ADAPTATION STRATEGIES ADOPTED BY CASSAVA FARMERS IN ETCHE LOCAL GOVERNMENT AREA, RIVERS STATE, NIGERIA

[1]Akwiwu, U. N. and [2]Iroegbu, M.
[1]Department of Agricultural Extension and Development Studies. Faculty of Agriculture. University of Port Harcourt, Rivers State.
[2]Department of Agricultural Extension and Development Studies. Faculty of Agriculture. University of Port Harcourt, Rivers State.
Correspondence details: uzoakwiwu@gmail,com

ABSTRACT
This study examined the adaptation strategies adopted by cassava farmers in Etche Local Government Area, Rivers State, in response to climate change. The objectives of the study were to describe the socio-economic characteristics of the respondents, identify source of information on adaptation strategies to climate change, determine adaptation strategies used in the study area, and constraints in using climate change adaptation strategies. A three-stage sampling technique was used to collect data from 120 cassava farmers through structured questionnaires, analyzed using descriptive statistics and Ordinary Least Squares (OLS) regression. Majority (54.17%) of the respondents were female, 48.33% had 10-15 years educational qualification, while 41.67% had above 10 years farming experience. Farmers primarily accessed climate adaptation information through interaction with peers (56.7%) and social media (49.2%). Major adaptation strategies included the use of organic manure ($\bar{x} = 3.04$), improved cassava varieties ($\bar{x} = 3.00$), and adjusting land preparation timing ($\bar{x} = 2.93$). Key constraints were high labour costs ($\bar{x} = 2.95$), poor extension services ($\bar{x} = 2.88$), lack of government support ($\bar{x} = 2.88$), and land tenure issues ($\bar{x} = 2.82$). Marital status ($t = 2.468$, $p < 0.05$), household size ($t = 3.287$, $p < 0.01$), education level ($t = 2.864$, $p < 0.01$), monthly income ($t = 3.871$, $p < 0.01$), and extension contact ($t = 2.314$, $p < 0.05$) were significantly associated with adaptation adoption. The study concluded that marital status, household size, educational status, monthly income and extension contact socio-economic factors strongly influence climate change adaptation. It recommends strengthening extension services, capacity building in climate-smart agriculture, and enhanced government and institutional support through subsidies and infrastructure development.
Keywords: Climate change, Adaptation strategies, Cassava, Farmers,

INTRODUCTION

Cassava is a staple and food security crop which generates income for millions of people in Africa. It is grown mainly for its tuberous roots; the leaves are fed to livestock and also eaten in some parts of the world (Henri-Ukoha, 2020), and they are good sources of carbohydrates, protein, vitamins, and minerals (Bayatagna, 2019). The cassava tubers are also used as raw materials in the garment, bakery, food, and pharmaceutical industries (Immanuel et al., 2024). Its adaptability allows it to be processed into various forms such as garri, fufu, and tapioca, which are integral to Nigerian diets. Beyond its dietary importance, cassava serves as a raw material in industries producing starch, sweeteners, biofuels, and biodegradable products, thereby contributing to both food security and economic development (Ekanem & Umoh, 2024).

After rice and maize, cassava is the third-most-significant source of calories in Africa's tropical and subtropical regions (Food and Agriculture Organisation, FAO, 2020), which is commonly grown in several sub-Saharan African nations (Osuji et al., 2023). Nigeria is the major producer of cassava on a global scale, followed by South-East Asia, Brazil, Indonesia, Thailand, and Vietnam (FAO, 2021), and the production of cassava in Nigeria accounts for up to 20 per cent of the world, about 34 per cent of Africa's and about 46 per cent of West Africa's (FAO, 2019a). Over 90% of Nigeria's rural families routinely consume cassava (Osuji et al., 2023).

Although cassava tolerates all soil types, its productivity is adversely affected by weather and the changing climate. Cassava cultivation is increasingly vulnerable to the impacts of climate change. Changes in temperature and precipitation patterns can affect cassava yields and quality. For instance, elevated temperatures and altered rainfall can lead to increased pest and disease prevalence, adversely impacting cassava production (Emenyonu et al., 2020). It has been widely reported that climate also plays a major role in altering the development of cassava pests and pathogens, shifting their interactions (FAO, 2019b).

In Nigeria, cassava farming is predominantly managed by smallholder farmers who rely on traditional agricultural practices. These farmers often have limited access to modern farming technologies and inputs, making them particularly susceptible to climate-related challenges. The combination of minimal mechanisation and dependence on rain-fed agriculture exacerbates their vulnerability to climate variability. As climate change intensifies, these farmers face increased risks of reduced productivity and income instability. Climate change is seen as changes in climate initiated by anthropogenic activities and intrinsic variation that changes the composition of the global atmosphere observed over a comparable period (Agriculture Management Information System, AMIS, 2018). Climate change is mainly attributed to such human activities as gas flaring, burning of fossil fuels, and deforestation for agricultural and industrial uses, which results in the release of high concentrations of greenhouse gases to the atmosphere (Henri-Ukoha, 2020). The evidence of climate change is real, and its consequences are being felt globally, with poor rural households in developing countries bearing the brunt of the burden (Omerkhil et al., 2020). Therefore, farmers need to be equipped with recent knowledge and information on climate change and agronomic practices to enable them to cope with climate change and other socio-economic conditions (Henri-Ukoha & Osuji, 2017). This will help in the development of suitable and effective adaptation options, which will increase the adaptive capacities of farmers.

Farm households used several adaptation strategies to resist the various risks posed by climate change. These adaptation strategies include variation in sowing time, the use of improved crop variety (e.g., stress-tolerant variety), and shifting to new crops (Stringer et al., 2020; Ojo and Baiyegunhi, 2020). Adaptation strategies can also involve varying land size, sales of crops, mulching, application of agrochemicals, livestock rearing, mixed cropping, mono-cropping, water and soil conservation practices, among others (Asfaw et al., 2018; Danso-Abbeam et al., 2021). These farm-household strategies could significantly reduce risk and, as a result, reduce the negative impact of climate change (Danso-Abbeam et al., 2021).

The issue of climate change is crucial for the agricultural industry, particularly in poor nations where farming largely depends on climatic factors like rainfall and temperature (Omodara et al., 2023). Thus, the looming threat of climate change necessitates proactive measures to protect and sustain cassava production. By adopting targeted adaptation strategies, cassava farmers can enhance their resilience against climate-induced challenges, ensuring the continued contribution of cassava to the nation's food systems and economic development.

In Rivers State, particularly cassava farming is predominantly rain-fed and heavily reliant on traditional agricultural practices. This dependence on consistent climatic conditions renders cassava cultivation highly susceptible to the adverse effects of climate change. Recent studies have highlighted that fluctuations in temperature and precipitation patterns significantly impact cassava yields, leading to food insecurity and economic instability among farming communities (Ajiere & Weli, 2018). Despite the recognition of climate change impacts, there is a paucity of localized research focusing on effective adaptation strategies tailored for cassava farmers in Etche Local Government Area, Rivers State. Existing studies have often generalized findings across broader regions, failing to account for the unique environmental and socio-economic contexts of this specific area. This gap in localized knowledge hinders the development and implementation of targeted interventions that could enhance the resilience of cassava farmers against climate-induced challenges.

Moreover, while some farmers have adopted indigenous coping mechanisms, these strategies are frequently based on traditional knowledge and may not suffice to combat the escalating threats posed by climate variability. The lack of access to modern agricultural technologies, climate-resilient cassava varieties, and comprehensive extension services further exacerbates the vulnerability of these farmers. Without empirical research to identify and promote effective adaptation strategies, cassava production in the region faces a potential decline, threatening both livelihoods and food security. Therefore, this study investigates the climate change adaptation strategies that are specifically suited to the cassava farmers in Etche Local Government Area, Rivers State. The aim is to bridge the existing knowledge gap by providing actionable insights and recommendations.

The broad objective of this study is to investigate the climate adaptation strategies employed by cassava farmers in Etche Local Government Area, Rivers State.

Specifically, this study is to:

1. describe the socio-economic characteristics of cassava farmers in Etche Local Government Area, Rivers State,
2. identify the sources of information on adaptation strategies to climate change adopted by cassava farmers in Etche Local Government Area, Rivers State;
3. determine the major adaptation strategies to climate change adopted by cassava farmers in Etche Local Government Area, Rivers State; and
4. ascertain the constraints in using viable climate change adaptation strategies by cassava farmers in Etche Local Government Area, Rivers State.

The null hypothesis that was tested in this study is stated that there is no significant relationship between socio-economic characteristics of the cassava farmers and the adaptation strategies to climate change adopted by cassava farmers in Etche Local Government Area, Rivers State.

METHODOLOGY

The study area is Etche Local Government Area (LGA), in Rivers State, Nigeria. Etche is in Agricultural zone 2, as part of the Agricultural Development Programme (ADP) structure within the State. Each zone is further subdivided into blocks and circles to facilitate agricultural extension services and project implementation. Rainfall is generally seasonal, variable, as well as heavy, and occurs between March and October through November. The wet season peaks in July, lasting more than 290 days. Temperatures throughout the year are relatively constant with little variation throughout the seasons. Average temperatures are typically between 25°C and 28 °C (77°F and 82 °F) (Okeowo et al., 2022). The population of this study comprises cassava farmers in Etche LGA, Rivers State. Etche Local Government Area (LGA) is one of the four LGAs within Agricultural Zone II of Rivers State, which also includes Ahoada East, Ahoada West, Ogba/Egbema/Ndoni, and Omuma LGAs. Etche LGA was purposively selected due to its agrarian nature and comprises of three (3) blocks. A three-stage sampling procedure was used to select the sample for this study. In the first stage, all three blocks in Etche were selected for inclusivity and comprehensive representation of the area. The second stage involved a random sampling of four circles out of eight circles within each block. The final stage involves randomly sampling ten (10) cassava farmers from each circle, ensuring a total of 120 respondents for the study.

Table 1: Sampling Summary

Sampling stage	Units selected	Total units selected
1 — First stage	All blocks in Etche	3 blocks
2 — Second stage	4 circles per block	3 blocks × 4 circles = 12 circles
3 — Third stage	10 farmers per circle	12 circles × 10 farmers = 120 farmers

Field Survey, 2025

The primary instrument for data collection in this study is a structured questionnaire designed to align with the study's objectives. A midpoint value of 2.5 was established to interpret the responses in objective three and four. Mean scores equal to or greater than 2.5 indicate agreement or a high level of adoption, while mean scores below 2.5 signify disagreement or a low level of adoption. The data collected for this study were analysed using descriptive and inferential statistical tools. Objectives one, two, three, and four were analysed using frequency counts, percentages, and mean scores, while the hypothesis was tested using Ordinary Least Squares regression analysis.

Model Specification for the Ordinary Least Squares Regression Analysis is stated as follows:

Y = f (X1, X2, X3, X4, X5, X6, X7, X8, X9, X10, e)

Where Y is the Pooled index of the adaptation strategies to climate change adopted by cassava farmers in Etche Local Government Area, Rivers State, measured with a 4-point Likert scale of Strongly Agree (4), Agree (3), Disagree (2), and Strongly Disagree (1).

X_1 = Gender (Dummy: Male = 1, Female = 0)

X_2= Marital status (Dummy: Married = 1, Single= 0)

X_3= Household size (No. of persons)

X_4 Age (Years)

X_5 = Educational Status (No. of years spent in school)

X_6 = Farming experience (No. of years)

X_7 = Monthly income (Naira)

X_8 = Farm size (Ha)

X_9= Cooperative membership (Yes= 1, No =0)

X_{10}= Extension contact (Yes= 1, No =0)

E = Error term

It is expected a priori that the coefficients of X1, X2, X3, X4, X5, X6, X7, X8, X9, X10 >0

RESULTS AND DISCUSSION

Socioeconomic characteristics

Table 2 reveals the socio-economic characteristics of cassava farmers in the study area. The findings show that female farmers (54.17%) participate more than their male counterparts (45.83%) which aligns with the observations of Ukonu et al., (2023), who noted that women play a significant role in agricultural production, especially in root and tuber crops in Nigeria. The majority (35.83%) of the farmers were between the age ranges of 46-55. This suggests a mature and active workforce, which is critical for labour-intensive crops like cassava. The relatively low representation of younger adults reflects the growing concern of youth disengagement in agriculture, a trend also reported by Fawole & Ozkan (2019) and Mukwedeya & Mudhara (2024). Most (62.5%) of the farmers were married. Household size (45.83%) is relatively large among respondents, with the majority of them having 6-10 members which may influence labour availability on farms. Majority (48.33%) of the cassava farmers spent between 10-15 years in formal education. This implies a moderate literacy level among the farmers, which could influence their adoption of innovations. Farm size distribution shows that nearly half (49.17%) of the respondents cultivate between 1–3 hectares indicating a dominance of small-scale farming. On income levels, the highest proportion (33.33%) earn between ₦501,000 and ₦1,000,000 monthly, few earn less than ₦100,000 (while 6.67%), reflecting a varied income range among farmers. Based on the level of experience, most farmers (81.67%) have over 6 years of farming experience, indicating a knowledgeable and seasoned farming population. However, access to extension services is limited, with only a few (40.83%) farmers reporting access to extension services which could hinder technology dissemination. This is consistent with Adzenga & Dalap (2023), who stressed that inadequate extension contact hampers technology transfer in agriculture.

Table 2: Distribution of the Socio-economic Characteristics of Cassava Farmers in the Study Area

Variables		Frequency	Percentage (%)
Sex	Male	55	45.83
	Female	65	54.17
Age	Below 25	11	9.17
	25-35	19	15.83
	36-45	28	23.33
	46-55	43	35.83
	Above 55	19	15.83
Marital Status	Single	45	37.50
	Married	75	62.50
Household Size	1-5	22	18.33
	6-10	55	45.83
	11-15	32	26.67
	Above 15	11	9.17
Educational Qualification (Yrs)	Above 15	29	24.17
	10-15	58	48.33
	Below 10	33	27.50
Farm Size	> 5 hectares	8	6.67
	3-5 hectares	21	17.50
	1-3 hectares	59	49.17
	Below 1 hectare	32	26.67
Monthly Income	Less than ₦100,000	8	6.67
	₦100,000 – ₦300,000	19	15.83
	₦301,000 – ₦500,000	28	23.33
	₦501,000 – ₦1,000,000	40	33.33
	Above ₦1,000,000	25	20.83
Years of Experience	1-5	22	18.33
	6-10	48	40.00
	Above 10	50	41.67
Extension service	Access	49	40.83
	No Access	71	59.17
Number Extension Visits	None	71	59.17
	1-3 visits	39	32.50
	3-5 visits	10	8.33
Cooperative Membership	Member	58	48.33
	Non-member	62	51.67

Field Survey, 2025

Sources of information on adaptation strategies to climate change adopted by cassava farmers

Table 3 reveals that cassava farmers in the study area primarily relied on fellow farmers (56.7%) and social media (49.2%) for information on climate change adaptation strategies. This aligns with the findings of Kanu et al. (2021), who reported that peer networks significantly influence farmers' decision-making and innovation adoption. The high usage of social media supports Kanu et al. (2021), who observed the increasing role of digital platforms in agricultural information dissemination among rural farmers in Nigeria (Mapiye et al., 2023). Conversely, formal channels such as extension agents (39.2%), research institutions (8.3%), and extension bulletins (1.7%) were less utilized. This supports Lawal (2023), who noted the limited effectiveness of traditional extension services due to poor coverage and weak farmer-extension linkages.

Major adaptation strategies to climate change adopted by cassava farmers

According to Table 4, the most adopted adaptation strategies, as reflected by the highest mean values, were intensive use of organic manure ($\bar{x}$ = 3.04), use of improved cassava varieties ($\bar{x}$ = 3.00), and changes in the timing of land preparation ($\bar{x}$ = 2.93). These strategies suggest a strong shift towards soil fertility enhancement and the use of resilient varieties in response to changing climatic conditions.

Table 3: Percentage frequency of the sources of information on adaptation strategies to climate change adopted by cassava farmers in the study area

SN	Source of Information	Yes (%)	No (%)
1	Extension agent	47 (39.2)	73 (60.8)
2	Research institution	10 (8.3)	110 (91.7)
3	Social media	59 (49.2)	61 (50.8)
4	Fellow farmers	68 (56.7)	52 (43.3)
5	Seminars	15 (12.5)	105 (87.5)
6	Friends/relations	31 (25.8)	89 (74.2)
7	Farmers' co-operative	29 (24.2)	91 (75.8)
8	Extension bulletins	2 (1.7)	118 (98.3)
9	Radio programme	15 (12.5)	105 (87.5)
10	Television programme	8 (6.7)	112 (93.3)
11	Social organizations	24 (20.0)	96 (80.0)

Field Survey, 2025

These findings are consistent with the study by Henri-Ukoha (2020) and Oyetunde-Usman & Shee (2025), which highlighted farmers' preference for low-cost and yield-enhancing strategies in adapting to climate change. Similarly, the adoption of improved varieties has been reported by Effiong et al. (2024) as a critical response to climate variability due to their resilience and productivity under stress. Conversely, the low adoption of contour cropping ($\bar{x}$ = 1.46), drainage construction ($\bar{x}$ = 2.06), tree planting ($\bar{x}$ = 2.13), and alternative tillage methods ($\bar{x}$ = 2.05) suggests that structural or capital-intensive measures are less favoured. This supports the findings of Osuji et al. (2023), who reported that such strategies are often constrained by financial limitations, lack of technical knowledge, or land tenure insecurity among smallholder farmers.

Table 4: Adaptation Strategies to Climate Change Adopted by Cassava Farmers in the Study Area

S/N	Adaptation Strategies	SA (%)	A (%)	D (%)	SD (%)	$\bar{x}$	SD
1	Irrigation practices	20 (16.7)	57 (47.5)	19 (15.8)	24 (20.0)	2.61**	0.97
2	Use of improved cassava varieties	40 (33.3)	54 (45.0)	12 (10.0)	14 (11.7)	3.00**	0.89
3	Crop rotation	24 (20.0)	50 (41.7)	27 (22.5)	19 (15.8)	2.66**	0.98
4	Changes in planting and harvesting dates	17 (14.2)	51 (42.5)	33 (27.5)	19 (15.8)	2.55**	0.94
5	Mulching/cover cropping	11 (9.2)	44 (36.7)	45 (37.5)	20 (16.7)	2.38*	0.91
6	Soil and water conservation techniques	10 (8.3)	42 (35.0)	43 (35.8)	25 (20.8)	2.31*	0.91
7	Reliance on climate information and forecasts	30 (25.0)	45 (37.5)	33 (27.5)	12 (10.0)	2.78**	0.98
8	Construction of drainages	14 (11.7)	28 (23.3)	29 (24.2)	49 (40.8)	2.06*	1.06
9	Intensive use of organic manure	51 (42.5)	41 (34.2)	10 (8.3)	18 (15.0)	3.04**	0.94
10	Land rotation	12 (10.0)	54 (45.0)	40 (33.3)	14 (11.7)	2.53**	0.89
11	Mixed cropping	27 (22.5)	37 (30.8)	43 (35.8)	13 (10.8)	2.65**	0.95
12	Terracing	19 (15.8)	29 (24.2)	46 (38.3)	26 (21.7)	2.34*	0.93
13	Contour cropping across hill slopes	0 (0.0)	8 (6.7)	39 (32.5)	73 (60.8)	1.46*	0.71
14	Use of different tillage systems	12 (10.0)	25 (20.8)	40 (33.3)	43 (35.8)	2.05*	0.93
15	Tree planting	17 (14.2)	19 (15.8)	46 (38.3)	38 (31.7)	2.13*	0.95
16	More frequent weeding	23 (19.2)	58 (48.3)	20 (16.7)	19 (15.8)	2.71**	0.92
17	Changes in timing of land preparation	38 (31.7)	49 (40.8)	20 (16.7)	13 (10.8)	2.93**	0.93
18	Use of herbicides	18 (15.0)	55 (45.8)	19 (15.8)	28 (23.3)	2.53**	0.96
19	Shortened bush fallowing	28 (23.3)	39 (32.5)	25 (20.8)	28 (23.3)	2.56**	0.99

Field Survey, 2025; ** Agee; *Disagree

Constraints in using viable climate change adaptation strategies by cassava farmers

The findings from Table 5 show that the most common constraint to using viable climate change adaptation strategies in the study area was the high cost of labour ($\bar{x}$ = 2.95). Similarly, poor extension services ($\bar{x}$ = 2.88), lack of government support ($\bar{x}$ = 2.88), and land tenure issues ($\bar{x}$ = 2.82) were also highly rated. This aligns with the findings of Henri-Ukoha (2020), who emphasized that labour-intensive practices in rural Nigeria are often hindered by high labour costs, especially during peak farming periods. Institutional barriers such as poor extension services and lack of government support (both $\bar{x}$ = 2.88) further compound the problem, reflecting weak linkages between policy frameworks and grassroots implementation, an issue previously reported by Osuji et al. (2023).

Table 5: Constraints in using viable climate change adaptation strategies by cassava farmers in the study area

S/N	Constraints	SA (%)	A (%)	D (%)	SD (%)	$\bar{x}$	SD
1	High cost of labour	38 (31.7)	51 (42.5)	18 (15.0)	13 (10.8)	2.95**	0.96
2	Inadequate information on climate change issues	21 (17.5)	54 (45.0)	34 (28.3)	11 (9.2)	2.71**	0.84
3	High incidence of pests and diseases	20 (16.7)	47 (39.2)	39 (32.5)	14 (11.7)	2.61**	0.88
4	Poor extension services	31 (25.8)	56 (46.7)	20 (16.7)	13 (10.8)	2.88**	0.92
5	Inadequate credit facilities to adopt practices	25 (20.8)	59 (49.2)	19 (15.8)	17 (14.2)	2.77**	0.95
6	Low capital	23 (19.2)	50 (41.7)	24 (20.0)	23 (19.2)	2.61**	1.00
7	Land tenure issues	27 (22.5)	54 (45.0)	29 (24.2)	10 (8.3)	2.82**	0.88
8	Scarcity of drought-resistant varieties	18 (15.0)	37 (30.8)	31 (25.8)	34 (28.3)	2.33*	1.08
9	High cost of drought-resistant varieties	21 (17.5)	49 (40.8)	31 (25.8)	19 (15.8)	2.60**	0.96
10	Conflict in the community	12 (10.0)	29 (24.2)	40 (33.3)	39 (32.5)	2.12*	1.02
11	High insecurity levels	18 (15.0)	30 (25.0)	42 (35.0)	30 (25.0)	2.30*	1.04
12	Ignorance of climate change issues	20 (16.7)	33 (27.5)	37 (30.8)	30 (25.0)	2.36*	1.04
13	Poor market network	18 (15.0)	30 (25.0)	42 (35.0)	30 (25.0)	2.30*	1.04
14	High incidence of floods	21 (17.5)	49 (40.8)	31 (25.8)	19 (15.8)	2.60**	0.96
15	Low returns from cassava sales	28 (23.3)	40 (33.3)	30 (25.0)	22 (18.3)	2.62**	1.02
16	High cost of transportation	21 (17.5)	56 (46.7)	30 (25.0)	13 (10.8)	2.71**	0.88
17	Lack of government support	29 (24.2)	60 (50.0)	18 (15.0)	13 (10.8)	2.88**	0.91
18	Delay in government response	23 (19.2)	57 (47.5)	20 (16.7)	20 (16.7)	2.69**	0.96
19	Poor road network	23 (19.2)	50 (41.7)	24 (20.0)	23 (19.2)	2.61**	1.00
20	Stealing of farm produce	21 (17.5)	49 (40.8)	31 (25.8)	19 (15.8)	2.60**	0.96

Field Survey, 2025; ** Agee; *Disagree

Test of Hypothesis

The findings in Table 6 show that the semi-log function yielded an R^2 value of 0.869, indicating that approximately 86.9% of the variance in the climate change adaptation strategies adopted by cassava farmers can be explained by their socio-economic characteristics. Marital status (X_2) exhibits a positive and significant relationship with a coefficient of 0.077 (t = 2.468), suggesting that married farmers are more likely to adopt climate change adaptation strategies. The findings align with existing literature, which emphasizes the role of socio-economic factors in shaping farmers' responses to climate variability and environmental stressors. As supported by Henri-Ukoha (2020), socio-economic attributes such as education, household size, and access to extension services critically determine farmers' capacity and willingness to adapt to climate change. Similarly, household size (X_3) shows a strong positive relationship with a coefficient of 0.085 (t = 3.287), implying that larger households may adopt more strategies, possibly due to increased labour availability or a higher dependency on agriculture for household sustenance, and this finding is corroborated by Anarah et al. (2021), who noted that large households tend to have greater capacity to respond to climatic threats due to the availability of more labour and social support within the household unit. Educational status (X_5) also has a significant and positive effect (coefficient = 0.054, t = 2.864), indicating that farmers with higher levels of education are more likely to implement effective climate change adaptation strategies. Monthly income (X_7) is one of the most influential variables in the model, with a coefficient of 0.092 (t = 3.871), showing that wealthier farmers are more capable of affording and adopting diverse adaptation strategies. Extension contact (X_{10}) is another critical variable with a positive coefficient of 0.061 (t = 2.314), reflecting that frequent interaction with extension agents enhances awareness and the ability to implement appropriate adaptation measures.

Table 4.5: Showing the relationship between socioeconomic characteristics of cassava farmers and the adaptation strategies to climate change

Variables	Linear	+Semi-log	Exponential	Double-log
Constants	2.511	0.032	-13452.32	1.356
	(0.521)	(1.925)	(-2.013)	(3.012)***
Gender (X_1)	-1.123	0.014	-2450.23	-0.042
	(-0.412)	(0.634)	(-1.203)	(-0.823)
Marital Status (X_2)	0.401	0.077	214.57	0.062
	(1.242)	(2.468)**	(2.783)	(2.024)**
Household Size (X_3)	0.732	0.085	340.12	0.112
	(2.130)**	(3.287)***	(2.364)**	(2.768)***
Age (X_4)	-0.054	-0.003	-850.12	-0.018
	(-0.832)	(-1.476)	(-2.061)	(-1.352)
Educational Status (X_5)	0.923	0.054	745.84	0.087
	(2.541)**	(2.864)**	(1.972)**	(2.457)**
Farming Experience (X_6)	0.215	-0.002	120.57	-0.005
	(1.621)	(-0.731)	(1.342)	(-0.754)
Monthly Income (X_7)	1.473	0.092	5789.21	0.342
	(4.283) ***	(3.871)***	(4.236)***	(5.183)***
Farm size (X_8)	0.023	0.007	68.91	0.016
	(0.614)	(0.432)	(0.672)	(0.785)
Cooperative membership (X_9)	0.034	0.009	57.63	0.021
	(0.783)	(0.541)	(0.603)	(0.672)
Extension contact (X_{10})	0.618	0.061	340.45	0.089
	(2.812)**	(2.314)**	(2.489)**	(2.641)**
R^2	0.811	0.869	0.744	0.831
F-value	31.782	47.921	23.112	41.602
N	120	120	120	120

t-ratios are in parentheses; ** t-ratios significance at 5%, *** t-ratios significance at 1%

CONCLUSION AND RECOMMENDATIONS

The findings revealed that while farmers have adopted a range of strategies, such as the use of improved varieties, organic manure, and altered planting schedules, their reliance on informal information sources like fellow farmers and social media was significant. Formal support systems, such as extension services and research institutions, remained underutilized. Constraints such as high labour costs, poor access to credit, inadequate government support, and weak infrastructure continued to hinder effective adaptation. Marital status, household size, educational status, monthly income and extension contact influenced farmers' adoption of adaptation strategies, highlighting the need for targeted interventions to improve resilience and climate-smart farming practices among cassava farmers in the region.

Based on the findings, the recommendations include:

1. There is a need to strengthen the structure of agricultural extension services to improve farmers' access to formal adaptation information.
2. Capacity building and training on climate-smart agricultural practices should be regularly organized and promoted.
3. Increase government and institutional support for rural farmers through subsidies and infrastructure development.
4. Encourage the formation and support of farmers' cooperatives for knowledge sharing and group access to credit.
5. Promote the use of improved, climate-resilient cassava varieties.

REFERENCES

Adzenga, J. I., & Dalap, S. L. (2023). Agricultural technology transfer in Nigeria: A review of the challenges and prospects in the contemporary times. Journal of Agricultural Extension, 28(1), 21-29.

Agriculture Management Information System, AMIS. (2018). Agriculture Management Information System. Available:www.namis.gov.np

Ajiere, S. I., & Weli, V. E. (2018). Assessing the impact of climate change on maize (Zea mays) and Cassava (Manihot esculenta) yields in Rivers State, Nigeria. Atmospheric and Climate Sciences, 8(2), 274-285.

Anarah, S. E., Osuafor, O. O., Umeh, O. J., & Meludu, N. T. (2021). Small scale cassava producers' adaptation strategies to climate variability in Anambra State, Nigeria.

International Journal of Agriculture & Bioscience, 10(1): 1-5.

Asfaw, E., Suryabhagavan, K. V., & Argaw, M. (2018). Soil salinity modeling and mapping using remote sensing and GIS: The case of Wonji sugar cane irrigation farm, Ethiopia. Journal of the Saudi Society of Agricultural Sciences, 17(3), 250-258. https://doi.org/10.1016/j.jssas.2016.05.003.

Bayatagna. A. (2019). Review on nutritional value of cassava for use as a staple food. *Science Journal of Analytical Chemistry*. 7, 91.

Danso-Abbeam, G., Ojo, T. O., Baiyegunhi, L. J., & Ogundeji, A. A. (2021). Climate change adaptation strategies by smallholder farmers in Nigeria: does non-farm employment play any role. *Heliyon, 7*(6). 1-10. https://doi.org/10.1016/j.heliyon.2021.e07162.

Effiong, M. O., Uwah, E. D., & Akwo, T. C. (2024). Climate Change Adaptation Strategies and Technical Efficiency of Cassava Producers in Ikom Agricultural Zone of Cross River State, Nigeria. *Journal of Agriculture, Environmental and Resource Management*, *6*(4), 114-125.

Ekanem, J. T., & Umoh, I. M. (2024). Cassava Farmers' Indigenous Strategies for Climate Change Adaptation and Mitigation in Akwa Ibom State, Nigeria. In *Handbook of Nature-Based Solutions to Mitigation and Adaptation to Climate Change* (pp. 1-20). Cham: Springer International Publishing.

Emenyonu, C. A., Eze, C. C., & Ejike, O. U. (2020). Factors influencing cassava farmers' climate change risk perception in Anambra State, Nigeria. *American Journal of Climate Change*, *9*(3), 217-227.

FAO. (2019a). *Cassava for food and energy security: Investing in sustainable production systems*. Food and Agriculture Organization of the United Nations. Retrieved from https://www.fao.org/

Fawole, W. O., & Ozkan, B. (2019). Examining the willingness of youths to participate in agriculture to halt the rising rate of unemployment in South Western Nigeria. *Journal of Economic Studies*, *46*(3), 578-590.

Food and Agricultural Organization (2019b). Roots, tubers, plantain and banana in human nutrition. Toxic substances and nutritional factors. (under epidemic spastic para paresis). http://www.fao.org/docrip/t020TE00.htm.

Food and Agriculture Organisation, (2020). Climate change and agricultural production in Nigeria. Food and Agriculture Organisation of the United Nations, Rome Italy.

Henri-Ukoha, A, & Osuji, E. E. (2017). Determinants of Arable crop farmers' use-levels of sustainable soil management techniques in Imo State, Nigeria. Nigerian Journal of Agriculture, Food and Environment. 2017;13(2):163-168.

Henri-Ukoha, A. (2020). Assessment of the viability of climate adaptation strategies of cassava-based farmers in southern Nigeria. *Journal of Agriculture and Food Sciences*, *18*(1), 105-117.

Immanuel, S., Jaganathan, D., Prakash, P., & Sivakumar, P. S. (2024). Cassava for Food Security, Poverty Reduction and Climate Resilience: A Review. *Indian Journal of Ecology*, *51*(1), 21-31.

Kanu, I. M., Okezıe, C. R., & Nnah, S. G. (2021). Social Capital and Adoption of Cassava Innovation among Rural Farmers in Abia State, Nigeria. *Quantrade Journal of Complex Systems in Social Sciences, 3*(2), 3-14.

Lawal, K. F. (2023). *Perceived Effectiveness of Public Extension Services Among Maize Based Smallholder Farmers in Kwara State, Nigeria* (Master's thesis, Kwara State University (Nigeria).

Mapiye, O., Makombe, G., Molotsi, A., Dzama, K., & Mapiye, C. (2023). Information and communication technologies (ICTs): The potential for enhancing the dissemination of agricultural information and services to smallholder farmers in sub-Saharan Africa. *Information Development*, *39*(3), 638-658.

Mukwedeya, B., & Mudhara, M. (2024). Factors affecting rural youth participation in the smallholder farming sector. *Journal of Agriculture, Food Systems, and Community Development*, *13*(4), 259-275.

Ojo, T. O., & Baiyegunhi, L. J. S. (2020). Determinants of climate change adaptation strategies and its impact on the net farm income of rice farmers in south-west Nigeria. *Land Use Policy*, *95*, 103946. https://doi.org/10.1016/j.landusepol.2019.04.007

Omerkhil, N., Chand, T., Valente, D., Alatalo, J. M., & Pandey, R. (2020). Climate change vulnerability and adaptation strategies for smallholder farmers in Yangi Qala District, Takhar, Afghanistan. *Ecological Indicators*, *110*, 105863. https://doi.org/10.1016/j.ecolind.2019.105863

Omodara, O. D., Ige, O. A., Oluwasola, O., Oyebanji, A. T., & Afape, O. O. (2023). Factors influencing cassava farmers' choice of climate change adaptation practices and its effect on cassava productivity in Osun State, Nigeria. *FARA Research Report*, *7*(23), 274–288. https://doi.org/10.59101/frr072323

Osuji, E. E., Igberi, C. O., & Ehirim, N. C. (2023). Climate Change Impacts and Adaptation Strategies of Cassava Farmers in Ebonyi State, Nigeria. *Journal of Agricultural Extension*, 27(1), 35–48. https://doi.org/10.4314/jae.v27i1.4

Oyetunde-Usman, Z., & Shee, A. (2025). Farmer preferences for adopting drought-tolerant maize varieties: evidence from a choice experiment in Nigeria. *Renewable Agriculture and Food Systems*, *40*, e10.

Stringer, L. C., Fraser, E. D., Harris, D., Lyon, C., Pereira, L., Ward, C. F., & Simelton, E. (2020). Adaptation and development pathways for different types of farmers. *Environmental Science & Policy*, *104*, 174-189.https://doi.org/10.1016/j.envsci.2019.10.007.

Ukonu, B. U., Amadi, G., & Egesi, Z. O. (2023). Roles of Women in Building a Resilient Root and Tuber Crops Research for Prosperity in Nigeria. *Centennial*, 899.