

Perceived Effectiveness of Climate Change Adaptation Strategies Among Cocoa Farmers in Ogbomosho Agricultural Zone, Oyo State, Nigeria

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Abstract: Climate change poses significant challenges to cocoa farming, affecting productivity, crop quality, and farmer livelihoods due to increased temperatures, erratic rainfall patterns, and vulnerability to pests and diseases. This study assessed the perceived effectiveness of climate change adaptation strategies among cocoa farmers in Ogbomosho Agricultural Zone, Oyo State, Nigeria. Specifically, the study determined the level of adoption of climate adaptation strategies and the level of perceived effectiveness of these adaptation strategies. A multistage sampling procedure was employed to select 172 respondents for the study. Data were collected using a structured interview schedule. The findings showed that agro-forestry (WMS = 3.29), regular pruning of older cocoa branches (WMS = 3.06), planting of climate-resilient cocoa varieties (WMS = 2.97), and climate information and advisory (WMS = 2.64) were the most climate change adaptation strategies adopted and perceived to be moderately effective by cocoa farmers. The study showed that a significant relationship existed between age ($r = 0.373$, $p < 0.05$), number of years spent in schooling ($r = 0.281$, $p < 0.05$), and years of cocoa production experience ($r = 0.488$, $p < 0.05$) and the level of perceived effectiveness of climate change adaptation strategies. In conclusion, most (68%) of cocoa farmers perceived the effectiveness of climate change adaptation strategies as moderate. It was recommended that Extension agencies should collaborate with the Meteorological stations in disseminating accurate weather information regarding the appropriate climate adaptation strategies to the farmers.

Keywords: Perception, Climate change, Adaptation strategies, Effectiveness, Cocoa farmers.

INTRODUCTION

Climate change is the shift or variation in the normal functioning of the atmospheric temperature, weather, and precipitation. It occurs when there's a release of greenhouse gas (GHG), such as carbon dioxide (CO₂), methane, etc, as a result of human activities which in turn affects agricultural production negatively, causing reduction in yield, low profit and lead to food insecurity which hinders the achievement of some Sustainable Development Goals (SDG), Intergovernmental Panel on Climate Change (IPCC, 2022).

According to the Central Bank of Nigeria (CBN, 2023), cocoa beans and their derivatives (like cocoa butter and powder) are the top 3 to 5 non-oil export commodities, which means while contributing a small fraction to the overall GDP, cocoa remains a vital, consistent earner of foreign exchange that underpins the government's current diversification strategy from reliance on crude oil. Deforestation disrupts local weather patterns and causes carbon emissions, contributing to global climate change. As weather patterns evolve, like high temperatures and droughts, farmers aren't able to grow as much cocoa because they are forced to expand into new areas. (Cocoa Life, 2024). Climate change poses significant challenges to cocoa farming, affecting productivity, crop quality, and farmer livelihoods due to increased temperatures, erratic rainfall patterns, and heightened vulnerability to pests and diseases.

Farmers consistently connect shifts in temperature and rainfall to reduced cocoa production. Research by Winston *et al.* (2017) indicates that farmers report declines in both the number and size of cocoa pods due to erratic rainfall

and prolonged dry seasons, disrupting flowering and fruiting cycles. Economically, the reduction in yield and quality translates to lower incomes, a critical concern for farmers. Srinivasa *et al.* (2022) document an increase in pests and diseases, such as the Black Pod, due to warmer and more humid conditions, raising production costs and necessitating more pesticide use.

In response, cocoa farmers are actively implementing various adaptation strategies that blend traditional knowledge and modern practices, although resource limitations hinder their effectiveness. Strategies such as agroforestry and improved agricultural practices are vital for sustainable cocoa production. Farmers engage in agroforestry by planting shade trees to protect cocoa from temperature stress and adopt practices like pruning, mulching, and fertilising to enhance soil health (Orimogunje *et al.*, 2020). Although some strategies are widely perceived as effective, actual effectiveness varies by local context.

However, several studies have assessed the adaptation strategies of climate change by cocoa farmers (Michael *et al.*, 2023; Obaniyi *et al.*, 2023). But the problem lies in the insufficient understanding and information on the factors that shape cocoa farmers' perception about the resultant effect of those adaptation strategies, as observed by Elisha *et al.* (2017), and addressing this gap is the primary motivation for this study. Therefore, this study investigated the level of perceived effectiveness of climate change adaptation strategies among cocoa farmers in Ogbomosho Agricultural Zone, Oyo State. Specifically, the study described the socio-economic characteristics of the respondents, evaluated the frequency of occurrence of types of climate change manifestations among

cocoa farmers, examined the level of utilisation of climate change adaptation strategies, and identified the challenges faced by cocoa farmers in implementing climate change adaptation strategies in the study area. It was hypothesised that a significant difference existed in the perceived effectiveness of climate change adaptation strategies across the selected local government areas.

METHODOLOGY

The study was carried out in the Ogbomoso Agricultural zone, Oyo State, Nigeria. It is situated approximately at the intersection of latitude 8° 8' North and longitude 4° 15' East. The rainy season typically begins in March and continues until November. The dry season is characterised by very hot temperatures, except during the harmattan period when the weather becomes cold and dry. Ogbomoso Agricultural zone is situated in the forest savannah transitional zone, a unique ecological niche that allows for the cultivation of both forest crops (like cocoa and oil palm) and savannah crops (like yams, maize, and cashew). (Owoade & Akinwale, 2019) A multistage sampling technique was employed in selecting the respondents for the study. Ogbomoso Agricultural zone, which consists of 5 local government areas, was selected for the study. The reason for the choice of the area is the high concentration of cocoa farming activities in the area, which ensures the data collected are relevant to the research objectives. The first stage in the sampling involved a selection of the 3 rural local government areas in the zone, which are Ogooluwa, Surulere, and Oriire. The population of the study includes 676 registered Cocoa farmers in the Ogbomoso Agricultural Zone. Registered cocoa farmers were found in 41 villages in Ogooluwa, 42 villages in Surulere, and 19 villages in Oriire local government. This sampling procedure was employed to narrow the study's scope to specific local areas that were confirmed to have a significant population of the target group (registered cocoa farmers), ensuring that the study effectively captured insights relevant to cocoa farming activities. The second stage involved the random selection 20% of registered cocoa farmers from each village. Iwo- ate, Pere, Idere, Otamokun, Idi araba, Elegu, Ibere, and Fade were selected from Ogooluwa Local Government; Alaroponla, Elesun, Adegbite, and Opeola were selected from Oriire Local Government, and Sungbe, Gbena, Iresaadu, Lekewogbe, Oke Asa, Labode, Ikunsin, and Fasina were selected from Surulere Local Government. This stage was employed to introduce randomness and reduce selection bias in choosing the specific villages from a list for this study, so that every village with registered cocoa farmers had a chance of being included, and to improve the representativeness of the sample. The third stage involved a random selection of 25% of registered

cocoa farmers from each village, which will constitute 172 respondents for the study. This final stage was used to select the specific respondents from the chosen villages in a non-biased manner, which ensures that the final sample is statistically representative of the population of interest.

RESULTS AND DISCUSSION

Respondents' Socioeconomic Characteristics

Respondents' Age - Results presented in Table 1 revealed a significant portion (47.6%) of cocoa farmers fell within the age range of 41 to 50 years, while 21.5% were aged between 31 and 40 years, and 18% were aged between 51 and 60. Additionally, 7% were above 60 years old, and 5.8% were below or equal to 30 years old. The mean age was 46 years for the cocoa farmers, which indicates that the majority of the cocoa farmers sampled were adults within this age range, implying their activeness and capability in engaging in cocoa production and contributing immensely to the agricultural output in the study area. This study aligns with Abidogun *et al.* (2019), who noted a higher percentage of cocoa farmers fell within the age range of 41-50 years in Southwest, Nigeria.

Sex - The results presented in Table 1 further revealed that the majority (91.9%) of cocoa farmers were male, with only 8.1% being female. This implies that both males and females are involved in cocoa production, although males dominate the sector. The results indicate that cocoa production in the study area is predominantly handled by males, which is common in African farm households. This aligns with previous results, such as Adeola *et al.* (2022), who reported that the majority (91.2%) of cocoa farmers were male in Africa.

Marital Status - The results presented in Table 1 further observed that the majority (95.9%) of the cocoa farmers were married, while 4.1% were single. The results indicate that a significant portion of the cocoa farmers were married, which could maximally contribute to increased production levels, particularly through the provision of unpaid labour from household members. This aligns with the results of Oladokun *et al.* (2025), who also found that the majority (99.05%) of cocoa farmers were married, and Onemolease *et al.* (2025) also reported that (95%) of the cocoa farmers surveyed were married in Ondo State, Nigeria.

Number of Years Spent in Schooling - The results presented in Table 1 further show that the number of years spent in schooling has a mean of 16 years. These results indicate that all cocoa farmers were literate, albeit with a relatively low level of education. This suggests that respondents will adapt to and adopt any form of innovation that can enhance their farming system. This relates to the results of Martins *et al.* (2021), who found that (66.1%) of farmers were formally educated.

Household Size of the Respondents - The results presented in Table 1 further observed that the mean household size is 5 people. This indicates that the typical cocoa farming household has a relatively average family size, potentially influencing their livelihood, resource allocation, and climate change adaptation strategies. This result is further supported by Onemolease *et al.* (2025) who also noted that cocoa farmers in the study area had household sizes ranging between 3 - 20 in a household in Ondo State, Nigeria.

Years of cocoa production experience - Result presented in Table 1 further shows that approximately 40.2% of respondents had between 11 and 20 years of cocoa production experience followed by 36.6% with less than or equal to 10 years of experience, 16.3% had between 21 and 30 years of experience, 5.3% with 31 and 40 years of experience and with 1.8% had above 40 years of experience in farming. The mean years of experience for cocoa farmers were approximately 17 years. This suggests a significant level of experience among cocoa farmers, which may contribute to their expertise and proficiency in farming activities. This aligns with the results of Oluyole *et al.* (2015) who reported a mean farming experience of 18 years for cocoa farmers. These

results further reinforce the notion that cocoa farming in Nigeria is largely undertaken by experienced individuals who have spent a considerable number of years in the agricultural sector.

Cocoa farm size - The results presented in Table 1 further illustrate that 87.2% of cocoa farmers cultivate farm sizes ranging from 2 to 3 hectares, 8.2% cultivate less than or equal to 1 hectare, and 4.7% cultivate above 3 hectares of cocoa farmland. The mean farm size for cocoa production was 2.4 hectares. These results suggest that cocoa production in the study area is primarily carried out on small to medium-sized farms, as the vast majority of farmers cultivate between 2-3 hectares. This prevalence of relatively smaller farm sizes suggests that cocoa farming might largely be a smallholder activity, potentially influencing production capacity and the adoption of large-scale farming technologies. This result aligns with Ayodele *et al.* (2020), who noted that a significant portion of cocoa production occurs on farms within the 2 to 3-hectare range, indicating a consistent pattern of small to medium-scale operations. Kolapo *et al.* (2025) also found that the mean farm size of cocoa farmers was 2.3 hectares.

Table 1: Distribution of respondents by socioeconomic characteristics (n = 172)

Variables categories	Socioeconomic characteristics	Frequency	Percentage	Mean
Age (years)	≤30	10	5.8	46
	31-40	37	21.5	
	41-50	82	47.6	
	51-60	31	18	
	Above 60	12	7	
Sex	Male	158	91.9	
	Female	14	8.1	
Marital status	Married	165	95.9	
	Single	7	4.1	
Number of years spent in schooling	≤6	4	2.4	16
	7-12	18	10.5	
	13-18	130	75.6	
	Above 18	20	11.6	
Household size (people)	≤5	119	69.2	5
	6-10	50	29.1	
	Above 10	3	1.8	
Years of cocoa production experience	≤10	63	36.6	17
	11-20	69	40.2	
	21-30	28	16.3	
	31-40	9	5.3	
Cocoa farm size (hectares)	Above 40	3	1.8	2.4
	≤1	14	8.2	
	2-3	150	87.2	
	Above	8	4.7	

Source: Field survey, 2025

Level of adoption of Climate Change Adaptation Strategies by Cocoa Farmers

The results presented in Table 2 show that planting of shade or cover trees (Agroforestry) ranked 1st with a weighted mean score of 3.29, followed by regular pruning of older cocoa branches, which ranked 2nd, with a WMS of 3.06. Planting of climate resilient cocoa varieties was ranked 3rd with a WMS of 2.97, climate information and advisory was ranked 4th with a WMS of 2.64, integrated pest management was ranked 5th with a WMS of 2.45, application of fertiliser was ranked 6th with a WMS of 2.27, control of soil erosion was ranked 7th with a WMS of 1.48, and changing the planting date of cocoa was ranked 8th with a WMS of 0.74. This result indicates that cocoa farmers in the study area are employing various climate change adaptation strategies, with agroforestry (planting shade or cover trees) emerging as the most widely adopted practice. Regular pruning of older cocoa branches and planting climate-resilient cocoa

varieties are also prominent adaptation methods among farmers. These strategies likely help farmers mitigate climate-related stressors and promote sustainable cocoa production. The result can inform policy and extension services to prioritise support for agroforestry and climate-resilient practices. By promoting these adaptation strategies, stakeholders can enhance the resilience and livelihoods of cocoa farmers in the face of climate change. Oluyole *et al.* (2024) indicated that cocoa farmers widely adopt practices such as planting shade trees (agroforestry) and using improved, climate-resilient cocoa varieties to cope with changing climatic conditions. They also noted that farmers engage in improved cultural practices like pruning to maintain farm health, agroforestry (planting shade trees), using improved crop varieties (implicitly climate-resilient ones), and integrated pest management (IPM) as key adaptation measures to mitigate climate change effects.

Table 2: Distribution of respondents according to the level of adoption of climate change adaptation strategies by cocoa farmers

Statements	WMS	Rank
Planting of shade/cover tree (Agroforestry)	3.29	1st
Application of fertiliser	2.27	6th
Planting of climate-resilient cocoa varieties	2.97	3rd
Integrated pest management	2.45	5th
Control of soil erosion	1.48	7th
Changing of planting date of cocoa	0.74	8th
Climate information and advisory	2.64	4th
Regular pruning of older cocoa branches	3.06	2nd

WMS= Weighted Mean Score

Source: Field survey, 2025

Level of perceived effectiveness of climate change adaptation strategies

The results presented in Table 3 show that regular pruning of older cocoa branches ranked (1st) with a weighted mean score of 3.41, followed by planting of shade or cover trees (Agroforestry), which ranked (2nd) with a WMS of 3.39. Climate information and advisory ranked (3rd) with WMS of 3.20, planting of climate-resilient cocoa varieties ranked (4th) with WMS of 3.14, application of fertiliser ranked (5th) with a WMS of 2.88, integrated pest management ranked (6th) with WMS of 2.09, and control of soil erosion ranked (7th) with WMS of 1.93. These results imply that cocoa farmers find regular pruning of older cocoa branches and agroforestry practices (planting shade or cover trees) to be the most effective climate change

adaptation strategies. Climate information and advisory services, as well as planting climate-resilient cocoa varieties, are also considered effective strategies. This result corroborates the result of Oluyole *et al.* (2020), who highlight that farmers who implement good agricultural practices, including regular pruning and the adoption of improved climate-resilient cocoa varieties, experience better yields and more sustained production in the face of climate variability. Onemolease *et al.* (2025) also indicate that practices such as pruning, and the planting of new, resilient cocoa seedlings are seen by farmers as effective in improving farm productivity and resilience against environmental stresses.

Table 3: Distribution of respondents by the level of perceived effectiveness of climate change adaptation strategies by cocoa farmer

Statement	WMS	Rank
Planting of shade/cover trees (Agroforestry) regulates farm temperature.	3.39	2nd
Planting of climate-resilient cocoa varieties maintain consistent cocoa yield.	3.14	4th
Climate information and advisory	3.20	3rd
The use of integrated pest management controls pest outbreaks on the farm.	2.09	6th
Control of soil erosion prevents loss of nutrients during flooding.	1.93	7th
The practice of regular pruning of older cocoa branches improves air circulation.	3.41	1st
The application of fertiliser boosts tree immunity.	2.88	5th

WMS = Weighted Mean Score

Source: Field survey, 2025

Categorisation of the level of effectiveness of climate change adaptation strategies by cocoa farmers

The data in Table 3 shows the distribution of the respondents by categorisation of the level of effectiveness of climate change adaptation strategies in the study area. Using the mean and standard deviation as a categorisation index, the result indicates that (16.3%) of cocoa farmers perceived their strategies as highly effective. Also, cocoa farmers generally perceive their adaptation strategies as moderately effective, supported by the grand mean of 20.04 and the largest segment of respondents (68.0%). This suggests that while the adaptation strategies employed, such as agroforestry or planting of shade trees, are providing discernible benefits and mitigating some climate risks, they are not yielding complete solutions for the majority of farmers, while (15.7%) found the adaptation strategies to be of low effectiveness.

This result implies that while the majority of cocoa farmers are proactively engaging in adaptation strategies, as evidenced by only 15.7% reporting low effectiveness, their strategies are generally falling short of providing optimal protection against climate change, with 68.0% achieving only moderate effectiveness. This strongly suggests that the core challenge is not a lack of farmers' awareness or effort, but rather systemic constraints such as limited access to finance and extension services, which prevent the majority from successfully implementing the most effective measures needed to reach the highly effective tier. This result corroborates with Frank *et al.* (2021), which indicates that most farmers perceived the benefit to be a little bit higher (i.e., moderate) than the cost because their capacity to fully implement highly effective strategies is limited by external constraints.

Table 4: Categorisation of the level of effectiveness of climate change adaptation strategies by cocoa farmers

Level of effectiveness	Range	Class interval	Frequency	Percentage
Low	$\bar{x} - 1\sigma$	≤ 17.88	27	15.7
Moderate	$\bar{x} \pm 1\sigma$	17.89 – 22.20	117	68.0
High	$\bar{x} + 1\sigma$	Above 22.21	28	16.3
Total			172	100.0

Mean ($\bar{x}$) = 20.04

Standard Deviation (σ) = 2.16

Source: Field survey, 2025

Challenges faced by cocoa farmers in implementing climate change adaptation strategies

The results presented in Table 4 revealed that cocoa farmers faced the following challenges with their percentage in descending order respectively; 94.8% of difficulty in climate change prediction, 93% of uncertainty of weather patterns, 92.4% of lack of policy incentives, 90.7% of inadequate training or technical support, 76.2% of limited access to technology, 71.5% of lack of access to climate resilient cocoa varieties, 70.9% of difficulty in accessing markets for diversified crops, 41.9% of lack of financial resources, 33.7% of lack

of knowledge and information about climate change adaptation strategies.

These results indicate that cocoa farmers encounter significant challenges when attempting to implement climate change adaptation strategies. The most pressing issues include difficulties in predicting climate change and the uncertainty of weather patterns. Additionally, a lack of policy incentives, insufficient training, and limited access to technology further impede farmers' ability to adapt. Several research findings supported this, such as Martins *et al.* (2021), they noted that farmers face challenges related to the high cost of labour and limited access to land and inadequate information on

weather. Adeyemo *et al.* (2019) also implicitly point to the lack of financial resources as a barrier, as farmers often diversify due to insufficient income

from cocoa. It also suggests that limited access to markets for new ventures (diversified crops) can be a challenge.

Table 5: Distribution of respondents by the challenges faced by cocoa farmers in implementing climate change adaptation strategies

Challenges	Frequency	Percentage
Lack of financial credit	72	41.9
Lack of access to climate-resilient cocoa varieties	123	71.5
Inadequate training or technical support	156	90.7
Uncertainty of weather patterns	160	93.0
Difficulty in accessing markets for diversified crops	122	70.9
Lack of knowledge and information about climate change adaptation strategies	58	33.7
Lack of policy incentives	159	92.4
Limited access to technology	131	76.2
Difficulty in climate change prediction	163	94.8

Source: Field survey, 2025

Test of Hypothesis

Relationship between the socioeconomic characteristics of cocoa farmers and the perceived effectiveness of climate change adaptation strategies. Pearson Product-Moment Correlation analysis result presented in Table 5 shows a notable and significant relationship between socioeconomic attributes of the respondents and the perceived effectiveness of climate change adaptation strategies. Specifically, there exists a positive correlation between the age of the respondents and the perceived effectiveness of climate change adaptation strategies ($r = 0.373$, $p < 0.05$). This suggests that as the age of cocoa farmers increases, their perceived effectiveness of climate change adaptation, strategies also tend to increase, indicating that the older farmers may have more experience or knowledge about effective adaptation measures. Furthermore, a significant positive correlation is observed between the number of years spent in schooling of the respondents and the perceived effectiveness of climate change adaptation strategies ($r = 0.281$, $p < 0.05$). These

results suggest that formal education plays a role in enhancing their understanding and application of adaptation measures, which indicates that farmers who spent more years in school tend to perceive climate change adaptation strategies as more effective. Lastly, a significant positive correlation is observed between the years of farming experience and the perceived effectiveness of climate change adaptation strategies ($r = 0.488$, $p < 0.05$). This suggests that farmers with more years of experience tend to perceive climate change adaptation strategies as more effective, suggesting that knowledge and experience gained over time may enhance their ability to adapt to climate change. Consequently, based on these results, the null hypothesis, which stated no significant link between the socio-economic characteristics of the respondents and the perceived effectiveness of climate change adaptation strategies, is thereby rejected in favour of the alternative hypothesis. This underscores the important role played by socioeconomic factors such as the age of the respondents, number of years spent in schooling, and years of farming experience in cocoa farming.

Table 6: Pearson correlation analysis showing a significant relationship between selected socioeconomic characteristics of the respondents and the perceived effectiveness of climate change adaptation strategies

Socio-economic variables	r-value	p-value	Remark
Age	0.373	0.000	Significant
Number of years spent schooling	0.281	0.000	Significant
Years of farming experience	0.488	0.000	Significant
Farm size	0.136	0.075	Not Significant

Source: Field Survey, 2025

*Correlation is significant at the 0.05 level (2-tailed)

CONCLUSION AND RECOMMENDATIONS

In conclusion, most (68%) of the cocoa farmers perceived the effectiveness of climate change adaptation strategies as moderate. Planting of shade or cover trees (Agroforestry), regular pruning of older cocoa branches and planting of climate resilient cocoa varieties were the most

adopted climate change adaptation strategies in the study area. However, farmers face considerable challenges in implementing these strategies, primarily the inherent difficulty in predicting climate change and uncertainty in weather patterns. It was recommended that Extension agencies should collaborate with the Meteorological stations in

disseminating accurate weather information regarding the appropriate climate strategies to the farmers.

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