



CONTRIBUTION OF CLIMATE-SMART AGRICULTURE TO THE ECONOMIC EMPOWERMENT OF RURAL WOMEN IN RWANDA: CASE STUDY OF GENDER CLIMATE CHANGE AND AGRICULTURE SUPPORT PROGRAMME (GCCASP), NYARUGURU AND NGOMA DISTRICTS.

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ABSTRACT:

The study assessed the contribution of climate-smart agriculture to the economic empowerment of rural women in Rwanda: Gender Climate Change and Agriculture Support Programme (GCCASP), Nyaruguru and Ngoma Districts. The study applied the mixed method including quantitative and qualitative approaches. Total population was 1121 female beneficiaries of both Districts. The sample size was 295 respondents which was selected using a stratified sampling and random methods. Data collection instruments were questionnaires; and documentation review. Descriptive statistics methods, correlation coefficient and regression analysis were statistical methods. Findings confirmed that there is significant, and positive moderate correlation between management of farms, crops, livestock, aquaculture as in climate-smart agriculture practices and economic empowerment of rural women farmers in GCCASP, Nyaruguru and Ngoma Districts as Pearson correlation are 0.270** with p-value of .000 less than standard significance level of 0.01. There is a significant, and positive high correlation between Ecosystem and landscape management to conserve ecosystem services as climate-smart agriculture practices and economic empowerment of rural women farmers in GCCASP, Nyaruguru and Ngoma Districts as Pearson correlation is 0.735** with p-value is .000, which is less than standard significance level of 0.01, and this indicates that, out of the considered other factors of climate-smart agriculture practices, only ecosystem and landscape management to conserve ecosystem services have a significant relationship of 73.5% within economic empowerment of rural women farmers in GCCASP, Nyaruguru and Ngoma Districts. The results also indicated the existence of positive and very strong correlation between Services for farmers and land managers to enable them to implement the necessary changes and economic empowerment of rural women farmers in GCCASP, Nyaruguru and Ngoma Districts as Pearson correlation is .759** with the p-value is 0.000 that is less than standard significance level of 0.01. This indicates that, out of the considered other factors that affecting economic empowerment of rural women farmers in GCCASP, Nyaruguru and Ngoma Districts, only services for farmers and land managers to enable them to implement the necessary changes have a significant and positive relationship of 75.9% to economic empowerment of rural women farmers in GCCASP, Nyaruguru and Ngoma Districts. The study findings generally indicated sum Pearson Correlation of .701** with p-value of 0.01 that is less than 0.00.

Key Words: *climate-smart agriculture, economic empowerment, rural women, GCCASP*

1. INTRODUCTION:

Climate-smart agriculture in developed countries like United States, and those from Europe involve farming practices that improve farm productivity and profitability, assist farmers adapt to the poor results of climate trade and mitigate weather exchange consequences, e.g., by soil carbon sequestration or reductions in greenhouse gasoline emissions. climate-smart practices, together with the regionally practiced conservation agriculture, purpose at retaining soil moisture, preserving crop residues for soil fertility, stressful the soil as minimally as viable and diversifying thru rotation or intercropping (Shiela, 2019). More than 29,000 farmers' cooperatives have stated higher incomes and expanded weather resilience through this challenge. another these days finished task has reduced greenhouse gasoline emissions through 23,732 heaps of CO₂ equal and extended the soil carbon sink with the aid of 71,683 heaps CO₂. Weather resilience is also being advanced in the Philippines, via a task this is improving the capability of nearby government to higher manipulate biodiversity conservation and fisheries assets (Institution, world financial institution, 2021).

In Africa, bank-supported challenge in Niger this is particularly designed to supply climate-smart agriculture aims to gain 500,000 farmers and pastoralists in 44 communes through the distribution of stepped forward, drought-tolerant seeds, extra green irrigation, and accelerated use of forestry for farming and conservation agriculture techniques. to this point, the project has helped 336,518 farmers greater sustainably manipulate their land and taken 79,938 hectares under greater sustainable farming practices. In EAC, the goal of the weather clever agriculture venture in Kenya is to boom agricultural productivity and build resilience to weather-trade risks in smallholder farming and pastoral groups. that is performed by scaling up weather-clever agricultural practices, strengthening climate-smart agricultural studies and seed systems, and helping agrometeorological, market, climate, and advisory offerings (Wollenberg and Richards, 2020).

Government of Rwanda is strongly devoted to promoting equality and fairness amongst all Rwandans. Article 16 of the charter of the Republic of Rwanda of 2003 amended in 2015 stipulates that "all Rwandans are born and remain equal in rights and freedoms", discrimination based totally on ethnic starting place, pores and skin colour or race, intercourse, monetary categories, monetary reputation, bodily or mental disability are prohibited and punishable with the aid of law" (Ministry of Gender and Family Promotion, 2021). Extra specifically for women, the constitution of the Republic of Rwanda confers at least 30% of positions to girls in all selection-making organs. In Rwanda therefore, selling Gender Equality and Women Empowerment (GEWE) is commonly a human right issue, encompassing girls and girls' same rights, combatting discriminatory practices and tough the roles and stereotypes that

propagate inequalities and exclusion (Ministry of Gender and Family Promotion, 2021). Law N° 43/2013 of 16/06/2013 governing land in Rwanda: This law ensures identical rights for women and men on land access, possession, and utilization. law N° 66/2018 of 30/08/2018 regulating labor in Rwanda. This offers for protection of employees in opposition to gender-based violence and any type of harassment on the place of business (Ministry of Gender and Family Promotion, 2021). However, mainstreaming CSA into policies and programmes and increasing adoption of site-particular CSA practices and technologies requires stronger cooperation and integration among those actors which includes women farmers and weather exchange-associated stakeholders (Wollenberg, and Richards, 2016).

2. PROBLEM STATEMENT

Despite the present-day efforts made by Government of Rwanda in increasing productiveness of agriculture zone, and enhancing farmers' livelihoods, there are nevertheless demanding situations affecting trends and overall performance of this sector, wherein Rwandan agriculture is frequently rain-fed, and consequently greater exposed to weather-associated dangers, specifically to excessive, common, and prolonged dry spells occurring at some stage in the cropping seasons. Farmers counting girls in drought-prone areas lack know-how, talents, and ok infrastructure to address such harsh conditions, experiencing severe losses in agricultural manufacturing and household earnings. Pests and diseases have greatly affected agricultural production at some point of the United States of America, triggering losses in yields and profits, however additionally expanded use of agrochemicals. Declines in soil fertility, especially due to the dearth of nutrient replenishment, have also introduced approximately important losses in agricultural yields (McSweeney, 2018).

There also are extraordinary key regions where gender inequality issues which might be most mentioned along with low levels of financial inclusion amongst girls, notwithstanding the increase of Rwanda's financial sector and an ordinary upward push in get right of entry to finance in recent years, access to economic services stays a chief bottleneck for company advent. The ladies revel in lower stages of financial inclusion compared to men (Ministry of Agriculture and Animal resources, 2019). And also, reference was made to previous studies, the findings showed that there are still a scarce of studies which identify these issues in Rwanda that focusing on the CSA practices adaptation and productivity, and its benefits to agriculture of women farmers in Rwanda. Therefore, this study was undertaken to determine the contribution of climate-smart agriculture to the economic empowerment of rural women in Rwanda: Gender Climate Change and Agriculture Support Programme (GCCASP) in Nyaruguru and Ngoma Districts.

3. OBJECTIVES OF THE STUDY

The study assessed the contribution of climate-smart agriculture to the economic empowerment of rural women in Rwanda. Specific Objectives

1. To examine climate-smart agriculture practices in GCCASP, Nyaruguru and Ngoma Districts,
2. To find out the extent of economic empowerment of rural women in GCCASP, Nyaruguru and Ngoma Districts,
3. To identify relationship between climate-smart agriculture practices and economic empowerment of rural women in GCCASP, Nyaruguru and Ngoma Districts.

4. HYPOTHESES

This study verified the following research null (H0) and alternative (H1) hypotheses below.

- 1) **H0:** There is no significant and positive role of climate-smart agriculture practices on economic empowerment of rural women in GCCASP, Nyaruguru and Ngoma Districts;
- 2) **H1:** There is significant and positive role of climate-smart agriculture practices on economic empowerment of rural women in GCCASP, Nyaruguru and Ngoma Districts.

5. Conceptual Framework

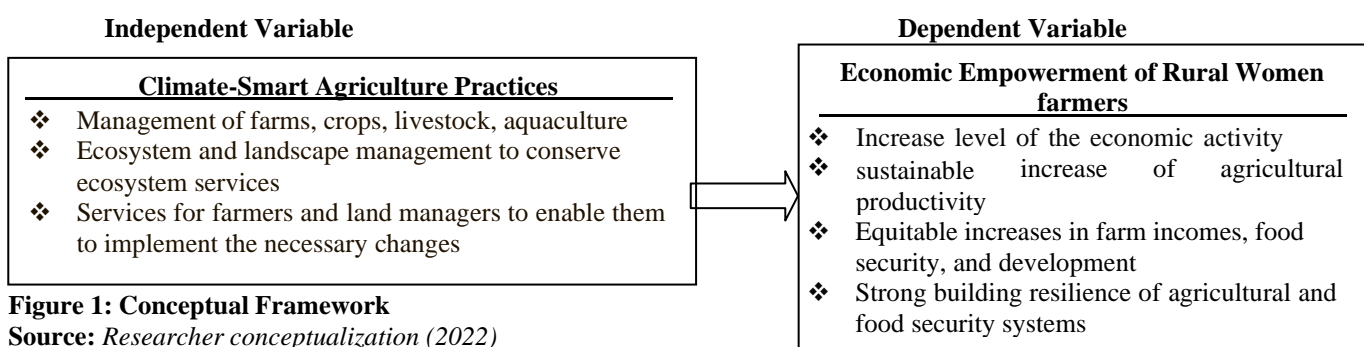


Figure 1: Conceptual Framework

Source: *Researcher conceptualization (2022)*

6. REVIEW OF LITERATURE

This section presents the review of the available literature related to the research under study. The review of the relevant literature considered various sources of information like textbooks, journals, magazines and internet. Thus, it traces the literatures on climate-smart agriculture and economic empowerment of rural women.

6.1. Climate-Smart Agriculture Practices

The effects of climate alternate, which include growing temperatures, shifting precipitation patterns, extra intense and common intense weather occasions and the lack of surroundings services and biodiversity, undermine agricultural production systems and food structures, especially in agricultural groups in growing nations wherein poverty, hunger and malnutrition are the maximum accepted (Porter et al., 2014). The agricultural sectors, which consist of crop and cattle manufacturing, forestry, fisheries and aquaculture, also are a primary contributor to global greenhouse gasoline emissions. in step with FAO estimates, in 2010, emissions from the agriculture, forestry and different land use (AFOLU) zone at once accounted for 22 percentage of general international emission (FAO, 2016).

6.1.1 The objectives and pillars of climate-smart agriculture

In line with Green Climate Fund, (2015) climate-smart agriculture practices are actually being piloted around the world, with the capability to meet a couple of environmental, socioeconomic, and business goals immediately. CSA is a relatively new area, farmers and agribusinesses are still checking out practices by means of region and enterprise. All climate-clever agriculture involves strategies to sustainably growth agricultural yields and incomes; adapt to weather trade, strengthening person and collective resilience; and mitigate for GHG emissions in agricultural systems by lowering or removing them wherein feasible. those goals incorporate three pillars of weather-smart agriculture.

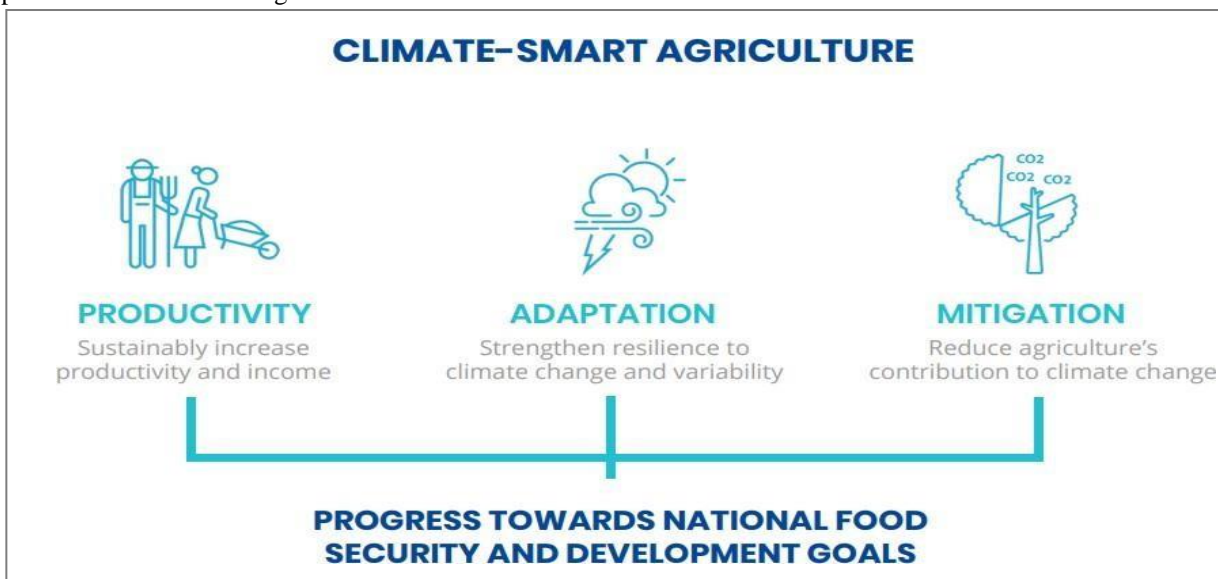


Figure 2: Objectives and pillars of climate-smart agriculture

Source: Green Climate Fund, (2015) objectives and pillars of climate-smart agriculture

A gender-responsive approach gain more effective and equitable outcomes, reduce mission risks, and decrease the gender gap in outcomes from weather alternate sports (Green Climate Fund, 2015) as it higher displays the lives and reports of agricultural groups. the following discussion explains why gender equality is applicable in all 3 pillars of CSA.

Pillar 1. Sustainably increase agricultural productiveness and earning

Efforts to cope with gender inside the context of Pillar 1 consist of systematic gender evaluation to pick out where there may be differences in guys' and ladies' productiveness; resolution of the challenges ladies reports in gaining access to, the use of, and supervising farm hard work; development in women's access to effective inputs and assets inclusive of extension and technologies (FAO, 2011).

Pillar 2. Adapt to and build resilience to climate change

The impacts of climate exchange and related adaptive techniques are not gender-neutral because vulnerability is regularly decided by socio-monetary factors, livelihoods, humans' potential and get entry to knowledge, statistics, offerings and aid all of which may additionally range along traces of gender. further, ladies and men may also have one-of-a-kind coping techniques. one of the important consequences of environmental stress in farming structures is the intensification of girls' workloads and reduces in property of poor households (Jost et al., 2015).

Pillar 3. Lessen and/or cast-off greenhouse gasoline emissions, in which feasible

In keeping with the definition of climate-smart agriculture, decreasing and removing greenhouse gases frequently comes as a co-advantage of activities improving productivity, resilience and/or efficiency and reducing waste and losses alongside the meals chain (Twyman et al., 2014).

6.1.2 Climate resilience, Climate-Smart Agriculture and gender

The growing variability in climatic events threatens the resources of livelihood of many, along with a massive range of smallholder farmers. The incidence of extreme events (e.g., droughts or floods) coupled with the unpredictable of climate trade (e.g., shortening or lengthening of cropping seasons) is already skilled in Sub-Saharan Africa (Morton, 2017). weather-clever Agriculture (CSA) offers a framework for reworking and adapting agricultural structures to hold meals protection in the context of weather exchange (Lipper et al., 2014).

6.1.3 Other important factors influencing adaptation and gender roles

The age and education are believed to steer both variation and gender roles. Furthermore, get admission to extension, to credit, distance to street, farm place, possession of livestock and of agricultural belongings and village-specific effects are often noted as relevant manage variables. Besides influencing a man or woman's power within its household, the age of a farmer partially determines their ability to make selections, whereby younger farmers are much more likely than older ones to alternate cutting-edge farming systems (Ngigi et al., 2017). Deressa *et al.*, (2010) conclude that excessive degrees of training undoubtedly affect using one or of a combination of practices. The mechanisms thru which weather variability and shocks can result in gender-differentiated adaptation. The weather variability impacts all households of a network. Each person is affected depends on their duties inside the family and community.

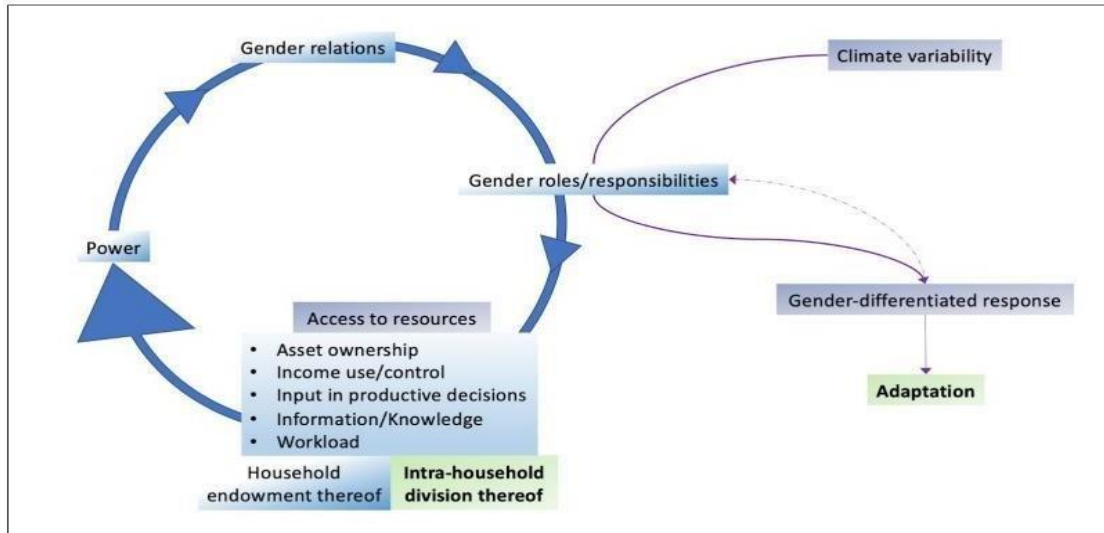


Figure 3: Other important factors influencing adaptation and gender roles

Source: Kakota *et al.*, (2011) Each individual is affected depends on their responsibilities within the household and community.

The gender wheel lays out how access to resources adjustments or reinforces gender roles. Gender-unique expectancies and obstacles determine people's endowment in resources (including asset possession, profits use/control, enter in effective selections, statistics/know-how and workload). Those five factors are based on a framework illustrating the components of gender equity the ladies' empowerment in Agriculture Index (WEAI) (IFPRI, 2012). The strength of a man or woman depends on their get right of entry to assets. It is in all likelihood to enhance or reshape gender roles. The natural sources become scarce and girls are in most cases chargeable for fetching meals and collecting water, weather variability further will increase workload. These compromises their get entry to food and schooling as well as the time devoted to earnings-generating activities, thereby reducing their electricity. Guys can be anticipated emigrate and look for different income sources, consequently resulting in new duties for girls at the homestead (Huyer, 2016).

6.1.4 Demand and Supply Theory

According to (Singh and Nyandemo, 2017) Theory of demand forms the basis of pricing, and it enables firms to measure the reaction of customers towards critical market forces. With intense knowledge and understanding of demand and supply theory, production and the subsequent sale of the produce is well forecasted. This reduces losses attributed to excess supply in agricultural for women by helping to understand the role of climate-smart agriculture practices on sustainable increase of agricultural productivity of women farmers in GCCASP, Nyaruguru and Ngoma Districts.

6.2 Economic Empowerment of Rural Women

According to (Amy and Christian, 2020) women's empowerment is a critical aspect of achieving gender equality. Women's empowerment is achieved when women and girls acquire the power to act freely, exercise their rights, and fulfil their potential. While empowerment often comes from within individuals themselves, cultures, societies, and institutions create conditions that facilitate or undermine the possibilities for empowerment. The process of empowerment is incremental and involves changes to multiple aspects of a woman's life. Promoting women's economic empowerment in inclusive market systems requires donors and implementers to understand empowerment within its local context and its interactions with the system (s) targeted for change by a development project. There are enhanced access and agency are key indicators of empowerment; gendered rules are a key determinant of access and agency; rules influence and are influenced by multiple subsystems in market systems; non-economic factors are important influencers of access and agency; and the combined effect of both structural transformation and bottom-up change interventions lead to sustained empowerment for women (Amy and Christian, 2020).

1. Enhanced access and agency are key indicators of Empowerment

According to Rahman *et al.*, (2016) women's economic empowerment introduced by the international center for research on women, as the combination of two primary outcomes: enhanced access and agency. A woman's access has been enhanced when she has the capacity to obtain greater economic resources. Women have multiple roles in the household, community, workplace, etc., and as such may access resources as consumers, entrepreneurs, workers, and/or beneficiaries. Access and agency are inter-connected and

jointly essential for empowerment. A woman's access to resources and services can enhance her capability to act upon and influence the systems with which she interacts. Similarly, a woman's ability to make decisions and speak her mind is necessary for her to be able to capitalize on the economic resources that are available to her. Agency is essential for her to negotiate better access to resources such as skills training or business networks.

2. Gendered Rules are a Key Determinant of Access and Agency

Market systems are shaped by rules, which influence an individual's behavior and the structures in which individuals interact. Informal and formal gendered rules, norms, relations, laws, and policies create and reinforce power differentials that often grant unequal values, resources, and degrees of authority to women and men (Amy and Christian, 2020).

3. Rules influence and are influenced by Multiple Subsystems in Market Systems

According to (Igor, 2019) barriers to and opportunities for empowerment exist in each of the subsystems within a market system where women engage. These include the household, community, workplace, supporting institutions, and enabling environment.

Table 2: Market subsystems and sample changes to enhance empowerment

Subsystem	Potential changes	
	Changes to Access	Changes to Agency
Household	Changes in access to resources at the household level such as increased access to income, nutritious food, or productive assets	Changes in household relationships, participation in household decision making, household valuing of women's roles and entitlements, time use, and rates of violence within the household
Community	Changes in access to community resources such as public services, infrastructure, or community-based savings platforms	Changes in participation in community decision making, community leadership roles, community valuing of women's roles and entitlements, and rates of violence or harassment in public spaces
Workplace	Changes in sales, production, occupational segregation, profit, work hours, conditions, and remuneration; access to markets as buyers and sellers	Changes in workplace participation, decision making, and roles and responsibilities
Supporting institutions (e.g., banks, media, NGOs)	Changes in access to their services and their products that meet the needs and preferences of women	Changes in the understanding, valuing, and portrayal of women; decision-making opportunities within the institution
Enabling environment (e.g., government, industry associations)	Changes in policies and regulations that affect women; access to basic services	Changes in decision-making ability and influence, political leadership roles, and valuing of women's roles and entitlements

Source: (Amy and Christian, 2020) *empowering Women: four theories tested on four different aspects of gender equality*

6.3 Relationship between climate-smart agriculture and economic empowerment of rural women

Consistent with (Amy and Christian, 2020) empowering girls: four theories tested on four different elements of gender equality. The elements may discern prominently in reasons of girls' increasing empowerment: (1) socioeconomic improvement; (2) growing gender egalitarian attitudes that remodel financial development into a cultural technique of human development; (3) historical legacies stemming from a society's cultural and political traditions; and (4) institutional design factors. This look at is the primary to compare the have an impact on of these factors throughout 4 components of gender equality, equality profits in simple living situations, participation in civic movements, positional empowerment and political representation. The degree of cultural modernity is the unmarried most critical rationalization across all components of gender equality with socioeconomic elements and institutional layout elements exerting have an impact on one or two aspects.

Consistent with (IDRC, 2020) producing evidence on gender sensitive climate-smart Agriculture to tell coverage in critical America. the overall objective of this mission was to assist the scaling up of gender-sensitive climate-smart Agriculture (CSA) as a mechanism to boom resilience and improve the livelihoods of vulnerable households within the face of weather-associated influences. targeted on international locations, Guatemala and Honduras, it aimed to generate technology-based totally actionable records, equipment and processed that aid selection making via stakeholders at one-of-a-kind scales, from farmers to subnational, countrywide and local degrees. Its particular goals have been to generate information and knowledge on the effect of specific CSA alternatives on the livelihoods and food security in addition to adaptive capacity of susceptible families in international locations in imperative the United States in a context of weather variability. To offer technology-based proof of the hyperlinks between gender problems and adoption elements of CSA practices/technologies; both how gender issues1 relate to adoption of CSA and the way adoption impacts on gender (in)equality. To increase families/local level corporations' capacities to plan for and access, put in force and monitor gender sensitive CSA interventions that growth climate and livelihood resilience. To feed science-primarily based proof from neighbourhood level into country wide and local policy communicate and offer particular pointers to manual the design and operationalization of gender and socially inclusive CSA approach lately formulated by way of significant America Agricultural Council.

7. MATERIALS AND METHODS

The paper applied the mixed method including quantitative and qualitative approaches. Quantitatively the study describes the perception of respondents using questionnaires to capture data on the role of climate-smart agriculture practices on sustainable increase of agricultural productivity of women farmers in GCCASP, Nyaruguru and Ngoma Districts; the role of climate-smart agriculture practices on equitable increases in farm incomes, food security and development of women farmers in GCCASP, Nyaruguru and Ngoma Districts; and the role of climate-smart agriculture practices on building resilience of agricultural and food security systems of women farmers in GCCASP, Nyaruguru and Ngoma Districts. It was qualitative because this paper interviewed GCCASP implementing institutions to obtain supportive data on results from questionnaires.

Total population was 1,121 female beneficiaries of both Districts comprising people from Nyaruguru District, and Ngoma District and with implementor partners of project including Action Aid, ALUPA in Nyaruguru District, and Nile Basin Club, RWARI in Ngoma District-Sake Sector. Sample size was selected from the target population. This paper used 5% of margin errors and confidential is 95%. The study applies the formula of Taro Yamane (1982).

$$n = \frac{N}{1+N*(e^2)}; \mathbf{n} = \text{sample size}; \mathbf{N} = \text{Total population}; \mathbf{e} = \text{margin error}; \mathbf{n} = \frac{1,121}{1+(1121*(0.05)^2)} = 295$$

This paper selected only 295 respondents involved in Gender climate change and agriculture support programme (GCCASP) at Nyaruguru and Ngoma Districts as sample size. Questionnaires were distributed to respondents at Gender Climate Change and Agriculture Support Programme (GCCASP) from Nyaruguru and Ngoma Districts. The questionnaire was composed by close end questions where we expected the participation rate of 100% for responding the questionnaire. To design questionnaire, the researcher used five Likert scales to assess the appreciations of respondents.

A correlation coefficient was a numerical measure of some type of correlation, meaning a statistical relationship between two variables. They all assumed values in the range from -1 to +1, where ± 1 indicated the strongest possible agreement and 0 the strongest possible disagreement. The correlation coefficient (R) of a model (say with variables x and y) took values between -1 and 1. It described how x and y are correlated. If x and y were in perfect harmony, then this value was positive 1. If x increased while y decreased in exactly the opposite manner, then this value was -1. 0 is a situation where there was no correlation between x and y. This R-value was only useful for a simple linear model (just an x and y).

Once the researcher considered more than one independent variable (x1, x2, x3). This was where the R² value comes into play. It was simply the square of the correlation coefficient. It took values between 0 and 1, where values close to 1 implied more correlation (whether positively or negatively correlated) and 0 implied no correlation. Regression analysis was a powerful statistical method that allowed to examine the relationship between two or more variables of interest. There were many types of regression analysis, at their core they all examined the influence of one or more independent variables on a dependent variable. The regression models were formulated to measure the relationship between sub-variables. Based on the variables, the following functions have been set $Y = f(X)$; therefore, $Y = \beta_0 + \beta_1x_1 + \beta_2x_2 + \beta_3x_3 + \varepsilon$; where β_0 = constant, β_1 - β_3 are coefficients of determination; X: climate-smart agriculture practices while Y was economic empowerment of rural women as dependent variable; x1: management of farms, crops, livestock, aquaculture; x2: Ecosystem and landscape management to conserve ecosystem services; x3: services for farmers and land managers to enable them to implement the necessary changes; and ε is standard error.

8. RESULTS AND DISCUSSIONS OF FINDINGS

Results were presented and interpreted in accordance with the research objectives that examine the climate-smart agriculture practices in GCCASP, Nyaruguru and Ngoma Districts, find out the extent of economic empowerment of rural women in GCCASP, Nyaruguru and Ngoma Districts, and identifying relationship between climate-smart agriculture practices and economic empowerment of rural women in GCCASP, Nyaruguru and Ngoma Districts. Questionnaires were distributed to 295 of respondents from GCCASP, Nyaruguru and Ngoma Districts. Findings showed that 272 out of 295 of respondents were able to bring back the filled questionnaires. That means the participation rate in responding was 92.2% of respondents, while 23 of respondents equivalent 7.8% of questionnaires distributed were not returned from respondents in Gender Climate Change and Agriculture Support Programme (GCCASP), Nyaruguru and Ngoma Districts. The results obtained above indicated the participation rate of respondents did not disturb us to continue with study analysis for providing results on the study was done on Gender Climate Change and Agriculture Support Programme (GCCASP) in Nyaruguru and Ngoma Districts. Gender participation rate indicated 18.0% of participants who were males while 74.2% of respondents were females. Findings showed 40.3% respondents have the age between 21 and 30 years; 29.5% of respondents have age between 31 and 40 years; 16.6% of respondents have between 41-50 years, while 5.8% of respondents have >51 years.

8.1 Correlation Coefficient Matrix

A correlation matrix is simply a table which displays the correlation. It is best used in variables that demonstrate a linear relationship between each other coefficients for different variables (i.e.: management of farms, crops, livestock, aquaculture ecosystem and landscape management to conserve ecosystem services, services for farmers and land managers to enable them to implement the necessary changes and economic empowerment of rural women farmers). The matrix portrays the correlation between all the possible pairs of values as in table 1.

Table 1: Correlation Coefficient Matrix

		Management of farms, crops, livestock, aquaculture	Ecosystem and landscape management to conserve ecosystem services	Services for farmers and land managers to enable them to implement the necessary changes	Economic Empowerment of Rural Women farmers
Management of farms, crops, livestock, aquaculture	Pearson Correlation	1			
	Sig. (2-tailed)				
	N	272			
Ecosystem and landscape management to conserve ecosystem services	Pearson Correlation	.301**	1		
	Sig. (2-tailed)	.000			
	N	272	272		
Services for farmers and land managers to enable them to implement the necessary changes	Pearson Correlation	.479**	.863**	1	
	Sig. (2-tailed)	.000	.000		
	N	272	272	272	
Economic Empowerment of Rural Women farmers	Pearson Correlation	.270**	.735**	.759**	1
	Sig. (2-tailed)	.000	.000	.000	
	N	272	272	272	272

***. Correlation is significant at the 0.01 level (2-tailed).*

From the correlation matrix Table 1 demonstrated a linear relationship between each other coefficients for different variables including Climate-Smart Agriculture Practices and Economic Empowerment of Rural Women farmers in GCCASP, Nyaruguru and Ngoma Districts. Findings showed that there is a significant, and positive moderate correlation between Management of farms, crops, livestock, aquaculture as in Climate-Smart Agriculture Practices and Economic Empowerment of Rural Women farmers in GCCASP, Nyaruguru and Ngoma Districts as Pearson correlation are .270** with p-value of .000, which is less than standard significance level of 0.01. This indicates that out of other factors considered in Climate-Smart Agriculture Practices that affect Economic Empowerment of Rural Women farmers in GCCASP, Nyaruguru and Ngoma Districts, only Management of farms, crops, livestock, aquaculture have a significant effect on 27.0% of Economic Empowerment of Rural Women farmers in GCCASP, Nyaruguru and Ngoma Districts. The findings illustrated that there is a significant, and positive high correlation between Ecosystem and landscape management to conserve ecosystem services as Climate-Smart Agriculture Practices and Economic Empowerment of Rural Women farmers in GCCASP, Nyaruguru and Ngoma Districts as Pearson correlation is .735** with p-value is .000, which is less than standard significance level of 0.01, and this indicates that, out of the considered other factors of Climate-Smart Agriculture Practices, only Ecosystem and landscape management to conserve ecosystem services have a significant relationship of 73.5% within Economic Empowerment of Rural Women farmers in GCCASP, Nyaruguru and Ngoma Districts. Once again, the results indicated existence positive and very strong correlation between Services for farmers and land managers to enable them to implement the necessary changes and Economic Empowerment of Rural Women farmers in GCCASP, Nyaruguru and Ngoma Districts as Pearson correlation is .759** with the p-value is 0.000 that is less than standard significance level of 0.01. This indicates that, out of the considered other factors that affecting Economic Empowerment of Rural Women farmers in GCCASP, Nyaruguru and Ngoma Districts, only Services for farmers and land managers to enable them to implement the necessary changes have a significant and positive relationship of 75.9% to Economic Empowerment of Rural Women farmers in GCCASP, Nyaruguru and Ngoma Districts.

Table 2: Correlation Coefficient between Climate-Smart Agriculture Practices and Economic Empowerment of Rural Women farmers in GCCASP

		Climate-Smart Agriculture Practices	Economic Empowerment of Rural Women farmers
Climate-Smart Agriculture Practices	Pearson Correlation	1	.701**
	Sig. (2-tailed)		.000
	N	272	272
Economic Empowerment of Rural Women farmers	Pearson Correlation	.701**	1
	Sig. (2-tailed)	.000	
	N	272	272

***. Correlation is significant at the 0.01 level (2-tailed).*

The Pearson correlation measures the strength of the linear relationship between two variables. It has a value between -1 to 1, with a value of -1 meaning a total negative linear correlation, 0 being no correlation, and + 1 meaning a total positive correlation. The findings in this study indicated sum Pearson Correlation of .701** with p-value of 0.01 that is less than 0.00. This is an indicator of existing positive and significant strong correlation coefficient/relationship between Climate-Smart Agriculture Practices and Economic Empowerment of Rural Women farmers in GCCASP, Nyaruguru and Ngoma Districts.

8.2 Regression Analysis

Linear regression analysis is used to predict the value of a variable based on the value of another variable. The variable we want to predict is called the dependent variable. The variable we are using to predict the other variable's value is called the independent variable. However, the tables below show the findings related to linear regression analysis including model summary, ANOVA,

regression coefficients. The models were as follows: X= independent variable is Climate-Smart Agriculture Practices which has three factors including x1= Management of farms, crops, livestock, aquaculture; x2= Ecosystem and landscape management to conserve ecosystem services; x3= Services for farmers and land managers to enable them to implement the necessary changes. Y= dependent variable is Economic Empowerment of Rural Women farmers comprised by y1= increased level of the economic activity; y2= sustainable increase of agricultural productivity; y3=equitable increases in farm incomes, food security, and development; and y4=strong building resilience of agricultural and food security systems. Based on these variables, the following functions have been set where $Y = f(X)$, therefore, Y equals $\beta_0 + \beta_1x_1 + \beta_2x_2 + \beta_3x_3 + \epsilon$.

Table 3: Model Summary^b

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Durbin-Watson
1	.778 ^a	.605	.601	1.686	1.875

a. Predictors: (Constant), Services for farmers and land managers to enable them to implement the necessary changes,

Management of farms, crops, livestock, aquaculture, Ecosystem and landscape management to conserve ecosystem services

b. Dependent Variable: Economic Empowerment of Rural Women farmers

The researcher used coefficient of determination which was obtained from the model summary in the table 3 that was used to explain whether the model is a good predictor. From the results of the analysis, the findings showed that the independent variables (Services for farmers and land managers to enable them to implement the necessary changes, Management of farms, crops, livestock, aquaculture, Ecosystem and landscape management to conserve ecosystem services) contributed 60.5% of the variation in Economic Empowerment of Rural Women farmers as explained by $r^2 = .605$ which indicates that the model is positive and high, as the independent variable highly explained the dependent variable (Economic Empowerment of Rural Women farmers) and show that the model is a good prediction.

Table 4: ANOVA^a

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	1168.409	3	389.470	136.969	.000^b
	Residual	762.057	268	2.843		
	Total	1930.467	271			

a. Dependent Variable: Economic Empowerment of Rural Women farmers

b. Predictors: (Constant), Services for farmers and land managers to enable them to implement the necessary changes,

Management of farms, crops, livestock, aquaculture, Ecosystem and landscape management to conserve ecosystem services

Findings in table 4 revealed that the level of significance was .000^(b) this implies that the regression model is significant in predicting the relationship between Climate-Smart Agriculture Practices and Economic Empowerment of Rural Women farmers. Findings show that the level of fit model is 136.969 which remains also positive and significant with p-value of .000^b that is less than standard significance level of 0.01. This means that null hypothesis (H_0) stated that there is no significant and positive relationship between Climate-Smart Agriculture Practices and Economic Empowerment of Rural Women farmers was rejected, and we have retained the opposite called “alternative hypothesis” stated independent variables (Climate-Smart Agriculture Practices) have significant and positive effect influence on Economic Empowerment of Rural Women farmers in GCCASP, Nyaruguru and Ngoma Districts.

Table 5: Regression Coefficients^a

Model	Unstandardized Coefficients		Standardized Coefficients	t	Sig.	
	B	Std. Error	Beta			
(Constant)	3.351	.639		5.246	.000	
1	Management of farms, crops, livestock, aquaculture	.056	.031	.080	1.767	.001
	Ecosystem and landscape management to conserve ecosystem services	.136	.038	.279	3.556	.000
	Services for farmers and land managers to enable them to implement the necessary changes	.273	.042	.556	6.527	.000

a. Dependent Variable: Economic Empowerment of Rural Women farmers

From the above Table 5, the study sought to establish extent to which Climate-Smart Agriculture Practices as independent variable (x1= Management of farms, crops, livestock, aquaculture; x2= Ecosystem and landscape management to conserve ecosystem services; x3= Services for farmers and land managers to enable them to implement the necessary changes) influence Economic Empowerment of Rural Women farmers as Y (dependent variable represented by y1= increased level of the economic activity; y2= sustainable increase of agricultural productivity; y3= equitable increases in farm incomes, food security, and development; and y4= strong building resilience of agricultural and food security systems). Based on these variables, the following regression equation results was obtained: $Y = f(X)$; $Y = \beta_0 + \beta_1x_1 + \beta_2x_2 + \beta_3x_3 + \epsilon$; where $Y = 3.351 + .056x_1 + .136x_2 + .273x_3 + .639$. The multiple linear regression

equation results showed that economic empowerment of rural women farmers will always depend on a constant factor of 3.351 regardless of the presence of other factors. The other variables explain that; every unit change in x_1 ; x_2 ; x_3 will significantly change economic empowerment of rural women farmers by .056; .136; .273 respectively with standard error of .639 in the model.

9. CONCLUSION AND RECOMMENDATIONS

The implementation of the GCCASP was significantly contributing to achievements of the national priorities related to Environment, Climate change and Gender. The three pillars are cross cutting areas of the recently new adopted Rwanda National strategy for transformation. The well-coordinated Program in long run led to increase in the high production and income to the target communities through a combination of institutional strengthening, stakeholder capacity building and access to resources and new technology. Considerable amount of time was invested in documentation of the best practices, regular monitoring of Project activities at the field, to provide basis of upscaling best practices and proven climate smart agriculture and gender responsive technologies. Based to the findings indicated in chapter four, after testing the research hypotheses we concluded that null hypothesis (H_0) stated that there is no significant and positive relationship between climate-smart agriculture practices and economic empowerment of Rural Women farmers was rejected, and the study has retained the “alternative hypothesis” stated that climate-smart agriculture practices have significant and positive contribution on economic empowerment of rural women farmers in GCCASP, Nyaruguru and Ngoma Districts as study findings indicated.

Recommendations:

The respect of improved agricultural practices was key to the increased production. Now, most of the farmers have kept the harvested variety of beans for the planting seasons. The farmers are thankful for having access to an improved variety of beans and the training received on CSA. These have enabled them to boost the bean yield compared to the previous harvests. The farmers have been impressed on how the yield has increased dramatically when using Climate Smart Agriculture practices. Findings indicated that the activities in Climate Smart Agriculture practices were achieved as planned.

The general observation was all farmers are keen to receive any assistance in irrigation, as long as water is a big challenge for Ngoma district farming. For the sites where the area is not complete as planned, we have recommended that mobilizing neighbouring farmers. They can make together with the cooperative members a joint water users association that make later a cooperative. The experience is well working for Zaza site visited during the trip. At that site, there were mobilization of neighbours' farmers to get 10 hectares. For the area with complete area, it is a room to enhance surface area be availed and many people can get profit from this innovation in irrigation. The reason is that, according to technical experts, when the dam is big enough, the area to irrigate depend on the pipe's connection length.

It was observed that Nile Basin Club (NBC) and RWARII made some efforts to sustain what was achieved during the pilot phase, this was not the same to case to ALUPA and Action Aid whose activities are not progressing as expected. The small holder farmers supported by NBC and RWARII have demonstrated high level of resilience to build on pilot achievements to move towards transforming their livelihoods. Nile Basin Club and RWARII can be financially supported to scale up GCCASP project activities. Their activities are likely to create big positive impact if they are implemented at a wider coverage. Both beneficiaries and partner representative said the challenge (for not growing vegetables in the greenhouse) was the lack of water. The tank which is said to have been damaged by a thunder disaster is kept at a neighbor's home (who was not a beneficiary), it should be repaired.

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