CHALLENGES OF UTILIZING CLIMATE CHANGE ADAPTATION STRATEGIES AMONG MALE AND FEMALE CASSAVA FARMERS IN SOUTH-EAST, NIGERIA

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ABSTRACT
The study comparatively analyzed the constraints faced by male and femalecassava farmers in utilizing climate change adaptation strategies in South-East, Nigeria. Specifically, the study described the socio-economic characteristics of male and female cassava farmers. It assessed the effects of climate change on cassava production, as well as determined the constraints militating against the use of indigenous and modern climate change adaptation strategies. Data were collected from 280 farmers with the aid of structured questionnaire. Frequency distribution, percentage count and mean were used in analyzing the data.From the mean age of male and female farmers were 47 and 45 years, respectively. Majority of the male farmers (44.2%)had tertiary education while 42.86% of the female farmershad tertiary education. The result indicates that climate change negative effects werefelt in the form of prolonged drought ($\overline{x} = 3.4$), and incidence of pest and disease ($\overline{x} = 3.4$).The constraints faced by male farmers in the use of climate change adaptation strategies were high cost of labour ($\overline{x} = 2.7$), high cost of improved cassava varieties ($\overline{x} = 2.7$), inadequate farm land ($\overline{x} = 2.7$), lack of access to metrological report ($\overline{x} = 2.6$), scarcity of improved cassava varieties ($\overline{x} = 2.6$), inadequate knowledge on climate change ($\overline{x} = 2.5$) and poor capacity building on climate change. While the constraints faced by the female farmers included scarcity of improved cassava varieties ($\overline{x} = 2.9$), high cost of improved cassava varieties ($\overline{x} = 2.8$), inadequate knowledge on climate change ($\overline{x} = 2.6$). The study concludes that no significant difference across states irrespective of the gender indicating that the male and female cassava farmers in each state are almost using similar climate change adaptation strategies. Hence, it is also recommended that male and female cassava farmers should form vibrant farmers' association that can come together to share knowledge among themselves on the effects of climate change, sustainable adaptation strategies and constraints to effective climate adaptation and proffer possible solutions to climate change.
Keywords: Cassava production, Climate change, Adaptation strategies, Rural farmers

INTRODUCTION

Cassava has evolved from being a low-yield famine reserve crop to a high-yield cash crop and is among the widely cultivated crop in Nigeria. Otekunrin and Sawicka, (2019) reported that among cassava farmers, smallholder producers account for 95% of the total cassava production in Nigeria, making them the backbone of the cassava value chain. In terms of energy supply, itprovides approximately 95% of the minimum energy needs of an average Nigerian through cereals, roots, and tubers and annual per capita consumption of 300 kg in some regions (Udemezue and Onwumeme, 2017). Additionally, cassava's versatility, adaptability to diverse climatic and soil conditions, and ability to be cultivated year-round reinforce its prominence in Nigeria's agricultural landscape (Okeke and Emaziye, 2017;Orji *et al*., 2024). The crop is processed into various edible forms, such as garri, fufu, tapioca, chips, and cassava flour, while non-edible derivatives, including starch, ethanol, and animal feed, contribute to significant industrial consumption.

Despite its economic and nutritional importance, cassava production in Nigeria is increasingly threatened by climate change. Climate change, defined as significant variations in temperature, precipitation, or wind patterns over extended periods (Adebisi, Oyebode, Owosibo, 2020), poses risks to agricultural productivity and food security. The Intergovernmental Panel on Climate Change (IPCC) 5th Assessment Report projects that without adaptation measures, climate change will negatively impact crop yields, with variations depending on regions and crops. Predictions for the period 2030–2049 indicate that while some areas may experience yield increases of over 10%, others could suffer losses exceeding 25% compared to 20th-century levels (IPCC, 2014). These disruptions extend beyond production, affecting food accessibility, utilization, and price stability, thereby exacerbating poverty, particularly in developing nations.

In response to these challenges, adaptation strategies have become essential to sustaining cassava production. Adaptation to climate change refers to adjustments in agricultural practices to mitigate

climate-induced risks and enhance resilience (Ajayi*et al*., (2021). Studies have documented various adaptation strategies, which can be broadly categorized as indigenous or modern approaches. Indigenous methods include improved fallows, crop rotation, minimum tillage, organic farming, residue retention, high sanitation, grazing zones, and renewable energy utilization (Yakubu. Appiah and Siaw, 2019;Orisakwe and Okoroma, 2020).). Modern adaptation techniques involve irrigation systems, drought-tolerant crop varieties, early-maturing cultivars, diversified livelihoods, pest control, cover cropping, gully stabilization, extension services, and agricultural insurance schemes (Madu, 2019). Farmers' behavioral responses to climate change range from modifying cropping patterns and seeking new farming information to reverting to traditional methods, consulting fellow farmers, engaging in value addition and storage, or, in extreme cases, abandoning farming altogether (Ifeanyi-Obi and Ugorji, 2020).

However, despite the availability of adaptation strategies, smallholder cassava farmers in South-East Nigeria face significant constraints in implementing them. Limited access to financial resources, inadequate extension services, low literacy levels, and weak institutional support hinder farmers' ability to adopt climate-smart practices. Additionally, socio-cultural factors, such as gender disparities, further exacerbate adaptation challenges. Women, who constitute approximately 80% of Nigeria's agricultural labor force (Anyaoha et al., 2023), play a vital role in cassava production. Yet, they often face greater barriers in accessing land, credit, and agricultural inputs compared to their male counterparts (Egbule and Agwu, 2014; Yakubu. Appiah and Siaw, 2019). Given their critical role in food production and environmental management, gender-sensitive adaptation policies are crucial to ensuring equitable access to climate adaptation resources.

The urgency for a proactive rather than reactive approach to climate risk management cannot be overstated. Understanding the constraints hindering the adoption of climate change adaptation strategies is essential for designing effective interventions. While much research has focused on the impacts of climate change and farmers' adaptation strategies (Madu, 2019), there is a need to critically analyze the barriers limiting smallholder farmers' ability to adapt. Addressing these constraints through targeted policies, improved extension services, financial incentives, and gender-inclusive strategies will be key to sustaining cassava production in South-East Nigeria amidst a changing climate.

Objectives of the Study

Specifically, the objectives of the study include to:

i. describe the socio-economic characteristics of male and female cassava farmers in South-East, Nigeria;
ii. ascertain the perceived effect of climate change on cassava production by male and female cassava farmers in each state;
iii. identify the constraints on the use of climate change adaptation strategies in cassava production rural farmers in South-East, Nigeria
iv. assess gender differential in the use of climate change adaptation strategies between rural cassava farmers in South-East Nigeria.

METHODOLOGY

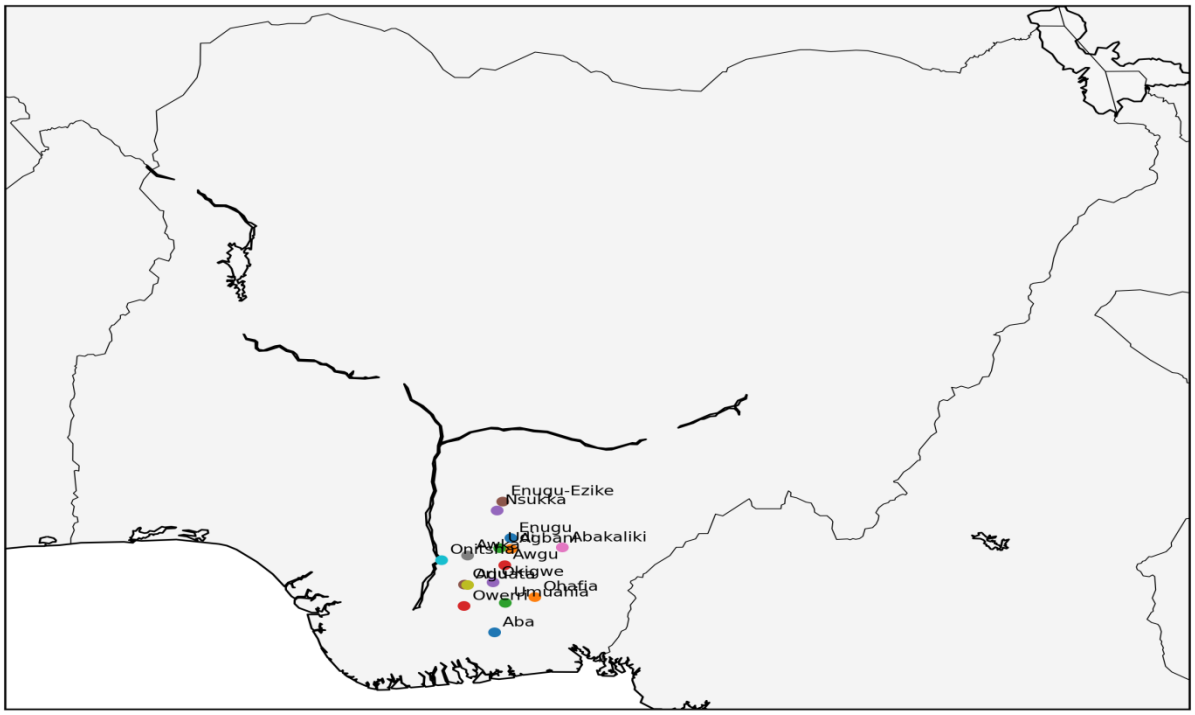

Figure 1: Map of Nigeria Showing the Area of Study
Source: Author's Geospatial illustration of sampled study locations (2026).

The target population for this study comprised male and female cassava farmers across the South-East region, specifically within key agricultural zones. These zones included Aba, Ohafia, and Umuahia in Abia State; Owerri, Okigwe, and Orlu in Imo State; Ebonyi North, Ebonyi Central, and Ebonyi South in Ebonyi State; Anambra, Awka, Aguata, and Onitsha in Anambra State; and Enugu, Agbani, Udi, Awgu, Nsukka, and Enugu-Ezike in Enugu State. A multi-stage sampling procedure was adopted to select participants for the study. In the first stage, a simple random sampling technique was used to select the five states in the South-East region based on their significance in cassava production and their vulnerability to climate change (Henri-Ukoha, 2020). In the second stage, three states—Abia, Imo, and Ebonyi—were randomly selected due to their proximity to the researcher. The third stage involved selecting two agricultural zones from each of the three states. In Abia State, Aba Zone (Okpulumobo and Aba Urban blocks) and Umuahia Zone (Ikwuano North and Umuahia North blocks) were chosen. In Imo State, Owerri Zone (Ohaji-Egbema and Ikeduru blocks) and Orlu Zone (Ideato North and Ideato South blocks) were selected, while in Ebonyi State, Ikwo Zone (Ndufu-Echara and Amegu blocks) and Abakaliki Zone (Ndufu-Amagu and Onueke blocks) were included. This resulted in a total of twelve blocks.

In the fourth stage, simple random sampling was used to select eight circles from each block, yielding a total of 48 circles. Some of the selected circles included Ogbor, Eziama, Umule, Umugbai, Ezeukwu, Asaokpuaja, Osusu, and Obuda in Aba Urban Block; Asa/Obike, Umugwo, Obokofia, Umuapu, Umuekanne, Obitti, Mgbuisi, and Obosima in Ohaji-Egbema Block; and Ndufu-Echara, Ekpa-Omaka, Okpuitmo, Ekpelu, Ekawoke, Amegu, Ndeagu, and Nnoye-Alike in Ikwo Block. In the fifth stage, a proportionate sampling technique was applied to account for the uneven distribution of sub-circles, with an 11.5% proportion selection rate (Eze et al., 2019), leading to the selection of 34 sub-circles. Finally, in the sixth stage, simple random sampling was used to select ten male and ten female farmers from each state, culminating in a total sample size of 158 male cassava farmers and 122 female cassava farmers.

Primary data collection was carried out using structured questionnaires and interview schedules. The structured questionnaire was designed to elicit information on the socio-economic characteristics of farmers, cassava farming practices, climate change adaptation strategies, and challenges faced in adaptation. The collected data were analyzed using both descriptive and inferential statistical techniques. Descriptive statistics, including frequencies, percentages, means, and standard deviations, were used to summarize the data. Inferential statistical methods were applied to test hypotheses and examine relationships between key variables, ensuring a comprehensive understanding of the factors influencing cassava farming in South-East Nigeria.

Table 1: Sampling frame /distribution of zones population and respondents

Selected three (3) states	d two zones per state	No of blocks selected	ircles selected (4 per block)	ub-circle	% sub-circles	assava farmers	Total
Abia	Aba	2	8	482	6	5	30
	Umuahia	2	8	535	6	5	30
Imo	Owerri	2	8	768	9	10	90
	Orlu	2	8	576	7	10	70
Ebony	Ikwo	2	8	256	3	10	30
	Abakaliki	2	8	256	3	10	30
	6	12	48	2873	34	50	280

Source: Field survey data (2022)

RESULTS AND DISCUSSION

The Socio-Economic Characteristics of Cassava Farmers

The result in Table 2 showed that the mean age for males were 47 years while that of the female cassava farmers were 45 years Majority (88%) of male farmers and (66.19%) of female farmers were married while 35.37% (females) and 32.67% (males) acquired secondary education and 44.2% of the male farmers acquired tertiary education while 42.86% of the female farmer acquired tertiary education. The mean farming experience of male farmers were 21 years while the females were 18years.The mean household size for the male farmers were 5 persons while the females were 5 persons. The mean farm sizes of male farmers (1.7 hectares) while the females (1.1 hectares). The result also revealed that majority (56.18%) of the males and a moderate proportion (44.52%) of funds practiced all the cropping systems stated, a good proportion (43.07%) of female farmers while 53.35% practiced mixed cropping, majority (53.62%) of the male and 45.95% of the female farmers were members of cooperative societies. The mean annual farm income of male farmers were (₦416,395) while that of female farmers was ₦393,716 for the female farmers. Majority (65.72%) of female farmers and a good proportion (54.59%) of the male farmers had monthly extension visit with extension agents. The result aligns with earlier findings of Eze*et al*. 2019; Orisakwe andOkoroma, 2020 ;Anyaoha*et al* 2023; on the socioeconomic characteristics in Southeast region of Nigeria

Perceived Effects of Climate Change on Cassava Production

From Table 3 the result revealed that the male farmers indicated that prolonged drought ($\overline{x} = 3.4$), incidence of pest and disease ($\overline{x} = 3.4$), increased flooding ($\overline{x} = 3.3$), delay in planting period ($\overline{x} = 3.3$), changes in timing and length of growing crops ($\overline{x} = 3.3$), reduced farm land due to flood ($\overline{x} = 3.3$), poor yield ($\overline{x} = 3.1$), stunted growth rate of crops ($\overline{x} = 3.0$), increased soil erosion ($\overline{x} = 2.9$), decreased fertility depletion ($\overline{x} = 2.9$), and rotting of tubers and roots ($\overline{x} = 2.9$), were major perceived effects of climate change on cassava production. While the female farmers indicated that prolonged drought ($\overline{x} = 3.4$), increased flooding ($\overline{x} = 3.4$), reduced farm land due to flood ($\overline{x} = 3.3$), incidence of pest and diseases ($\overline{x} = 3.3$), changes in timing and length of growing of crops ($\overline{x} = 3.2$), delay in planting period ($\overline{x} = 3.2$), increased soil erosion ($\overline{x} = 3.1$), rotting of tubers and roots ($\overline{x} = 3.0$), stunted growth rate of crops ($\overline{x} = 2.9$), poor yield ($\overline{x} = 2.9$) and decreased fertility depletion ($\overline{x} = 2.7$) were major perceived effects of climate change on cassava production.The grand mean perceived effects of the male farmers in the South-East was 3.0, while that of the female was 2.9, indicating a high level perception about the effects of climate change on cassava production.

This result suggests that climate change negative impacts are already being felt, in the form of increasing temperatures, weather variability, shifting agro-ecosystem boundaries, invasive crops and pests, and more frequent extreme weather events. According to the World Bank (2021), numerous scientific studies have confirmed that climate variability and change severely affect the environment, food production and food security, causing detrimental socioeconomic and livelihood impacts on smallholder farmers particularly in developing countries. In corroboration with the results, Yakubu. Appiah and Siaw, (2019) Adebisi, Oyebode, Owosibo, (2020), Ajayi*et al*., (2021), and reported that cassava farming is subjected to various challenges ranging from scarcity of land, and poor soil fertility, natural hazards, soil degradation, pest and diseases infestation and changes in climatic elements such as Henri-Ukoha, Ugwuga, Oladejo, Zigakolbari and Onyema, (2018) Ifeanyi-Obi and Ugorji, (2020), as they obtained a similar result among female farmers in Rivers State, Nigeria, that climate change has negative impact on cassava production.

Constraints to the Use of Climate Change Adaptation Strategies in the Study Area

Table 4 result shows mean results of

constraints to the use of climate change adaptation strategies by the male and female farmers in the study area. The male farmers indicated that the constraints to the use of climate change adaptation strategies were high cost of labor ($\overline{x} = 2.7$), high cost of improved cassava varieties ($\overline{x} = 2.7$), inadequate farm land ($\overline{x} = 2.7$), lack of access to metrological report ($\overline{x} = 2.6$), scarcity of improved cassava varieties ($\overline{x} = 2.6$), inadequate knowledge on climate change ($\overline{x} = 2.5$) and poor capacity building on climate change. While the constraints by the female farmers were scarcity of improved cassava varieties ($\overline{x} = 2.9$), high cost of improved cassava varieties ($\overline{x} = 2.8$), inadequate knowledge on climate change ($\overline{x} = 2.6$), high cost of labor ($\overline{x} = 2.5$), inadequate farm land ($\overline{x} = 2.5$), inadequate funding ($\overline{x} = 2.5$), other constraints were poor agricultural extension delivery ($\overline{x} = 2.4$), and lack of access to metrological report ($\overline{x} = 2.4$). The pooled mean of male farmers in the South-East was 2.5 while that of the female famers was also 2.5, indicating that they had serious constraints to the use of climate change adaptation strategies in the study area. Mogaka, Bett, and Ng'ang'a, (2021), Mwaura, Kiboi, Bett, Mugwe, Muriuki, Nicolay and Ngetich, (2021), affirmed that vulnerability to climate change comes both from being located in the tropics, and from various socioeconomic, demographic, and policy trends limiting its capacity to adapt to change. Kanyenji, Oluoch-Kosura, Onyango and KaranjaNg'ang'a, (2020), reported that little capacity to adapt to climate change due to low levels of awareness, human and financial resources and institutional and technological capabilities were serious constraints to use of climate change adaptation strategies to the study area. Ehiakpor, Danso-Abbeam and Mubashiru, (2021), Onyeneke, Ohalete and Uwazie, (2019), opined that lack of knowledge, inadequate information, centralized institution that can champion and coordinate climate change and spatial planning activities militate against the use of these strategies as climate change requires adaptation, hence spatial planning which contributes to both mitigation and adaptation. Cipriano, Ifeanyi-Obi, Togun, Lamboli, Adesope and Arokoyu, (2017) reported that most of these challenges, high cost of labor and high cost of improved varieties were faced by cocoyam farmers in adapting to climate change in Southeast Nigeria.

Table 2: Distribution of male and female cassava farmers according to their socio-economic characteristics

Socioeconomic characteristics	Abia		Ebonyi		Imo		(Pooled mean) Southeast Zone	
	Male	Female	Male	Female	Male	Female	Male	Female
Age/(years)								
20-29	6.25	0.0	0.0	0	16.85	0.0	7.70	0.00
30-39	28.13	21.43	8.11	17.39	12.36	12.68	16.19	17.16
40-49	25.00	50.00	35.14	78.26	12.36	40.85	24.20	56.37
50-59	40.62	28.57	56.75	4.35	58.43	46.48	51.93	26.47
Means ($\bar{x}$)	**45**	**45**	**49**	**43**	**46**	**48**	**47**	**45**
Marital status								
Single	9.38	0.0	0.0	0.0	14.61	0.0	7.90	0.00
Married	84.37	82.14	100.0	100.0	82.02	18.31	88.00	66.91
Divorced	6.25	3.57	0.0	0.0	0.0	1.41	2.00	1.76
Widowed	6.25	14.29	0.0	0.0	3.37	80.28	3.00	31.52
Educational Level								
No formal	6.25	3.57	0.0	0.0	2.25	4.23	2.83	2.60
Primary	37.50	25.00	5.41	4.35	17.98	28.17	20.29	19.17
Secondary	34.38	39.29	24.32	21.75	39.33	45.07	32.67	35.37
Tertiary	21.88	32.24	96.77	73.90	40.45	11.53	44.21	42.86
Farming Experience (years)								
1-15	40.63	46.43	13.51	73.91	32.58	28.17	28.91	49.50
16-30	31.24	42.86	83.79	26.09	43.82	45.07	52.95	38.00
31-45	28.13	10.71	2.70	0	23.60	26.76	18.14	12.50
Mean ($\bar{x}$)	21	21	22	22	18	22	**21years**	**18years**
Household size (numbers)								
4-6	59.37	50.00	56.76	82.61	39.33	61.97	51.82	64.86
7-9	28.13	28.58	35.13	4.35	38.20	19.72	33.82	17.55
10-12	3.12	10.71	0.0	0.0	1.12	0.0	14.36	17.59
Mean ($\bar{x}$)	**6**	**5**	**5**	**6**	**6**	**5**	**5**	**5**
Farm Size (hectares)								
0.25-1.00	18.75	50.00	8.11	56.52	56.18	74.65	27.68	60.39
1.25-2.00	31.25	32.14	59.46	43.48	28.09	21.12	39.60	32.24
2.25-3.00	50.00	10.72	32.43	0.0	14.61	4.23	32.34	4.98
3.25-4.00	0.0	7.14	0.0	0.0	1.12	0.0	0.38	2.39
Mean ($\bar{x}$)	**1.9**	**1.9**	**1.2**	**1.5**	**1.3**	**1.1**	**1.7**	**1.1**
Cropping system								
Sole cropping	0.0	3.57	0.0	0	2.25	2.82	0.75	2.13
Mixed cropping	100.0	96.43	0.0	8.70	29.21	54.93	43.07	53.35
All of the above	0.0	0.0	100.0	91.30	68.54	42.25	56.18	44.52
Farm organization membership								
Member	56.25	71.43	54.05	8.69	50.56	57.75	53.62	45.95
Non member	43.75	28.57	45.95	91.31	49.44	42.25	46.38	54.05
Extension contact								
Monthly	59.38	85.71	59.46	56.52	44.94	54.93	54.59	65.72
Fortnightly	37.50	10.72	40.54	43.48	38.20	36.62	38.74	30.27
No contact	3.12	3.57	0.0	0.0	16.86	8.45	6.67	4.01

Annual farm income (₦)								
60,000-150,000	0.0	0.0	0.0	0.0	0.0	0.0	0.00	0.00
151,000-241,000	3.13	7.14	0.0	0.0	8.99	2.82	4.04	3.32
242,000-332,000	25.00	42.86	0.0	0.0	6.74	43.65	10.58	28.84
333,000-423,000	50.00	14.29	0.0	0.0	23.60	30.99	24.53	15.09
424,000-514,000	21.87	35.71	100.0	100.0	60.67	22.54	60.85	52.75
Mean ($\bar{x}$)	**369,468**	**358,500**	**469,000**	**469,000**	**410,719**	**353,648**	**416,395**	**393,716**

Table 2: Distribution of male and female cassava farmers according to their socio-economic characteristics

Source: Field Survey, 2022

Table 3: Mean distribution of male and female cassava farmers according to perceived effects of climate change on cassava production

S/N	Perceived Effects	Abia		Ebonyi		Imo		(Pooled mean) South-East	
		Male	Female	Male	Female	Male	Female	Male	Female
1.	Increased flooding	3.5	3.9	4.0	4.0	2.5	2.2	3.3*	3.4*
2.	Decreased flooding	1.9	1.4	3.2	3.2	2.0	2.0	2.4	2.2
3.	Increased soil erosion	3.2	3.3	3.1	4.0	2.5	2.0	2.9*	3.1*
4.	decreased soil erosion	1.9	1.7	3.2	3.3	2.0	2.0	2.4	2.3
5.	Decreased fertility depletion	3.8	3.2	3.1	3.0	2.0	2.0	2.9*	2.7*
6.	Prolonged drought	3.3	3.4	4.0	4.0	2.8	2.8	3.4*	3.4*
7.	Incidence of pest / disease infestation	3.4	3.4	3.9	4.0	2.8	2.4	3.4*	3.3*
8.	Poor yield	3.5	3.3	3.0	3.2	2.8	2.3	3.1*	2.9*
9.	Delay in planting period	3.4	3.1	3.2	3.3	3.2	3.2	3.3*	3.2*
10.	Changes in timing and length of growing crops	3.4	3.1	3.1	3.1	3.5	3.4	3.3*	3.2*
11.	Stunted growth rate of crops	3.3	3.3	3.1	3.0	2.7	2.5	3.0*	2.9*
12.	Rotting of tubers & roots	3.3	3.6	2.9	3.0	2.5	2.5	2.9*	3.0*
13.	Reduced farm land due to flood.	3.3	3.5	4.0	4.0	2.5	2.4	3.3*	3.3*
	Grand mean	**3.3**	**3.1**	**3.4**	**3.5**	**2.5**	**2.4**	**3.0**	**2.9**

Source: Field Survey, 2022

Table 4: Mean distribution of male and female cassava farmers according to constraints to use of climate change adaptation strategies in the study area

S/N	Constraints	Abia		Ebonyi		Imo		(Pooled mean) South-East	
		Male	Female	Male	Female	Male	Female	Male	Female
1.	Scarcity of improved cassava varieties	2.2	3.0	3.0	2.9	2.6	2.7	2.6	2.9
2.	High cost of labour	2.3	2.8	3.2	2.0	2.7	2.7	2.7	2.5
3.	High cost of improved cassava varieties	2.3	2.6	2.9	3.0	2.9	2.9	2.7	2.8
4.	Poor agricultural extension services delivery	1.7	2.3	2.9	3.0	1.7	2.0	2.2	2.4
5.	Inadequate of knowledge on climate change adaptation strategies	1.7	2.2	3.0	3.0	2.7	2.7	2.5	2.5
6.	Inadequate farm land	2.4	2.1	2.8	2.7	2.9	2.8	2.7	2.5
7.	Inadequate funding	2.2	2.1	2.6	2.5	2.2	2.8	2.3	2.5
8.	Poor capacity building on climate change	2.3	2.0	2.6	2.6	2.6	2.3	2.5	2.3
9.	Inadequate availability of Climate Change Information	2.1	1.8	2.4	2.3	2.5	2.3	2.3	2.1
10.	Lack of access to metrological report	2.4	1.8	2.6	2.6	2.8	2.8	2.6	2.4
11.	High cost of irrigation facilities	2.1	1.8	1.8	1.3	2.0	2.0	1.9	1.7
12.	Inadequate early warning information on climate change	1.8	1.9	2.0	2.2	2.7	2.5	2.2	2.2
	Grand mean	**2.1**	**2.2**	**2.7**	**2.7**	**2.6**	**2.6**	**2.5**	**2.5**

Source: Field Survey, 2022 Any $\bar{x} \geq 2.0$= serious Any $\bar{x} < 2.0$= not serious

Gender differential in the extent of use of indigenous and modern climate change adaptation strategies among cassava farmers in South-East Nigeria

Result as shown in Table 4 indicated that the mean extent of use of indigenous and modern climate change adaptation strategies for male and female cassava farmers were 85.7342 (SD = 9.6337) and 87.5333(SD= 10.4685), respectively with Z calculated (Zcal = 1.4756) less than Z tabulated (Ztab = 1.6432). These indicate that there is no significant differences between the use of indigenous and modern climate change adaptation strategies among male and female cassava farmers in the study area, therefore, the null hypothesis was accepted. In corroboration with the findings, Tarfa, Ayuba, Onyeneke, Idris, Nwajiuba and Igberi, (2019) revealed that a farmer's gender was statistically insignificant variable to determine a farmer's choice of an adaptation strategy. The hypothesis which states that there is no significant difference in the use of climate change adaptation strategies among male and female cassava farmers in South-East, Nigeria is thereby accepted and the alternative rejected.

Table 4: Test of Significant Differences between the extent use of indigenous and modern climate change adaptation strategies between male and female cassava farmers

Variables	Observation	Mean	Standard deviation	Z_{cal}	Z_{tab}	Decision
Adaptation strategies by Male	158	;.7342	9.6337	1.4756	1.6432	NS
Adaptation strategies by Female	122	'.5333	10.4685			

Source: Analysis on Field data, 2022
NS=Not Significant

CONCLUSION AND RECOMMENDATIONS

This study has provided new knowledge that could enhance and convince male and female to do something differently and better in terms of promoting proactive and strategic climate change adaptation strategies in order to enhance sustainable cassava production and food security in Nigeria. Hence, it is recommended that:

1. Male and female cassava farmers should form vibrant farmers' association that can come together to share knowledge among themselves on the effects of climate change, sustainable adaptation strategies and constraints to effective climate adaptation and proffer possible solutions to climate change. This is because climate change requires collective efforts by all stakeholders.
2. For long term solution, government should integrate issues of climate change as well as adaptation strategies into the natural development plan since the climate change risk is not only a challenge to agriculture development (food supply) but to the country's general development and sustenance of the entire citizenry.
3. Strengthening the nation's extension services in disseminating farm level climate adaptation strategies, extension education campaigns, seminars and follow up visit activities by extension agents should be intensified to increase male and female knowledge on climate change adaptation strategies and to promote male and female utilization of climate change adaptation strategies.
4. Gender should also be an important component to consider in developing climate adaptation measures for farmers. It is also important to identify as well as develop climate adaptation measures that are within the financial status of the farmers (especially the female farmers). Climate adaptation measures that are above farmers' financial capacity may not be readily adopted even though it may be effective. When they adopt it out of cogent need, it may not be sustained.

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