DRIVERS OF PERCEIVED SUSTAINABILITY OF CLIMATE SMART AGRICULTURAL PROJECTS IN KAKAMEGA COUNTY, KENYA.

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ABSTRACT

Climate uncertainty challenges the livelihoods of smallholder farmers in Sub-Saharan Africa. The sustainability of climate-smart agriculture projects is considered essential for the continued delivery of services to the beneficiary farmers beyond external financing. However, various factors cause climate-smart agriculture projects to fail the sustainability test. This study evaluated the perceived sustainability of climate-smart agriculture projects and the socio-economic and institutional determinants of sustainability. Stratified sampling was used to select 240 climate-smart project participants from the 12 sub-counties in Kakamega County. The study collected primary data using questionnaires and interview schedules from the sample project participants. Most farmers (94%) perceived climate-smart agriculture projects as sustainable. The Ordered Probit results demonstrated that the perceived sustainability of the projects was positively influenced by the number of practices adopted from the project (at $P> 0.00$ level), the longevity of farmer participation (at $P> 0.09$ level) and training (at $P> 0.06$ level); and negatively influenced by legal land ownership status (at $P> 0.02$ level), farming experience (at $P> 0.08$ level) and adoption cost (at $P> 0.03$ level). The study recommends that projects and practices should be designed and developed under a bottom-up approach that allows the initial assessment of local needs. Farmers should be involved right from the onset to reduce unnecessary expenses. Training on innovative agriculture practices should also be tailored to suit farmers' different needs and capabilities so that farmers become capable and skilled to increase their farm productivity.

Keywords: climate-smart agriculture, smallholder, farmers, sustainability, Kenya

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INTRODUCTION

Agricultural projects are regarded as a critical instrument in improving rural livelihoods by creating employment opportunities and improving the economy and food provision (Mbatha *et al*., 2021). Climate-Smart Agriculture (CSA) is an agricultural approach that aims to increase agricultural productivity under the new realities of climate change. This includes increasing soil fertility and carbon sequestration, reducing Greenhouse Gas (GHG) emissions, enhancing resilience to climate change, and prudent use of natural ecosystem services (Ogola and Ouko, 2021). Projects centred around the CSA approach usually promote the adoption of technologies and practices and services aimed at increasing agricultural productivity while enhancing producers' climate adaptation and mitigation capacities (Gutierrez-Montes *et al.,* 2020).

Sustainability is an important factor that must be clearly addressed as a requirement during the design and inception of any agricultural project. Project sustainability directs focus on sustaining the flow of benefits into the future rather than on sustainable programs or projects. Project sponsors need to ensure that any project can continue to provide benefits to its beneficiaries even after the donor terminates significant financial, managerial, and technical support (Limo, 2013).

Numerous studies have been carried out in Kenya to investigate factors influencing the sustainability of agricultural projects (Kaimenyi, 2010; Wabwoba and Wakhungu, 2013; Mulee, 2015; Mutunga *et al.,* 2017). Nonetheless, they did not specifically focus on assessing the sustainability of agricultural projects that advocated for either of the three triple wins of CSA (increased productivity, resilience to climate change and reduction of greenhouse gases). Most of the studies focused on determinants of sustainability of community-based projects or donor-funded projects. These studies also failed to present a precise measurement of the sustainability of projects and only focused on factors that affected the sustainability of the projects. Sustainability was treated as a binary variable in some of the studies as opposed to this study which aims to present measurements for different perceived project sustainability levels before determining factors that affect the sustainability of the projects. Provision of literature with a rigorous investigation of the determinants of sustainability of CSA projects in Kakamega County is also yet to emerge. This study, therefore, aimed to evaluate the perceived sustainability of CSA projects among smallholder farmers in Kakamega County. This study adds to the body of knowledge on agricultural projects. It informs governmental and non-governmental agencies of the key areas to focus on to enhance sustainable agricultural development through project implementations.

MATERIAL AND METHODS

Study area

This study was conducted in Kakamega County, where agricultural projects have been increasing yearly, most of them dependent on foreign donations. This is due to the high vulnerability of the county to climate hazards such as drought, occasional floods, moisture stress, extreme rainfall and changes in the seasons (MoALF, 2017). Kakamega County is located in the former Western region of Kenya and covers an area of 3,050.3 km^2. It lies between longitudes 34 and 35° East and 0 and 1° North latitudes. Administratively, the county has 12 sub-counties with 60 wards, 24 divisions, 72 locations, and 233 sub-locations (GoK, 2013). It consists of 433,207 households, and the population is 1,861,332 (GOK, 2019). The county has two main ecological zones, the Upper Medium (UM) and the Lower Medium (LM). The Upper Medium covers the central and northern parts of the county, including Ikolomani, Lurambi, Malava, Navakholo, and Shinyalu, which practice intensive maize, tea, beans, and horticultural production mainly on a small scale; and Lugari and Likuyani where small-medium scale farming is practised. The LM covers a major portion of the southern part of the county that includes Butere, Khwisero, Mumias East, Mumias West, and Matungu. In this zone, the main economic activity is sugarcane production, with some farmers practising maize, sweet potatoes, tea, groundnut, and cassava production.

Sample selection

The target population comprised all maize, dairy cattle, and fish farmers who had adopted CSA practices through participation in an agricultural project aiming to promote integrated farming approaches. The goal of the integrated approaches was to increase productivity and incomes or/and increase resilience or/and reduce or remove Greenhouse Gas Emissions. Stratified sampling was used to select 240 CSA project participants of the respective value chains from the 12 sub-counties in Kakamega County. The face-to-face survey was conducted by trained enumerators between December 2020 and April 2021 using structured questionnaires and interview schedules.

Analytical framework

The Triple Bottom Line (TBL) accounting measure of the degree of sustainability that John Elkington introduced in the mid-1990s was used. The TBL, goes beyond the traditional measures of profits, return on investment, and shareholder value and includes environmental and social dimensions. There is no universal standard method for calculating the TBL. Neither is there a universally accepted standard for the measures that comprise each of the three TBL categories. This can be viewed as a strength because it allows a user to adapt the general framework to the needs of different entities (businesses or nonprofit projects) (Elkington, 1994). The researchers borrowed from Chen et al. (2019) to measure perceived sustainability, whereby climate-smart agriculture project participants ranked and weighed the selected key project sustainability indicators (KPSI) under the respective economic, environmental, and social indicators. Figure 1 shows the selected key project sustainability indicators.

Project participants used a five-point Likert scale (strongly disagree=1, disagree=2, undecided=3, agree=4, and strongly agree=5) to rate various factors encompassed within project sustainability's economic, environmental and social indicators. The KPSIs included five factors in the economic group, five factors in the environment group and five factors in the social group. Borrowing from Ajidasile *et al*. (2015) and Terano *et al*. (2015), the underlying principle was that farmers' responses must show some degree of variation for them to be included in the sustainability index. Each key project sustainability

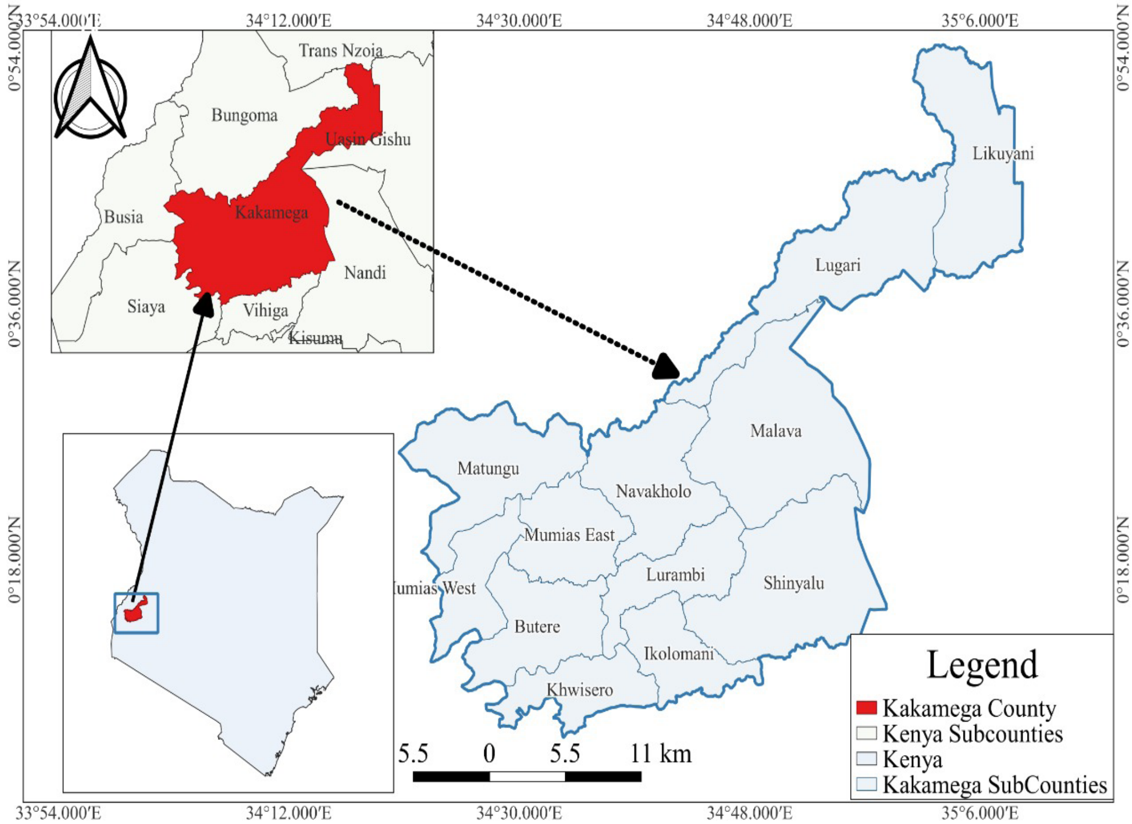

Figure 1: kakamega county map showing sub counties

indicator's mean score and weights were then determined in IBM SPSS version 25. The weight was calculated by the mean score of each factor from the survey questionnaire.

$$W_i = \frac{M_i}{\sum_{i=1}^{n} M_i} \quad , \quad 0 \leq W \leq 1 \qquad (1)$$

Where W_i = Weighting, M_i= Mean score of each KPSI

To develop the overall Project Sustainability Index (PSI), the means of each KPSI in each of the three groups were transformed in IBM SPSS version 25, and the total PSI was determined by integrating the three categories of sustainability performance. The continuous Project Sustainability Index values were assigned to three discrete sustainability categories, with the following range of index values 1. Unsustainable 0-1.66 (≤33%) 2. Sustainable 1.67- 3.33 (34-67%) and 3. Very Sustainable 3.34 -5.00 (68-100%). The indices were adjusted to fall within a range of 0 to 100 as a quotient in order to facilitate the interpretation of the Project Sustainability Index scores.

The ordered probit regression was then used to analyze how socio-economic and institutional factors affect the sustainability of CSA projects. The Ordered Probit model is expressed as:

$$y_i^* = \chi'\beta + \varepsilon_i \qquad \varepsilon_i \sim N(0,1) \quad i = 1 \ldots \ldots, N \qquad (2)$$

Where; y_i^* is the latent variable measuring degree of sustainability of i[th] projects only known when it crosses thresholds, χ' is the vector of observed non-random independent variables (education level, farm size, legal land ownership status, farming experience, primary occupation, type of project funders, funding period, number of practices adopted from the project, longevity of participation in the project, frequency of extension visits, credit access, training, market distance and adoption cost), β is the vector of unknown parameters of the regression to be estimated and ε_i is the vector of error term assumed to be normally distributed with zero mean and unit variance (Greene, 2003). Thus, y_i, which is the observed ordinal variable, takes on the following values:

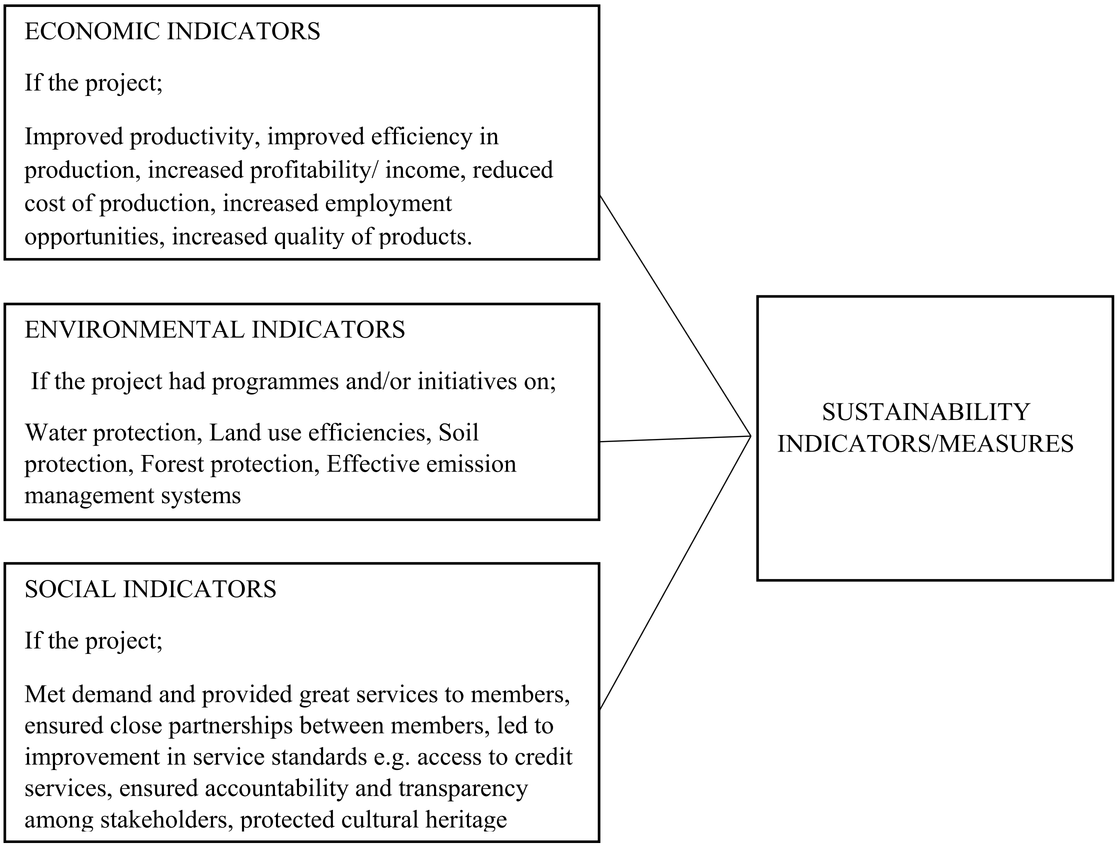

Figure 2: framework of project sustainability indicators. Source: adopted from chen *et al.* (2019)

$$y_i = j \; if \; u_{j-1} < y_i^* \leq u_j \quad (3)$$

Where; j = 1(unsustainable), 2(sustainable), 3(very sustainable). For instance;

$$y_i = 2 \; if \; u_{j-1} < y_i^* \leq u_j \quad (4)$$

Where; 2= sustainable, u_{j-1}= unsustainable threshold (1.66), u_j= very sustainable threshold (3.34)

We are also concerned with how much change in the predictors translates into the probability of observing a particular ordinal outcome. Therefore probabilities of each ordinal outcome are considered as follows;

$$P_{ij} = P(y_i = j) = P(u_{j-1} < y_i^* \leq u_j) \quad (5)$$

Data analysis

Data were received on an aggregate server in real-time, where regular quality checks were done to ensure that the data collected met the required standards. Upon completing the field survey, the final datasets were downloaded from the Kobo collect server as CSV files and exported to SPSS version 25 software and Stata version 16 for analysis. Descriptive analysis was done by calculating frequencies, means, and standard errors.

RESULTS AND DISCUSSION

Descriptive characteristics of the farmers

The summary statistics for the categorical socio-economic characteristics of the respondents are presented in Table I. The selected sample was 240 CSA project participants from the 12 sub-counties in Kakamega County.

In terms of the gender of the farmer, the results show that only 39% of the respondents were female. The presence of many males in the selected sample could be explained by the fact that according to the cultural and social settings of African people, men are more likely to access and control land resources which are fundamental in agriculture, thus will have great influence on the household participation in the project activities.

Regarding the marital status of the farmers, a significant proportion (99%) of the selected sample was married, with only 0.4% single and 0.4% widowed.

Regarding legal land ownership status, 77% of the respondents had title deeds to their lands and were the sole owners of their land, whereas about 23% indicated that they did not possess title deeds. The land they farmed on had been leased, jointly owned or belonged to the family.

TABLE I- CATEGORICAL SOCIO-ECONOMIC CHARACTERISTICS OF PROJECT PARTICIPANTS IN KAKAMEGA COUNTY, KENYA

Variable		Count (%)	N	Mean	SD	Min.	Max
Gender of the farmer	Female	94 (39.17)	240	0.608	0489	0	1
	Male	146(60.83)					
Highest Education level of the farmer	Non-formal	13(5.42)	240	2.454	0.713	1	4
	Primary	123(51.25)					
	Secondary	86(35.83)					
	Tertiary	18(7.50)					
Marital status of the farmer	Single	1(0.42)					
	Married	238(99.17)	240	2.000	0.091	1	3
	Widowed	1(0.42)					
Legal land Ownership Status	Sole ownership	185(77.08)					
	Family land	54(22.50)	240	1.233	0.434	1	3
	Joint ownership	1(0.42)					
Primary Occupation of the farmer	Off-farm income	2(0.83)	240	0.992	0.091	0	1
	Farm income	238(99.17)					
Agricultural credit access	No	190(79.17)	240	0.208	0.407	0	1
	Yes	50(20.83)					
Agricultural extension access	No	6(2.50)	240	0.975	0.156	0	1
	Yes	234(97.50)					

SD.: Standard deviation: Min.: Minimum; Max.: Maximum

With regards to the highest education level, about 52% of the respondents had attained primary education, followed by secondary education at 36 %. Only 5 % of the farmers had attained tertiary education, and 7 % had no formal education. Generally, this implies that a good proportion of the farmers had attained formal education and had sufficient capacity to read, understand, and apply farm principles, thus adapting the CSA practices and new technologies. As indicated by the mean of 2.45 years, most of the project participants had attained primary education on average.

Farming was the primary occupation for a majority of the respondents, with farm income as the primary source of income at 99 % and non-farm income at 1%. This shows that majority of the respondents were full-time farmers. At the same time, only a small proportion of the salaried and business people participated in farming as they had alternative jobs to farming activities. In addition, participation in off-farm income-generating activities lowers the ability of farmers to interact with extension providers, which makes them less knowledgeable on intended interventions such as CSA projects. Table II gives a summary of the continuous socio-economic variables.

TABLE II- CONTINUOUS SOCIO-ECONOMIC CHARACTERISTICS OF PROJECT PARTICIPANTS IN KAKAMEGA COUNTY, KENYA

Variable	**N**	**Mean**	**SD**	**Min.**	**Max.**
Age of the farmer (in years)	240	52.48	11.04	23	92
Household size of the farmer(no.)	240	6.27	2.30	2	18
Farm size (in acres)	240	1.75	1.50	1	11
Farming experience (in years)	240	21.06	9.90	4	70
Income (in 10000 shillings)	240	5.79	2.20	1	11 6
Frequency of Extension (contacts)	240	2.16	1.06	1	

SD.: Standard deviation: Min.: Minimum; Max.: Maximum

The mean age of the participants was 52 years. This shows that most of the sampled farmers were past their youthful age. This can be explained by the fact that the study was interested in people who participated in projects that had been completed some years back and thus the older people were more likely to have been selected for the study.

On average, the household size and farm size of participants were 6 people and 1.75 acres, respectively. This implies that smallholder farmers with many household members and smaller pieces of land were more willing to participate in CSA projects than those with lesser household members and large pieces of land. This could be because large households could sufficiently provide labour, which was not likely to be catered for by the project on their small pieces of land.

The participants' average years of farming experience were 21, ranging from 4 to 70. This means that farmers were highly experienced. Experienced farmers are likely to understand CSA intervention better and adapt the new CSA practices and technologies to increase productivity.

Regarding income, results reveal that the mean annual income for participants was 5.79. The results also indicate that project participants had 2.16 times the frequency of extension contacts.

Perceived sustainability of climate-smart agriculture projects

As shown in Table III, the economic indicator with the highest mean (4.47) was projects helped farmers to improve their farm productivity, while projects that reduced the cost of production had the lowest mean of 2.31. This implies that most project participants (97%) agreed that participating in the project had helped them improve their productivity levels. However, on the other hand 74 % of the participants disagreed that the project had made efforts to help the reduction of the cost of production.

Concerning environmental indicators, project efforts towards addressing soil protection had the highest mean of 4.28, while efforts towards an effective emission management system had the lowest mean of 3.00. Ninety percent of the project participants agreed that the project had addressed soil protection measures. Only 20% agreed that the project had addressed the effective emission management system, and 24% of the project participants disagreed. In comparison, 55% of the participants were undecided whether it had made an effort to address an effective emission management system or not. This could imply that the project had not created adequate awareness of effective emission management systems.

Lastly, social indicators were also rated. The project meeting farmers' demands and providing great services was rated highly with a mean of 3.97 while protecting people's cultural heritage had the least mean of 2.91.

The findings in Figure 2 indicate that the majority (60.4%) of the farmers who participated in the project believed that the projects were very sustainable. About 34% felt that the projects were sustainable, while only 5.4% of the participants rated the projects as unsustainable. This implies that most project participants (94%) claimed that the impact of the completed CSA projects results in the county can still be traced up to date and farmers still utilize the CSA projects benefits after the end of direct involvement of the donors/ stakeholders.

TABLE III- SUSTAINABILITY INDICATORS

	Mean	SD	Strongly disagree (%)	Disagree (%)	Undecided (%)	Agree (%)	Strongly agree (%)
Economic Indicators							
The project;							
Improved productivity	4.47	0.78	2.9	0.0	0.0	40.8	56.3
Improved production efficiency	4.39	0.88	2.5	3.3	1.3	38.3	54.6
Increased profitability/ income	4.33	0.89	2.5	3.3	3.3	40.0	50.8
Reduced cost of production	2.31	0.99	14.2	59.6	12 9	7.9	5.4
increased quality of products	3.98	1.09	2.1	12.5	9.6	36.7	39.2
Environmental Indicators							
The project had programmes on;							
Water protection	4.10	0.90	3.3	3.8	4.6	56.3	32.1
Land use efficiencies	4.24	0.97	4.6	2.5	2.5	45.0	45.4
Soil protection	4.28	0.99	5.5	1.3	2.9	40.8	49.6
Forest protection	3.89	0.81	1.3	3.3	21.3	53.8	20.4
Effective emission management	3.00	0.87	3.3	20.8	55.4	13.8	6.7
Social Indicators							
The project;							
Met demand and provide great services to members e.g trainings	3.97	0.84	4.2	1.7	6.7	67.9	19.6
Ensured close partnerships between members	3.88	0.89	3.3	3.3	15.8	56.7	20.8
Led to improvement in service standards e.g access to credit services, extension	3.80	0.82	2.1	3.8	21.7	56.7	15.8
Ensured accountability and transparency among stakeholders	3.28	0.77	1.3	11.3	50.4	32.9	4.2
Protected cultural heritage	2.91	0.94	6.3	24.6	46.3	17.5	5.4

1=Strongly disagree, 2=Disagree, 3=Undecided, 4=Agree, 5=Strongly agree

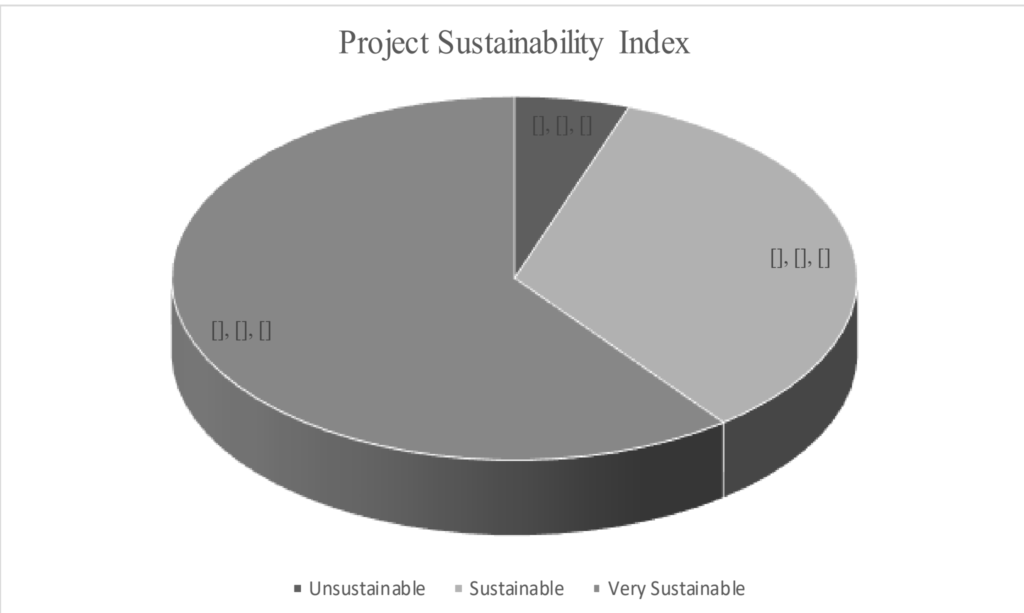

Figure 3: Project Sustainability Index

Determinants of perceived sustainability of climate-smart agriculture project

The ordered Probit was used to determine socio-economic and institutional factors affecting the sustainability of CSA projects. Table IV shows that the ordered probit model was satisfactory given its statistical significance (Prob> chi^2 =0.000) with pseudo R^2 of 0.3003 and log-likelihood of −138.51. Legal land ownership status, farming experience, number of practices adopted from the project, longevity of project participation, training and adoption cost are all significant determinants of the perceived sustainability of CSA projects.

Legal land ownership status negatively affected the perceived sustainability of CSA projects. The marginal effects reveal that an increase in farmers without title deeds for their farms as compared to farmers with title deeds (sole owners) decreased the probability of a project being very sustainable by 15% (at P> 0.01 level). In comparison, it increased the probability of the projects being sustainable by 10% (at P> 0.01 level) and unsustainable by 4% (at P> 0.02 level). Sole landowner farmers were more likely to adopt CSA practices than those who hired land. This implies that secured property rights give sufficient incentives to the farmers to increase their efficiencies in terms of productivity and ensure environmental sustainability. Land ownership empowers farmers' ability to adopt several CSA practices, thus contributing to project sustainability.

The results also showed that the perceived sustainability of CSA projects was negatively influenced by farming experience (at P> 0.08 level). A unit increase in farming experience decreased the probability of projects being very sustainable by 0.5 % (at P> 0.08 level). In comparison, it increased the probability of the project being sustainable and unsustainable by 0.3 % (at P> 0.08 level) and 0.1 % (at P> 0.09 level) respectively. This could be attributed to the fact that due to experience with climate-related shocks over years, older farmers acquire indigenous knowledge that allow them to be relatively resilient to shocks than younger farmers such that they find it convenient to rely on their indigenous knowledge than adopt modern practices that may have steep learning curves (Nyong *et al.*, 2007). Similar findings were reported by Adesida *et al.* (2021). Their results demonstrated that farmers with more farming experience were less likely to adopt crop diversification, animal manure, cover crops, and planting basins. This raises concerns about providing enough information and visible demonstrations of the benefits for more experienced farmers to adopt some CSA practices.

The number of practices adopted by the farmer from the project was found to positively affect the perceived sustainability of CSA projects (at P> 0.00 level). The marginal effects indicate that a unit increase in the number of practices adopted by a farmer increased the probability of a project being very sustainable by 6% (at P> 0.01 level). In comparison, the chances of the projects being sustainable and unsustainable decreased by 4% (at P> 0.00 level) and 2% (at P> 0.01 level), respectively. Technological change is a major driving force for increasing agricultural productivity and incomes, considering that farmers presumably compare all potential profits from alternative practices before making an adoption decision (Greiner and Gregg, 2011). For as long as a new practice or technology increases productivity and incomes, farmers would continue utilizing it. Similar findings were reported by (Mulee, 2015), who found out that one unit change in the adoption of new technologies increased the sustainability of agricultural projects. However, according to (Cunguara and Darnhofer, 2011), technologies must be complemented by sufficient outreach and education for adoption to occur.

Regarding the longevity of participation in the projects, the results revealed that (at P> 0.09 level) an additional month of project participation increased the likelihood of the projects being very sustainable by 0.2% (at P> 0.09 level). In comparison, it decreased the likelihood of the projects being sustainable by 0.1% (at P> 0.09 level) and unsustainable by 0.1% (at P> 0.10 level). Effective project sustainability depends on community participation in project implementation at different stages (Mulwa, 2008). Without participation, there would be no development and no program (Aref, 2011). These results could be attributed to the fact that participation equips beneficiaries with skills, expertise, and knowledge that helps them continue utilizing the project benefits and train other interested farmers even after the cessation of the projects. This enables them to be more supportive of the project, thus increasing the likelihood of its success. In addition, participation in the projects generates a sense of ownership by the community, thereby improving long term management and increasing maintenance of the programmes (World Bank, 2014).

TABLE IV- ORDERED PROBIT REGRESSION ESTIMATES

	Coef.	Unsustainable (≤33%) dy/dx	Sustainable (34-67%) dy/dx	Very Sustainable (68-100%) dy/dx
Highest education level of farmer	0.130	-0.010	-0.023	0.033
Farm size (in acres)	0.062	-0.005	-0.011	0.016
Legal land ownership dummies;				
Family land	-0.571**	0.043**	0.101**	-0.152**
Farming experience (in years)	-0.018*	0.001*	0.003*	-0.005*
Primary occupation dummies;				
Off farm occupation	-0.556	0.042	0.098	-0.140
Project funders dummies;				
Anglican church of Kenya	-0.460	0.035	0.081	-0.115
German cooperation	-0.554	0.042	0.098	-0.140
Swedish Government	-0.109	0.008	0.019	-0.027
Funding period (in years)	-0.099	0.007	0.018	-0.025
Number of practices adopted	0.246***	-0.019***	-0.044***	0.062***
Longevity of participation(months)	0.007*	-0.001*	-0.001*	0.002*
Frequency of extension visits	-0.042	0.003	0.007	-0.018
Credit access	-0.007	0.000	0.001	-0.002
Training on CSA practices	0.696*	-0.053*	-0.123*	0.176*
Distance to the market (in km)	-0.246	0.019	0.044	-0.062
Adoption cost	-0.392**	0.030**	0.069**	-0.099**
Sub County dummies included	Yes	Yes	Yes	Yes

Log likelihood= -138.513 LRchi^2(27)= 118.88 N =239
Pseudo R^2 = 0.3003 Prob> chi^2 =0.000

*, **, *** is significant at 10%, 5% and 1% respectively.

These findings are consistent with Chrisostome (2018) findings which established that with various aspects of beneficiary participation, the sustainability of the Farming God's Way Project was positively influenced by different magnitudes. When beneficiary participation was zero, the project's sustainability was negatively influenced. Overall, projects' sustainability improves with greater beneficiary participation throughout the project cycle.

A unit increase in farmer training increased the probability of the project being very sustainable by 18% (at P> 0.06 level). In contrast, it decreased the probability of the projects being sustainable and unsustainable by 12% (at P> 0.06 level) and 5% (at P> 0.07 level) respectively. This implies that frequent training of farmers on the new CSA practices and technologies will likely bring about a high level of sustainability in climate-smart agricultural projects. Sufficient training enables farmers to continue training other farmers and generate intended project benefits. These findings are in line with Mugo *et al.* (2016), who found that capacity building positively affects the sustainability of agricultural food projects. This is also backed up by Stirman *et al.* (2012), who noted that capacity building, together with factors related to the programme, has an influence on the sustainability of projects.

Adoption cost of CSA practices also negatively affected the sustainability of CSA projects (P> 0.03). A unit increase in the cost of adopting CSA practices decreased the probability of the projects being very sustainable by 10% (at P> 0.02 level). In comparison, it increased the probability of the projects being sustainable and unsustainable by 7% (at P> 0.03 level) and 3% (at P> 0.04 level) respectively. According to Rodriguez *et al.* (2009), the most frequently mentioned economic factor preventing farmers from adopting sustainable agricultural practices are costs and the financial situation of farmers. Initial and transition costs are important barriers as there is uncertainty about the new practices. Without adopting sustainable CSA practices, it is impossible to have sustainability of the projects.

CONCLUSION AND POLICY RECOMMENDATIONS

Based on the study's outcome, we conclude that farmers perceive CSA projects as sustainable, confirming farmers' willingness to embrace and participate in them. On socio-economic and institutional determinants of perceived sustainability of CSA projects, the Ordered Probit results demonstrated that sustainability of the projects was positively influenced by the number of practices adopted from them (P> 0.00), the longevity of farmer project participation (P>0.09) and training (P>0.06); and negatively influenced by legal land ownership status (P>0.02), farming experience (P>0.08) and adoption cost (P>0.03).

Both number of practices adopted and the longevity of participation which are measures of farmers' extent of participation in CSA projects, positively influenced the perceived sustainability of CSA projects. This demonstrates that participation is a critical factor in enhancing the sustainability of projects. It is thus recommended that projects and practices are designed and developed under a bottom-up approach that allows the initial assessment of local needs. Farmers should be involved in project implementation right from the onset or identification to reduce unnecessary efforts or expenses and enhance the sustainability of the projects.

Training of farmers positively influenced the perceived sustainability of CSA projects. Donors and governments, therefore, need to continue investment in support of capacity development. The government, policymakers and other relevant stakeholders should launch massive programs for capacity building and training of rural communities. Resources and efforts should be mobilized and coordinated in providing relevant training and demonstrations to farmers regarding various CSA practices to enhance adoption of the practices and technologies, therefore contributing to the sustainability of the projects. They should also ensure that the education, training, and assistance offered to farmers related to CSA technologies are tailored to suit farmers' different needs and capabilities to become capable and skilled in raising their farm productivity.

The study also suggests that project management should target more youth participation instead of the usual norm of high elderly participation. The challenge is that as much as the elderly highly participate in the projects, they are also likely unwilling to divert from older practices they are comfortable with, thus abandoning the new practices along the way. This poses a substantial negative impact on the sustainability of the projects.

Adoption costs negatively impacted the perceived sustainability of CSA projects. Government Support programmes should focus on the design of appropriate policies and strategies targeting adequate incentive provision. Policies should be developed to guide incentive provision programs and agents when choosing beneficiaries to ensure that farmers who are genuinely interested and can maximize the impact of the provided resources can lead to a better impact of the incentive program.

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