

## Nexus between value addition in maize and empowerment of rural women: evidence from Osun state, Nigeria

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### Abstract

Women often involved in the processing and marketing of maize products. Yet, they are usually marginalized and lack access to resources that can help them improve their livelihoods. Therefore, we, assessed value addition in maize and empowerment of rural women in Osun state, Nigeria. Specifically, we identified the quantity produced of maize value-added products and various maize value activities, examined the empowerment status of women and assessed the effect of value addition on empowerment. A purposive sampling method was employed, selecting 5 Local Government Areas with maize farming households. Data were collected from 120 respondents through structured questionnaires and oral interviews, and analysis involved descriptive analysis, empowerment index and Tobit regression. The results indicated that the average monthly income was ₦67,740, and while value-added product revenue was profitable, most didn't exceed ₦100,000. Various maize products were produced, with different production levels and market values. Packaging, roasting, and steaming were the most common value-addition activities. Empowerment analysis revealed that the majority of rural women were not empowered, with limited education and income influencing their status. Tobit regression showed age, total revenue, and years of schooling as significant predictors of empowerment. In conclusion, rural women in Osun State engaged in maize value addition predominantly experience low empowerment levels due to various socio-economic factors. Recommendations include government support for financial, educational, and skill development initiatives and credit facilities. These measures aim to empower rural women and enhance their participation in value addition activities, thereby promoting gender equality and improving their livelihoods.

**Keywords:** Empowerment; value addition; gender equality; rural women; Nigeria.

### 1. Introduction

Maize is an essential cereal crop in Nigeria, the country is one of the largest producers of maize in Africa (Food and Agriculture Organization, 2021). It is a significant source of food and income for smallholder farmers, who account for over 70% of the country's agricultural production (National Population Commission, 2019). Maize production in Nigeria has increased significantly

in recent years, but most of the maize produced is sold in its raw form, limiting the earning potential of smallholder farmers. Value addition is therefore, critical in enhancing the profitability of maize production, as it allows farmers to process and package maize products for sale at higher prices (Oluwole, 2020).

Maize is often processed into various value-added products, such as Cornflakes, Cornmeal, and Corn starch, among others (Akinola, 2020). Other popular value-added products from maize in Nigeria include Maize flour, Beer, Solid gel


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(Eko), Tuwo, Maize ball (Adun), Maize buns (Masa), Popcorn, and Pap (popularly known as Ogi among the south-westerners). Despite the potential benefits of value addition in maize production, many smallholder farmers in Nigeria lack the knowledge and resources to engage in value-addition activities. Rural women, who are often involved in the processing and marketing of maize products, are particularly affected by this challenge. They face various challenges, including limited access to finance, technology, and markets, which limit their ability to add value to maize products and improve their livelihoods (Ogundari & Ojo, 2020). This situation is further compounded by gender-based discrimination and cultural norms that prevent women from fully participating in economic activities (Olawoye & Adekunle, 2020).

Osun State is one of the major maize-producing regions in Nigeria, with a significant proportion of rural women engaged in maize farming and processing (National Bureau of Statistics, 2021). It is a vital source of food and income for many households in the state. However, there is limited information on the level of value addition in maize production and the factors that influence women's empowerment in the sector (World Bank, 2021). Additionally, women who are often involved in the processing and marketing of maize products are usually marginalized or excluded socially and lack access to resources that can help them improve their livelihoods and economic status. This study seeks to address this gap by assessing the level of value addition in maize and empowering rural women in Osun State to enhance their incomes.

This study is undertaken to answer the following research objective:

1. determine the quantity of maize value added products produced;
2. identify the various maize value addition activities carried out;
3. determine the empowerment status of the women;

4. determine the effect of value addition on empowerment status of women in the study area.

## 2. Materials and Methods

### 2.1. Study Area

This study was carried out in Osun state. Osun State is a state in southwest Nigeria that is occasionally referred to as the State of Osun by the state administration. It is bordered to the east by the states of Ekiti and Ondo, to the north by the state of Kwara, to the south by the state of Ogun, and to the west by the state of Oyo. The state was created on August 27, 1991, from the southeast of Oyo State, and is named after the River Osun, an important river that flows through the state. Osogbo serves as the state's capital (Onyeakagbu, 2021).

Osun State is the ninth-smallest and nineteenth-most populous of the 36 states in Nigeria, having a total surface area of roughly 9,251 square kilometres. As of 2016, its estimated population was 4.7 million (National Population Commission, 2019). Geographically, the state is divided between the drier Guinean forest-savannah mosaic in the north and the lowland forests of Nigeria in the majority of the state. The state's interior is split in half by rivers, including the River Osun, which also forms much of the state's southern boundary with Oyo State before flowing south. The Erinle and Oba rivers, which are also Osun tributaries and flow from the north before meeting the Osun around the southwest border, are two other significant rivers.

The Yoruba ethnic group, particularly the Ibolo, Ife, Igbomina, Ijesha, and Oyo subgroups, make up the majority of the population in Osun State. Almost 70% of the population live in rural areas in Osun State, which is primarily rural economically. Rural areas in Osun State are Ikire, Ede, Iwo, Ejigbo, Ila Orangun, Ilesa, Ife, Ode-Omu, Igbajo, Ipetu-Ijesa, Ikirun, Ijebu-Jesa, Gbongan, Ikoyi, Ilase, Oluponna, Erin-Ijesa,

Ilobu, Aagba and Oba-Ile (Olaniyi & Olaniyi, 2017).

Agriculture, particularly the production of cocoa, cassava, millet, maize, potato, and yam crops, is the state's main industry (Oluwole, 2020). Services, particularly in metropolitan areas, artisanal mining, and animal herding are other important businesses.

## 2.2. Sampling techniques and Sample size

A two-stage sampling technique was employed for the selection of respondents which were women in rural areas of Osun State who are involved in the processing and marketing of maize products.

The first (1<sup>st</sup>) stage involved the use of a purposive sampling method which was used to select five (5) Local Government Areas (LGAs) in Osun State. These LGAs were chosen because they predominantly have maize farming households in rural areas. The selection aimed to ensure representation from various maize farming communities within the state.

In the second (2<sup>nd</sup>) stage, a simple random sampling method was employed to select respondents within each of the five (5) selected Local Government Area. The criteria for selection included identifying rural households engaged in maize farming. An average of 20 rural households was selected from each Local Government Area using this method. This process resulted in a total of one hundred and twenty (120) respondents, spread across the five (5) Local Government Areas (LGAs), who met the criteria for inclusion in the study

## 2.3. Method of data collection

Primary and Secondary data were used for this study. The secondary data was gathered from the internet, journals and library. The primary data was gotten from the field through a structured questionnaire and oral interview schedules, to solicit information from the respondents.

## 2.4. Data Analysis

### 2.4.1. Descriptive statistics

was employed to identify the value added products of maize in the study area and the quantity produced, also to identify the various maize value activities carried out in the study area. Descriptive statistics like mean, mode, frequency distribution and percentages were used.

### 2.4.2. The Empowerment Index

is a statistical tool used to measure the empowerment status of individuals or groups. It is a composite indicator that combines different indicators to provide a comprehensive measure of empowerment.

The Empowerment Index is usually calculated by assigning weights to each of the individual indicators and combining them into a single score using a statistical formula. The resulting score provides an overall measure of empowerment that can be used to compare different groups or individuals.

The empowerment index is calculated by summing the products of the normalized indicators and their weights. Indicators could include age, education level, income, level of involvement in maize value-addition activities, and access to resources. The resulting score provides an overall measure of the level of empowerment of the rural women in the study area.

The model is given as follows;

$$\text{Empowerment Index} = \sum (W_i \times S_i) \dots\dots (1)$$

Where;

$\sum$  = Summation of all variables involved

$i$  = Identified indicators

$W_i$  = Weight assigned to each indicator  $i$

$S_i$  = Normalized score of each indicator  $i$  (scaled between 0 and 1)

The empowerment index of the respondents was constructed using the five domains of empowerment (5DE), which shows how empowered women are, capturing the roles and extent of women's engagement in the five domains, namely, Production (decisions over

agricultural production); Resources (access to and decision-making power over productive resources), Income (control over use of income); Leadership (leadership in the community); Time (time use).

**Tobit regression model** was used to analyse the effect of maize value addition on the empowerment status of women in rural areas. The Tobit model is typically expressed as follows;

$$Y^* = X\beta + \epsilon_i \dots \dots (2)$$

The observed dependent variable,  $Y$ , is related to the latent variable,  $Y^*$ , as follows:

$$Y = \{ Y^* \text{ if } Y \text{ is } > 0 \text{ and } 0 \text{ if } Y \text{ is } \leq 0 \}$$

In other words, if  $Y^*$  is positive, we observe  $Y$  as  $Y^*$ ; otherwise, we observe  $Y$  as 0.

Where;

$Y^*$  = It is the dependent variable. It is also the latent (unobserved) variable. In the case of the study it is the empowerment status because it may have upper and/or lower bounds that restrict the range of observed values.

$X$  = matrix of independent variables. These are the predictors or explanatory variables that are associated with the dependent variable. These could include: Age, Education level, Household income etc.

$\beta$  = vector of coefficients to be estimated.

$\epsilon$  = error term, which is assumed to follow a normal distribution.

Equation (2) can be explicitly re-specified as follows:

$$Y^* = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3 + \beta_4 X_4 + \beta_5 X_5 + \epsilon_i \dots (3)$$

Where;

$Y^*$  = empowerment status (1 = empowered, 0 = otherwise)

$\beta_0$  = Constant term (intercept)

$\beta_1 - \beta_5$  = Coefficients

$X_1$  = Age (years)

$X_2$  = Total revenue (naira)

$X_3$  = Marital status (1 = married, 0 = otherwise)

$X_4$  = Years of schooling (years)

$X_5$  = Household size (number)

$\epsilon_i$  = error term

### 3. Results and discussion

#### 3.1. Types of Value Added Products of Maize and the Quantity Produced in the Study Area

The results for the various types of value added products of maize and the quantity produced are presented in Table 1 below

Table 1 shows the various types of value added products processed by the rural women. It reveals that on average, 135 kg of maize flour are produced. This indicates a moderate level of production, and the average revenue generated from this product is ₦4,885. This suggests that while the quantity produced is moderate, it still contributes a reasonable income, indicating a stable market presence. The average production of pap (Ogi) is 87.1 kg. This indicates a relatively lower quantity compared to maize flour. However, the product still generates an average revenue of ₦4,390, suggesting that it has a decent market value. Approximately 105.77 kg of solid gel (eko) are produced on average. This quantity is also moderate, and the product commands a higher average revenue of ₦10,236.67 monthly, it suggests strong market demand and profitability. On average, 198.6 kg of Tuwo are produced. This is one of the higher quantities among the products, and it generates an average revenue of ₦5,355.83. It seems to be both a popular and profitable product. The average production of maize ball (adun) is 39.67 kg, indicating a lower quantity. It yields an average revenue of ₦547.5, suggesting it may be a niche or less common product. Approximately 119.25 kg of boiled maize are produced on average. This is a moderate quantity, and the product generates a substantial average revenue of ₦7,617.0, indicating it has a good market demand. On average, 106.85 kg of roasted maize are produced. This product is also moderately produced and commands a relatively high average revenue of ₦9,560.83, indicating it's both popular and profitable. The average production of donkunnu is 67.66 kg. While the quantity is moderate,

**Table 1.** Quantity Produced from Different Maize Value Addition Products

Different Maize Value Addition products	Average Quantities Produced in Kg	Average Revenue in Naira (₦)
Maize flour	135	4,885
Pap (ogi)	87.1	4,390
Solid gel (eko)	105.77	10,236.67
Tuwo	198.6	5,355.83
Maize ball (adun)	39.67	547.5
Boiled maize	119.25	7,617.08
Roasted maize	106.85	9,560.83
Donkunnu	67.66	3,123.00
Donkwa	29	181.25
Corn chips	34.1	3,131.67
Popcorn	198.5	4,456.25
Maize kernel	288.33	420

Source: Field Survey, 2023

the average revenue is ₦3,123.00, suggesting a decent market value. Approximately 29 kg of donkwa are produced on average, indicating a lower quantity. The average revenue is ₦181.25, suggesting it may cater to a specific market niche. On average, 34.1 kg of corn chips are produced, which is a relatively lower quantity. However, it generates an average revenue of ₦3,131.67, indicating a potentially higher market value. The average production of popcorn is 198.5 kg, making it one of the higher quantity products. It generates an average revenue of ₦4,456.25, indicating that it's both popular and profitable. A substantial average of 288.33 kg of maize kernels are produced. However, the average revenue for this product is lower at ₦420, suggesting it may have a lower market value in the study area.

But bearing in mind that they each weigh differently, due to their different nature and various mode of measurement, which were just converted to kg for the sake of this study.

### 3.2. Various Maize Value Activities Carried Out in the Study Area

The results for various maize value activities carried out in the study area are presented in Table 2 below. Results in Table 2 show that respondents were able to identify 11 maize value addition activities out of which Packaging (50.00%) was the most utilized among them, followed by Roasting (43.86%), Steaming (40.83%), Soaking (17.54%), Storage (15.83%), Popping (15.79%), Frying (15.79%), Milling (11.67%), Sorting/grading (6.67%), Drying (5.0%), Shelling (5.83%).

**Table 2.** Various Maize Value Addition Activities

Maize Value Addition Activities	Frequency	Percentage
Drying	8	6.67
Shelling	7	5.83
Sorting/grading	9	7.50
Packaging	60	50.00
Storage	19	15.83
Milling	14	11.67
Steaming	49	40.83
Others		
Frying	9	15.79
Moulding	4	7.02
Popping	9	15.79
Roasting	25	43.86
Soaking	10	17.54

Source: Field Survey, 2023

This finding indicated that the majority of respondents could only use indigenous value addition techniques, indicating that they had limited knowledge of modern techniques. As a result, there is a need for relevant organizations to intervene in terms of capacity development training programs for maize processors on current techniques, as this has the potential to make the enterprise appealing to the unemployed rural populace.

Most processors use local or indigenous processes that they are familiar with. Lack of utilization of the modern techniques could also be as a result of limited knowledge or lack of necessary equipment and technology (Chikaire and Nnadi, 2011).

### 3.3. Empowerment Status of the Women

The results for the empowerment status of the women in the study area are presented in Table 3 below

**Table 3.** Five Domains of Empowerment and their Corresponding Weights

Domain	Indicator	Score
Production	Input in productive decisions	0.041
	Autonomy in production	0.02
	Ownership of assets	0.042
Resources	Purchase, sale or transfer of assets	0.036
	Access to and decision on credit	0.01
Income	Control over use of income	0.148
Leadership	Group member	0.022
	Speaking in public	0.028
Time	Workload	0.028

The 5 Domains of Empowerment measures how empowered women are in many sectors. "Empowerment" within an area denotes that the individual has acceptable achievements or has "achieved adequacy" in that domain. The weights indicate the relative importance or contribution of each indicator to the overall assessment of empowerment within its respective domain. The table shows that Control over the use of income

emerged the highest with a score of 0.148 indicating it being very important.

According to Alkire *et al.* (2013), an individual is identified as empowered in the 5 Domain of Empowerment if he or she has adequate achievements in half of the five domains or enjoys adequacy in some combination of the weighted indicators that sum to 50 percent or more.

**Table 4.** Summary of Index on Empowerment

Empowerment status	Frequency	Percentage %	Percentage Score	Mean
Low	66	55	< 0.382	0.382
High	54	45	>0.382	0.382

The composite index obtained in the process lie between 0 and 1. The composite score of rural women was classified as low level empowerment (below the mean score) and high level of empowerment (above the mean score). Based on the Percentage and frequency from Table 5, the rural women in the study area are mostly not

empowered, due to the Low empowerment status being higher than the High empowerment status.

### 3.4. Effect of Value Addition on Empowerment Status

The results for the analysis of the effect of value addition on empowerment status in the study area are presented in Table 5 below

Number of observations = 120

Prob > chi<sup>2</sup> = 0.0000

LR chi 2 (5) = 33.04

Pseudo R<sup>2</sup> = 0.9451**Table 5.** Effect of Value Addition on Empowerment Status

Variables	Coefficients	Standard error	t-value	p-value
Age (years)	0.0076426	0.0023628	3.23	0.002 *
Total revenue	2.22e-06	5.575e-07	3.87	0.000*
Marital status	0.0583442	0.495837	1.18	0.242
Years of schooling	0.0105688	0.0038766	2.73	0.007 *
Household size	-0.133648	0.0131311	-1.02	0.311
Constant	-0.14716	0.1125295	-1.31	0.194

\*Statistically significant values at the 0.05 level, Log likelihood = -0.95888626

Table 5 shows that Tobit regression model was used to determine the relationship between value addition and empowerment status in the study area. The index serves as a dependent variable which takes the value of 0 and 1.

The results show that the age variable had a negative and statistically significant coefficient of 0.002, indicating that an increase in the age (years) leads to an increase in empowerment status. The total revenue had a negative and significant coefficient of 0.000, indicating that an increase in the level total revenue leads to an increase in empowerment status as well. The p-value for Years of schooling is 0.007. This indicates that years of schooling have a statistically significant positive effect on empowerment status. As the number of years of schooling increases, empowerment status tends to increase.

In summary, the regression analysis suggests that age, total revenue, and years of schooling are statistically significant predictors of empowerment status, while marital status and household size do not have a statistically significant effect in this model. The model as a whole is highly significant, and it explains a significant portion of the variance in empowerment status, as indicated by the high pseudo R-squared value.

#### 4. Conclusion

The study revealed that, according to the empowerment index, rural women engaged in

maize value addition in Osun state are predominantly not empowered. A significant number of these women have limited formal education, potentially constraining their access to modern value addition techniques and knowledge. Additionally, the processors' relatively low monthly income suggests the importance of exploring avenues to enhance their income potential.

#### Recommendations

Based on the findings of this study, the following recommendations were made:

1. Government policy and extension programs aiming at promoting rural women's welfare and livelihoods should focus on empowering them by providing appropriate financial support, input subsidies, and increased access to land and facilities.
2. There should be availability of credit facilities such as loans. This will enable the rural women to have sufficient capital to finance the maize value-addition enterprise.
3. The government should prioritize education and skills development for rural women in the study area. This investment will empower them with knowledge and abilities essential for active participation in value addition activities, broadening their income opportunities and promoting gender equality.

4. Agricultural extension services should improve efforts by organizing training to facilitate and encourage the diversification of rural women maize producers to improve the overall socioeconomic position of poor households in Nigeria.

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All authors are contributed in this research

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#### Institutional Review Board Statement

All Institutional Review Board Statements are confirmed and approved.

#### Data Availability Statement

Data presented in this study are available on fair request from the respective author.

#### Ethics Approval and Consent to Participate

Not applicable

#### Consent for Publication

Not applicable.

#### Conflicts of Interest

The authors disclosed no conflict of interest.

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