

EMPOWERING WOMEN IN CASSAVA VALUE CHAINS: BARRIERS AND PATHWAYS TO INCLUSIVE AGRICULTURAL DEVELOPMENT IN BENUE STATE, NIGERIA

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ABSTRACT

This study evaluated gender dynamics within cassava value chains in Benue State, Nigeria. A sample of 150 respondents was selected using a multi-stage sampling technique involving purposive, stratified, and simple random sampling. Data were collected using structured questionnaires and analyzed using descriptive and inferential statistics. Findings revealed that women made up 58.7% of the workforce and dominate labor-intensive tasks such as planting, weeding, and post-harvest processing. Despite their central role, only 48% of women own farmland and 55.3% lack access to credit, limiting their capacity to scale production. Prior studies have described women's participation but failed to quantify its impact or explore the institutional and cultural constraints that reinforce gender disparities. Chi-square analysis ($X^2 = 165.04$, $p < 0.05$) confirmed significant gender-task segmentation, with men leading land preparation and women concentrated in post-harvest roles. Regression results showed that female-led farms achieved higher yields ($\beta = +0.82$, $p = 0.03$), especially when supported by training ($\beta = +1.10$, $p = 0.001$), improved varieties ($\beta = +0.95$, $p = 0.005$), and education ($\beta = +0.35$, $p = 0.016$). These findings therefore, highlight the urgent need for gender-responsive policies that strengthen women's access to land, credit, training, and leadership key drivers of equitable and productive agricultural development. Inclusive interventions that expand women's access to resources, education, and institutional support are essential for advancing gender equity and accelerating agricultural development in Nigeria.

Keywords: Women, Agriculture, Gender Equity, Cassava Value Chain and Productivity Drivers.

INTRODUCTION

Cassava (*Manihot* Spp.) is Nigeria's most vital staple crop, accounting for over 20% of global production and providing a foundation for food security for millions of rural households. Its adaptability to marginal soils, drought resilience, and year-round storability make it a dependable source of calories and income in sub-Saharan Africa (Omoluabi and Ibitoye 2024). In Nigeria alone, annual cassava output exceeds 63 million tonnes, contributing significantly to GDP and providing raw material for food, feed, starch, and biofuel industries (Adebayo and Silberberger 2021).

However, the economic promise of cassava is shaped by complex social dynamics, particularly gender roles within its value chain. While men often control land preparation and mechanized cultivation, women are disproportionately responsible for labor-intensive tasks such as planting, weeding, harvesting, and post-harvest processing including peeling, fermenting, and garri production. These roles, though essential, are undervalued and rarely linked to decision-making power or resource access. This segmentation influences income distribution and reinforces structural inequalities in access to credit, training, and market networks (Ezeibe *et al.*, 2015).

Although, a couple of studies has documented women's participation in cassava processing and marketing (Agada *et al.*, 2018; Onyemauwa, 2012), and highlighted barriers such as limited land ownership and exclusion from extension services. However, these studies often fall short of quantifying the impact of female participation on cassava yield. Moreover, few have examined the institutional and cultural constraints that shape women's roles across different agro-ecological zones. The literature tends to describe participation rather than interrogate its implications on yield, efficiency, or empowerment.

Critically, there remains a gap in understanding how female-led cassava farms perform relative to male-led ones, especially in high-production regions like Benue State. Few studies have quantified yield differences or assessed the impact of training, education, and improved varieties on women's productivity. This study addresses that gap by examining gender dynamics across cassava production stages, evaluating the productivity of female-led farms, and identifying structural barriers to gender-inclusive agricultural transformation in Benue State.

STATEMENT OF THE PROBLEM

Despite the leading role Benue State play in cassava production and its strategic importance to Nigeria's food security, gender-based inequalities continue to shape participation across the cassava value chain. Men dominate land preparation and mechanized farming, while women are relegated to labor-intensive roles such as planting, weeding, harvesting, and processing. This division of labor is not merely unequal; it is structurally disempowering. Only 15% of women in Benue State have access to land compared to 85% of men, severely limiting their ability to scale production, access credit, or benefit from agricultural innovations (Agada *et al.*, 2018).

Furthermore, women are largely excluded from decision-making forums and institutional support networks, reinforcing their marginalization. These socio-economic and institutional barriers restrict women's agency, income potential, and visibility within the agricultural sector. While previous studies have documented gender participation in cassava farming, there is a notable gap in literature addressing how these disparities affect women's access to resources, market integration, and long-term empowerment in Benue State. This research seeks to fill that gap by critically examining the structural constraints and proposing gender-responsive strategies for inclusive agricultural development.

OBJECTIVES

The broad objective of the study is to examine gender dynamics within cassava value chains in Benue State, Nigeria. The specific objectives include to:

- i. describe the socio-economic characteristics of the respondents

- ii. explore gendered labor patterns across cassava production stages
- iii. quantify the impact of female participation on cassava yield
- iv. identify key constraints to gender-inclusive cassava development

METHODOLOGY

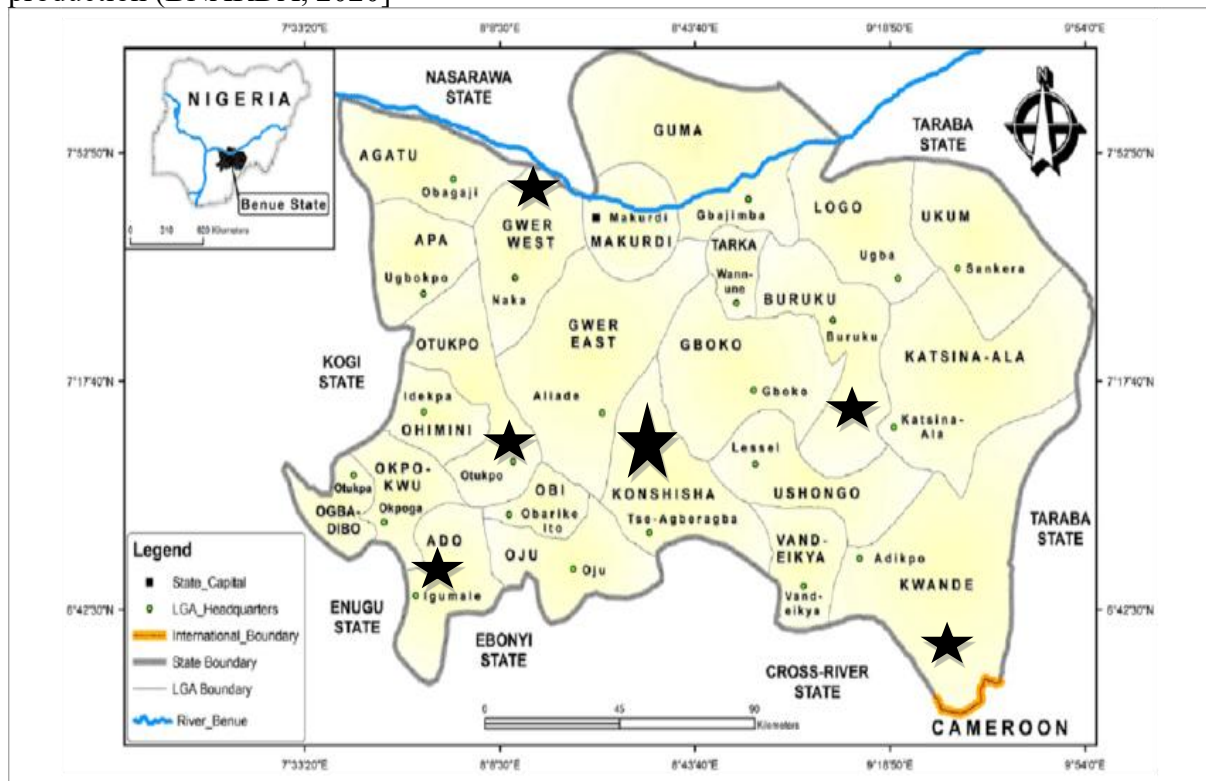
Research Design

The study adopted a descriptive cross-sectional survey design to investigate public opinion on the subject matter. The descriptive approach was chosen to capture and summarize the characteristics, attitudes, and perceptions of a specific population at a single point in time.

The Study Area

The study was conducted in Benue State. Benue State is located in the North Central region of Nigeria. It has a population of approximately 6.85 million. Benue is known for its strong agricultural base, where an estimated 80% of the population engages in farming activities. The state enjoys a tropical climate with distinct wet (May – October) and dry (November–April) seasons, and annual rainfall ranging from 1250mm in the north to 1700mm in the south, creating favorable conditions for crop cultivation (NBSDSB, 2024).

Benue State is a leading producer of cassava, along with other staple crops such as yam, maize, and sweet potato. The state is divided into three agricultural zones namely. Eastern, Northern, and Central with 23 Local Government Areas with active farming communities. Gender roles in agriculture are prominent, with both men and women participating in cassava production (BNARDA, 2020]



The study Area

Fig 1: Map of Benue State showing the location of the study area.

POPULATION AND SAMPLE SIZE SELECTION

Population and Sample Size Selection

The population for this study comprised all cassava farmers across the three agro-ecological zones of Benue State: Eastern, Northern, and Central. A multi-stage sampling technique was employed to ensure representativeness:

Stage 1: Benue State was purposively selected due to its high concentration of cassava farmers.

Stage 2: The state was stratified into three agricultural zones Eastern, Northern and Central.

Stage 3: Two Local Government Areas (LGAs) were purposively selected from each zone based on their prominence in cassava production: Eastern Zone: Kwande and Konshisha, Northern Zone: Buruku and Gwer West and Central Zone: Ado and Otukpo

Stage 4: Two rural communities were randomly selected from each of the six LGAs, resulting in twelve communities.

Stage 5: A sampling frame was developed for each selected community, yielding a total population of 861 cassava farmers.

To determine the appropriate sample size, Yamane's (1967) formula was applied:

$$n = \frac{N}{1 + Ne^2}$$

Where:

n = sample size

N = population size (861)

e = margin of error (0.05)

$$n = \frac{861}{1 + 861(0.05)^2} = 273$$

Although the calculated sample size was 273, the final sample size was adjusted to 150 respondents due to fieldwork limitations. Statistically, a sample of 150 still provides a 95% confidence level with a precision of $\pm 7.5\%$, which is acceptable for exploratory and descriptive research in agricultural studies. This level of precision allows for meaningful inference while balancing feasibility and resource constraints.

Respondents were proportionally allocated across the twelve communities based on each community's share of the total population. A detailed breakdown of the sampling frame and proportional allocation is presented in the table below:

Sample Size Selection Plan

Zone	LGA	Community	Sampling Frame	Calculation	Sample Size
Eastern	Konshisha	Agidi	76	$(76 \div 861) \times 150 = 13.24$	13
		Agberagba	65	$(65 \div 861) \times 150 = 11.33$	11
	Kwande	Barakur	79	$(79 \div 861) \times 150 = 13.77$	14
		Abwa	68	$(68 \div 861) \times 150 = 11.84$	12
Northern	Buruku	Tyogbenda	92	$(92 \div 861) \times 150 = 16.03$	16
		Mbaton	77	$(77 \div 861) \times 150 = 13.41$	13
	Gwer West	Phekor	72	$(72 \div 861) \times 150 = 12.54$	13
		Naka	63	$(63 \div 861) \times 150 = 10.98$	11
Central	Otukpo	Otobi	74	$(74 \div 861) \times 150 = 12.90$	13
		Adoka	71	$(71 \div 861) \times 150 = 12.37$	11
	Ado	Utonkon	66	$(66 \div 861) \times 150 = 11.50$	12
		Agila	59	$(59 \div 861) \times 150 = 10.28$	10
Total	6	12	861	861	150

Source: BNARDA (2024).

Data Analysis Techniques

The study employed both descriptive and inferential statistical methods to analyze the data:

Descriptive Statistics

Frequency distributions, percentages, and means were used to summarize socio-economic characteristics

Inferential Statistics

Factor Analysis was conducted to identify underlying constructs influencing cassava farming practices using Varimax rotation method to enhance interpretability. Result interpretation was based on Kaiser rule of thumb which states that variables with correlation coefficient of 0.30 or more have a high loading and such are qualified to be used in classifying or naming a factor. While loading of below 0.30 are not named.

Chi-square tests were used to examine associations between categorical variables, particularly gender and roles in cassava Production.

Linear Regression Analysis was applied to quantify the impact of female participation and other predictors on cassava yield.

Regression Model Specification

The model can be specified as:

$$Y_i = \beta_0 + X_1 + X_2 + X_3 + X_4 + X_5 + \varepsilon_i$$

Where:

Y_i = Cassava yield for respondent measured in kilograms per hectare (kg/ha)

β_0 = Intercept term

X_1 to X_5 = Coefficients for each predictor

X_1 = Education: Level of formal education attained

X_2 = Age: Age of the respondent

X_3 = Gender: Dummy variable (1 = Female, 0 = Male)

X_4 = Training: Access to agricultural training (1 = Yes, 0 = No)

X_5 = Improved Varieties: Use of improved cassava varieties (1 = Yes, 0 = No)

ε_i = Error term

This linear model was estimated using Ordinary Least Squares (OLS), Statistical significance of each coefficient was evaluated using p-values, and model fit was assessed through R-squared and F-statistics.

Chi-Square Model Specification

The chi-square test was used to examine the association between gender and roles in cassava Production activities.

Formula:

$$\chi^2 = \frac{\sum(O - E)^2}{E}$$

Where:

O = Observed frequency for gender and task

E = Expected frequency under the assumption of independence

The test was applied across five task categories: land preparation, planting/weeding, harvesting, post-harvest processing, and marketing/selling.

Degrees of Freedom:

$$[df = (r - 1) (c - 1)]$$

Where (r) is the number of gender categories and (c) is the number of task categories.

RESULTS AND DISCUSSION

Results

Socio-Economic Characteristics of Respondents

Table 2 showed that majority (58.7%) of the respondents were female, reinforcing the central role women play in cassava farming. Most respondents were aged between 41–50 years, with a mean age of 46.4, indicating a mature and experienced farming population. Marital status showed that 83.91% were married, and household sizes averaged 8.4 members, suggesting strong family labor potential. Educational attainment was relatively high, with 52.3% having completed secondary education and 22.41% attaining tertiary education. an encouraging sign for innovation uptake. Income levels were modest, with 78.16% earning between ₦750,001 and ₦1,000,000 annually. Farming experience was substantial, as 62.7% had over 10 years of experience. However, only 48% owned their farmland, and 55.3% lacked access to credit, highlighting structural barriers. Most of the respondents cultivated 3–5 hectares and produced 11–20 tons of cassava annually, with 82.7% processing their harvest, reflecting a strong orientation toward value addition. These roles reflect longstanding labor patterns in Nigerian agriculture, where women frequently occupy the domains of crop management and food transformation, yet remain marginalized in asset control and economic decision-making (Onyemauwa, 2012; Ugwu, 2019).

Table1: Socio-Economic Characteristics of Respondents (n = 150)

Category	Variable	Frequency	(%)	Mean
Sex	Female	88	58.70	
	Male	62	41.30	
Age	21–30	15	10.00	
	31–40	37	24.70	
	41–50	42	28.00	46.4
	51–60	30	20.00	
	Above 60	26	17.30	
Marital Status	Single	18	5.30	
	Married	120	83.91	
	Widow/Widower	10	6.60	
	Divorced	2	1.33	
Household Size	1–5	22	14.70	
	6–10	85	56.70	8.4
	10 or more	43	28.70	
Education Level	No formal education	6	4.02	
	Primary	32	21.26	
	Secondary	79	52.30	
	Tertiary	33	22.41	
Annual Income (₦)	1–250,000	1	0.57	
	500,001–750,000	5	2.87	

Category	Variable	Frequency	(%)	Mean
	750,001– 1,000,000	136	78.16	
	Above 1,000,000	32	18.39	
Farming Experience (Years)	Less than 5	34	22.70	
	5–10	46	30.00	
	11–20	48	32.70	
	Over 20	22	14.70	
Land Ownership	Owned	72	48.00	
	Leased	32	21.30	
	Communal (shared)	35	23.30	
	Other	11	7.30	
Farm Size (ha)	Less than 1	19	12.70	
	1–2	49	32.70	
	3–5	55	36.70	
	More than 5	27	18.00	
Credit Access	Yes	67	44.70	
	No	83	55.30	
Cassava Production (tons)	Less than 10	52	34.80	
	11–20	61	40.60	
	21 and above	37	24.60	
Cassava Utilization	Processed	123	82.70	
	Industrial use	27	17.30	

Gender Roles in Cassava Production:

The chi-square test ($X^2 = 165.04$, $p < 0.05$) confirmed gendered patterns in task allocation, with men predominantly handled land preparation (78 observed vs. 40.6 expected), while women dominated planting and weeding (81 observed vs. 67 expected) and post-harvest processing (108 observed vs. 67 expected). Harvesting and marketing were more evenly shared. The findings reflect entrenched cultural norms and labor expectations, where women are custodians of food systems but often excluded from mechanized and upstream activities. The results underscore the need for gender-responsive interventions that redistribute labor and improve access to mechanization and decision-making platforms for women. These distinctions mirror patterns noted by Amadi *et al.*, (2020) and Nkeme *et al.*, (2021), who highlighted how cultural and physiological expectations frame labor roles within agricultural value chains.

Table 3: Chi-Square Analysis: Gender Roles in Cassava Production

Variables	Mostly Male (O/E)	Mostly Female (O/E)	Jointly (O/E)	(O-E) ² /E Total
Land Preparation	78 / 40.6	18 / 67.0	54 / 42.4	72.96
Planting & Weeding	32 / 40.6	81 / 67.0	37 / 42.4	5.57
Harvesting	41 / 40.6	67 / 67.0	42 / 42.4	≈0.01
Post-Harvest Processing	13 / 40.6	108 / 67.0	29 / 42.4	49.34
Marketing & Selling	39 / 40.6	61 / 67.0	50 / 42.4	1.95
Total X² Value				165.04

Degrees of Freedom (df): 8

Critical Value ($\alpha = 0.05$): 15.51

Impact of Female Participation on Cassava Yield

The regression analysis reveals that female participation in cassava farming significantly enhances productivity, with women-led farms showing a positive yield effect ($\beta = +0.82, p = 0.03$). Training emerges as the most influential factor ($\beta = +1.10, p = 0.001$), underscoring the transformative impact of agricultural capacity-building. The adoption of improved cassava varieties also contributes substantially to yield gains ($\beta = +0.95, p = 0.005$), while education plays a meaningful role ($\beta = +0.35, p = 0.016$), suggesting that literate farmers are better equipped to implement effective practices. Age, though modest in effect ($\beta = +0.04, p = 0.04$), may reflect the value of experience. Collectively, these findings advocate for inclusive agricultural policies that prioritize female empowerment through education, training, and access to improved cassava varieties. They also challenge prevailing gender stereotypes, demonstrating that when women are adequately supported, they not only match but often surpass productivity expectations in farming. This finding aligns with the work of Onyemauwa *et al.*, (2023) and Jayne *et al.* (2019), that innovation uptake and targeted extension services improve productivity, especially among medium-scale women farmers.

Table 4: Linear Regression: Impact of Female Participation on Cassava Yield

Variable	Coefficient(β)	p-value
Education	+0.35	0.016
Age	+0.04	0.04
Gender (Female)	+0.82	0.03
Training	+1.10	0.001
Improved Varieties	+0.95	0.005

Model Fit Statistics:

$R^2 = 0.62$

Adjusted $R^2 = 0.59$

F-statistic = 21.47

p-value (F-test) < 0.001

Number of observations (n) = 150

Barriers to Gender-Inclusive Cassava Development

The factor analysis revealed three major barriers to gender equity:

Factor 1: Input and Market Access: Includes lack of credit (0.79) and poor market access (0.72), highlighting financial and infrastructural barriers.

Factor 2: Capacity and Workforce Limitations: Includes inadequate training (0.77) and labor shortages (0.73), pointing to institutional gaps in extension services and skilled labor.

Factor 3: Socio-Cultural Restrictions: Cultural norms (0.82) emerged as the strongest barrier, limiting women's land ownership, leadership, and strategic decision-making. These constraints reflect deep-rooted systemic issues that require multi-level interventions policy reforms, community sensitization, and institutional strengthening to foster inclusive agricultural transformation. This is consistent with FAO (2011) and Ajadi *et al.*, (2015), that widespread resource exclusion among female farmers across sub-Saharan Africa has posed a constraint to cassava production. The second factor, capacity gaps due to inadequate training and labor shortage; suggests institutional weaknesses in extension outreach. comprising the third barrier, reflect deep-rooted norms that hinder women from owning land, accessing leadership positions, and making strategic farming decisions (Dutse, 2025).

Table 5: Barriers to Gender Equity

Constraint	Factor 1	Factor 2	Factor 3
Lack of credit	0.79	0.23	0.21
Poor market access	0.72	0.11	0.22
Inadequate training	0.12	0.77	0.14
Labor shortage	0.16	0.73	0.19
Cultural restrictions	0.15	0.05	0.82

varimax Rotational method

Factor 1: Input and Market Access

Factor 2: Capacity and Workforce Limitations

Factor 3: Socio-Cultural Restrictions

CONCLUSION

Cassava production in Benue State showed significant opportunities for gender-inclusive agricultural development. Empirical findings from the study revealed that women constitute 58.7% of cassava farmers and dominate labor-intensive roles such as planting, weeding, and post-harvest processing. Despite their central involvement, only 48% of women own farmland and 55.3% lack access to credit, limiting their capacity to scale production. Chi-square analysis confirmed significant gendered task segmentation ($\chi^2 = 165.04$, $p < 0.05$), with men leading land preparation and women concentrated in post-harvest activities. Regression analysis showed that female-led farms achieved higher cassava yields ($\beta = +0.82$, $p = 0.03$), especially when supported by training ($\beta = +1.10$, $p = 0.001$), improved varieties ($\beta = +0.95$, $p = 0.005$), and education ($\beta = +0.35$, $p = 0.016$). These results underscore the need for gender-responsive policies that enhance women's access to land, credit, training, and leadership.

RECOMMENDATIONS

1. Federal Ministry of Agriculture and Rural Development (FMARD) should partner with National Root Crops Research Institute (NRCRI Umudike,) to develop high-yield, disease-resistant cassava varieties and promote climate-smart agricultural practices.
2. FMARD should partner with Women Farmers Advancement Network (WOFAN) to ensure gender-sensitive policies and access to inputs.
3. FMARD should deploy digital extension platforms to reach remote farming communities with timely advice and weather updates.

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