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A Gender-Responsive Approach to Climate-Smart Agriculture. A Case Study of Community Garden Support

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ABSTRACT:

This study explores a gender-responsive approach to Climate-Smart Agriculture (CSA) in community garden support, emphasizing its role in enhancing agricultural productivity, income stability, and social empowerment. A systematic sampling method was used to select a population of 10 farmers, and qualitative data collection techniques—including interviews, focus group discussions, and observations—were employed. Interviews were conducted with Agricultural Extension (Arex) officers and community garden farmers, while focus group discussions and observations provided additional insights into CSA practices. Key CSA techniques identified in community market gardens include mixed cropping, mulching, crop rotation, and pest and water management. These gender-sensitive practices have contributed to improved agricultural yields, economic resilience, and knowledge-sharing platforms. Additionally, CSA has influenced social dynamics by shaping perceptions, interactions, and the distribution of power and resources within farming communities. However, despite these advancements, challenges persist. Farmers continue to struggle with inefficient irrigation methods, such as the bucket system, and inadequate market access, limiting their agricultural potential. To address these barriers, the study recommends the adoption of advanced irrigation technologies like the Symphony irrigation system, improved market access, and enhanced packaging strategies to ensure sustainable rural livelihoods. These interventions align with the United Nations Agenda 2030 for sustainable development, aiming to foster inclusive and resilient agricultural systems. By integrating gender-sensitive approaches within CSA, policymakers and stakeholders can create equitable agricultural frameworks that empower communities and promote long-term environmental and economic sustainability.

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1.0 Introduction

The gender gap in agriculture is a pattern, documented worldwide, in which women in agriculture have less access to productive resources, financial capital and to advisory services compared to men (FAO, 2017). In the context of Climate-Smart Agriculture (CSA), this gap means that men and women are not being at par towards CSA on a level playing field. While gender shapes both men's and women's lives, the tendency is for women to have a more disadvantaged position in comparison to men. This approach means that the particular needs, priorities, and realities of men and women need to be recognized and adequately addressed in the design and application of CSA so that both men and women can equally benefit (World Bank, FAO and IFAD, 2016). The gender responsive approach means that the monitoring and assessment of CSA needs to include gender-sensitive indicators which help track progress in closing

the gender gap in agriculture (Huyer et al., 2019). Additional gender-responsive efforts in the field of CSA gives attention to gender issues in CSA policymaking, building an evidence base on gender in CSA, developing financial instruments that respond to women's and men's needs; and introducing institutional change to develop capacity and build commitment on gender equality and empowerment (Lipper et al., 2019)

1.2 Background of the study

Gender responsive Climate Smart Agriculture (CSA) is a conceptualization to model the management of agriculture in the times of climate change. Since the launch of the concept in 2009, it has been reshaped through inputs and interactions of various stakeholders being involved in developing and implementing the concept. Climate-Smart Agriculture (CSA) practices refers to systems and new technologies that can be used by farmers to improve their livelihoods and adaptation (WFP, 2020). CSA aims to provide globally applicable principles on managing agriculture, food security and income generation through interaction and the distribution of power and resources in society (Nhemachena, 2017). In the year 2009, the UN's Food and Agriculture Organization (FAO) launched the concept of gender responsive Climate Smart Agriculture (CSA) to draw attention to linkages between achieving food security and combating climate change through agricultural development (Lipper et al., 2018). As a concept, CSA is therefore geared towards guiding the management of agriculture in the era of climate change (Lipper and Zilberman, 2018) and achieving food security, while also mitigating climate change and contributing to other development goals (Verhagen et al., 2016). CSA as an approach therefore helps women and men farmers to reduce vulnerability, increase adaptive capacity and to better cope with ex-post risk (Lipper et al., 2018).

The influences on how people perceive themselves has enhanced gender responsive Climate Smart Agriculture (CSA) to be a concept gaining considerable traction at international and national levels to meet the challenges of addressing agricultural planning and gender equality under climate change. CSA seeks to sustainably increase agricultural productivity by reducing greenhouse gas emissions relative to conventional practices (Manzungu, 2019). Climate change is a threat to food security systems, to human lives and one of the biggest challenges in the 21st century (FAO, 2018). CSA is a way of earning livelihoods and supply of needs like food, income and services that are adapted for benefit (Kulkami et al, 2017). An integrated approach to managing landscapes promotes agricultural best practices like integrated crop management, soil management, pest management, water management, energy management and pest management at and interaction of the community. CSA has to address simultaneously three intertwined challenges hence ensuring food security through increased productivity, income generation and adapting to CSA (FAO, 2020). Crop production, which is vital to global food security, is being affected by climate change all over the world. However, the impact is being felt more severely in the more impoverished communities.

A wealth of material exists on the potential consequences of Climate Smart Agriculture on agricultural production and methods of adjusting to the new technology (Adams et al., 1998). These studies usually

show that farmers can mitigate the negative effects of CSA by employing adaptation techniques. Much of the literature review on agricultural adaptation to climate change has focused on a variety of factors influencing the adoption of such strategies by smallscale farmers. Many of these studies simply identify family, agricultural, and institutional factors as major predictors of adoption (Marenya & Barrett, 2007). However, there is a scarcity of data on the factors that influence decision and the impact of certain CSA practices on the food security status of small-scale farmers' households.

1.3 Statement of the problem

Climate change poses threats to local agriculture, having an effect to the wellbeing of both men and women resulting in hunger, malnutrition and poverty. The gender gap in agriculture is of relevance to CSA as it potentially puts women and men in unequal positions in terms of participating in and befitting from site-specific CSA practices and options.

Due to limited information on how can CSA-sensitive practices be identified, designed and implemented in a way that takes into account the local, existing differences and inequalities between men and women contributing to the promotion of gender equality. Therefore, the study is geared towards filling this knowledge gaps by an explanatory study on the gender responsive approach to CSA in Bikita.

1.4 Research Questions

i. What are the Climate Smart Agricultural practices in Community Garden Support? ii. What is the significance of gender responsive Climate Smart Agriculture on fostering gender equality on theCommunity Garden Support?

iii. What are the farmers challenges to adapt to the new CSA technology?

1.5 Research design

Research design is regarded as a road map that directs plans and helps the study to be achieved (Cresswell, 1998). A research design requires the researcher’s initiatives of how to go on, hence being a comprehensive plan that underpins the process to be taken in a research. Also, the research design was defined by Patton and Cochran (2002) as the procedures used by the research to form subjects into groups and administer the measures for data analysis. Qualitative research method is likely to construct data whiich is in written form. In order to produce various types of data information from qualitative research by utilizing diverse methods (Cresswell, 2003). For instance, the systematic sampling technique creates scientific data that can be investigated with the main objectives of determining and combining behavior and relationship. The study is set on the impact of gender responsive Climate Smart Agriculture on rural livelihoods in the community.

CSA is a complex arrangement therefore the qualitative research method is going to be used on the research. The preference of using qualitative research method instead of quantitative research method is mainly influenced by the form of information that is being needed and by the call for a human sense to understand the observable fact (Mugenda, 2019). Qualitative viewpoints highlight a phenomenological analysis in which reality depends on the view of individuals (Patton and Cochran, 2002). The important major advantage of qualitative research method is the ability to include both verbal

and non verbal proceedings, discover meanings, transmission feelings and skills concentrating to details.

1.5.1 Population

Population is defined as a group of individuals of the same species living and interbreeding within a given area (Lebreton et al., 2012). Members of a population often rely on the same resources, are subject to similar environmental constraints and depend on the availability of other members to persist over time. Scientists study a population by examining how individuals in that population interact with each other and how the population as a whole interacts with its environment. The population of the study consisted of the Agritex officers and 40 garden farmers in the community garden.

The first step in deciding how you will analyze the data is to define a unit of analysis (Trochim, 2016.) In a study, the unit of analysis is the "who" or the "what" that you are analyzing for your study. In this case, my unit of analysis is a group of market garden farmers and their households.

1.5.2 Sampling technique

Systematic sampling

Sampling is the collection of data from selected representatives of the population and using it as research information (Latham, 2017). On this sampling technique individuals are selected at regular intervals from the sampling frame. The intervals are chosen to ensure an adequate sample size. The sampling frame is referred to as the realistic version of the study population,which the researcher can identify and access (Davis and Gallardo, 2012). The process of selecting a portion of the population to represent the entire population is known as sampling (Polit & Hungler, 2019). This method in which only the first unit is selected at random, the rest being automatically selected according to a predetermined pattern, is known as systematic sampling.

If you need a sample size n from a population of size x, you should select every x/n^{th} individual for the sample. For example, in this case I want a sample size of 10 from a population of 40, select every 40/10 = 4^{th} member of the sampling frame.

Systematic sampling is often more convenient than simple random sampling and it is easy to administer. However, it may also lead to bias for example if there are underlying patterns in the order of the individuals in the sampling frame, such that the sampling technique coincides with the periodicity of the underlying pattern. As a hypothetical example, if a group of students were being sampled to gain their opinions on college facilities, but the Student Record Department's central list of all students was arranged such that the sex of students alternated between male and female, choosing an even interval (e.g. every 20^{th} student) would result in a sample of all males or all females. Whilst in this example the bias is obvious and should be easily corrected, this may not always be the case.

1.6 Data collection techniques

1.6.2 Interviews

Potter (2018), argues that interviews are valuable tools for collecting data in qualitative research. Interview method is the most popular method for collecting primary data. An interview is defined as a face to face interpersonal role situation in which one person the interviewer asks the respondent hence the interviewee questions designed to obtain answers pertaining the research (Cresswell, 2003). It is widely used in every field or sector. The interview technique is one of the important and powerful tools for collecting the primary data in social research like the impact of gender responsive Climate Smart Agriculture on rural livelihoods in the community garden. The technique involves presentation of oral-verbal stimuli and reply in terms of oral-verbal responses hence it is a direct method of data collection. The interview technique on this study being used is through personal interviews. In a structured interview the researchers ask a standard set of questions and nothing more (Leedy, 2010). Semi-structured type interviews were used in order to obtain data on the gender responsive approach to CSA in thecommunity. Purposive sampling was used in selecting the interviewees as they had better knowledge on the project and therefore enabled research objectives to be answered without difficulty. These interviewees were representatives from the AGRITEX, CARITAS and market garden famers. An interview yields the highest response rates in survey research due to personal presence of the interviewer, there is flexibility in the inquiry, additional supplementary information can also be obtained, the interviewer can usually control which person will answer the questions and generally non-response remains very low in this method.

Disadvantages

The main demerits of the interview technique are very difficulty method in the sense that the interviewer needs to be at the community garden interacting with the farmers. Also, there remains the possibility of the bias of the interviewer as well as that of the respondent as this method is relatively more-time consuming especially when the sample is large (Saunders et al, 2003). However in this case the sample size is small to adhere to Covid 19 preventative measures. Moreover, some respondents may not give true answers to the questions and due to fear of the visitors unknown Covid status.

Table 3.1 below shows the people who are going to be interviewed in the research

PERSONNEL TO BE INTERVIEWED	REASON FOR INTERVIEW
AGRITEX	-To acquire information on the role of the department. -To acquire information on trainings given to garden farmers and agricultural methods applied by project members concerning gender responsive approach to CSA on the garden -To find out CSA practices -To find out what strategies have been used on CSA
COMMUNITY GARDEN FARMERS	-To acquire information on the role of the men and women farmers -To acquire information on the impact of the garden to the community To find out the CSA practices -To find out how the beneficiaries are adapting

1.6.3 Focus groups or discussions

A focus group discussion (FGD) has been described as a rapid assessment, semi structured method of collecting data where a set of participants are purposively selected to discuss issues based on a list of key areas drawn up by the facilitator (Kumar, 2017). Focus groups provide a form of qualitative data. It functions with the help of a skilled moderator who facilitates a discussion with a small, selected group of participants for a specific amount of time.

Conducting FGDs for the study was important as they created a comfortable environment where project members could give in-depth information on different perspectives and experiences concerning the project whilst maintain social distance (Kothari, 2014). For example, their economic gains or their impression on the project. FGDs which are well run uncovers real feelings and issues along with non-verbal information (excitement, stress, doubt) which therefore provides more profound information that personal interviews or surveys can give (Office of Quality Improvement, 2007). One FGD session was carried out for the study, the group had 10 discussants and took 45 minutes. The facilitator used a FGD guide for gathering data through asking questions.

Advantages

Focus groups discussions provides a useful way to measure the reaction of farmers to a new method of farming hence gender responsive Climate Smart Agriculture. The farmers who participated in these gatherings provided immediate ideas that may improve the concepts being introduced through this medium. Also, an observation produces a significant amount of data about CSA concept through confirming insights obtained from other methodologies. The only problem with that approach for some

investigators is that the information can feel impersonal or lack authenticity. If the findings from previous efforts seem questionable, then a focus group can either confirm or deny the insights that researchers obtained through the use of other methodologies (Creswell et al, 2017). Focus groups are usually held in communities where a specific project is administered for a future concept. Participants sign up for these conversations today from locations all over the world. That means you can take a localized approach while gaining the international diversity needed to address potential pain points with an idea.

Disadvantages

There are some disadvantages as some participants have dominant and extroverted personalities which tends to dominate the conversation. Moderators try to temper this disadvantage by asking specific questions to the group so that individuals feedback gets encouraged, but there will always be a few people who have an aggressive approach to providing feedback (Kothari, 2017). Focus groups don't provide as much time to individual perspectives as interviews when trying to solicit a maximum amount of information about a specific issue. This disadvantage can cause some participants to rush through their perspectives because they feel like there won't be another chance to say something (Mugenda, 2018). Others can be hesitant to express their thoughts because they fear that someone else in the room will criticize them. Focus groups are more expensive to execute when compared to questionnaires or surveys. Although some participants will offer their time for free, many expect to receive compensation for their feedback in some way.

1.7 Data analysis

Data analysis is the process of carefully reviewing, purifying, and modelling data in order to extract meaning from it. According to Cooper and Schindler (2014), data analysis entails breaking down a large amount of data into manageable chunks, creating summaries, looking for patterns, and using statistical methods. The research questions and the literature review should be triangulated in the data analysis. This study adopted qualitative research as the research instrument to collect qualitative data from the participants. In doing so, thematic analysis—a qualitative method of data analysis—was chosen. Sorting the data collected, noting and identifying different ideas from the research, coding the data, and identifying different themes from the data are all steps and processes involved in the thematic analysis (Korsten's and Moser, 2018). When coding data, words, sentences, or paragraphs that are connected to or unconnected from a particular setting are used as codes.

Each transcript's data was thoroughly summarized, divided into different categories, and given a key concept identification. The main distinction between qualitative and quantitative research is that, unlike quantitative research, where assertions are predetermined, the themes in qualitative research emerge from the data. The codes created from each transcript were examined during the data analysis process to highlight emerging themes, connections, and patterns among the emerging themes. The emerging themes were then combined to form the core themes, which brought the key messages being conveyed

by the data together. As the discussion of the interpretation develops in this study, appropriate direct quotes from the transcripts were used for "transparency and coherence.".

1.8 Ethical considerations

Research ethics were created in anthropology to safeguard those who (human and non-human) are being researched and to protect the researcher from topics or events that may be unsafe or may make either party feel uncomfortable.Given the importance of ethics in conducting research and the challenges around conducting research, universities go to great lengths to protect the dignity and safety of research participants (Silverman, 2009). Ethics imply norms for conduct that distinguish between acceptable and unacceptable behavior and helps researchers grapple with ethical dilemmas through providing important insights, concepts, tools, principles, and methods that can be useful in resolving these dilemmas (Lincoln and Guba, 1985; King et al., 1994).

Following the critical steps in the researcher's endeavor for ethical considerations there is the need to seek written consent and authority from the local authority for the study area hence Bikita Rural District Council and the community garden farmers. The written consent in this regard was successfully issued. With regards the consent of thehouseholds, the Bikita Rural District Administrator, as the gate - keeper to the rural district has issued the research with the assurance for the necessary support and cooperation by his subordinates in the study area. This includes the traditional leaders and their subjects who work under the DA's authority. The research has therefore been granted authority, access to, and cooperation from the community leaders and their respective members, the garden famers other institutions operating in the district.

Given the high regard accorded to the need to guarantee anonymity and confidentiality to the participants in order to enhance the willingness of the human subjects to participate in the survey (Bailey, 2017), the study is committed to this research principle. Whilst it is this particular research's belief that most (not necessarily all) of the data and information collected is hardly classified as sensitive, confidentiality in particular and anonymity to a certain level have been a matter of serious consideration to the entire research process.

2.0 RESULTS AND DISCUSSION 2.1 CSA strategies

The community garden has given an opportunity to the garden farmers to practise a variety of Climate Smart Agriculture practises. Types of CSA practises undertaken by thefarmers are crop rotation, mixed farming, mulching, planting of buffer grass on weirs, use of cover crops, irrigation, mulching, use of different hybrid seeds, agroforestry, use of organic matter and integrated pest management through use of plants (Table 4.1 below).

Table 4.1 Climate Smart Agriculture strategies

CSA PRACTICE	COMPONENTS OF THE CSA STRATEGY
Soil management	Use of legumes in crop rotation, use of organic manure, mixed cropping, planting trees to prevent soil erosion and windshields
Crop management	Use of legumes in crop rotation, intercropping, mulching, mixed cropping, use of integrated hybrid seeds and integrated pest management (cultural, biological and disease resistant)
Water management	Mulching, storage tanks, water weirs, small dams, irrigation system, water reservoirs
Forestry	Planting of trees and buffer grass to prevent soil erosion
Energy management	Use of solar energy to pump water for irrigation

a) Soil Management

i) Mixed Cropping

The plate below shows a CSA strategy of mixed cropping where by carrots, covo, rape, lettuce and potatoes are planted in the same portion by one of the community garden farmers. From the interviews administered one of the male farmers revealed that:

"Mixed cropping is practiced in case when a crop fails or prices fluctuate the farmer can depend on the other crops in the garden and also farmers tend to harvest a variety of produce such as cereals, pulses, vegetables or fodder to meet the requirements of the family".

(Respondent 1)

Gender analysis, in the mixed farming systems, is required to understand the various roles of men, women and children in farming systems and the way these roles are affected by new interventions (Scott, 2018). Particular attention is normally given to the roles of women because in many cases they undertake major responsibilities in agricultural production, processing and marketing in addition to performing household chores and reproductive and child rearing activities (Gandure et al, 2010).

b) Crop Management

i) Intercropping and Mulching.

The plate below shows intercropping and mulching of maize and legumes as a CSA strategy in the garden. Maize stalks are being used to retain moisture in the soil. In an interview one of the garden female farmer revealed that:

"Legumes plays a crucial role in fixing the nitrogen in the soil whilst mulches conserve the soil moisture to enhance the nutrients status of soil, control the erosion losses, suppress the weeds in crop plants and remove the residual effects of pesticides. He further emphasized that mulches improve the aesthetic value of landscapes and economic value of crops". (Respondent 4)

c) Integrated Pest Management (IPM)

i) Cultural Pest Management

According to the United Nations Food and Agriculture Organization (FAO), Integrated Pest Management means considering all available pest control techniques and other measures that discourage the development of pest populations, while minimizing risks to human health and the environment. Farmers in the community market are taking measures to adapt to IPM through cultural measures to manage diseases, insects, weeds and other pests. Farmers revealed that

"Cultural methods are a flexible system that makes good use of local resources and the latest research, technology and knowledge. There, in our garden they contribute a lot as a solution for long term, sustainable agriculture that achieves adequate, safe and quality food production, improves rural livelihoods through the engagement of men and women". (Responded 10)

Considering gender in research on pests and diseases is increasingly important as it facilitates development of more efficient approaches to increasing the adoption of crop protection technologies and practices by women and men farmers according to their roles, knowledge, and capacities (Berry, 2019). However, this task is often assigned to social scientists in isolation from agronomists. While a gender perspective is increasingly recognized in the field of agricultural extension and training (Kariza, 2020), it is often insufficiently considered by agronomists and crop protection experts, who are focused on bio-technical solutions and pay little attention to social-economic factors and power relations among farmers in the field and off the field.

d) Biological

IPM improves crop profitability due to better pest control measures and appropriate use of crop protection products stable, reliable and quality crop yields, decreased severity of pest infestations and reduced potential for problems of pest resistance or resurgence. The farmers revealed that:

"The introduction of beneficial insects or predators by applying micro-organisms such as viruses, fungi and bacteria; using pheromones to lure, trap and kill or interfere with insects' mating habits. Currently we are doing a mass production of Bacteria, fungi, nematodes or viruses to control some pests. The most common and successful is Bacillus thuringiensis (Bt), a naturally occurring bacterium, which we are using to control several important pests like caterpillar pests in vegetables" (Respondent 6)

Women and men farmers often play different roles in agricultural production, and they possess different levels of knowledge about and involvement in, pest and disease management practices (Christie et al, 2015). Despite these gender differences, pest and disease management research and training often targets “farmers,” neglecting the specific needs of women and men as well as the power relationships within households and communities.

e) *Disease resistance*

In thecommunity market, garden farmers choose beneficial crop varieties, such as those with disease and pest resistance hence, a cornerstone of IPM. These varieties are derived from traditional cross-breeding and modern biotechnology pest-resistant and herbicide-tolerant varieties. One of the garden farmers gave an example:

"The mixture of crossbreeding and adoption of new farming systems may reduce the need for other crop protection measures. Biotech crops also facilitate, reduced or no-till practices, helping to maintain soil health and prevent erosion. As we plant different crops in alternate rows or undersow a crop like maize with a legume such as cowpea to help improve soil fertility and reduce weeds". (Respondent 10)

f) Use of Integrated Seed Systems

Scaling the adoption of improved varieties and quality seed among the garden farmers includes both formal and informal seed systems. In the garden much evidence shows that smallholder farmers source the majority of their seed from the informal system as they plant, exchange and sell a wide range of varieties that fall outside the production. One of the farmers revealed that:

"In the garden the farmers use the formal seed system from certified seed varieties. Whilst, famers also have a system whereby local farmers produces seeds directly from our own harvests and then we exchange and barter trade among friends, neighbors and relatives" (Respondent 8).

"The advantages our traditional seed systems through our local produces enhances the management and conservation of local agrobiodiversity through the production of seeds locally so that we can have easy access and consider their value" (Respondent 6)

Hybrid varieties usually have more uniform characteristics, making crops more predictable in quality (Dube, 2017). Hybridization in the garden is done in a carefully controlled manner so that all of the plants grown from the hybrid seed will be the result of the desired cross and will be nearly genetically identical. One of the farmers revealed that:

"On some crops we personally enhance pollination by hand like on hybrid cucumbers. Also, on maize, the male and female lines are inter-planted in the field and the tassels (male flowers) are removed from the female parent or a self-sterile female is used. The production of hybrid seed was trained in communities so we have higher chances in the production of hybrid seed as we are fully knowledge on the adaptive measures" (Respondent 11)

g) Water use and Energy Management

i) Solar-powered Irrigation Pumps (SPIPs) and tanks

In thecommunity garden the SPIP is a clean technology to lift water and provide irrigation facilities to the garden. SPIP is a proven technology for pumping water and the current challenge for implementers is to increase adoption of the technology (Kaye, 2021). From the interview's farmers mentioned some advantages on the usage of SPIPs:

"SPIP technology in the garden offers a wide range of benefits as it does not require electricity for operation always readily available increasing cropping intensity. Also, SPIPs reduce GHG emissions from agricultural production as compared to the use of water pumps powered by fuels thus reduction of local short-lived climate pollutants such as black carbon" (Respondent 2)

The water, energy, land and food (WELF) nexus has been touted as a cross-sectoral systems approach that presents an opportunity to address the grand challenges related to poverty, unemployment, inequality and climate change, especially in the global South (Ringler et al, 2013). However, as with any other developmental approach, the WELF nexus needs to mainstream gender, which often lies at the heart of poverty, unemployment, and inequality in sub-Saharan Africa.

h) Agroforestry i**) Soil Erosion prevention**

Farmers in thecommunity garden intervenes in agroforestry as an adaptive measure for soil erosion and windbreaks. Agroforestry systems are multifunctional systems that can provide a wide range of economic, sociocultural and environmental benefits. The predominant farm based economic activities in the community area is vegetable and tree crop production. Agroforestry can also be defined as a dynamic, ecologically based, natural resource management system that, through the integration of trees on farms and in the agricultural landscape, diversifies and sustains production for increased social, economic and environmental benefits for land users at all levels (Simmons, 2016). In particular, the farmers expressed that:

"Agroforestry is crucial to us because it can enhance stuffiest food supply, income generation, employment of men and women through vegetable and tree crop production". (Respondent 7) **2.2 The impact of Climate Smart Agriculture to men and women in theCommunity**

a) Social cohesion

The project has provided an opportunity for men and women in theto work collaboratively to attain a fruitful gender responsive CSA strategies implementation. In a focus group administered, men and women farmers revealed that there is a change in the community's rural livelihoods and gender inclusiveness perspective due to working together. The researcher observed that members of both genders seemed to be working together in the community garden amicably. Community gardens foster social inclusion and thereby encourage gendered conversation and problem solving (Kairiza et al, 2020). Through focus group discussion and observation the garden has improved social interaction among community members through cooperation and working together in the garden utilizing the resources.

b) Food supply

In a focus group discussion with the community garden farmers, the gender inclusivenes has brought a change in the community's standards of living. A gendered perspective to CSA by farmers enhances a source of food supply from the garden all year round hence maintaining the men and women's health status through a balanced diet (Harris et al, 2021). Respondents through a focus group discussion revealed that before the gender inclusiveness at thecommunity garden, rural livelihoods were a bit challenging as there was no adequate supply of food, only relying on the field produce before CSA was introduced whilst there was no gender equality. CSA explains why they opted for community gardens as a source of adequate food supply (Maulani et al, 2020). A gender sensitive approach to CSA has made the community produce food for households and food security for better rural livelihoods. Hence, both gemder could share roles, ideas, discuss problems and make collaborative decisions

c) *Employment*

According to Ngwenya (2021), explained that the bulk of labor for most garden operations in sub-Saharan Africa is provided by family members rather than hired persons. In an interview with the farmers revealed that:

"*because of high levels of unemployment in the country, the community garden through a gender sensitive approach to CSA has caused an improvement in the rural livelihoods of the community as a source of employment". (Respondent 3)*

The garden has become a form of employment to the men and women being engaged in the CSA initiative as they benefit from the project. Hence, through an interview one female famre mentioned that:

"The community garden has become a form of employment to the community as they spend much of its time working in the garden to improve their livelihoods" . (Respondent 11)

d) Source of income

Furthermore, observations and a focus group discussion with the men and women farmers actions and thoughts were revealed. The community garden has become a hub for attaining a source of income to the rural livelihoods. By being engaged in income generating activities through the sale of surplus products to other communities. From the focus group discussion about the community garden the farmers revealed that they could even now manage to pay their children school fees and purchase other materials through selling surplus from the market garden.

2.3 Gendered approach to CSA technology adaptation.

a) Trainings

Project members are always being engaged in gendered training during CSA implementation in relation to the new farming technologies to improve agriculture on CSA. A vast number of both genders in interviews also mentioned about their gender sensitive trainings on CSA. In the focus group discussion conducted, both genders revealed that:

"*They had gone under Lead Farmers training which include land use planning, soil and water management and Integrated Pest Management (IPM)". (Respondent 5)*

b) New Technology

Moreover, male and female farmers in thecommunity garden adapt to gender sensitive approach to CSA by practicing the recommended technologies. Many CSA practices are being undertaken to adapt agricultural systems in thecommunity garden which includes improvements in plant genetics (e.g. genetic modifications for hybrid yields, enhanced root architectures), soil conservation (e.g. planting legumes), crop management (e.g. crop rotation), water technologies (e.g. irrigation) and financial instruments through Rotating Schemes (Mukando). The strategies for adaptation, have high potential results as climate-smart practices and offer an important prioritization of soil and water conservation management practices whilst enhancing gender equality.

c) Gender-sensitive policies

Findings of this study show that there are pre-existing gender inequalities in farming communities, at household level and perpetuated by gender-blind CSA implementation. This study submits shows that gender responsive CSA adoption by women and men farmers to improve, there is need for existing and new policies to be gender-sensitive to ensure that issues of gender inequality are addressed to achieve gender parity. This requires a holistic assessment of gender responsive CSA that will consider implementation strategies and resilience capitals, and not just limited to technological benefits of gender responsive CSA (Chidavaenzi et al, 2021). There is need for policies directly or indirectly linked to gender responsive CSA, to be assessed for their implications on different genders, for instance, when considering issues of land tenure, marriage and property inheritance laws which affect CSA adoption decisions (Nyumba et al, 2018). Furthermore, other policy frameworks that need to be gendersensitive include technology development and economic empowerment.

d) Gender-equal farmer participation

CSA presents various opportunities where farmers should be engaged for active participation in CSA technology development (Cook, 2015). However, study findings showed that currently, participation of farmers in gender responsive CSA is mainly as recipients of already developed technologies and CSA information. CSA is characterised by top-down approaches, which when a gender lens is applied may fail to pay attention to critical gender issues that hinder adoption (Trotter et al, 2020). This study reiterates need for gender responsive CSA implementation to ensure equal participation of farmers in technology development and in identification of CSA options to adequately meet the resilience needs of diverse farmer categories. Gender-equal participation is also required in co-creation of knowledge through research, in gendered- risk assessments, vulnerability assessments and multi-hazard analysis. Gender-equal participation of farmers will likely assist in identification of gender-differentiated barriers of CSA adoption, and opportunities that can be harnessed to improve adoption across different genders (Chen & Chen, 2005)

2.4 Strategies to improve CSA adoption

a) Gender-equitable resilience capitals

Based on study findings, according to Mazwi (2021), resilience framing of CSA adoption compels consideration of gender inequality and gendered-vulnerability in access to, control and ownership of resilience capitals. The gender constructions that determine who owns, has access and controls need to be assessed in CSA as they shape farmers' adoption decisions. In order to achieve resilience-building through CSA, there is need for deliberate strategies aimed at establishing gender equality and equity in the ownership, control of and access to social, natural, physical, financial and human resilience capitals. This will require gender responsibe CSA to engage with the disparities and improve especially ownership of resilience capitals such as farming equipment, livestock, land and finance by women farmers to enable them to not only cope with climatic disturbances, but that they can also be equipped to build back better or bounce forward from each disturbance (Soto, 2020). Paying attention to resilience capitals also helps illuminate the key vulnerability issues that dispose farmers to either dis-adoption or non-adoption of gender responsive CSA Creating gender equality and equity in resilience capital ownership will require innovation in tackling the socio-culturally entrenched patriarchal systems and women's subordination, and contemporary gender mainstreaming approaches may be useful therein.

b) Risk-informed decision making

Adoption decisions of men and women smallholder-farmers are influenced by various factors depending on their gender roles (Khoza et al., 2019). Importantly, decisionmaking for men and women household-heads needs to be viewed in the multi-faceted context within which decisions are made and has to be risk-informed. There is need to acknowledge different factors and drivers that shape decision-making for different genders. A resilience framing of gender responsive CSA accommodates risk-informed decision making (RIDM) even at smallholderfarmer level (Weichselgartner and Pigeon, 2015). RIDM acknowledges that decision-making is not in simple linear fashion as traditionally understood. It is a more comprehensive analytical approach that interrogates and seeks to understand complex interactions between people, risks, hazards and systems. Risk-informed decisions pay attention to qualitative information from genderdifferentiated risk assessments (Gardoni et al., 2016), narratives and realities which shape decisions made by different farmers. However, (Apostolakis, 2004) caution against exclusive use of risk assessments to inform decisions, hence need for a more consolidated approach where gender-vulnerability assessments and multi-hazard analyses will also feed into decision-making.

2.5 Recommendations

- Promote inclusive gender equal participation of local communities in CSA research, policy formulation and implementation. The proposed gender-sensitive CSA adoption framework is anchored on people-centredness where farmers, regardless of their gender are recognised as key actors in CSA. This means farmers are recognised as both recipients and innovators of technologies, as those with knowledge, including indigenous knowledge that can be applied to inform technology development, or to

modify developed technologies. Participation of local communities will facilitate multidirectional flow of information, incorporate local perspectives and realities in CSA technology development and dissemination, while also harnessing strengths of local social capital to improve adoption.

- Promote integration of orthodox and contemporary feminism theories to inform gender mainstreaming in CSA, contributing towards inclusive gender equal participation. The study established inadequacies of traditional gender mainstreaming approaches such as WID, WAD and GAD. These often fail to acknowledge the heterogeneity of smallholder-farmers, with likely consequential outcomes of perpetuating gender inequalities and stereotypes, or possible creation of new inequalities, and entrenching the undesirable 'one-size-fits-all' approach. An integration of orthodox and contemporary gender mainstreaming approaches may direct pragmatic transformation of CSA implementation from a dominant focus on practical gender needs, towards addressing structural gender issues. Integrated gender mainstreaming approaches are likely to include local perspectives and realities, with a tack on patriarchy, women's subordination, while also drawing on the inherent capacities of the diverse women to achieve egalitarianism.

- Embrace resilience-thinking in CSA to inform research, policies and implementation strategies. The basis of a resilience approach in CSA draws from the second pillar of CSA, which also establishes the conceptual link between CSA and DRR. This paper recommends that domesticating CSA within DRR creates opportunities for more collective action that will address complexity of gendered-vulnerability that otherwise tends to inhibit CSA adoption. A resiliencethinking approach in CSA unearths other aspects of CSA adoption that would remain hidden within a simplistic linear approach. A resilience lens stimulates more consideration to transformation and equality goals as CSA is informed from a broader perspective. Importantly, contemporary resiliencethinking should form the basis of any attempts to build resilience of smallholderfarmers.

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