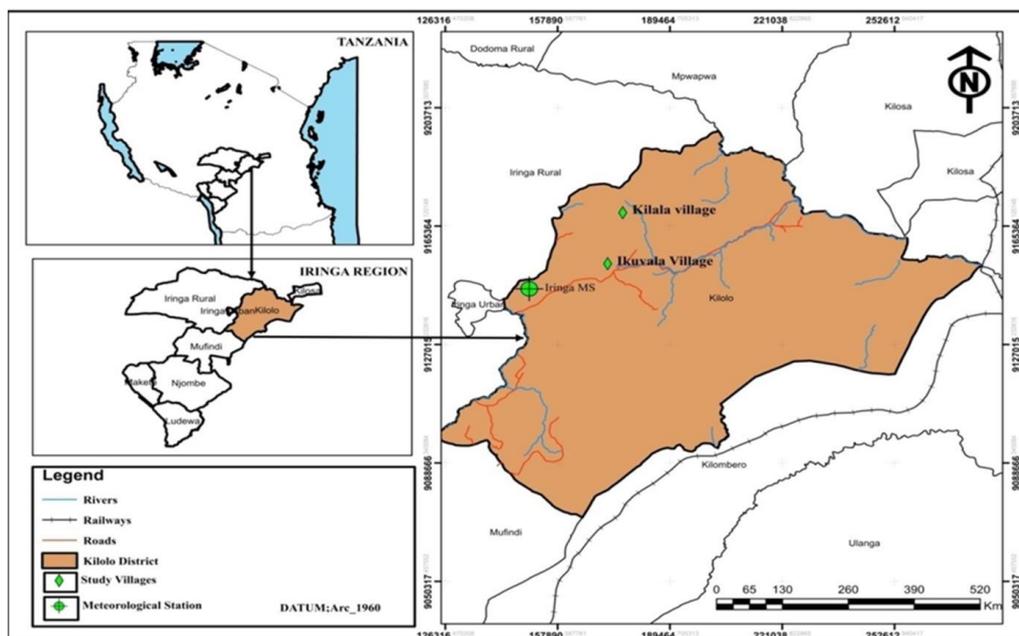


Figure 2: Map of the Kilolo District showing the study villages (Kilala and Ikuvala).

Study design

This study employed both quantitative and qualitative research designs. This enabled the researchers to collect both quantitative and qualitative data to meet the objective of this study.

Sampling procedures and sample size

A simple random sampling was used to select the study villages and household respondents (i.e. members and non-members of OAF), while purposive sampling was used to select discussants for focus group discussions (FGD) and key informants for key informant interviews (KII). Both FGD and KII were used to collect data that would complement the information obtained through household questionnaires. This study had a sample of 90 households whereby household heads were the respondents for household questionnaires. Where the household heads were not available, their

representatives were interviewed. From the given sample size, 60 households were selected from Kilala village with 600 households and 2,580 total population, while 30 households were selected from Ikuvala village with 301 households and a total population of 1,205. This sample is representative, as argued by Kothari (2004) that 10% of the total population is an optimum sample size to be used in research. Then, through stratified random sampling, the sample size in each village was split into two equal groups; one for smallholder farmers who engaged with OAF and the other for those who did not engage with OAF, as illustrated in Table 1. According to Kothari (2004), stratified random sampling is used when a population from which a sample is to be selected does not have a homogeneous group, hence a population is stratified into sub-groups, then a simple random sampling is used to select the samples from each stratum.

Table 1: Sample size distribution

Village	Members of OAF	Non-members of OAF	Total
Kilala	30	30	60
Ikuvala	15	15	30
Total	45	45	90

Data collection

Both primary and secondary data were used. The primary data were collected through household questionnaires, focus group discussions, and key informant interviews. *Household questionnaires* were made of both open- and close-ended questions, which were administered to 90 household heads, or household representatives who engaged and those who did not engage with OAF. This method of data collection was used to gather information related to the household's social-economic characteristics, household's source of income, and the climatic and non-climatic stresses farmers encounter during their farming activities. Additionally, information related to support/service provided by OAF to its clients and its related challenges were also collected through this method of data collection.

Focus group discussions (FGD) comprising of 8 and 10 participants from Ikuvala and Kilala village, respectively, shared their views and opinions concerning the checklist of open-ended questions related to the objective of this study. Smallholder farmers' age, gender, experience, and membership status to agricultural social enterprise (i.e. both members and non-members of OAF) were some of the criteria used to select participants for FGD.

Key informant interviews used open-ended questions to obtain first-hand information related to support provided by OAF to its clients and challenges facing both smallholder farmers engaged and those who did not engage with OAF in the study villages. The key informants involved were; 1 district agricultural extension officer from the Kilolo district headquarters, 2 village agricultural extension officers (i.e. 1 from each village), 2 village executive officers (i.e. 1 from each village), and 2 officers from OAF making a total of 7 key informants.

The secondary data for this study were collected through reviewing journals, articles, books, research reports, and other sources relevant to this study. Similarly, the data for mean annual rainfall and temperature for the

past 30 years (1989-2019), recorded at Iringa meteorological station, was obtained from the Tanzania Meteorological Agency (TMA) headquarters, Dar es Salaam. These data were used to establish the trends of rainfall and temperature of the Iringa region where the study villages are located.

Data analysis

The primary quantitative data collected through household questionnaires were edited, coded, entered, and analysed by using Statistical Product and Service Solutions (SPSS) version 20. Through SPSS, a descriptive analysis was performed to generate descriptive statistics such as mean that was used to calculate the average maize production by farmers before and after joining OAF and frequencies that were used to show the degree of occurrences of responses provided by respondents. In addition to that, cross-tabulation was performed to determine the relationship between variables (e.g. social enterprise membership status versus the ability to afford farm inputs). Whilst, the primary qualitative data obtained through key informant interviews and focus group discussions, were analysed through content analysis. The content analysis helped to obtain data that complemented the information gathered through household questionnaires. These data were translated to English from Swahili and native language (*Kihehe*) and then were presented in quotation. Microsoft Excel 2007 was used to analyse the trends of mean annual rainfall and temperature data for the past 30 years (1989–2019).

Results and Discussion

Socio-economic characteristics of the participants

Findings in Table 2 reveal that almost three-quarters (74.4%) of respondents involved in this study were males. This is attributed to Tanzania's tradition whereby males are the heads of the households. An overwhelming proportion (86.7%) of respondents was aged between 35 years and above, while 13.3% of respondents were aged

between 25-34 years. Furthermore, 65.6% of respondents were married and the rest were single (10%), separated (5%), divorced (3%), or widowed (14%). Additionally, 4.4% of respondents did not attain formal education, while the majority (70%) of respondents had attained primary education, and the rest had attained secondary (11.1%), certificate (6.7%), diploma (4.4%), and bachelor's degree education (3.3%). This study also found that over one-third (34.7%) and nearly one-third (32.8%) of the respondents engaged in farming and livestock keeping, respectively. This implies that farming and livestock keeping are the major economic activities to the majority of respondents in the study area, hence climatic stresses are anticipated to have repercussions on households' livelihoods. About 93.3% of

respondents owned the land/farms, out of whom more than one-third (34.4%) of respondents owned the land/farms of the size ranging between 3-4 acres, 26.7% of respondents owned the land/farms of the size ranging between 5-6 acres, 16.7% of respondents owned the land/farms of the size ranging between 1-2 acres, 14.4% of respondents owned the land/farms of the size ranging between 7 acres and above, and only 1.1% of respondent owned the land/farm of less than 1-acre size. Landholding size can influence adaptation strategies. This argument is in line with Dafieta and Raper (2014), who established that a farmer with a large land size is able to diversify his/her farming practices as one of the adaptation strategies to climate change than a farmer whose land size is small.

Table 2: Socio-economic characteristics of participants

Characteristics	Distribution						
	Male	Female	Total				
Gender							
	74.4%	25.6%	100.0%				
Age	25-34	35-44	45-54	55-64	65+	Total	
	13.3%	17.8%	33.3%	28.9%	6.7%	100.0%	
Marital status	Single	Married	Separated	Divorced	Widowed	Total	
	10%	65.6%	5.6%	3.3%	15.6%	100.0%	
Education	None	Primary	Secondary	Certificate	Diploma	Degree	Total
	4.4%	70.0%	11.1%	6.7%	4.4%	3.3%	100.0%
Social-economic Activities	Farming	Livestock keeping	Petty business	Employed	Casual works	Others	Total
	34.7%	32.8%	6.9%	3.1%	20.5%	1.9%	100.0%
Size of the land owned	<1 acre	1-2 acres	3-4 acres	5-6 acres	7+ acres	None	Total
	1.1%	16.7%	34.4%	26.7%	14.4%	6.7%	100.0%

Source: Field Survey 2020.

Perceived and measured rainfall and temperature trends

Respondents were probed about their experience on rainfall onset and cessation trends over the past 30 years. Findings indicated that the majority (84.4%) and (77.8%) of respondents report that there have been fluctuations in rainfall onsets and cessations, respectively. In terms of the total annual rainfall, findings revealed that the majority (72.2%) of respondents asserted that the amount of annual rainfall has been fluctuating, 18.9% of respondents asserted

that the amount of annual rainfall has been increasing, and 8.9% of respondents argued that the amount of annual rainfall has been decreasing for the past 30 years. Similarly, the rainfall data recorded at Iringa meteorological station for the past 30 years, from 1989 to 2019, indicate that the amount of mean annual rainfall in the region has been fluctuating at an increasing rate by a correlation coefficient of $R^2 = 0.045$ (Figure 3).

In terms of the perceived temperature trends in the study area, findings revealed

that over half (53.3%) of respondents asserted that temperature has been increasing, 36.7% of respondents argue that temperature has been fluctuating, and 10% of respondents argue that there has been an unchanged pattern of temperature trends in the study area. Similarly, the temperature trend data for the past 30 years, from 1989 to 2019, recorded at Iringa meteorological station shows that the mean maximum (Figure. 4)

and mean minimum temperature (Figure. 5) of the Iringa region where the study villages are located, has been increasing by a correlation coefficient of $R^2 = 0.245$ and $R^2 = 0.685$, respectively. In general, these findings imply that the smallholder farmers' perceptions of temperature trends and rainfall patterns from 1989 to 2019 align with the meteorological data for the Iringa region.

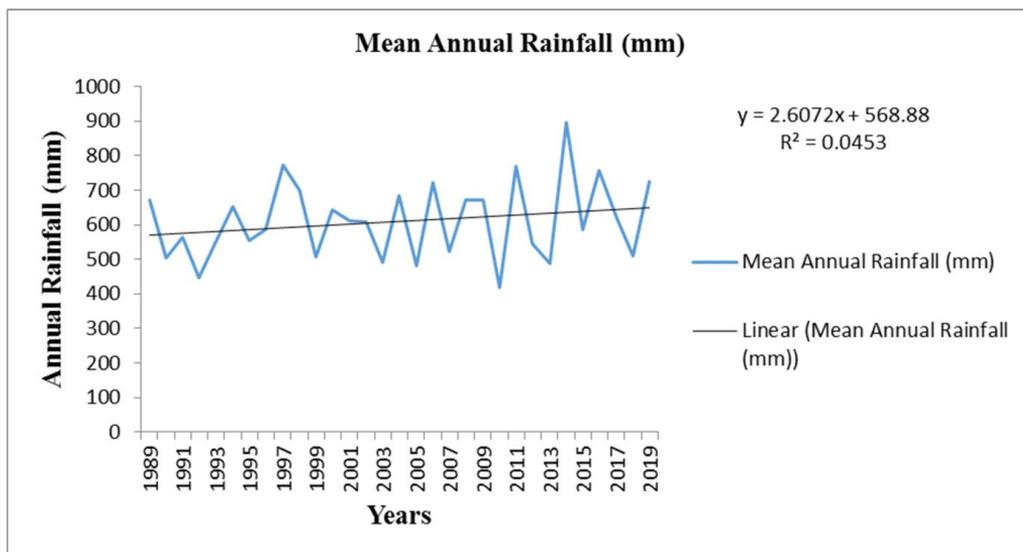


Figure 3: Mean annual rainfall of the Iringa region (1989-2019). **Source:** Tanzania Meteorological Agency (TMA) (2020).

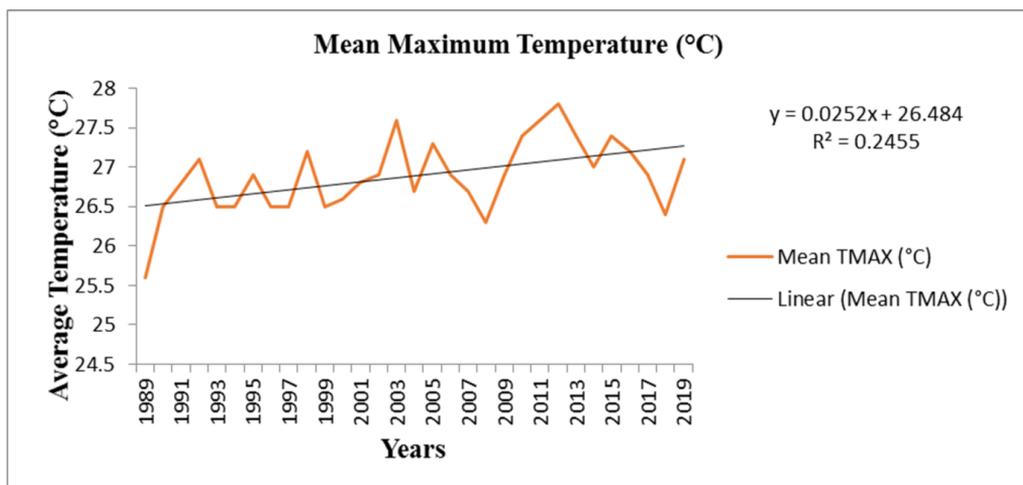


Figure 4: Mean maximum temperature of the region (1989-2020). **Source:** Tanzania Meteorological Agency (TMA) (2020).

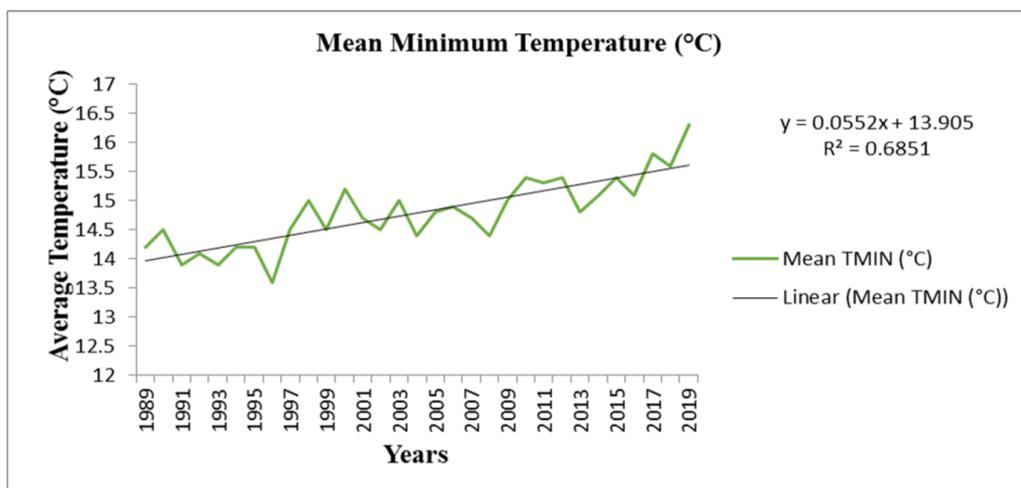


Figure 5 Mean minimum temperature of the Iringa region (1989-2020). **Source:** Tanzania Meteorological Agency (TMA) (2020).

Adaptive capacity levels among smallholder farmers

To examine the role of the agricultural social enterprise to smallholder farmers' adaptive capacity to climatic stresses in the study area, this paper ascertained how OAF influenced the functioning of the determinants/indicators of adaptive capacity to climatic stresses among its clients (i.e. smallholder farmers) such as social capital, economic resource, technology, awareness and training, institutions, and infrastructure, then comparing with non-members of OAF per each determinant since there is no general rule for measuring the levels of adaptive capacity (Dafiesta and Rapera 2014).

Social capital

Findings indicated that half (50%) of respondents engaged with OAF as the only farmer-based organization operating in the study area by the time this study was conducted. In addition to that, members of OAF were supposed to organize themselves in sub-groups consisting of about 10 members (equivalent to 10 households). The key informants (i.e. OAF officers) asserted that these sub-groups enabled smallholder farmers to work collectively, especially during the planting phase, and sometimes during weeding and harvesting, as result, it helps farmers to finish these activities within a shorter period because the workforce has

been multiplied. These findings are supported by Egyir et al. (2015), who established that social capital encompasses the participation of farmers in a farmer-based organization which in turn increases social networking. Additionally, a study by Shirima et al. (2016) asserted that increased social capital leads to increased accessibility to labour resources as one of the contributing factors that enhance the capacity of the farmers to adapt to climate change. This implies that OAF has influenced the functioning of social capital among OAF's members in the study area.

Contrary, findings indicate that 50% of respondents did not engage with OAF or any other farmer-based organization in the study area. In terms of the labour force, the majority of participants during FGD collectively asserted that non-members of OAF performed their farming activities independently at the household level because they are unable to hire minor labourers due to their limited income. This implies that low social networking and limited labour force are some of the factors that may constrain smallholder farmers' (i.e. non-members of OAF) adaptive capacity in the study area.

Technology

Findings revealed that OAF provided guidance and information to its clients on the variety of seeds such as Hybrid, Pioneer, and DeKalb with different characteristics such as

early maturing, drought-tolerant crops, and high yields crop varieties that can be used in the face of climatic stresses. Additionally, a key informant asserted that OAF provided farmers with training on soil management practices such as intercropping, the use of compost/manure, and control of soil erosion, which in turn can increase soil fertility and farmers' resilience to climatic shocks concurrently. This implies that OAF has influenced the functioning of technology as one of the determinants/indicators of adaptive capacity. These findings are in line with a study conducted in the Northern region of Ghana by Mabe et al. (2012), who established that farmers with knowledge about seed varieties to be used, especially the climate-resilient seeds, have a greater chance to adapt to climate change compared to those with little knowledge. Also, a study by David et al. (2013) in rural Namibia reported that farmers with knowledge about techniques to retain the fertility of the soil can adapt to undesirable effects of climate change, especially soil erosion. Hence, guidance from OAF on seed variety and Climate Smart Agriculture practices, especially the soil management practices was significant in enhancing farmers' adaptive capacity.

In contrast, findings revealed that smallholder farmers who did not engage with OAF lacked training on modern farming techniques from any other farmer-based organization or village agricultural extension services which was considered as non-existent because each study village had one extension officer who was reported to be unable to provide adequate services to all the farmers in the respective village. Findings revealed that 84.4% of respondents (non-members of OAF) did not have access to extension services, and only 15.6% of respondents had access to extension services provided by the village extension officers. This has limited farmers' transition from traditional farming to modern farming techniques. A study conducted in Uganda by Dixon et al. (2014) found that NGOs (e.g., OAF in this context) are one of the drivers of change that advocates shifting to modern farming techniques. According to the authors,

these transitions have had a positive impact on farmers' adaptive capacity.

Economic resource

This indicator includes sub-indicators such as access to credit, whereby a farmer with access to credit is economically able to adapt to climatic stresses than a farmer without access to credit (Dafiesta and Raper 2014). However, the findings in this study show that OAF did not provide farmers with credit (i.e. cash), but rather the enterprise provided asset-based loans, whereby the farmers (i.e. members of OAF) received improved maize seeds such as Hybrid, Pioneer, and DeKalb, storage facilities, and high-quality fertilizers on credit. This implies that OAF has increased farmers' adaptive capacity to climatic stresses through enhanced access to farm inputs as one of the determinants/indicators of adaptive capacity. On input services, a 48-year old farmer (i.e. member of OAF) had the following to say during FGD:

"Before the coming of OAF, I was not able to buy improved maize seeds and fertilizers because they are very expensive; hence I was supposed to use traditional seeds which are not productive. But after joining OAF, I have been receiving improved maize seeds and fertilizers; hence my maize production has also improved".

In terms of smallholder farmers who did not engage with OAF, findings revealed that only 8.9% of respondents, whose majority of them were employed, were able to afford farm inputs, whereas 41.1% of respondents were not able to afford improved farm inputs. The key informants (i.e. village agricultural extension officers) reported that the majority of smallholder farmers who did not engage with OAF normally used traditional maize seeds, which are not climate-resilient seed variety and are less productive. Since the majority (31.7%) of respondents depend on the selling of crops to generate income, the traditional and less productive maize seeds used by non-members of OAF will eventually result in low productivity that would later result in a low-income generation; hence, the farmers' adaptive capacity will be worse.

This finding is similar to a study by Uddin et al. (2014), who established that farmers' adaptive capacity can be constrained by limited access to farm inputs.

Awareness and training

Findings indicate that half (50%) of respondents (i.e. members of OAF) were exposed to climate change information from OAF's extension officers. Also, members of OAF received climate change-related agricultural extension services such as training on Climate Smart Agriculture practices (e.g., intercropping, control of soil erosion, and the use of composite manure) and the use of climate change-resilient maize seeds. This implies that OAF has improved farmers' adaptive capacity through the provision of extension services which in turn increases farmers' awareness about climate change and variability. These results are supported by Lo and Emmanuel (2013), who established that farmers' capacity to adapt to climatic stresses increases if they have greater accessibility to climate change-related information. Also, a study by Frank and Penrose (2012) argued that the knowledge and skills of the farmer in relation to climate change and related adaptation practices and technology are enhanced by farmers' accessibility to climate change-related agricultural extension services.

In terms of smallholder farmers who did not engage with OAF, findings indicate that only 7.8% of respondents had access to agricultural extension services from the village agricultural extension officers, whereas 42.2% of respondents did not have access to agriculture extension services. During FGD, a 61-year old participant (i.e. non-member of OAF) asserted that;

"The extension services in this village are considered non-existent because one agricultural extension officer per village cannot afford to provide adequate agricultural extension services to farmers of the whole village".

Hence, limited access to extension services deprives farmers' accessibility to climate change information and related adaptation strategies, which in turn reduces

farmers' adaptive capacity. This concurs with a study by Somda et al. (2017) conducted in West African countries (Ghana, Mali, Niger, Senegal, and Burkina Faso), which reported that farmers' limited access to extension services is one of the factors that limit farmers' adaptive capacity to climatic stresses.

Infrastructure

Findings indicated that 50% of respondents (i.e. members of OAF) received special storage facilities/bags called Purdue Improved Crop Storage (PICS) to protect maize yields from pests, which have been reported to be increasing at an alarming rate. This implies that OAF has enhanced smallholder farmers' resilience to climatic shocks, especially the increased crop pests, and consequently the adaptive capacity has also been enhanced. This result is supported by Williams et al. (2019), who assert that a household's capacity to adapt to climatic stresses can be enhanced by multiple factors, including the availability of storage facilities to protect crop yields from pests. On storage facilities, a 55-year old participant (i.e. member of OAF) asserted the following during FGD:

"PICS has helped us to store maize yields for as many months as possible, contrary to previous years where the maize was attacked by pests a few days after storing them, which resulted in food shortages because maize which is our main source of food was destroyed by pests".

In terms of smallholder farmers who did not engage with OAF in the study area, findings revealed that they struggled to store their crop yields, especially maize, due to increased crop pests. On this, a 50-year old participant (i.e. non-member of OAF) asserted the following during FGD;

"In case we fail to purchase modern pesticides or proper storage facilities, we normally use traditional pesticides, especially ashes, to protect maize yields against pests. However, this method has been ineffective in recent time due to increased crop pests".

This has affected farmers' income flow and food security, and consequently has

affected farmers’ adaptive capacity. This is similar to Williams et al. (2019), who established that inadequate storage facilities is one of the factors that limit farmers’ adaptation strategies to climatic stresses.

Institutions

Findings revealed that OAF provided crop insurance to its clients in case of the occurrence of climatic shocks such as drought spells that might result in post-harvest losses. The crop insurance is normally provided at the end of the season after observing the shocks that have been experienced during the growing season. However, participants during FGD argued that the value of the insurance covered does not relate to the actual loss that the farmer might incur in case of the occurrence of shocks. Nevertheless, this means that OAF has enhanced smallholder farmers’ resilience to climatic shock and adaptive capacity concomitantly. This finding is supported by Jones et al. (2010), who established that the provision of disaster relief assistance in times of undesirable climatic shocks enhances farmers’ adaptive capacity.

In contrast, the key informants reported that smallholder farmers who did not engage with OAF as the only agricultural social enterprise operating in the study area by the time this study was conducted, were not covered by crop insurance in times of climatic stress, which are undeniably unpredictable. This implies that smallholder farmers were likely to incur losses in times of

climatic stresses and eventually limited farmers’ adaptive capacity.

Generally, the overall findings reveal that agricultural social enterprise (i.e. OAF) has enhanced the adaptive capacity of smallholder farmers (i.e. members of OAF) in the study area since OAF has positively influenced the functioning of the determinants of adaptive capacity through the services it provides. The enhanced smallholder farmers’ adaptive capacity is likely to improve farmers’ livelihoods, similarly to Dafieta and Rapera (2014) who argued that the determinants/indicators of adaptive capacity are directly linked to Sustainable Livelihood Framework consisting of five assets, namely natural, social, physical, financial, and human capital on which people’s livelihoods are built. In contrast, smallholder farmers who did not engage with agricultural social enterprise were likely to have low adaptive capacity since they exhibited low functioning of the determinants of adaptive capacity.

Furthermore, this study found that the enhanced adaptive capacity of smallholder farmers who engaged with OAF had implications on farmers’ crop productivity and food availability. Findings illustrated in Table 3 indicate that 45.6% of respondents have increased their average (mean) production of maize per acre by 54.5% after joining OAF. In addition to that, 45.6% of respondents asserted that due to increased maize productivity, which is a main source of food in the study area, food availability has also increased after joining OAF.

Table 3: Respondents’ average yields of maize per acre before and after joining OAF

	N	Minimum	Maximum	Mean	Std. Deviation
Average yields of maize per acre before joining OAF (number of bags/sacks)	41	3.00	6.00	3.5366	0.71055
Average yields of maize per acre after joining OAF (number of bags/sacks)	41	9.00	15.00	11.9512	1.35925

Source: Field Survey 2020.

Challenges and opportunities for agricultural social enterprise

This study examined challenges facing both smallholder farmers who engaged with OAF and challenges facing OAF in the study area. This study found that the majority (36.7%) and (34.7%) of respondents asserted that market constraints and higher cost of returns, respectively, were the major challenges facing smallholder farmers who engaged with OAF in the study area. On market constraints, respondents established that OAF neither bought farmers' produce nor connected its clients with the market/buyers of their agricultural produce, especially maize. Hence, farmers were supposed to search for the market, which is generally unreliable. Also, there have been price fluctuations, and in most cases, farmers have been selling their crops at low prices. On the higher cost of returns, respondents asserted that OAF has recently increased the cost of returns for the input-extension services (i.e. the asset-based loan) compared to when OAF started its operation in the study area.

On the challenges facing OAF in the study area, the key informants reported that some of their clients/farmers fail to complete the payments for the input-extension services (i.e. the asset-based loan) they receive from the enterprise. This has been affecting the functioning of OAF because the enterprise depends on farmers' repayments to ensure its sustainability. Also, this study found that the limited purchasing power of smallholder farmers is another challenge facing OAF. The key informants asserted that despite a wide range of services provided by the enterprise to support smallholder farmers, the majority of smallholder farmers have not joined OAF due to various factors, including farmers' misconceptions about agricultural social enterprises.

On opportunities, this study found that the absence of the government's agricultural subsidies provides OAF with a niche market within the study area and elsewhere in the country that an enterprise can exploit. However, we argue that OAF must invest much of its efforts in designing attractive

packages with reasonable costs and provide more education to smallholder farmers to clear their misconceptions so as attract more clients.

Conclusion

This study concludes that agricultural social enterprises such as OAF have the potential to boost up smallholder farmers' adaptive capacity to climatic stresses through services they provide to their clients, which in turn enhances the functioning of the determinants of adaptive capacity. This study further concludes that agricultural social enterprises alone are not enough to comprehensively improve smallholder farmers' adaptive capacity to climatic stresses, because these enterprises are not capable of addressing all the challenges encountering smallholder farmers. For instance, this study found that market constraints and limited access to credit are the prominent challenges that were raised by the smallholder farmers in the study area and have not been addressed by OAF. Hence, this study recommends that joint efforts from other stakeholders are required to ensure that farmers' resilience and adaptive capacity to climatic stresses are enhanced concomitantly. Also, this study recommends greater government involvement, especially in recognition and regulations of social enterprises. This can be done through the development of a social enterprise-relevant policy framework to guide and protect the operations of social enterprises in the country. Lastly, we recommend that further research involving more than one agricultural social enterprise with different mode of operation should be conducted to determine how best these enterprises can help to enhance smallholder farmers' adaptive capacity.

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