

## RESEARCH ARTICLE

## EVALUATING FARM ACTIVITIES IMPACTS ON FOOD SECURITY IN ENHANCEMENT OF CLIMATE SMART AGRICULTURE IN TAITA-TAVETA COUNTY

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## ABSTRACT

The general management of food structures is mainly influenced by their consistency and interface with a number of other structures. The problem identified was that overall, the performance of farm activities greatly affected food security in the face of lasting changes in temperature and atmospheric conditions. The adoption of Climate-Smart Agriculture (CSA) is a panacea aiming to address fluctuations in food supplies and support increases in farm incomes. Information was gathered using questionnaires carried out on a sample population of 240 growers carefully chosen by means of probability sampling techniques in Taita-Taveta County. Results indicated that 79% of farmers actively engaged in farming to ensure food security through the adoption of CSA practices. 85% of farmers reported the County participated to ensure food security by implementing various food programs in collaboration with other agencies and institutions. Both genders had access to agricultural resources (72.2%) and 58.8% reported extension officers as the main source of agricultural information on a monthly basis. 71.9% of farmers had storage facilities as opposed to 66% who reported a lack of County strategic reserves for the vulnerable population. The overwhelming majority of 91% held the view that the county could not sufficiently cater to the vulnerable for at least 6 months. The outcome of these mechanisms' applications has not been documented. The study sought to document the impacts of farm activities on enhancing food security through CSA; to inform policy and best practices. The importance of CSA mechanisms cannot be overlooked in matters of food safety.

## KEYWORDS

Farm Activities, Mechanisms, Climate-Smart Agriculture, Food security, Taita-Taveta

## 1. INTRODUCTION

Farm activities and their impacts on food security can be enhanced by the adoption of climate-smart practices. There are numerous activities that take place in order to secure food production, but only a few are considered. In particular, the focus is on the participation of the farmer, and County government in supporting food security through the implementation of food programs and collaboration with other institutions and agencies which are very pivotal in improving food security. Farmer's adoption of new technology; especially climate-smart agriculture, farmer availability of information and frequency, resource availability and supply to the farmers, coupled with availability of farm storage facilities and county reserves give the basis for adopting climate-smart farm activities for food security in Taita Taveta County.

## 2. LITERATURE REVIEW

## 2.1 Role of the Farmer in Climate Smart Farm Activities

The world needs smallholder farmers to alleviate hunger and malnutrition, yet these farmers are increasingly having trouble making a living. In the current worldwide progression plan of the Sustainable Development Goals (SDGs), these farmers have a special role to play. Smallholder farms, which are responsible for the majority of the world's poor and hungry, are a vulnerable population that is disregarded by

development strategies despite the crucial role they play in attaining food security and nutrition (Fan and Rue, 2020). They can contribute much more to inclusive growth, job creation, reducing rural poverty, agrifood value chains, and the accomplishment of several SDGs if they are effectively integrated into a variety of rural economies. The ability of smallholder farms to enhance productivity and transition to lucrative agricultural systems is increasingly hampered by a variety of problems, both natural and human-caused. Farmers are forced to engage in lower-risk, lower-yielding agricultural activities—including ones that earn little to no profit—in order to overcome these obstacles, which add to the cycle of poverty. Access to productive resources like land, cattle, farm inputs, mechanization, trading places, outreach, and monetary services is particularly difficult for females in smallholdings and comprise a mean of 43% of the workforce in unindustrialized nations (FAO, 2011b). To increase farm products, food safety, and diet, smallholder farms must be connected to the contemporary agrifood product life cycle.

Formal solutions of cooperation amongst peasant farmers are needed to remove obstacles to entering contemporary value-added chains. Robust formal capability is necessary for these processes, as is a stable political climate that encourages private financing tailored to the requirements of subsistence farmers (Hill and Torero, 2009; Fan and Rue, 2020). By utilizing better technology and resource management, these interventions would increase the productivity of their farms, increase their own food security, and generate some money. Small-scale farmers have limited

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financial resources, thus financing or significantly subsidized inputs will be required. In addition to safety nets, subsistence farmers require assistance in creating resilient farming systems because they are frequently the most exposed to and sensitive to climate threats. In spite of the long-standing changes in heat and atmospheric situations, price fluctuations, constrained funding alternatives, and lack of wholesome and nutrient-dense foods, smallholder farms with profit potential are in danger. A supportive policy environment is necessary for the successful adaptation of successful livelihood initiatives (Fan and Rue, 2020). In addition to decreasing agricultural productivity (Messerl, 2006; Styger, 2007), unsustainable farming techniques can result in the destruction of natural habitats, the extinction of species, and a decline in ecosystem services (Powers and Jetz, 2019). Natural resources and biodiversity are under strain due to shifting cultivation on steep slopes with short fallow periods (Borgerson et al., 2018). According to a study rice growers' choices to practice soil and water management are inspired by their education, labour, financial restrictions, community groups, and agricultural advisers by (Martey et al., 2021). Due to decreases in soil productivity brought on by soil degradation, sustainable agriculture was created as an alternative to traditional farming (Su et al., 2021; Nyirenda and Balaka, 2021; Pooniya et al., 2021).

## 2.2 Role of the County Government

In Taita-Taveta County, agriculture makes up a substantial portion of the local economy. The agricultural industry is responsible for more than 30% of the nation's economic activities. About 50% of the families raise livestock and cultivate food crops. 14.9% of homes utilize irrigation, and agriculture is rain-fed (COG, 2020). To improve agro-processing, food security, and value addition in livestock, food security, horticulture, and poultry, the County works to form partnerships with the federal government, research organizations, and the business sector. Agriculture is a devolved role, under the Kenya Constitution (GoK, 2010). As a result, it is intended that each county would work with other organizations and institutions to guarantee food security. In its report, recommended that county governments take a multi-sectoral approach to resilience building that assures collaboration between farmer organizations, civil society, and the commercial sector (USAID, 2022).

## 2.3 Adoption of new technology for Climate Smart Agriculture

Improved agricultural technology adoption, such as the use of improved seed varieties and fertilizer application, is thought to be able to accelerate the transition from the low productivity, peasant, and subsistence farming that exists today to commercial farming that can generate surpluses. However, according to the rate of adoption of these technologies in underdeveloped nations has remained low (Ishola and Arumugam, 2019). Lowering their operational costs, boosting their negotiations, and getting actual marketplace knowledge, data, and communication technology also provide the chance to connect smallholder farms to markets (Hill and Torero, 2009). The availability and consumption of nutrient-dense foods can be increased with increased investments in the creation of crop types high in nutrients that are affordable to the poor (Fan and Rue, 2020). In research by Kimathi *et al.*, (2021), they discovered that the key influences on agriculturalists' choices to accept diverse weather-tolerant potatoes in Kenya were the availability of information, high-quality seeds, and training. The use of new technology is frequently anticipated to increase production and income, which will, in turn, reduce poverty and improve food security (Muhaimin, 2020). Numerous studies on the dissemination of technology have shown that farmers who embraced new technologies were able to increase farm output (Ali and Abdulai, 2010; Awotide, 2013). Additionally, numerous research has shown that the adoption of new technical innovations tends to increase the demand for labor and production inputs (Ali and Abdulai, 2010). As a result, farmers' income and consumption rose, and their farming output also did (Bezu, 2014). Increased technological adoption by farmers can help ensure the household food security of farmers, according to various research conducted in developing nations (Shiferaw et al., 2014; Kabunga et al., 2014; FAO, 2022). Since advisory services encourage education and knowledge transfer, small-scale farmers' right to use available advisory facilities has a stronger impact on the rate of taking on new modern farming technology (Ishola and Arumugam, 2019). That came to the conclusion that households needed practical training through demonstrations and extension services to boost productivity and adoption and that the availability of extension services was a critical factor in influencing the adoption of new technologies (Charles et al., 2017). Productivity will grow as a result of an agricultural strategy that encourages the deployment of production technologies (Wanyama et al., 2016). According to there are a number of institutional factors that affect and determine how quickly farmers adopt new technologies, including the accessibility of information bases, the type of extension services received,

and the nature of the laws and regulations they are subject to (Mamudu et al., 2012).

## 2.4 Climate-Smart Agriculture practices

Global emphasis has been focused on the outcome of continuous changes in heat and atmospheric conditions on societies and cultivation (Amadou, 2020; Acosta *et al.*, 2021). To safeguard growers from the influences of longstanding alterations in heat and atmospheric conditions, communal, commercial, and non-profitmaking establishments have extended their perspectives, focusing more on small-scale agriculturalists in Africa where the size of the outcome is extreme. (Alliagbor et al., 2020; Derbile et al., 2021). The main methods for managing the effects of continuous changes in high temperature and weather conditions are the propagation and application of climate-smart agriculture methods (CSAs) (Alliagbor et al., 2020; Waaswa et al., 2021). According to several studies the use of CSAs has the potential to increase and sustain agricultural productivity as well as strengthen farmers' resilience to shocks caused by climate change (Arslan et al., 2014; de Jalon et al., 2017; Martey et al., 2021). By increasing agricultural output and farm families' earnings outside of Africa, CSAs are a crucial tool for reducing hunger, food insecurity, and poverty. For instance, CSAs are continuously expanding in the Sub-Saharan region to acclimatize to long-standing alterations in heat and weather conditions and boost harvests (Chirambo, 2018; de Jalon et al., 2017). According to CSA mechanisms are the current tactic to shift and alter farming structures to combat foodstuff and dietetic poverty (Amadu et al., 2020). By endangering the agriculture on which smallholder farmers mainly rely for their livelihoods, climate change makes it harder for them to meet their current and future demands (Derbile et al., 2021; Lipper et al., 2017). Destroying agricultural food systems lowers their adaptability and capacity to replicate (Ingutia, 2021; Waaswa and Satognon, 2020). In order to reform and reposition agronomic and foodstuff structures to foster progression and advancement while protecting food safety from lasting alterations in temperature and meteorological conditions, CSA methods comprise an integrated and interdisciplinary strategy (Chandra et al., 2016, 2018). The Food and Agriculture Organization (FAO), 2010, 2014 defined "CSA practices" as "diverse production methods blended as a unified strategy to complement one another to increase and sustain agricultural outputs and incomes of the farmers." CSA practices include any expertise employed in farming that has the potential to help in the alleviation of extreme changes in temperature and weather patterns and defeat its deadly impacts on farming and food classifications (Lipper, 2017). They do not necessarily include new production methods and practices. Few agriculturalists respond to the long-standing changes in heat and environmental conditions by using climate-smart practices when farming as a result of the rebranding of some agricultural techniques (Nyongesa et al., 2019; Wekesa et al., 2018). Kenyan agriculturalists have not adopted many CSA techniques, which has had a considerable impact on their ability to make a living (Cavanagh et al., 2017; Faling, 2020; Kogo et al., 2021). Less adoption of the actions suggested to agriculturalists to disrupt the effects of changes of extreme weather events on their source of subsistence is due to many reasons, as well as the ways utilized to contact them with the climate-smart messaging as lengthy variations in heat and atmospheric conditions transformation methods. According to several obstacles prevent CSA methods from being used initially and generally (McCarthy et al., 2011). However, without enough funds to shift the agriculture segment, Kenya's economy cannot grow and prosper (Faling, 2020). 98% of Kenya's farmers are smallholder farmers who live primarily in rural areas and depend on rainfall for farming (Ongoma, 2019). According to climate change is expected to have a negative impact on smallholder farmers' well-being and means of subsistence, particularly in the tropics, where Kenya is located (Derbile *et al.*, 2021; Satognon et al., 2021). According to food and nutritional insecurity will be followed by a rise in poverty among smallholder farmers in Kenya to (Ambrosino et al., 2020). Taking out CSAs is the most reliable strategy to decrease these effects. Several CSA methods have been developed by study establishments, including institutions of higher education, the Kenya Agricultural and Livestock Research Organization (KALRO), non-governmental establishments (NGOs), and Kenya's Ministry of Agriculture, Livestock and Fisheries (MoALF) (GoK, 2017; Nyongesa et al., 2019; Satognon et al., 2021). Unfortunately, the adoption measures by farmers are still minimal, which discourages further study on CSA. Due to decreases in soil productivity brought on by soil degradation, conservation agriculture (CA), a kind of CSA, has become a viable alternative to traditional agriculture. According to studies, CA uses fewer labour costs, and time and input requirements are less than other types of farming methods that use more effort and require additional products permitted for use in organic farming. The it could also increase the continuous output and cost-effectiveness of peasant farmers. Increasing the resilience of small-scale agriculturalists in Africa to climate variations, agricultural environmental management has become a widespread type of

smart farming (Komarek et al., 2021; Hermans et al., 2020; Mupangwa et al., 2021; Brown et al., 2021; Byamungu, 2018).

## 2.5 Farmers' Supply of Resources

Agricultural productivity increase in Africa has been frustratingly slow over the years. The low productivity of agriculture in Africa is due to a number of causes, not the least of which is the sparse adoption of advanced agricultural technologies, including better seeds, fertilizers, and mechanization services, which are themselves a result of limited access to agricultural financing. Additionally, it is believed that the seeming lack of security surrounding land tenure discourages increasing investment in land improvement technology and promotes the use of unsustainable agricultural methods, which has a negative impact on household proceeds and nourishment (Langyintuo, 2020). The result of low productivity in the continent's primarily agribusiness markets is a widespread deficiency. With 413 million persons living on less than \$1.90 each day (World Bank, 2018) and 249 million undernourished (FAO, 2020), SSA has more than half of the world's severely poor.

By leveraging the limited resources that farming households already possess increasing the output of peasant farmers in Africa South of the Sahara gives the greatest possibility of eliminating scarcity amongst this age bracket of countryside poor. To fulfill the growing demand for food, it is also the best and quickest route. In countryside zones, where scarcity has been most pervasive, rising farm earnings by enhanced expertise suggest the quickest route to scarcity lessening (Larson et al., 2020).

## 2.6 Farmers' Storage Facilities

Unacceptable levels of food loss continue to occur every year throughout sub-Saharan Africa (SSA). Although these losses are being documented at every stage of the supply chain, from production to retail and consumer levels, the pre-farm gate, where subpar crop harvesting, drying, processing, and storage occurs, is the area of greatest concern (and where the greatest percentage of crop losses are documented). The crucial beginning of the supply chain is after harvest management at the farmhouse. One of the main causes of food uncertainty in Africa is the current inefficiency in this sector, which annually has significant adverse effects on the lives of millions of small-scale farming families and the amount of food that is available for trade and consumption in low-income, food-deficient nations. Although the biological deterioration of all crops is a natural occurrence, the rate of deterioration can be significantly influenced by a variety of factors, starting with specific farming techniques and extending through the chain of interdependent activities between harvest and food delivery to consumers (WFP, 2015). The multifunctional role that food storage plays in improving food access, nutrition, and financial security at the national, community, and household levels makes it significant on a global or national scale. Additionally, it is commonly acknowledged that using better storage facilities results in advantages such as decreased post-harvest loss, preserved product quality, and lengthened storage times (World Food Programme (WFP), 2015).

There is no literature supporting the upscaling of activities through CSA, despite the fact that all concur that diverse activities do occur. Further, the proximity of Africa to the equator, according to makes it sensitive to climate change (Kimathi et al., 2021; Martey et al., 2020; Abdulai and Huffman, 2014; Sarr et al., Onyeneke, 2021; Ahmed, 2022.). The focus is less on climate-smart practices, which encompass all activities and increase food yield. Recent research has demonstrated the potential worldwide benefits of CSA practices like minimum tillage, combined soil productivity, alternate soaking and exposure to air, and nitrogen use efficiency. Additionally, according CSA technology can significantly lessen the labor demands placed on women in agriculture to (Khatri-Chnetri et al., 2019). As a stressed that in order to fulfill consumer requirements, CSA prioritizing must also take special and temporal scales into account (Thornton et al., 2018). Great variability in farm profitability using CSA operations was demonstrated. Initiating support services, farm procedures, and pertinent mediations and activities in the geographic setting is made easier by an understanding of the limitations and local knowledge that affect CSA practices by (Lan et al., 2018).

The study, therefore, sought to evaluate the impact of farm activities on food security in Taita-Taveta with emphasis on the enhancement of climate-smart practices so as to increase agricultural productivity and overcome food insecurity. The advantages and significance of CSA cannot be disregarded. To achieve sustainable development, it is imperative to emphasize and promote the adoption of tried-and-true practices like CSA, especially among farmers. By preventing food and nutritive uncertainty, raising and maintaining harvests that result in higher profits, and, eventually decreasing scarcity, they can help to realize the goals of

sustainable development. This is so that farmers can adjust and lessen the effects of continuing alterations in heat and meteorological conditions. Nonetheless, some farmers still believe there is no way to avoid the terrifying impacts of shifts in temperature and weather patterns, and they are presently taking on a fairly passive approach as a result of the ineffective communication of CSA methods to the farmers (Waaaswa et al., 2021). These findings support the need for policy assessments on how to improve sustainable food systems by strengthening the County's adoption of the CSA mechanism.

Extreme weather, climatic unpredictability, and change are all threats to Taita-Taveta County. As a result, livelihoods have been lost as a result of decreased crop production and livestock losses as well, creating ongoing food insecurity. Despite efforts by the County government to improve activities for food availability, there is still a gap in the activities undertaken. Therefore, CSA has been proven to increase productivity through adaptation and mitigation measures. For the County to combat food insecurity, scaling up CSA practices is a need. Farmers would be able to adapt and strengthen the resilience of food security systems to climate change if climate-smart agriculture were improved.

## 3. MATERIALS AND METHODS

### 3.1 Study Area

Taita-Taveta County is located in the coastal strip of Kenya bordering Tana River, Kitui and Makeni Counties to the North, Kwale, and Kilifi Counties to the East, Kajiado County to the North-West, and Tanzania to the South and Southwest. Administratively, the Taita-Taveta has four sub-County units which are: Taita, Voi, Taveta, and Mwatate as the headquarter (MoALF, 2016). The survey was conducted in four Wards in Voi Sub-County namely: - Kasigau, Kaloleni, Mbololo, and Ngolia; Wundanyi and Werugha in Taita Sub-County (Figure 1). Taita-Taveta's total cover of the area is 17,128.3 Km<sup>2</sup> where 62 percent is covered by Tsavo East and West National Parks. The County's populace is 349,671 (KNBS, 2019). The study used a cross-sectional research design that adopts both qualitative and quantitative data minimizing biases (Creswell and Creswell, 2018).

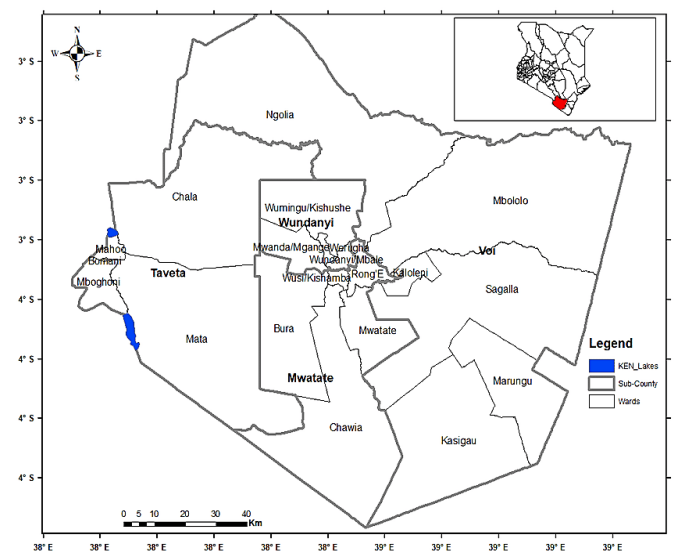


Figure 1: Map of Taita-Taveta sub-counties and Wards (Author: IEBC Constituency boundaries)

### 3.2 Sampling Technique

Two sub-counties, Voi and Taita, were chosen using the purposive sampling approach, and 240 farmers were chosen as the sample size. The administration of questionnaires was done using simple random sampling. The number of subjects in the survey was determined by Taherdoost, (2016) formula as follows;

$$n = p (100-p) z^2 / E^2$$

Where  $p$  is the percentage of states or conditions that occur, and  $n$  represents the necessary sample size.  $E$  is the greatest error percentage needed, and  $z$  is the value corresponding to the desired level of confidence. The formula was chosen because it provided a reliable estimate of sample size using a diverse set of data. As the fraction of the population at the study site was unknown, the values were set as  $p = 0.5$ ,  $Z = 1.96$ , and  $E = 0.05$ .

The collection of both qualitative and quantitative primary data involved the administration of a standardized questionnaire. To access information, secondary data from books and journal articles were employed. The information gathered was grouped carefully under several subjects. The use of subjective and measurable statistical analytical techniques. The structured questionnaire was used to collect qualitative information, which was then translated, processed thematically, and presented in a narrative format. In accordance with the goal of the study, procedures were followed while entering data measured in numerical values into the Statistical Package for Social Sciences (SPSS). Tables and pie charts were used to depict the data after descriptive analysis (Creswell and Creswell, 2018).

#### 4. RESULTS

##### 4.1 Role of the Farmer/County in Food Security

Respondents were asked whether there were any farming activities carried out to ensure food security. Statistical comparisons in **Table 1** indicate that Wundanyi and Werugha, reported high farming activities 26.3% and 24.7 % respectively as opposed to all the wards. **Figure 2** shows that Taita-Taveta sub-Counties adopted CSA mechanisms for food security. Cumulatively, 79% of respondents stated that they did their best to enhance food security through CSA as illustrated in **Figure 3**. 45% and 38% of the farmers reported that their mandate of guaranteeing food supplies was largely by implementing new technology such as climate-smart agriculture as directed by farmer advisers and researchers, while 15% and 2% reported that their part was to work with the local administration agencies to support agricultural activities and purchase of water storage equipment acquired through credit facilities, respectively **Figure 4**. The role of the County government was clearly pointed out to be that of ensuring food security by 85.2% of respondents as in **Table 2** while the rest 14.8 % disagreed.

Table 1: Role of the Farmer in the Improvement of food security in Taita-Taveta					
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Kasigau	58	23.9	23.9	23.9
	Wundanyi	64	26.3	26.3	50.2
	Mbololo	32	13.2	13.2	63.4
	Ngolia	9	3.7	3.7	67.1
	Kaloleni	20	8.2	8.2	75.3
	Werugha	60	24.7	24.7	100.0
	Total	243	100.0	100.0	

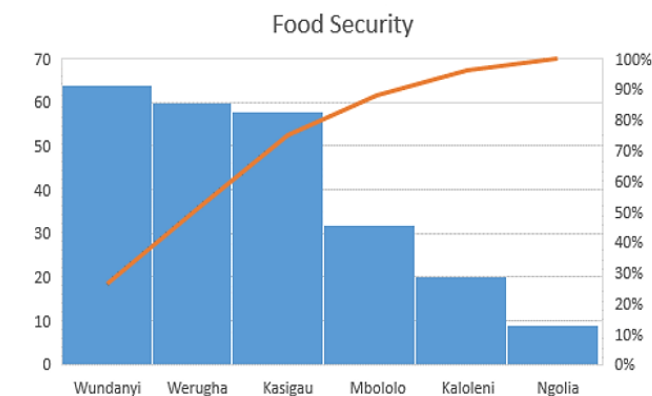


Figure 2: Taita-Taveta Counties Adopting CSA Mechanism for Food Security

Table 2: County Government Role in Food Security					
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Yes	195	80.2	85.2	85.2
	No	34	14.0	14.8	100.0
	Total	229	94.2	100.0	
Total		243	100.0		

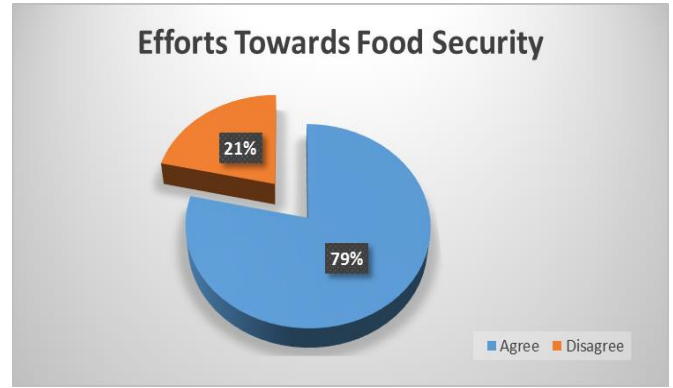


Figure 3 : Cumulative Roles Played by farmers in Enhancing Food Security through CSA

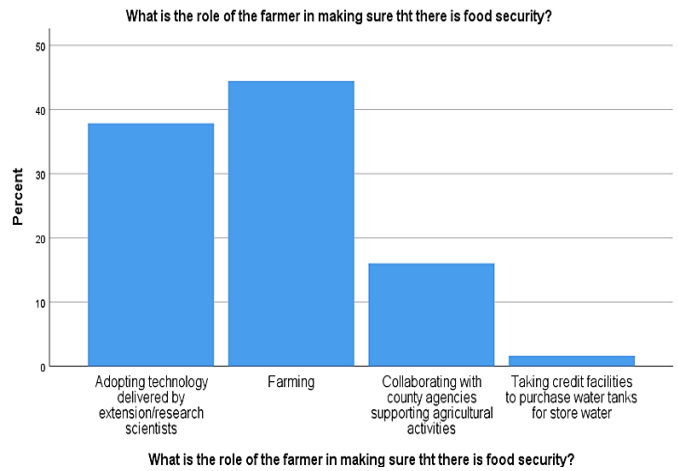


Figure 4: Farmers' role in ensuring food security

##### 4.2 Food programs implemented by the County to ensure food security

The following programs were implemented by the County government in the Sub-counties to ensure food security in order of priority **Table 3**. Climate-Smart Agriculture, dairy farming, cassava promotion and fish farming in order of priority were highly preferred and implemented by the farmers.

Table 3: Food programs implemented by County government to ensure food security Sub County				
		Sub County		Total
		Voi	Taita	
Food programs implemented by the county government to ensure food security	Cassava Promotion	15	8	23
	Banana Promotion	0	1	1
	Fish farming	0	2	2
	Dairy farming	24	25	49
	Climate-Smart Agriculture practices	53	74	127
	Improvement of local breeds i.e., goats	1	0	1
	Provision of high-yielding seeds	1	0	1
Total		94	110	204

##### 4.3 Agencies/institutions collaborating with the county government to ensure food security

The county government had collaborated with other institutions and agencies in ensuring food security with about 76% of the involvement in Taita Sub-County as opposed to Voi with 39% **Table 4**. The agencies and institutions listed in **Table 5** had collaborated with the County government in capacity building, conservation efforts, farm inputs, credit facilities for farm machinery, and weather forecasting among others, as lead roles they played in the county. Respondents noted that the county

government, private and NGO extension services, agro-dealers, and financial institutions offered resources to support farming activities in order of relevance.

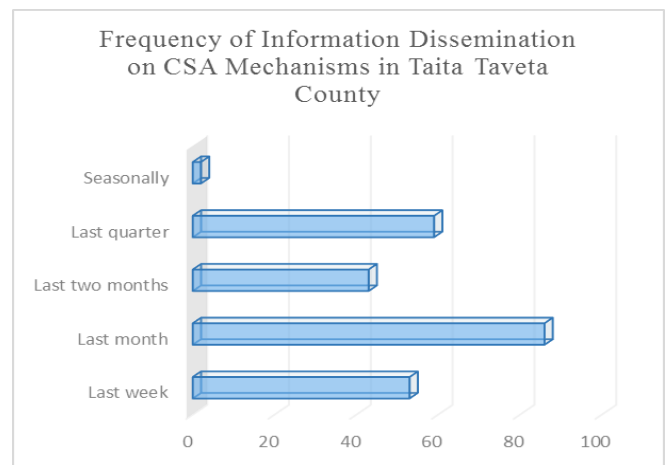
Table 4: Collaborations of the County government with other agencies/institutions				
		Sub County		Total
		Voi	Taita	
Are there agencies/institutions collaborating with the County gov. for food security?	Yes	39	76	115
	No	57	42	99
Total		96	118	214

Table 5: List of agencies/institutions in collaboration with the County Government and support offered	
Institution	Institutions Farm Activity Supported
Darius Mbela foundation	Support poultry farming
Kenya Climate-Smart Agriculture Project (KCSAP)	Supports farmer education on Climate-Smart Agriculture practices, issue of high-quality potato seeds, and poultry/chicken rearing
TRAWALA	Provides training on Bio-Waste
Kenya Agricultural & Livestock Research Organization (KALRO)	Farmer capacity building, providing seeds
MESPT	Farmer capacity building on Agricultural Micro Enterprises eg. Silaging
Permaculture Kenya	Farmer capacity building on French farming, Crafts (Box/Pit) agriculture farming technology
World Vision	Provides food during drought, Farmer capacity building on SLM farming methods, terrace grass strips
Horticultural Crops Development	Promote production and marketing of horticultural crops
National Drought Management Authority (NDMA)	Assessing food situation
Wildlife Works	Promote tree-planting practices
IRUWA Solar Energy	Issue loans for solar water pumps for irrigation

#### 4.3.1 Receipt and Frequency of Agricultural Information

Results revealed that farmers in both Sub-counties received information on agricultural practices from agricultural extension officers who were the main source at 58.5%, followed by the media at 27.7% **Table 6**. This information was often available on a monthly basis. The validity of this frequency of information was supported in the survey by an indication that at least 21.8% had received information the previous week and 35.4% in the past month of conducting this survey **Figure 5**. According to the survey, 92.6% of the respondents were of the opinion that both men and women had access to this information available to them **Table 7**; with about 58.8% of the beneficiaries being women **Table 8**.

Table 6: Sources of Agricultural information					
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Media	66	27.2	27.2	27.2
	Extension Officers	143	58.8	58.8	86.0
	NGOs	20	8.2	8.2	94.2
	Agro-dealers	12	4.9	4.9	99.2
	Other farmers	2	.8	.8	100.0
	Total	243	100.0	100.0	



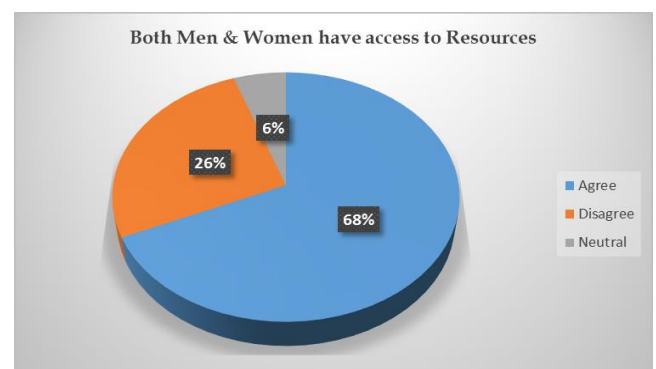
**Figure 5:** Frequency of Information Dissemination for CSA Mechanism in Taita Taveta County for Food Security

Table 7: Men and Women Access to Information					
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Yes	225	92.6	92.6	92.6
	No	18	7.4	7.4	100.0
	Total	243	100.0	100.0	

Table 8: Beneficiaries of information					
Gender					
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Male	100	41.2	41.2	41.2
	Female	143	58.8	58.8	100.0
	Total	243	100.0	100.0	

#### 4.3.2 Access to Resources

About 68% of the respondents believed both genders had access to resources such as land, labour, seeds fertilizers/manure pesticides, credit facilities, and agricultural technology in order of priority **Figure 6**.



**Figure 6 :** Men and women access to Resources

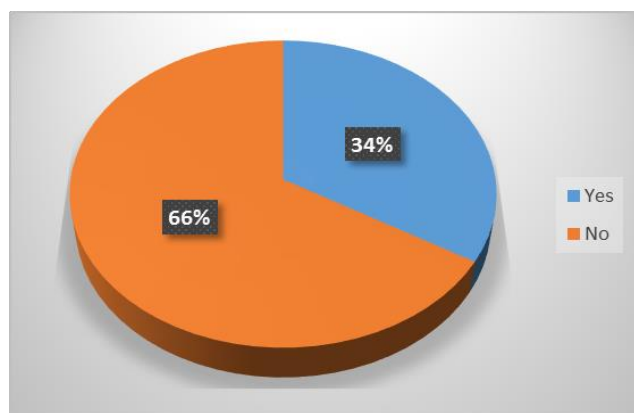
#### 4.3.3 Storage Available for Produce

According to the survey, 71.9% of the population agreed that they had their own local means of storage of farm produce **Table 9**.

Table 9: Storage facilities					
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Yes	174	71.6	71.9	71.9
	No	68	28.0	28.1	100.0
	Total	242	99.6	100.0	
Total		243	100.0		

#### 4.3.4 Strategic Reserves/Funds to Cater to Vulnerable Populations

The majority of respondents believe that the county does not have strategic reserves/funds to cater to vulnerable populations. This view was held by 66% of the population **Figure 7**. It was also observed that the county could not sufficiently cater to the vulnerable population for at least 6 months a view held by 91% of the respondent's **Table 10**. From the survey, a vast majority of those vulnerable to food insecurity depended mainly on the National government, relatives, and well-wishers among others.



**Figure 7:** County Strategic Reserve funds/foodstuffs

Table 10: Reserves sufficiency					
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Yes	13	5.3	9.0	9.0
	No	131	53.9	91.0	100.0
	Total	144	59.3	100.0	
Total		243	100.0		

## 5. DISCUSSION

The study's aim was to evaluate the impact of farm activities on food safety in Taita-Taveta County. Results showed that agriculturists and other players in food production value chains made key contributions to sustainable food security in the County as noted in Table 1-4. Farmers indicated that their role and main activity is farming to provide for their households by adopting new technology **Figure 4**. Strengthening the capability of farmers to enhance food security is one of the approaches at the centre of climate variabilities. Farmers interviewed reported their willingness to improve food availability if they were fully supported by the County officials. This argument is supported by (Fan and Rue, 2020).

The part played by farmers in enhancing food security through CSA was clearly underscored by 79% in **Figure 3**. Farmers need to employ a variety of alternative methods to lessen their susceptibility to long-standing changes in temperature and atmospheric conditions, including planting types of crops resistant to drought, changing the time of year they sow their seeds, switching to fresh crops (like crops that mature early), using irrigation and water collection methods, rotating their crops, diversifying their crops, and diversifying their sources of income as suggested by (De Pinto et al., 2020; Kabubo-Mariara and Mulwa, 2019; Kogo et al., 2020; Aryal et al., 2021; Mairura et al., 2021 and Musafiri et al., 2021). These alternative plans often lessen the intensity of the harm done as well as the dangers associated with exposure to natural hazards because of climate change. Therefore, compared to farmers who don't use any methods, farmers who use climate-shock alternative plans are more likely to have access to enough food. The high adoption of CSA technologies by farmers in Wundanyi (26%) and Werugha (24%) could be explained by the fact that these are highland areas with high rainfall patterns, good road networks, and nearness to Wundanyi town thus easily accessible extension officers.

Despite the myriad of challenges, the County government faced such as climate change, lack of sufficient funding, and many others, agree with who in their study of Taita-Taveta (Autio, et al., 2021). County acknowledged water shortage, prolonged droughts, and irregular or condensed rainwater as leading challenges in food sufficiency, 85.2%, of the farmers reported that the county did its best to support farmer activities as shown in **Table 2**.

In practice, farmers received information and training on new methods such as pests and disease control, management of post-harvest losses, recommended plant population, sustainable land management practices, and acquisition of certified seeds. Others received training on the selection of breeds and protection against diseases, proper animal breeding, and feeding of animals. 45% of the growers stated fall armyworms (*spodoptera frugiperda*) infestation as their most significant natural catastrophe. Fish rearing which was mostly practiced in Taita-Sub County, farmers were taught how to construct fish ponds and cages, feed, and sourcing of fingerlings. Agroforestry, tree spacing, grafting, and growing fruit trees were some of the training done. As a result, they reported improvement in their yields/harvests and the quality of animal breeds. Similar results were conveyed in Taita-Taveta as well as among smallholder farmers in Tanzania by (Autio, et al., 2021; Reincke, et al., 2018). According to the results in **Table 3**, the County government implemented food programs. Climate-smart agriculture (CSA) practices were highly received followed by new dairy farming techniques and cassava promotion in some parts of Voi and Taita Sub-counties so as to build resilience. Other ongoing programs include a banana promotion, provision of high-yielding seeds, and improvement of local animal breeds **Table 5**. Institutions and agencies such as Kenya Agricultural and Livestock Research Organization (KALRO), Kenya Climate Smart Agriculture Project (KCSAP), Darius Mbela Foundation, Micro Enterprises Support Programme Trust (MESPT), Permaculture Kenya, and others in collaboration with the County government, provided farmers with support in form of capacity building, seeds, farmer education on climate-smart practices, poultry farming, agricultural enterprises for example, silaging, French beans farming, crafts agriculture technology marketing of agricultural produce respectively, while others like World Vision provided foodstuffs to the vulnerable population as in **Table 5**. NGOs have been extremely helpful in Kenya's socioeconomic growth. They have made an effort to close service gaps in the public sector. Establishing alliances between NGOs and government agencies can help the Kenyan government improve its operations. This will increase the capacity of government departments while also increasing the effectiveness of providing services. (Ponge, 2019). As a assert that smallholders should be assisted in producing high-value goods for urban markets or expanding their farms if they want to do so.

Government officials in Wundanyi emphasized a lack of awareness as the primary factor behind the poor level of exploitation of CSA knowledge in intercropping, green manure, cover crops, and composting (Fan and Rue, 2020). Despite the sector's importance to the economy, poor judgments on agricultural output and related activities were the result of inadequate access to farmer extension information, which hindered the accomplishment of food safety (Toroitich et al., 2020). The capability for growth is essential as it requires more considerations in the future (Kenny et al., 2017).

The results alluded that formal and informal institutions such as NGOs, Agro-dealers, and financial institutions are actively involved in collaboration with the county government to supply the farmers with adequate resources needed. Results also showed that 68% percent of farmers confirmed access to resources such as land, labour, seeds, fertilizers/manure, pesticides, credit facilities, and agricultural technology, which ultimately increased their yields. The findings are in agreement that technological innovations must respond to challenges such as climate change, demographic changes, and scarcity if they have to be effective (Scheerder et al., 2014).

The study revealed that in Taita-Taveta, the main sources of information were the agricultural extension officers, followed by the media **Table 6**. This is in line with who confirmed that farmers in Taita-Taveta routinely ask other farmers, NGOs, and agricultural extension agents for new information (Autio et al., 2021). Information was available on a monthly basis and 92.6% of the farmers had access to it **Table 7**, with 58.8% of the beneficiaries being women. This concurs also with who stated that the level of awareness of marketing issues and the acceptance of new technology are both strongly influenced by agricultural extension initiatives (Toroitich et al., 2020). The study results also indicated 68% of both men and women had the right to use the assets such as land, seeds, fertilizers/manure, credit facilities, and agricultural technology **Figure 6**. According to the results obtained, 71.6% stated they had used local means of storage **Table 9**. The leading means of storage used by the majority of homes are enhanced silos, outdated stores, and their residences. However, the available means are not adequate and normally farmers would sell their produce at throwaway prices to prevent spoilage after they are harvested. The lack of proper storage facilities increases the vulnerability of grains to pests that live in storage, like weevils. The investigation also revealed that 66% of respondents stated that the County government did not have strategic food reserves and funds to cater to the vulnerable

population Figure 7 and that 91% held the view that the County could not sufficiently cater to the vulnerable even for a period of six months Table 10. Results from the survey noted that a vast majority of those vulnerable to food insecurity depended on the national government, their relatives, and well-wishers for the supply of food.

## 6. CONCLUSION

Farmers in Taita-Taveta County have demonstrated the role of farm activities that take place in enhancing food security. Importantly, the County government played a pivotal role through collaboration and partnerships with other agencies and institutions to support food initiatives. However, the activities that take place are not sufficient to support food availability. There is, therefore, a need to enhance food security through the adoption of climate-smart practices. This would ensure sustainability and further cushion the effects of climate change which perpetuate cycles of poverty. These results underpin the need for policy reviews on how to enhance sustainable food systems by improving the adoption of the CSA mechanism for the County.

The outcome of these mechanisms' applications have not been documented and the study sought to document them so as to inform policy and best practices. More importantly, if the adoption of CSA mechanisms is upscaled, they would provide farmers with a unique way of mitigating and adapting to climate change adverse effects on their crops and farm yields.

Worth noting is the need to have county strategic food reserves and a paradigm shift to having crop diversification as strategies to cope with the changing climate. The study highlights the need for the County also needs to undertake policy reviews in order to enhance sustainable farm activities that increase crop yields and in the long run improve the food security situation therein.

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