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EFFECT OF CLIMATE CHANGE ADAPTATION AND AGRIBUSINESS SUPPORT PROGRAMME (CASP) ON POVERTY ALLEVIATION AMONG MAIZE FARMING HOUSEHOLD IN KATSINA STATE, NIGERIA

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ABSTRACT

This paper presents an empirical analysis of the effects of climate change adaptation and agribusiness support programs on poverty alleviation among maize farming households in Katsina state. A three-stage sampling technique was used to collect data from 436 smallholder maize farming households with the use of a structured questionnaire. Descriptive statistics, Foster-Greer-Thorbecke (FGT) poverty indexes, and independent t-test analysis were used to achieve the objectives of the study. Results of descriptive statistics shown that the average age of participating households is 48.30 years while for non-participating is 50.52 years old. The average household size of participating households is 9.22 persons while that of non-participating households is 9 persons. And also indicates that the majority (89.75%) of participating household heads and 94.85% of the non-participating households were male with only 10.25% and 3.16% respectively are female. FGT result revealed that the Poverty incidents index was 44% for participating households and 63% for non-participating households; the poverty gap index (a = 1) is 36.9% for participating households and 46.8% for non-participating households and overall FGT analysis showed decreases in the incidence, depth, and severity of poverty among the CASP participating households due to income from maize production. Results from the t-test analysis revealed significant differences in revenue realized from the sales of Maize by the participating maize farming households is NGN 808,155 while those of non-participating households are NGN 693,184.Findings highlight that participation in CASP potentially contributes despite the climate change context to improving revenue and reducing poverty among participating households and recommended the mainstreaming of climate change adaptation strategies into production systems.

1.0 Introduction

Despite Nigeria's plentiful agricultural resources and oil wealth, poverty is widespread in the country and has increased since the late 1990s. Some 70 percent of Nigerians live on less than US$1.25 a day. Poverty is especially severe in rural areas, where up to80 percent of the population lives below the poverty line, and social services and infrastructure are limited. The country's poor rural women and men depend on agriculture for food and income. About 90 percent of Nigeria's food is produced by small-scale farmers who cultivate small plots of land and depend on

rainfall rather than irrigation systems. Lingering poverty and increasing youth unemployment are major obstacles to achieving development impact in Nigeria. The problems of youth unemployment and underemployment are more accentuated in rural areas, where agriculture remains the primary source of livelihood (IFAD, 2015).

The country like any other developing nation faces enormous challenges in trying to cope with climate change due mainly to their high poverty levels. The major concerns for those developing nation's key economic sectors with disastrous impact include; a heightened threat for food security, inadequate water resources availability, degeneration in natural resources, increasing land degradation that have link with climate change and poverty. We have two challenges, fighting global poverty and fighting climate change. Fail the one, fail the other (African Development Bank, 2012). And accordant to Ogbeide et al (2022) in his study found that climate change increasing poverty rather than inequality and poverty increasing climate change.

Maize production figures show that the area planted for maize in Nigeria has increased from 438,000 ha in 1981 to 4.8m ha in 2018 with an associated increase in production from 720,000 tons to 10.2m tons during the same period (Kamara et al, 2020) and increased to 12.4m ha with a total of about 11 MMT harvested in 2022 (NAERLS,2020). Maize is the major crop cultivated in Nigeria and is most prevalent in the northern region particularly in all the rural areas of the country. The average area cultivated area among the households growing the crop is 0.7 ha (NBS, 2019). However, the slow turnover of maize varieties and hybrids on farms coupled with limited availability of good quality improved seeds, fertilizer, climate variability in recent years and other inputs have minimized the potential yield gains recorded on farms in Nigeria. Cadjoe, et al, (2011) reported that climate variability and/or change has adverse consequences on maize production. For example, erratic and unpredictable rainfall patterns, shorter rainfall duration, and higher temperatures adversely affect maize yield. According to Ibrahim et al, (2014), the potential impact of climate change on net revenue from maize production in northern Nigeria indicates a negative impact of temperature on net revenue and a positive relationship between rainfall and net revenue during the growing season. This and other reasons necessitated the federal government to engage in collaboration with the International Fund for Agricultural Development IFAD to implement CASP by ensuring the productive capacity of the most vulnerable, via timely access to inputs, information, market, and liquidity. There are about 8,334 Household direct beneficiaries in Maize and Rice production across the seven CASP states in Nigeria with Katsina state having 1,964 beneficiaries. (Fraym, 2020).

Based on IFAD supervisory team reports and outcome surveys, CASP interventions have been seen as successful, especially in terms of increasing farmers' productivity, and linkage between farms and markets of high-value crops. However, the impact of the program on selected value crops farming households in the state on improving poverty status has not been rigorously analyzed. It is also not clear whether the CASP interventions had any effect on Maize farming household's poverty status in Katsina State. Thus, a study on the contribution of CASP in maize production to poverty alleviation remains imperative.

1.2 Objectives of the study

The general objective of the study was to examine the impact of climate change adaptation and agribusiness support programs on poverty alleviation among maize farming households in Katsina state, Nigeria. The specific objectives were to:

i. describe the socioeconomic characteristics of participating and non-participating maize farming households;

ii. determine the effect of CASP participation on Maize farming household's poverty status and
iii. Examine the effect of participation in CASP on the cost and revenue of maize production.

1.3 Hypotheses of the study

The following hypotheses stated in the null form (Ho) were tested for the study:

1. CASP has no significant effect on the Poverty level of participating maize farming households.
2. CASP has no significant effect on the cost and revenue of participating maize farming households.

2.0 Literature Review

Development of agriculture is a necessary ingredient for sustainable livelihood of urban and rural farming households and a vital tools for food security, poverty reduction and income generation (Oladimeji at al; 2019). Smallholder farmers are the driver of many economies and adverse effect of climate change will have undesirable result on the affected countries and farming households (Mthethwa et al, 2022). The effect include low productivity, food insecurity and high poverty. Climate change adaptation and agribusiness support program participation involve support and strengthen production and productivity through effective provision of extension service, training on good agronomics practices (GAPs), input subsidy and building resilience agriculture for smallholder farming households. This accordant to FAO, (2022) indicated that agriculture must be smart to feed the world and ensure sustainable rural development. Several study (Wekesa et at, 2018, Bayei, 2020) reported that adopting climate smart agricultural practice help improve food security, reduce poverty and productivity by mitigating the impact of climate change.

Agricultural production remains the major sources of livelihood among the rural poor in Nigeria. Boosting maize production in the context of climate change impact may be a way of alleviating poverty. Study conducted by Tolulope et al, (2023) on the relationship between poverty status and maize production in Southwest, Nigeria revealed reduction in poverty due to higher income generated from maize production. Kumar et at, (2023) explores the impact of farmer producer organization in poverty alleviation of smallholder dry chilies farmers in India and finding revealed that participating households poverty status significantly improved compare with non-participant households.

These finding underscore the importance of agricultural Programme intervention tailored to the local context, in addressing the poverty challenges faced by farming households, and promoting resilience agricultural system.

3.0 Methodology

3.1 Study area

The study was conducted in Katsina State. The state has a projected population of 10,368,500 people by 2022 based onan annual growth rate of 3.7%. (National Population Commission NPC, 2017) This reflects a population density of 196.6 persons per square kilometer. The state has a total area of 24,192 Km2, of which about 2.8 million hectares are devoted to the cultivation of crops. The state lies entirely within the tropics (latitude 110 07″N to 130 22″N and 60 45′E to 90 05′E) with a distinct rainy season between May and October, and a dry season between November and April. The extreme northern part lies within the Sahel Savannah with rainfall on average of less than 600mm per year. The northern part lies within the Sudan Savannah with a rainfall average of about 800mm per year and the southern part in the Guinea Savannah with rainfall averages of 1000mm per annum (Bishiret al. (2018).There are distinct seasons in the state,a cool dry (Hamattan) season from December to February, a hot dry season from

March to May, a warm wet season from June to September, and a less marked season after rains from October to November which is characterized by a decreasing rainfall and gradual lowering temperature (Ibrahim and Abdullahi,2022).

The natural vegetation varies from the thorn scrub, annual grass-dominated and semi-arid Sahel-Sudan savannah in the north to the thick woodland, tall perennial grass-dominated Northern Guinea savannah in the South. The state lies on a major water divide between Niger North in the west, Lake Chad in the east, and Niger Central to the South. The river system to the west drains into River Rima (KTSG, 2006). A predominantly agrarian state with more than 800,000 farming families and cultivating more than 1.5 million hectares of farmlands is among the largest producers of cotton and maize in the country. The state has about 415,000 Maize farming households, those households make up about 33 percent of the smallholders in the state (Fraym, 2020)

3.2 Sampling technique and sample size

A Multi-stage sampling technique was used for the study. The first stage involved the randomly selecting six (6) local government areas from the list of participating LGAs in the state. (With two LGAs per each of the agricultural zone of the state). The selected local governments are Jibia and Mani in the Ajiwa zone, Danja and Musawa in the Funtua zone, and Dutsin-Ma and Kusada in the Dutsin-Ma zone. The second stage involved the random selection of two participating villages and two non-participating villages from each selected LGA through balloting, making a total of 24 villages (12 participating and 12 non-participating). In the third stage, the Raosoft sample size calculator (which is also available online at www.raosoft.com), was used to determine the appropriate sample size from the number of the respondent's households obtained from the IFAD program support office, Katsina for the participating households and village listing survey conducted to arrive at the number of maize households for non-participating villages in the study area. The following expression of the proportionate sampling was used to arrive at sample size per village

$$n = \frac{X}{D} * N \quad (1)$$

Where:

n = Sample size of ith households selected per village.

X = Number of households in the village.

D = Total number of Participating/non-participating households in the village

N = Recommended Sample size by Raosoft sample size calculator.

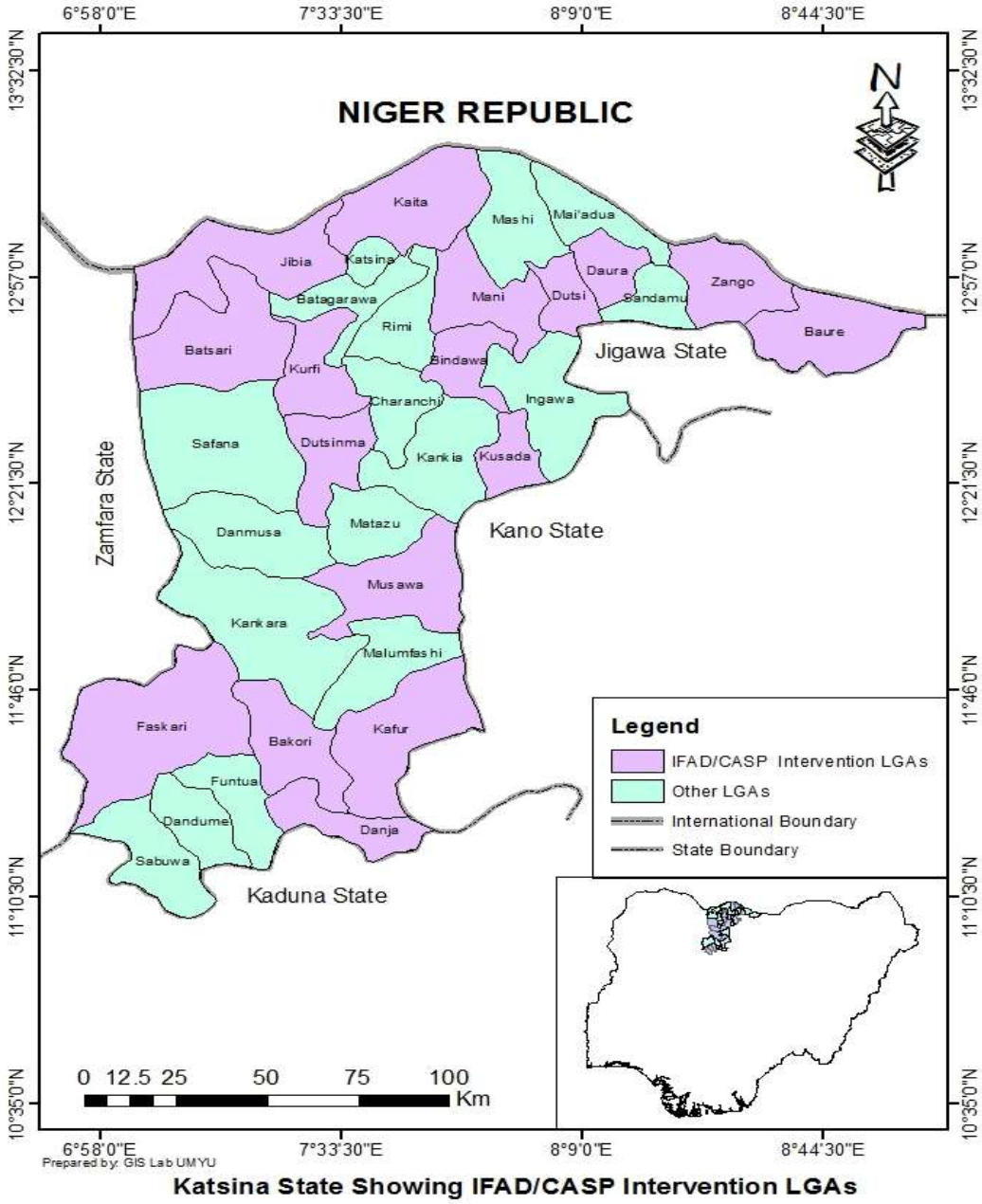
The proportionate distribution of participating and non-participating households is shown in Table 1.

Table: 1 Sample size for Participating and Non-Participating Maize Farming Households.

L.G.A Selected	Participating Villages	Participating maize (Sample Frame)	Participating HH (Sample size)	Non-Participating villages	non-Participating(Sample frame	non-Participating(Sample size)
Jibia	Farfaru	41	18	Daddara,	45	19
	Daga	40	18	Kusa	43	18
Mani	Tumurzawa	39	17	Bujawa,	38	16
	Danfau	42	19	Muduru	45	19

Dutsinma	Shema	35	15	Badole ,	38	16
	Alasawa	33	15	Kagara	35	16
Kusada	Kofa	42	19	G/Mutumdaya, Yashe	48	21
	Aganta	38	17		42	18
Danja	Danja A	47	21	Kakoni,	50	22
	Tandama	41	18	Dabai	47	20
Musawa	Kira	42	19	Danjamku	43	18
	Garu	44	19	Dangani	41	18
Total	12	484*	**215**	12	**515****	221

* Source: IFAD/CASP Program Support Office, Katsina.
** Source: Village listing survey (2023).



Katsina State Showing IFAD/CASP Intervention LGAs

3.3 Analytical tools

Data analysis was done using descriptive statistics, The Foster-Greer-Thorbecke (FGT) poverty indexes and independent t-test analysis.

Descriptive statistics: Descriptive statistics involves the use of means, frequency counts, percentages, and standard deviation.

Poverty index analysis: The Foster-Greer-Thorbecke (FGT) poverty indexes were used to determine the incidence, depth, and severity of poverty among the respondents. This analysis was based on the p–alpha ($P\alpha$) poverty measure proposed by Foster Greer and Thorbecke (1984) which is expressed as:

Head Count Index: It is the share or percentage of the population of interest whose consumption expenditure reflects below the poverty line. This is represented in Equation (2).

$$FGT_0 = \frac{H}{N} \quad (2)$$

Where H represents the number of poor maize-producing households in the sample of N maize farmer households that are below the poverty line using the cost of basic need approach (NBS, 2020)

Poverty gap: it shows how much should be transferred or given to the poor to at least raise their income to the poverty line. This is represented in Equation (4).

$$FGT_1 = \frac{1}{N}\sum_{i=1}\begin{pmatrix} Z - Y_i \\ Z \end{pmatrix}1 \quad (3)$$

Where Z= is the poverty line using the mean per capita expenditure of the respondent's households

N = is the sample size of maize farming households.

Y =Observed Maize farming households expenditure.

Poverty severity: It is the square of the poverty gap index and it measures the inequality among the poor. The measure implicitly puts more weight on observations that fall well below the poverty line. This is represented in Equation (4).

$$FGT_2 = \frac{1}{N}\sum_{i=1}\begin{pmatrix} Z - Y_i \\ Z \end{pmatrix}2 \quad (4)$$

3.4 Independent sample T-test

An Independent sample T-test was conducted to test the research hypothesis that the program has no significant effect on the cost and revenue of participating maize farming households.

4.0 Results Presentation

4.1 Socio-economic characteristics (Continuous Variable)

The socioeconomic characteristics of Household heads of participating and non-participating CASP maize farming households are presented in Tables 2 and 3 This includes age, sex, marital status household size, education attainment years, extension contact per capita assets value, years of farming experience, farm size. The difference between the socioeconomic characteristics of participating and non-participating is also tested for significance using the Chi-square test and t-test.

Table:2 Socio-economic characteristics 1

Variables	NPHH Mean (Standard Deviation)	PHH Mean (Standard Deviation)	Pooled Mean Standard Deviation	Mean Difference	t-value	P-value
Age	50.52 (10.91)	48.30 (10.59)	49.27 (10.77)	2.22	2.1354	0.0166
Household Size	9.11 (6.22)	9.22 (6.31)	9.17 (6.26)	-0.11	0.189	0.5750
Years of Formal Education	10.45 (5.52)	11.67 (5.63)	11.15 (5.59)	-1.22	2.2639	0.0120
Years of Farming experience	23.83 (11.73)	21.10 (11.08)	22.29 (11.43)	2.73	-2.476	0.0136
Years of Maize Farming experience	15.19 (12.26)	14.12 (10.28)	14.45 (10.61)	1.07	-2.236	0.0129
Farm Size	1.82 (1.23)	1.92 (1.47)	1.88 (1.37)	-0.13	-0.750	0.7733

Source: Field Survey Data, 2023

The average age of Participating households is 48.30 years while for non-participating is 50.52 years old. The age difference (2.22) between the two household groups is statistically significant (0.016 <0.05) which indicates that participating household heads are younger than their non-participating counterparts. These younger age participants in the program may be active in all the activities. This is in agreement with the findings of Gambo et al, (2016). His study on Socio-Economic Factors Influencing the Participation of the Marginalized and Vulnerable Farmers in the International fund for Agricultural Development– Community-Based Agriculture and Rural Development Programme in Katsina State, Nigeria indicates the younger age of the participants of the program.

Furthermore, the mean household size of participating households is 9.22 while for non-participating households is 9.11 and the pooled households group is 9.17, and the mean difference between the two groups is -0.11 which indicates that households with high size participate more in CASP intervention similarly the years of formal education. This is contrary to the finding of Makama et, al (2022) who reported that Household size was equally found to significantly reduce maize production and indicated that as households increase, farmers face more financial constraints, thus diverting resources off the farm. The table shows that participating household has an average of 1.92 ha while the non-participating households have 1.82 ha and these slight differences in farm size among the maize farming household corroborate the work of Okunlola (2019), which asserted that a characteristic feature of the agricultural production system in Nigeria is the disproportionately large fraction of the farm output that is in the hands of smallholder farmers. The notable indicator here is that Participating households have a slightly lower average age and higher years of formal education compared to non-participating households. The differences were statistically significant, with p-values of 0.0166 and 0.0120, respectively. This suggests that younger and more educated farmers are more likely to participate in CASP, possibly because they are more open to adopting new technologies and practices.

4.2 Socioeconomic Characteristics (Categorical Variable)

The result in Table 3 indicated that the majority (89.75%) of participating household heads and 94.85% of the non-participating households were male with only 10.25% and 3.16% respectively female-headed households. The finding is in line with the

World Bank, (2018) which reported that men usually have the decision-making power among Nigerian small family farms and only a small share of farms. The majority (95.75% and 94.21%) of Maize farming households are married, which implies the household's immense responsibilities towards meeting the household members' income needs. Regarding education level attainment, the result revealed that household heads attain different levels of education with non-formal as the higher this implied that maize farming household heads among the two groups had achieved a certain level of education.

Table: 3 Socio-economic characteristics of maize farming household head (Categorical Variable).

Variable	Categories	Non-participating Household % (190)	participating Household % (245)	P-Value
Sex	Female	3.16	10.25	0.656
	Male	96.84	89.75	
Marital Status	Single	5.79	3.28	0.800
	Married	94.21	95.08	
	Divorce	0.00	0.41	
	Widow	0.00	1.23	
Highest Level of Education Completed	Non-Formal	43.68	45.08	0.907
	Primary	17.89	17.21	
	Secondary	20.00	23.77	
	Tertiary	15.26	12.70	
	Others	3.16	1.23	
Extension Contact	No	19.47	8.20	0.160
	Yes	80.53	91.80	
Membership of Cooperative	No	19.47	13.93	0.077**
	Yes	80.53	86.09	
Access to Credit	No	44.74	30.33	0.000***
	Yes	55.26	69.67	
Participation in the Productivity trail	No	43.16	22.95	0.022**
	Yes	56.84	77.05	

Source: Field Survey Data, 2023.

4.3 Result of Poverty Analysis Using Foster-Greer-Thorbecke Approach

The relative poverty line of the farmers was defined based on their two-third mean per capita expenditure. The expenditure approach was used with household poverty indices, developed by Foster Greek and Thorbecke (1984) to analyze the poverty status of participating and non-participating CASP maize farming households. This Approach according to Grootaert, (1986) considered an adequate measure of household welfare in developing countries because a component of household consumption is measured more accurately than income and is less susceptible to income volatility as a result of over-dependence on agricultural income by rural farmers so also the use of household consumption expenditure as the welfare indicator for poverty measurement reflects both conceptual and practical reasons. Conceptually, consumption expenditure is a better measure of both current and long-term welfare. Practically, income is considerably more difficult to measure.

The poverty line was defined based on the mean per capita expenditure of the respondent's households. A relative approach in which the respondent

household's expenditure is regarded as related to another household within the maize farming households in the study area. Households with per capita expenditure less than the mean per capita expenditure will be classified as poor while those with mean per capita expenditure equal to or greater than mean per capita expenditure as non-poor. Two-thirds (2/3) mean per capita expenditure for a household was used as the poverty line as adopted by (Oyedejiet al, (2013) and Osowole, et al, (2018). Given that the poverty expenditure threshold is NGN 116,045.59 per member was used as the poverty line for all the respondents' households.

Table 4: The **headcount, Gap, and severity of poverty among the maize farming Households**

FGT Poverty measures	Participating Household	Non-Participating HH	Pooled	Differences
Poverty Head Count (α = 0)	0.44	0.63	0.52	-0.1918
Poverty Gap index (α = 1)	0.369	0.468	0.412	0.0991
Poverty Severity (α = 2)	0.14	0.22	0.17	0.08

Source: Field survey, 2023

In Table 4 above, Poverty incidents indicate that 44% of participating households and 63% of non-participating households were categorized as poor with a sample total of 52% poor This result compares favorably with the findings of NBS (2022) that reported 63% (133 million) of Nigerians are poor and 65% (86 million people) of the 63% (133 million people) poor people in Nigeria live in the North. According to IFAD/CASP, 2013 rapid rural appraisal of the program areas showed 74.2% of Katsina state are poor although they are differentiated into three socio-economic strata by household expenditure level: the core poor, the moderately poor, and the non-poor.

The poverty gap index (α = 1) is 36.9% for participating households and 46.8% for non-participating households, this implies that the current level of per capita expenditure of participating and non-participating maize farming household have to be raised by an average of 36.9% and 46.8% respectively for them to be full out of the poverty and similarly poverty gab donate the proportion of expenditure shortfall from the poverty line. The poverty indices reveal that participating households have lower poverty incidence, gap, and severity compared to non-participating households. The poverty incidence is 44% for participating households versus 63% for non-participating ones. This reduction in poverty among participants is consistent with findings from IFAD/CASP (2013) which reported a reduction in poverty incidents as a result of Agricultural program interventions and Ahmadu and Edeoghon (2018), who reported that the poverty gap between the farmers without and with income from maize production was 63% and 39% respectively, indicating that maize production contributed 24% reduction in the poverty gap of the Maize farming households.

To construct a measure of poverty that takes into account inequality among the poor, the squared poverty gap index indicates that Non-participating households are 22% worse off compared to poor people on average, this means that they have to mobilize financial resources of 22% more of the poverty line per poor person than it required for the average poor. The participating households have only a 14% poverty severity index and the finding is in agreement with Ekenem and Oluwatoyin,(2021) which found out lower

poverty index of beneficiaries compared to non-beneficiaries of commercial agricultural development programs in Nigeria.

Therefore poverty indices result revealed that the poverty status of CASP participating maize farming households thrived better as indicated by lower indices compared to non-participating households. Akinmulewa et al, 2023 reported a similar finding in a study on the assessment of the contribution of the Gurara dam irrigation scheme to poverty reduction among farming households in Kaduna State, Nigeria. In another finding on Poverty Status and Scale Economies of Maize-based Farmers in Southwest, Nigeria. Tolulope et al, (2023) using Foster-Greer-Thorbeecke (FGT) analysis approach, results showed that there is a significant improvement in poverty index status among small-scale farmers across the cropping patterns. It further highlighted the potential of medium and large-scale farming operations in reducing poverty due to their capacity for higher income generation. The overall FGT analysis showed decreases in the incidence, depth, and severity of poverty among the CASP-participating households due to income from maize production. This means that the income from maize production had caused a significant reduction in the poverty level of the households. Therefore, the null hypothesis in each case is rejected.

The findings of this study also reiterate the empirical evidence on the impact of climate change adaptation and agribusiness support program participation on smallholder farming household income and rural economy. Ogbeide-Osaretinet al, 2022 in his finding revealed that there is a significant impact between climate change on poverty and income inequality in Nigeria. The impact of climate change on income inequality shows a U-shaped hypothesis and upshot that there is a feedback substantial connectivity between climate change and income inequality

4.4 Costs and Returns Analysis of Maize production in the Study Area

The results for the significant difference between production, cost, and profitability characteristics between CASP participating and non-participating Maize farming households are presented in this section. The Variables analysed and presented here are labour cost, Total variable cost, total revenue, Gross margin, Benefit-cost ratio, and profitability index.

The result in Table 5 revealed that the average labor cost incurred for the production of Maize by Participating households (N 34,757) is smaller compared to (N 66,197) Non-participating households. This implies that non-participating incurred more labour costs. This is in agreement with the findings of Mujeyi et al (2021) and Tesfaye et al (2020) who reported that adaptation of climate-smart agriculture (CSA) technology reduces labour costs. Furthermore, in average total variable cost (minus labor), participating households have lower (N 104,671) compared to (N 115,649) non-participating households. It is also noted (table 5) that the average total variable of all inputs in the maize production of participating households is relatively low compared to the TVC incurred by non-participating households (Mean difference: N 42,417). This implies that participating in the CASP program for maize farming households is cost-effective as it involves the application of smart agricultural practices. This is in line with Zheng et al, (2024) who reported the existing evidence supports the notion that adopting climate smart-agricultural practices is an effective strategy for resource use efficiency which involves the reduction and utilization of input in crop production.

On total revenue generated by the Maize farming households the result for the distribution of Participating and non-participating households by their Total Revenue (TR) from maize production in NGN. The difference between the two

groups is also tested for significance using the t-test. The mean total revenue realized from the sales of Maize by the participating maize farming households is N 808,155 while those of non-participating households are N 693,184. Therefore, we conclude that significant differences exist between the total revenue of participating and non-participating households.

To further the analysis, the farm budget measure of profitability for participating and non-participating households is estimated using gross margin (GM), Benefit-cost ratio (BCR), and profitability index. The results show that Participating in CASP by farming households is profitable given the positive values of GM, BCR, and PI for Maize production. Outputs obtained from two groups of households, as indicated in the result, showed that productivity across all the groups was significantly higher for participating than non-participating households. However, the highest maize yields were from participating households with an average of 2.30tons/ha, while the lowest yield, 1.98tons/ha, was obtained from non-participating households. Households using adaptation techniques promoted by the CASP program obtained higher farm output. The analysis of production costs and profitability shows that participating households incur lower labor costs and total variable costs, making CASP participation more cost-effective. Participating households also generate higher total revenue from maize production, with a significant difference in gross margin and benefit-cost ratio (BCR). Specifically, the BCR for participating households is 8.3, compared to 5.7 for non-participating households. This suggests that CASP's climate-smart practices enhance productivity and profitability.

Table 5: Distribution of Participating and Non-Participating Households Production Cost, Profitability Characteristics.

Variable	Non-Participating	Participating	Combined	Difference	t-Value	P-value
Labour Cost	66,197	34,757	48,321	-31,439	-7.3919	0.0000
Total Variable Cost(Minus Labour)	115,649	104,671	109,477	-10,977	-0.99	0.8398
Total Variable Cost	181,847	139,429	157,999	-42.417	-3.508	0.999
Total Revenue	693,184	808,155	757,822	114,971	8.0303	0.000
Gross Margin	511,336	668,726	599,823	157,389	8.855	0.000
Benefit Cost Ratio(BCR)	5.7	8.3	7.2	2.6	5.74	0.000
Profitability Index	4.8	7.4	6.24	2.6	5.74	0.000
Output (Tones)	1.98	2.30	2.16	0.32	8.0303	0.000

Source: Field survey, 2023

5.0 Conclusion and Recommendations

The study has established that maize production by CASP participating households contributed significantly to improvement in the well-being of farming households in Katsina State, Nigeria. Specifically, the significant increase in revenue of the households due to maize production led to a significant decrease in their poverty incidence, depth, and severity. Our findings highlight that participation in CASP potentially contributes despite the climate change context to improving

revenue and reducing poverty among participating households. Thus, counsel for the reduction in poverty and food insecurity through climate change adaptation and mitigation techniques among smallholder farming households. We recommended the mainstreaming of climate change adaptation strategies into production systems. This will reduce poverty, ensure food secured household and increased income to the farming households on a sustainable basis as one of the cardinal objective of sustainable development goal.

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