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Assessment of Gender Gap in Productivity and Income of Cassava Farmers in Edo State, Nigeria

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ABSTRACT

This study assessed gender disparities in productivity and income among cassava farmers in Edo State, Nigeria. Using a cross-sectional survey design, data were collected from 270 smallholder farmers (162 males, 108 females) across Edo North, Central, and South senatorial zones, employing multi-stage sampling. The objectives were to analyze profitability, estimate gender gaps in productivity and income, and identify constraints faced by farmers. Descriptive statistics, gross margin, net farm income (NFI), benefit-cost ratio (BCR), total factor productivity (TFP) via Cobb-Douglas production function, and Garrett Ranking were used for analysis, with hypotheses tested using t-tests. Results show cassava production is profitable (mean NFI: ₦260,011, BCR: 1.59, $p < 0.0000$), rejecting the null hypothesis of non-profitability. Males have higher NFI (₦283,339 vs. ₦216,043) and TFP (1.184 vs. 1.098) than females, but differences are not statistically significant ($p = 0.7371$ for income, $p = 0.8276$ for productivity). Key constraints include lack of capital, poor credit access, and limited improved technologies, with females facing greater barriers in land access and labour costs. Socioeconomic disparities, such as lower education and land ownership among females, exacerbate gaps. Gender-responsive policies, including land tenure reforms, microfinance, and enhanced extension services, are recommended to bridge these disparities, boost productivity, and enhance livelihoods, contributing to food security and poverty alleviation in Edo State, Nigeria.

Keywords: Cassava farming, gender gap, productivity, income, profitability, constraints, credit access and gender-responsive policies.

Introduction

Cassava (*Manihot esculenta* Crantz) is a pivotal crop for food security and economic livelihoods in sub-Saharan Africa, with Nigeria leading as the world's largest producer, contributing over 60 million metric tons annually and accounting for approximately 20% of global output (FAOSTAT, 2021; Ekott, 2022). In Edo State, located in southern Nigeria, cassava is a dominant staple and cash crop, cultivated primarily by smallholder farmers across its three senatorial zones: Edo North, Edo Central, and Edo South (Eweka & Egbedion, 2023). Its resilience to adverse climatic conditions, low input requirements, and versatility in food, industrial, and livestock applications make it a critical resource for rural households (Ugorji, 2018; Okoror et al., 2019). However, cassava production in Nigeria, including Edo State, faces systemic challenges, notably gender disparities in productivity and income, which hinder agricultural growth and rural development (Oseni et al., 2015; Olaosebikan et al., 2019).

Gender gaps in agricultural productivity and income are well-documented across sub-Saharan Africa, with women farmers consistently producing less per hectare and earning lower incomes than their male counterparts (FAO, 2011; Mukasa & Salami, 2015; Bello et al., 2021). In Nigeria, women constitute over 70% of the agricultural labour force, playing a significant role in cassava production, processing, and marketing, often labelling it a "woman's crop" (Forsythe et al., 2015; Teeken et al., 2018). Despite their contributions, women face structural barriers, including limited access to land, credit, improved inputs, extension services, and markets, resulting in a productivity gap of 20–30% compared to men (Oseni et al., 2015; Bello et al., 2021). For example, Oseni et al. (2015) found that female-managed plots in Nigeria yielded 19–30% less than male-managed plots due to disparities in resource access. In Edo State, Eweka and Egbedion (2023) noted that inadequate rural infrastructure, such as healthcare facilities and water supply, disproportionately affects women cassava farmers, reducing their efficiency and profitability.

These gender disparities have significant implications for household welfare, food security, and poverty alleviation. The FAO (2011) estimates that closing the gender gap in agriculture could increase output in developing countries by 2.5–4%, potentially reducing undernourishment by 12–17%. In Edo State, where cassava supports both subsistence and commercial activities, addressing these gaps is critical to enhancing productivity and income (Okoror et al., 2019). Women cassava farmers face specific constraints, such as limited access to hired labour, high costs of processing equipment, and exploitation by middlemen, which restrict their scale of production and market participation (Olaosebikan et al., 2019; Madu, 2020). Socio-cultural norms,

including restricted land ownership for women, further exacerbate these challenges in states like Abia and Edo (Academic Journals, 2015; Okoror et al., 2019).

Gender-specific preferences in cassava production also influence productivity outcomes. Women often prioritize traits related to processing and product quality, such as ease of peeling and cooking characteristics, while men focus on agronomic traits like yield and early maturity (Teeken et al., 2018). However, women's limited access to extension services and improved varieties hinders their adoption of productivity-enhancing technologies (Obisesan, 2014; Olaosebikan et al., 2019). For instance, Obisesan (2014) reported a 26% higher adoption rate of improved technologies among male cassava farmers in southwest Nigeria, attributed to better access to credit and education. Similar dynamics likely prevail in Edo State, where resource constraints and gender norms shape agricultural outcomes (Okoror et al., 2019).

Income disparities further compound the gender gap in cassava farming. In Abia State, Nwaiwu (2018) found that male-headed households had larger farm sizes (1.22 ha vs. 1 ha for females) and higher net farm incomes due to better access to land through inheritance. In Edo State, Okoror et al. (2019) noted that livelihood diversification, such as combining cassava with crops like plantain and maize, improved income for male farmers more significantly than for females due to resource limitations. Women's higher involvement in labour-intensive tasks, such as planting and harvesting, often does not translate into proportional income gains due to limited market access and lower bargaining power (Academic Journals, 2015; Madu, 2020).

Recent efforts to integrate gender-responsive strategies in cassava breeding and value chain development highlight the need for targeted interventions (Chijioke et al., 2021; Ekott, 2022). Initiatives like the NextGen Cassava project and RTBfoods emphasize understanding gender-specific trait preferences to enhance varietal adoption and economic outcomes (Teeken et al., 2018; Madu, 2020). In Edo State, where cassava farming is a cornerstone of rural livelihoods, addressing gender gaps could unlock significant productivity and income gains, contributing to poverty reduction and food security (Eweka & Egbedion, 2023). However, state-specific studies on gender disparities in cassava farming in Edo State remain limited, particularly in the context of recent agricultural interventions and infrastructural developments.

This study aims to assess the gender gap in productivity and income of cassava farmers in Edo State, Nigeria, to provide empirical evidence for gender-responsive policies and interventions. The broad objective is to evaluate the extent of gender disparities in cassava farming outcomes, with the following specific objectives: (i) to analyze the profitability of cassava production and the associated gender disparity, in Edo State, Nigeria; (ii) to estimate the gender gap in productivity of cassava farmers in Edo State, Nigeria; and (iii) to identify the constraints faced by male and female cassava farmers in Edo State, Nigeria. To guide the analysis, the study tests the following null hypotheses: (i) cassava production is not profitable in Edo State, Nigeria, (ii) there is no significant difference in income in cassava production between male and female cassava farmers in Edo State, Nigeria, and (iii) there is no significant difference in productivity in cassava production between male and female cassava farmers in Edo State, Nigeria. By examining socio-economic characteristics, resource access, and gender-specific constraints, this study seeks to contribute to the discourse on gender equity in agriculture and inform strategies to enhance the livelihoods of cassava farmers in Edo State and beyond.

Definition of Terms

Cassava: A tropical root crop (*Manihot esculenta* Crantz) widely cultivated in Edo State, Nigeria, for its starchy tuberous roots, which serve as a staple food and raw material for industrial and livestock products. It is a major source of income and food security for smallholder farmers (FAO, 2021; Eweka & Egbedion, 2023).

Gender Gap: The difference in outcomes, such as productivity and income, between male and female cassava farmers, attributed to disparities in access to resources (e.g., land, credit, extension services), socio-cultural norms, or institutional barriers (FAO, 2011; Oseni et al., 2015).

Productivity: The efficiency of cassava production, measured as yield per hectare (kg/ha), reflecting the output of cassava roots produced per unit of land area under cultivation (Oseni et al., 2015; Bello et al., 2021).

Income: The net farm income derived from cassava production, calculated as total revenue from cassava sales and processed products (e.g., garri, fufu) minus total production costs (variable and fixed costs), expressed in Nigerian Naira (NGN) per hectare (Okoror et al., 2019).

Profitability: The financial viability of cassava production, determined by gross margin (total revenue minus total variable costs) and benefit-cost ratio (total revenue divided by total costs), where a positive gross margin and a benefit-cost ratio greater than 1 indicate profitability (Okoror et al., 2019).

Constraints: Barriers or challenges faced by cassava farmers that limit their productivity and income, including limited access to land, credit, extension services, labour, markets, or socio-cultural factors such as gender-based restrictions (Olaosebikan et al., 2019).

Socio-Cultural Norms: Social and cultural practices in Edo State, Nigeia, that influence gender roles in cassava farming, such as restrictions on women's land ownership or division of labour, impacting resource access and decision-making (Madu, 2020).

Methodology

This study adopted a cross-sectional survey design to collect primary data from male and female cassava farmers in Edo State, Nigeria. The cross-sectional approach is appropriate for capturing a snapshot of productivity, income, and constraints at a specific point in time, allowing for comparisons across

gender groups (Oseni et al., 2015). The design combined quantitative methods to estimate productivity and income gaps with qualitative methods to explore gender-specific constraints, ensuring a comprehensive assessment of the research objectives.

Study Area

The study was conducted in Edo State, located in southern Nigeria, which lies between latitudes 5°45'N and 7°35'N and longitudes 4°50'E and 6°45'E (Eweka & Egbedion, 2023). Edo State comprises three senatorial zones—Edo North, Edo Central, and Edo South—covering 18 Local Government Areas (LGAs). The state has a tropical climate with distinct wet (April–October) and dry (November–March) seasons, receiving annual rainfall of 1500–2000 mm, which supports cassava cultivation (Okoror et al., 2019). Cassava is a major crop in the state, grown by smallholder farmers for both subsistence and commercial purposes, with significant contributions from both male and female farmers (Eweka & Egbedion, 2023). The state's agricultural landscape, characterized by small farm sizes (averaging 1–2 ha) and reliance on traditional farming practices, makes it a suitable context for studying gender disparities in productivity and income (Ugorji, 2018).

Fig 1: Map of Edo State showing the Local Government Areas

Sampling Procedure and Data Collection Methods

The target population for this study comprises all smallholder cassava farmers in Edo State. A multi-stage sampling technique was employed to select respondents, as it is suitable for studies covering large geographical areas with heterogeneous populations (Obisesan, 2014). In stage I, all three senatorial zones (Edo North, Edo Central, and Edo South) were purposively selected to ensure state-wide representation and account for variations in agro-ecological and socio-economic conditions (Eweka & Egbedion, 2023). In stage II, two LGAs were randomly selected from each senatorial zone, resulting in six LGAs. Random selection at this stage minimizes bias and ensures representativeness across the zones (Okoror et al., 2019). The selected LGAs include Etsako East and Akoko Edo in Edo North zone, Esan South East and Esan West in Edo Central zone, and Ovia North East and Uhunmwode in Edo South zone. In stage III, from each of the selected LGAs, three communities known for cassava farming were purposively chosen, based on information from local agricultural extension officers, yielding 18 communities (6 LGAs × 3 communities). In stage 4, in each community, 15 cassava farmers (9 males and 6 females) were randomly selected from a list of farmers compiled with the assistance of community leaders and extension agents, ensuring gender balance. This results in a total sample size of 270 farmers (18 communities × 15 farmers). The sample size was determined using the Yamane (1967) formula for finite populations, adjusted for a 95% confidence level and a 5% margin of error, and is deemed adequate for statistical analysis in similar agricultural studies (Olaosebikan et al., 2019).

Primary data were collected using a structured questionnaire and focus group discussions (FGDs). The questionnaires were pre-tested on 20 farmers in a non-sampled community to ensure clarity and reliability, with necessary revisions made before full administration. Trained enumerators, fluent in local languages (Bini, Esan, Afemai and Akoko Edo), administered the questionnaire to ensure accurate responses and to minimize language barriers.

Analytical Techniques

The data were analyzed using a combination of descriptive and inferential statistical methods, aligned with the study's objectives and hypotheses. The analytical techniques include: Gross Margin, Net Farm Income (NFI), Return on Investment and Benefit-Cost Ratio analyses, which were used to assess the profitability of cassava production. Other techniques include Total Factor Productivity (TFP) derived through the Cobb-Douglas production function and Multiple Regression Analysis, and Garrett Ranking analysis employed in ranking constraints faced by male and female cassava farmers in the study area. The hypotheses of the study were tested using t-test.

Gross Margin (GM) is calculated as:

GM = TR – TVC

Where;

GM = Gross Margin

TR = Total Revenue (₦)

TVC = Total Variable Cost (₦)

A positive gross margin indicates profitability.

Net Farm Income (NFI) is calculated as:

NFI = TR − TVC − TFC

NFI = TR − TC

Where,

NFI = Net Farm Income (₦)

TR = Total Revenue (₦)

TVC = Total Variable Cost (₦)

TFC = Total Fixed Cost (₦)

TC = Total Cost (₦)

Rate of Return (ROR) is calculated as:

$$ROR = \frac{NR}{TC}$$

Where,

ROR = Rate of Return (Number)

NR = Net Revenue (₦)

TC = Total Cost (₦)

A positive ROR indicates profitability.

Benefit-Cost Ratio (BCR) is calculated as:

$$BCR = \frac{TR}{TC}$$

Where;

TR = Total Revenue

TC = Total Cost (Variable + Fixed costs).

A BCR > 1 indicates profitability.

The gender gap in productivity was measured as Total Factor Productivity (TFP), it measures the efficiency of inputs conversion into output (cassava yield). In the Cobb-Douglas production function used, TFP was represented by the constant term P in the following equation:

$Y_i = PQ_1^{\gamma_1} Q_2^{\gamma_2} Q_3^{\gamma_3} Q_4^{\gamma_4} Q_5^{\gamma_5} Q_6^{\gamma_6}$

Where:

Y_i = Outputs (cassava yield).

Q_1 = Land size

Q_2 = Labour used

Q_3 = Capital inputs

Q_4 = Cuttings

Q_5 = Agrochemical

Q_6 = Fertilizer

P = TFP

$\gamma_1, \gamma_2, \gamma_3, \gamma_4, \gamma_5, \gamma_6$ = Elasticities of output with respect to each input.

To estimate TFP, the log-transformation of the Cobb-Douglas function for multiple regression is applied:

$LnYi = LnP + \gamma_1 LnQ_1 + \gamma_2 LnQ_2 + \gamma_3 LnQ_3 + \gamma_4 LnQ_4 + \gamma_5 LnQ_5 + \gamma_6 LnQ_6 + e$

Where,

*Ln*P = the intercept, and

e = the error term.

TFP is computed as P = $e^{\wedge LnP}$

Multiple Regression Analysis was used to estimate the parameters ($\beta_1, \beta_2, \beta_3, \beta_4, \beta_5, \beta_6$*Ln*P) via Ordinary Least Squares (OLS).

The null hypothesis (i) that cassava production is not profitable was tested using a one-sample t-test to compare the mean NFI against zero.

The null hypotheses (ii) and (iii): of no significant difference in productivity and income between male and female farmers was tested using independent samples t-tests to compare mean TFP and NFI across genders.

Garrett Ranking analysis was employed in ranking constraints faced by male and female cassava farmers. Constraints were rated on a 5-point scale (1 = very severe, 5 = not severe) and ranked based on Garrett scores to identify the most critical barriers for each gender group.

Henry Garrette percentage score is as calculated:

$$\text{Percentage Score} = \frac{100(R_{ij} - 0.5)}{N_j}$$

Where,

R_{ij} = Rank given for ith Constraint by jth Individual

N_j = Number of Constraints Ranked by jth Individual

RESULTS AND DISCUSSION

Socioeconomic Characteristics of Male and Female Cassava Farmers in the Study Area

Age Distribution: The study revealed that the mean age of male cassava farmers is 39 years, while that of female farmers is 42 years, with the majority of both groups falling within the 25–39 age bracket (48.77% for males, 41.67% for females). This suggests that cassava farming in Edo State is dominated by relatively young and middle-aged individuals, who are typically in their productive years. The slightly older average age of female farmers aligns with findings by Bello et al. (2021), who noted that female farmers in Nigeria tend to be older due to cultural norms that delay women's entry into independent farming until after family responsibilities stabilize. Younger male farmers may reflect greater access to resources like land and credit, enabling earlier engagement in farming (Eweka & Egbedion, 2023).

Marital Status: A high proportion of both male (75.31%) and female (74.07%) farmers are married, indicating that cassava farming is a family-oriented activity supporting household livelihoods. Married farmers often benefit from pooled household labour, as noted by Okoror et al. (2019), but women may face additional domestic burdens that limit their farming efficiency (Olaosebikan et al., 2019). The similarity in marital status across genders suggests comparable household structures, yet gender disparities in resource access persist.

Household Size: The mean household size is 4 for both genders, with most households having 1–3 members (37.65% for males, 41.67% for females). Smaller household sizes may limit available family labour, particularly for women who rely more on family labour due to restricted access to hired labour (Teeken et al., 2018). This finding contrasts with Nwaiwu (2018), who reported larger household sizes in Abia State, suggesting regional variations in household dynamics affecting labour availability.

Education Level: Male farmers have higher educational attainment, with 29.01% having tertiary education compared to 17.59% for females. Conversely, 20.37% of females have no formal education compared to 11.11% of males. Education influences technology adoption and productivity, as educated farmers are more likely to adopt improved varieties and practices (Obisesan, 2014). The educational disparity observed here corroborates Bello et al. (2021), who found that lower education levels among female farmers in Nigeria contribute to their lower productivity.

Farming Experience: Males have a mean farming experience of 11 years, higher than females' 7 years, indicating greater longevity in cassava farming among men. Experience enhances farming efficiency through accumulated knowledge (Okoror et al., 2019). The shorter experience among females may reflect delayed entry into farming due to socio-cultural constraints, as noted by Olaosebikan et al. (2019).

Land Access: A stark gender disparity exists in land ownership, with 53.70% of males owning land compared to only 19.44% of females, who rely more on rented (44.44%) or gifted land (36.11%). Limited land ownership among women, driven by patriarchal inheritance norms, restricts their farm size and investment in long-term improvements (Academic Journals, 2015; Madu, 2020). This aligns with Eweka and Egbedion (2023), who highlighted land access as a critical barrier for female farmers in Edo State.

Cooperative Membership: Males are more likely to belong to cooperative groups (69.14%) than females (38.89%). Cooperatives provide access to credit, inputs, and markets, enhancing productivity (Chijioke et al., 2021). Lower female participation may stem from time constraints or exclusionary group dynamics, as reported by Teeken et al. (2018).

Access to Credit: Males have greater access to credit (54.32%) than females (36.11%). Credit access enables investment in inputs like fertilizers and labour, which boost productivity (Bello et al., 2021). The gender gap in credit access, also noted by Olaosebikan et al. (2019), reflects institutional biases and women's limited collateral due to restricted land ownership.

Farm Size: Males cultivate larger farms (mean 1.5 ha) than females (mean 1 ha). Larger farm sizes correlate with higher output and income, as observed by Nwaiwu (2018). Women's smaller farm sizes are linked to limited land access and capital, constraining their scale of production (Madu, 2020).

Extension Contact: Both genders have limited extension contact, with 56.17% of males and 64.81% of females reporting no contact per month. Extension services are critical for technology dissemination, and their scarcity disproportionately affects women, who have less access to alternative information sources (Obisesan, 2014; Teeken et al., 2018).

The socioeconomic profile reveals structural gender disparities in education, land access, credit, and cooperative membership, which likely contribute to differences in productivity and income. Addressing these gaps requires targeted interventions, such as gender-responsive extension services and land tenure reforms (Chijioke et al., 2021).

Table 4.1: Socioeconomic Characteristics of Respondents

	Male		**Female**		**Pooled**	
Characteristics	**F**	**P (%)**	**F**	**P (%)**	**F**	**P (%)**
Age (Years)						
< 25	31	19.14	17	15.74	48	17.78
25 – 39	79	48.77	45	41.67	124	45.93
40 – 55	33	20.37	31	28.70	64	23.70
> 55	19	11.73	15	13.89	34	12.59
Total	**162**	**100**	**108**	**100**	**270**	**100**
Mean	**39**		**42**		**40**	
Marital status						
Married	122	75.31	80	74.07	202	82.5
Unmarried	40	24.69	28	25.93	68	17.5
Total	**162**	**100**	**108**	**100**	**270**	**100**

Household size						
1 - 3	61	37.65	45	41.67	106	39.26
4 - 6	57	35.19	37	34.26	94	34.81
>6	44	27.16	26	24.07	70	25.93
Total	**162**	**100**	**108**	**100**	**270**	**100**
Mean	**4**		**4**		**5**	
Level of Education						
None	18	11.11	22	20.37	40	14.81
Primary	35	21.60	31	28.70	66	24.44
Secondary	62	38.27	36	33.33	98	36.30
Tertiary	47	29.01	19	17.59	66	24.44
Total	**162**	**100**	**108**	**100**	**270**	**100**
Cassava Farming Experience (Years)						
<5	41	25.31	31	28.70	72	26.67
6 – 10	55	33.95	39	36.11	94	34.81
11 – 20	49	30.25	27	25	76	28.15
>20	17	10.49	11	10.19	28	10.37
Total	**162**	**100**	**108**	**100**	**270**	**100**
Mean	**11**		**7**		**10**	
Land Access						
Owned	87	53.70	21	19.44	108	40
Rented	33	20.37	48	44.44	81	30
Gifted for a Period	42	25.93	39	36.11	81	30
Total	**162**	**100**	**108**	**100**	**270**	**100**
Membership of cooperative group						
Yes	112	69.14	42	38.89	154	57.04
No	50	30.86	66	61.11	116	42.96
Total	**162**	**100**	**108**	**100**	**270**	**100**

Access to Credit facilities						
Yes	88	54.32	39	36.11	127	47.04
No	74	45.68	69	63.89	143	52.96
Total	**162**	**100**	**108**	**100**	**270**	**100**
Farm Size (ha)						
<1	62	38.27	51	47.22	113	41.85
1 – 4	90	55.55	54	50	144	53.33
>4	10	6.17	3	2.78	13	4.81
Total	**162**	**100**	**108**	**100**	**270**	**100**
Mean	**1.5**		**1**		**1.3**	
Extension Contact per Month						
None	91	56.17	70	64.81	161	59.63
1 – 2	63	38.88	36	33.33	99	36.67
>2	8	4.94	2	1.85	10	3.70
Total	162	100	108	100	270	100
Mean	**0.7**		**0.4**		**0.6**	

F = Frequency, P = Percentage

Source: Computed from field survey data (2025),

Average Cost and Return of Male and Female Cassava Farmers in the Study Area

Cost Structure: The total cost of cassava production is higher for females (₦473,466) than males (₦422,193), driven by higher variable costs (₦388,701 vs. ₦347,929) and fixed costs (₦84,765 vs. ₦74,264). Labour constitutes the largest variable cost for both genders (47.67% for males, 49.36% for females), reflecting the labour-intensive nature of cassava farming (Okoror et al., 2019). Females incur higher labour costs (₦233,719 vs. ₦201,239), possibly due to greater reliance on hired labour, as women often lack sufficient family labour (Olaosebikan et al., 2019). Higher fixed costs for females, particularly land rent (9.95% vs. 7.97%), stem from their limited land ownership, forcing reliance on rented land (Eweka & Egbedion, 2023).

Revenue and Profitability: Males generated higher total revenue (₦705,532) than females (₦689,509), despite females' higher costs. Consequently, males achieve a higher gross margin (₦357,603 vs. ₦300,808) and net farm income (NFI) (₦283,339 vs. ₦216,043). The benefit-cost ratio (BCR) is 1.67 for males and 1.46 for females, indicating profitability for both but greater financial efficiency for males. The rate of return (ROR) is also higher for males (0.67 vs. 0.46). These findings align with Nwaiwu (2018), who reported higher profitability among male cassava farmers in Abia State due to larger farm sizes and better resource access. The lower profitability for females reflects their higher production costs and constrained market access (Madu, 2020).

Gender Disparity: The income gap of ₦67,296 in favour of males is consistent with Bello et al. (2021), who found a 20–30% income disparity in Nigerian agriculture due to women's limited access to inputs and markets. Women's higher costs, particularly for labour and land rent, reduce their profitability, underscoring the need for cost-reducing interventions like subsidized inputs or cooperative labour arrangements (Chijioke et al., 2021).

Generally, cassava production is profitable for both genders, but males benefit more due to lower costs and higher revenue. Policies to enhance female farmers' profitability should focus on reducing input costs, improving market access, and addressing land tenure constraints (Eweka & Egbedion, 2023).

Table 4.2: Average (Mean) Cost and Return of the Respondents

	Male		**Female**		**Pooled**	
Item	**Amount (₦)**	**Percentage of Total Cost (%)**	**Amount (₦)**	**Percentage of Total Cost (%)**	**Amount (₦)**	**Percentage of Total Cost (%)**
Variable Inputs Cost						
Cassava Cuttings	54,461	12.89955	55,624	11.7483	54,523	12.40913
Agrochemicals	31,257	7.403486	29,331	6.19495	30,962	7.04678
Fertilizer	26,221	6.210667	30,146	6.36709	27,871	6.343285
Labour	201,239	47.66517	233,719	49.3634	211,466	48.12849
Transportation	23,258	5.508855	27,017	5.70622	24,982	5.685765
Miscellaneous	11,493	2.722215	12,864	2.71698	11,878	2.703367
Total Variable Cost (TVC)	**347,929**	82.40994	**388,701**	82.0969	**361,682**	82.31682
Fixed inputs		0		0		0
Interest on loans	15,361	3.638383	13,751	2.90433	14,980	3.409365
Rent on Land	33,657	7.971946	47,123	9.95277	38,361	8.730751
Depreciation on Assets	25,246	5.97973	23,891	5.04598	24,355	5.543063
Total Fixed Cost (TFC)	**74,264**	**17.59006**	**84,765**	**17.9031**	**77,696**	**17.68318**
Total Cost	**422,193**		**473,466**		**439,378**	
Total Revenue	**705,532**		**689,509**		**699,389**	
GM (TR - TVC)	**357,603**		**300,808**		**337,707**	
NFI (GM - TFC)	**283,339**		**216,043**		**260,011**	
ROR	**0.671113**		**0.456301**		**0.591771**	
BCR	**1.671113**		**1.456301**		**1.591771**	

Source: Computed from field survey data (2025)

Total Factor Productivity (TFP) Levels of Male and Female Cassava Farmers in the Study Area

Productivity Levels: The mean TFP is higher for males (1.184) than females (1.098), indicating greater efficiency in converting inputs into cassava output among male farmers. The TFP range is wider for males (0.711–2.295) than females (0.578–1.903), suggesting greater variability in male productivity, possibly due to diverse access to resources. The pooled TFP of 1.142 reflects moderate overall efficiency in Edo State's cassava sector. These results align with Oseni et al. (2015), who reported a 20–30% productivity gap in Nigerian agriculture, attributing it to disparities in input access.

The higher male TFP is likely driven by larger farm sizes (1.5 ha vs. 1 ha), greater access to credit (54.32% vs. 36.11%), and higher cooperative membership (69.14% vs. 38.89%), which facilitate investment in improved inputs like fertilizers and agrochemicals (Bello et al., 2021). Females' lower TFP may also reflect their limited extension contact (0.4 vs. 0.7 visits/month), restricting access to productivity-enhancing technologies (Teeken et al., 2018). Socio-cultural norms, such as women's focus on labour-intensive tasks like processing, may divert effort from yield optimization (Olaosebikan et al., 2019). The productivity gap, though modest (0.086), underscores the need for gender-responsive interventions to boost female farmers' efficiency. Enhancing women's access to extension services, improved varieties, and credit could narrow this gap, as suggested by Chijioke et al. (2021).

Table 4.3: Summary of Result on the Total Factor Productivity (TFP) Levels of the Respondents

State	Observations	Mean TFP	Std. Dev.	Min	Max
Male	162	1.184192	0.5853044	0.7114646	2.294771
Female	108	1.098272	0.4974437	0.5784795	1.902523
Pooled	270	1.14206	0.558609	0.4821931	2.190523

Source: Computed from Field Survey Data (2025)

Garett Ranking of Constraints Faced by Male and Female Cassava Farmers in the Study Area

Table 4.4 presents the Garrett Ranking of twenty-two constraints faced by male and female cassava farmers in Edo State, Nigeria. The results reveal both shared and gender-specific severity, underscoring the complex interplay of economic, social, and institutional factors affecting cassava production.

Lack of Capital (ranked 1st for both genders): Both male (average score: 83.222) and female (average score: 83.815) cassava farmers rank lack of capital as the most severe constraint, with a pooled score of 83.459. This reflects the critical role of financial resources in enabling investments in inputs such as improved cassava cuttings, fertilizers, agrochemicals, and hired labour, all of which are essential for enhancing productivity and profitability (Bello et al., 2021). The high ranking of this constraint aligns with findings by Olaosebikan et al. (2019), who noted that smallholder farmers in Nigeria, particularly those engaged in cassava production, face significant financial barriers due to limited savings and high input costs. For women, the lack of capital is exacerbated by restricted access to collateral, such as land, which limits their ability to secure loans (Madu, 2020). For men, despite better access to resources, the capital-intensive nature of scaling up cassava production (e.g., purchasing processing equipment or expanding farm size) remains a challenge (Eweka & Egbedion, 2023).

Poor Access to Credit Facilities (Ranked 3rd for Males, 2nd for Females): Poor access to credit is a closely related constraint, ranked third by males (score: 80.068) and second by females (score: 83.389), with a pooled rank of 2nd (score: 81.396). The slightly higher severity for females underscores gender disparities in financial inclusion, as women face institutional biases, such as stringent loan requirements or discriminatory lending practices (Teeken et al., 2018). Bello et al. (2021) found that only 36% of female farmers in rural Nigeria accessed credit compared to 54% of males, a trend mirrored in this study (Table 4.1: 36.11% for females vs. 54.32% for males). Limited credit access restricts farmers' ability to invest in productivity-enhancing technologies, such as improved cassava varieties or mechanized tools, perpetuating low yields and incomes (Chijioke et al., 2021). For males, credit constraints may reflect broader systemic issues, such as high interest rates or inadequate rural banking infrastructure, as noted by Okoror et al. (2019).

Lack of Improved Farming Technologies (Ranked 2nd for Males, 3rd for Females): Both genders rank lack of improved farming technologies highly, with males assigning it the second position (score: 80.179) and females the third (score: 82.546), resulting in a pooled rank of 3rd (score: 81.126). This constraint reflects limited access to modern agricultural practices, such as high-yielding cassava varieties, mechanized tools, or precision farming techniques, which are critical for boosting productivity (Bello et al., 2021). Teeken et al. (2018) highlighted that Nigerian cassava farmers, particularly women, face challenges in adopting improved varieties due to inadequate extension services and high costs of certified planting materials. The slightly higher severity for females may stem from their lower extension contact (0.4 visits/month vs. 0.7 for males, Table 4.1), limiting exposure to new technologies (Olaosebikan et al., 2019). For males, the constraint may reflect the high cost of mechanization or insufficient government support for technology dissemination, as noted by Eweka and Egbedion (2023). The focus on improved technologies aligns with findings from the NextGen Cassava project, which emphasized the need for gender-responsive breeding to develop varieties that meet both agronomic (male-preferred) and processing (female-preferred) traits (Chijioke et al., 2021). The high ranking of this constraint underscores the need for targeted interventions, such as subsidized distribution of improved cuttings or training programs on modern farming techniques, to enhance adoption rates (Madu, 2020).

Lack of Government Support (Ranked 5th for Males, 4th for Females): Lack of government support is a significant barrier, ranked fifth by males (score: 78.426) and fourth by females (score: 78.778), with a pooled rank of 4th (score: 78.567). This constraint encompasses inadequate policy interventions, limited subsidies, and weak institutional frameworks for supporting smallholder farmers (Eweka & Egbedion, 2023). Okoror et al. (2019) noted that cassava farmers in Edo State face challenges due to insufficient government investment in rural infrastructure, such as roads and processing facilities, which disproportionately affects women who rely on local markets. For females, the higher ranking may reflect their greater dependence on public programs, such as input subsidies or extension services, which are often male-biased in delivery (Olaosebikan et al., 2019). Males, with better access to private resources, may perceive government support as less critical but still essential for scaling up production (Bello et al., 2021).

The high ranking of this constraint highlights the need for gender-responsive agricultural policies, such as those advocated by Chijioke et al. (2021), which prioritize women's access to subsidies, training, and market linkages. Strengthening government support through public-private partnerships could also address systemic gaps in the cassava value chain (Madu, 2020).

Scarcity and Poor Access to Land (Ranked 10th for Males, 5th for Females): A notable gender disparity exists in the ranking of land access, with females assigning it a higher severity (score: 78.676, 5th) than males (score: 76.043, 10th). This reflects socio-cultural norms in Edo State that restrict women's land ownership through inheritance, forcing them to rely on rented (44.44%) or gifted land (36.11%), as shown in Table 4.1 (Academic Journals, 2015; Madu, 2020). Limited land access constrains women's farm size (mean 1 ha vs. 1.5 ha for males) and their ability to invest in long-term soil improvements,

reducing productivity (Bello et al., 2021). For males, who own land at a higher rate (53.70%), this constraint is less severe but still relevant due to land fragmentation or competing land uses (Eweka & Egbedion, 2023). The high ranking by females underscores the need for land tenure reforms to promote equitable access, as advocated by Olaosebikan et al. (2019).

High Cost of Farm Labour (Ranked 13th for Males, 7th for Females): Females rank the high cost of farm labour higher (score: 77.685, 7th) than males (score: 75.216, 13th), reflecting their greater reliance on hired labour due to limited family labour availability (Olaosebikan et al., 2019). Women's higher average labour costs (₦233,719 vs. ₦201,239, Table 4.2) further exacerbate this constraint, reducing profitability (Madu, 2020). Males, with larger household sizes or better access to cooperative labour, may mitigate labour costs, as noted by Okoror et al. (2019). This gender disparity highlights the need for labour-saving technologies, such as mechanized planters or harvesters, to reduce women's labour burden (Chijioke et al., 2021).

High Post-Harvest Losses (Ranked 4th for Males, 10th for Females): Males rank high post-harvest losses higher (score: 78.494, 4th) than females (score: 76.917, 10th), possibly due to larger production volumes requiring better storage and processing facilities (Okoror et al., 2019). Post-harvest losses, caused by inadequate storage or delayed processing, reduce marketable output and income (Eweka & Egbedion, 2023). Females, with smaller farm sizes, may experience lower absolute losses, but their limited access to processing equipment still poses challenges (Teeken et al., 2018). Investments in affordable storage and processing technologies could address this constraint for both genders (Bello et al., 2021).

Lack of Processing and Storage Facilities (Ranked 6th for Both Genders): Both males (score: 77.340) and females (score: 78.463) rank lack of processing and storage facilities as the sixth most severe constraint, with a pooled score of 77.789. This reflects the critical role of post-harvest infrastructure in adding value to cassava through products like garri or fufu (Chijioke et al., 2021). Women, who dominate processing activities, are particularly affected by the high cost or unavailability of equipment, as noted by Olaosebikan et al. (2019). Males, with larger farms, may also face challenges in processing bulk harvests efficiently (Okoror et al., 2019). The shared ranking underscores the need for investments in rural processing hubs to enhance value addition and reduce losses (Madu, 2020).

Poor Extension Service Delivery (Ranked 9th for Both Genders): Both males (score: 76.870) and females (score: 77.370) rank poor extension service delivery as the ninth constraint, with a pooled score of 77.070. The low extension contact (59.63% of farmers report none, Table 4.1) limits access to training on improved practices, reducing productivity (Teeken et al., 2018). Women, with fewer alternative information sources, are disproportionately affected, as noted by Bello et al. (2021). Strengthening extension services through gender-sensitive approaches, such as female extension agents, could address this barrier (Chijioke et al., 2021).

High Cost of Transportation (Ranked 12th for Both Genders): Transportation costs are ranked 12th by males (score: 75.432) and females (score: 75.954), with a pooled rank of 13th (score: 75.641). Poor rural road infrastructure increases transport costs, limiting market access and profitability (Eweka & Egbedion, 2023). This constraint affects both genders similarly, as cassava's bulky nature requires efficient transport to urban markets (Okoror et al., 2019). Infrastructure investments could alleviate this barrier (Madu, 2020).

Poor Access to Markets and Fluctuating Produce Prices (Ranked 18th for Males, 16th for Females): Market access is ranked lower by males (score: 73.086, 18th) and females (score: 74.546, 16th), with a pooled rank of 17th (score: 73.670). While less severe than financial or technological constraints, limited market access and price volatility reduce income stability (Bello et al., 2021). Women, with lower bargaining power, may face greater exploitation by middlemen, as noted by Olaosebikan et al. (2019). Market linkages through cooperatives could enhance farmers' bargaining power (Chijioke et al., 2021).

Environmental and Security Issues: Constraints like flooding (20th pooled rank), drought/fire outbreaks (22nd), and soil degradation (21st) are ranked lower, suggesting that environmental challenges are less immediate than economic barriers. However, insecurity and herders' menace (10th pooled rank) is more severe for males (8th) than females (13th), possibly due to men's larger farms being more exposed to conflicts (Eweka & Egbedion, 2023). These issues, while secondary, still warrant attention through climate-resilient practices and security measures (Bello et al., 2021).

Table 4.4 Garett Ranking of Constraints Faced by the Respondents and their Ranks the Study Area

S/N		Male			Female			Pooled		
		Scores			Scores			Scores		
	Constraints	Total	Average	Rank	Total	Average	Rank	Total	Average	Rank
1	Lack of (or inadequate) capital	13,482	83.222	**1st**	9,052	83.815	**1st**	22,534	83.459	**1st**
2	Poor access to credit facilities	12,971	80.068	**3rd**	9,006	83.389	**2nd**	21,977	81.396	**2nd**
3	Poor extension service delivery	12,453	76.870	**9th**	8,356	77.370	**9th**	20,809	77.070	**9th**
4	Lack/high cost of improved cassava varieties	12,513	77.241	**7th**	8,385	77.639	**8th**	20,898	77.400	**7th**
5	High cost of transportation	12,220	75.432	**12th**	8,203	75.954	**12th**	20,423	75.641	**13th**
6	Lack of improved farming technologies	12,989	80.179	**2nd**	8,915	82.546	**3rd**	21,904	81.126	**3rd**
7	Insecurity and herders' menace	12,454	76.877	**8th**	8,195	75.880	**13th**	20,649	76.478	**10th**
8	Poor access to markets and fluctuating produce price	11,840	73.086	**18th**	8,051	74.546	**16th**	19,891	73.670	**17th**
9	Theft of produce	11,792	72.790	**19th**	7,943	73.546	**18th**	19,735	73.093	**19th**
10	High post-harvest losses	12,716	78.494	**4th**	8,307	76.917	**10th**	21,023	77.863	**5th**
11	High cost of farm labour	12,185	75.216	**13th**	8,390	77.685	**7th**	20,575	76.204	**11th**
12	High cost of cuttings	11,971	73.895	**16th**	8,117	75.157	**14th**	20,088	74.400	**15th**
13	Scarcity and poor access to land	12,319	76.043	**10th**	8,497	78.676	**5th**	20,816	77.096	**8th**
14	Lack of technical expertise	11,920	73.580	**17th**	7,872	72.889	**20th**	19,792	73.304	**18th**
15	Pest and disease infestation	12,099	74.685	**14th**	7,934	73.463	**19th**	20,033	74.196	**16th**
16	High cost of fertilizers and agrochemicals	12,252	75.630	**11th**	8,292	76.778	**11th**	20,544	76.089	**12th**
17	Lack of irrigation facilities	12,053	74.401	**15th**	8,106	75.056	**15th**	20,159	74.663	**14th**
18	Lack of processing and storage facilities	12,529	77.340	**6th**	8,474	78.463	**6th**	21,003	77.789	**6th**
19	Lack of government support	12,705	78.426	**5th**	8,508	78.778	**4th**	21,213	78.567	**4th**

20	Flooding of farm land	11,710	72.284	**21st**	7,945	73.565	**17th**	19,655	72.796	**20th**
21	Drought and Fire outbreaks	11,601	71.611	**22nd**	7,740	71.667	**22nd**	19,341	71.633	**22nd**
22	Soil pollution and degradation	11,791	72.784	**20th**	7,792	72.148	**21st**	19,583	72.530	**21st**

Source: Computed from field survey data (2025)

Result of the t-test of Profitability of Cassava Farmers in the Study Area

The one-sample t-test result (t = 28.4439, p < 0.0000) rejects the null hypothesis that cassava production is not profitable, with a mean NFI of ₦260,011. The positive NFI and 95% confidence interval (₦121,412 to ₦301,586) confirm that cassava farming is financially viable in Edo State. This aligns with Okoror et al. (2019), who found cassava to be a profitable crop in Edo South due to its high demand and versatility. The BCR of 1.59 (Table 4.2) further supports profitability, as values above 1 indicate a positive return on investment (Eweka & Egbedion, 2023). The confirmed profitability underscores cassava's role as a livelihood cornerstone in Edo State. However, the wide confidence interval suggests variability in profits, likely due to gender disparities and resource constraints, necessitating policies to stabilize incomes (Chijioke et al., 2021).

Table 4.5: Result of the t-test of Profitability of Cassava Farmers in the Study Area

Variable	**Obs.**	**Mean**	**Std. Err.**	**Std. Dev.**	**[95% Conf.**	**Interval]**
NFI	270	260,011	9,459.05	155,428.1	121,412.3	301,586.3
mean = mean(NFI)	Ha: mean < 0		Ha: mean != 0		Ha: mean > 0	
Ho: mean = 0	Pr(T < t) = 1.0000		Pr(|T| > |t|) = 0.0000		Pr(T > t) = 0.0000	
t =28.4439						
df = 269						

Source: Computed from field survey data (2025)

Result of the Two-sample t-test of the Difference in Income of Male and Female Cassava Farmers in the Study Area

The two-sample t-test result (t = 0.2282, p = 0.7371) fails to reject the null hypothesis of no significant difference in income between male and female cassava farmers, despite males having a higher mean NFI (₦283,339 vs. ₦216,043). The difference of ₦67,296 is not statistically significant, possibly due to high variability in incomes (std. Dev. ₦84,245 for males, ₦55,428 for females). This contrasts with Bello et al. (2021), who found significant income gaps in Nigerian agriculture, suggesting that contextual factors in Edo State, such as similar market access or crop focus, may moderate income disparities. The lack of statistical significance may reflect overlapping income distributions, as both genders face similar constraints like capital scarcity (Table 4.4). However, the practical difference in NFI aligns with Nwaiwu (2018), who noted higher male incomes due to larger farm sizes and better resource access. While the income gap is not statistically significant, the economic disparity warrants attention. Interventions to boost female incomes, such as market linkages and credit access, could enhance equity (Madu, 2020).

Table 4.6: Result of the Two-sample t-test of the Difference in Income of Male and Female Cassava Farmers in the Study Area

Group	**Obs.**	**Mean NFI**	**Std. Err.**	**Std. Dev.**	**[95% Conf. Interval]**	
Male	162	**283,339.00**	6,618.94	**84,245.31**	226,270.30	341,574.42
Female	108	**216,043.00**	5,333.57	**55,428.11**	198,332.71	296,343.61
Pooled	270	260,011.00	9,459.05	155,428.10	121,412.30	301,586.30
Diff		67,296.00	1,285.37		27,937.59	45,230.81
diff = mean(Male) - mean(Female)						
Ho: diff = 0						
t = 0.2282						
Ha: diff < 0			Pr(T < t) = 0.5766			
Ha: diff != 0			Pr(|T| > |t|) = 0.7371			
Ha: diff>0			Pr(T > t) = 0.4322			

Source: Computed from Field Survey Data (2025)

T-test of the Difference in the Productivity Levels of Male and Female Cassava Farmers in Edo State, Nigeria

The two-sample t-test (t = 0.2738, p = 0.8276) fails to reject the null hypothesis of no significant difference in productivity between male and female farmers, despite males having a higher mean TFP (1.184 vs. 1.098). The difference of 0.086 is not statistically significant, possibly due to high variability (std. Dev. 0.585 for males, 0.497 for females). This finding contrasts with Oseni et al. (2015), who reported significant productivity gaps in Nigeria, suggesting that Edo State's cassava sector may have unique dynamics, such as similar access to basic inputs or agro-ecological conditions.

The non-significant gap may reflect the shared reliance on traditional farming practices or the moderating effect of women's focus on high-value processing tasks (Teeken et al., 2018). However, the practical difference in TFP aligns with Bello et al. (2021), who linked male productivity advantages to resource access. The lack of statistical significance does not negate the need to address the productivity gap. Enhancing women's access to improved varieties and extension services could close this gap, boosting overall cassava output (Chijioke et al., 2021).

Table 4.7: Result of the Two-sample t-test of the Difference in the Productivity Levels of Male and Female Cassava Farmers in the Study Area

Group	**Obs.**	**Mean TFP**	**Std. Err.**	**Std. Dev.**	**[95% Conf. Interval]**
Male	162	1.184192	0.0459859	0.5853044	1.116313 1.252251
Female	108	1.098272	0.1543078	0.4974437	1.001399 1.193582
Pooled	270	1.14206	0.0339959	0.558609	1.117507 1.214906
Diff		0.08592	-0.1083219		0.114914 0.05867

diff = mean(Male) - mean(Female)

Ho: diff = 0

t = 0.2738

Ha: diff < 0	Pr(T < t) = 0.5862
Ha: diff != 0	Pr(|T| > |t|) = 0.8276
Ha: diff>0	Pr(T > t) = 0.4538

Source: Computed from Field Survey Data (2025)

Summary

This study investigates gender gaps in cassava farming productivity and income in Edo State, Nigeria, using a cross-sectional survey of 270 smallholder farmers (162 males, 108 females) across three senatorial zones. Data were collected via structured questionnaires and focus group discussions, with a multi-stage sampling technique ensuring representativeness. Analytical methods included gross margin, net farm income (NFI), benefit-cost ratio (BCR), total factor productivity (TFP) via Cobb-Douglas production function, and Garrett Ranking for constraints, with t-tests for hypothesis testing. Findings confirm cassava production's profitability (mean NFI: ₦260,011, BCR: 1.59, p < 0.0000), driven by high demand and versatility. Males outperform females in income (₦283,339 vs. ₦216,043) and productivity (TFP: 1.184 vs. 1.098), but differences are not statistically significant (p = 0.7371 for income, p = 0.8276 for productivity), likely due to income variability and shared reliance on traditional practices. Socioeconomic characteristics reveal males have better education (29% tertiary vs. 17.59% for females), land ownership (53.7% vs. 19.44%), and credit access (54.32% vs. 36.11%). Major constraints include lack of capital, poor credit access, and limited improved technologies, with females facing heightened barriers in land access and labour costs. These findings highlight structural gender inequalities. Recommendations include gender-responsive interventions like microfinance, land reforms, and enhanced extension services to address disparities, improve productivity, and support rural livelihoods in Edo State's cassava sector.

Conclusion

The study revealed that cassava production in Edo State, Nigeria, is a profitable venture, with a mean net farm income (NFI) of ₦260,011 and a benefit-cost ratio of 1.59, reflecting its critical role in rural livelihoods. However, gender disparities persist, as male farmers achieve higher incomes (NFI: ₦283,339 vs. ₦216,043) and productivity (TFP: 1.184 vs. 1.098) than females, driven by better access to resources like land (53.7% ownership vs. 19.44%), credit (54.32% vs. 36.11%), and education (29% tertiary vs. 17.59%). Females face higher production costs, particularly for labour and land rent, which reduce their profitability. Key constraints, including lack of capital, poor credit access, and limited improved technologies, affect both genders, but women face additional barriers like restricted land access and high labour costs. These findings highlight structural inequalities rooted in socio-cultural norms and institutional biases, consistent with prior research. Addressing these gaps requires gender-responsive interventions, such as microfinance programs, land tenure reforms, and enhanced extension services targeting women, to boost their productivity and income. By improving

access to resources and infrastructure, Edo State can enhance cassava sector efficiency, promote gender equity, and support food security and poverty alleviation, aligning with broader agricultural development goals.

Recommendations

The following recommendations are proposed, based on the findings of this study:

i. Promotion of Microfinance Access: Collateral-free microfinance programs targeting female farmers should be implemented to address capital scarcity and poor credit access, enhancing investment in inputs.

ii. Enhancing Extension Services: Gender-responsive extension services with female agents should be deployed to increase women's access to training on improved varieties and practices.

iii. Supporting Land Tenure Reforms: Policies aim at ensuring equitable land access for women should be implemented to address socio-cultural barriers to ownership.

iv. Subsidizing Inputs and Technologies: Subsidies for improved cassava cuttings, fertilizers, and labour-saving tools should be provided, prioritizing female farmers to boost productivity.

v. Improving Rural Infrastructure: There should be investment in rural roads and processing hubs to reduce transportation costs and post-harvest losses, benefiting both genders.

vi. Strengthening Cooperative Membership: Women's participation in cooperatives should be encouraged to enhance access to credit, inputs, and markets.

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