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Relationship between Poverty Intensity and Technical Efficiency among Cassava and Tomato Entrepreneurs in Benue State, Nigeria

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Abstract: *The study engaged the Stochastic Frontier Production Function (SFPF) to analyze the technical efficiency of cassava processing and tomato production enterprises to ascertain poverty intensity among entrepreneurs while simple statistics, gross margin and Foster-Greer-Thorbecke poverty index were used to analyzed profitability of the enterprise and poverty status of the entrepreneurs. A multi-stage sampling technique was used to obtained data from 140 entrepreneurs, drawn from the 70 Cassava Enterprise and 70 from the tomato enterprise using a well-structured and pretest questionnaire. The findings revealed that the respondents' average age was 48.6 and was dominated by male (65%) with household size on the aggregate of eight people. Applying the Logistic regression model, the result showed that 58.3% of the respondents were below poverty margin. The severity of poverty was 63.7% and 54% for cassava and tomato enterprises. The study recommends that the capacities of entrepreneurs should be enhanced especially in the areas of the technical operations such as the use of improved seeds/seedlings and labor measured in terms of technical efficiency is capable of reducing the intensity of poverty among cassava and tomato enterprises. Also government at all levels should create an enabling environment where there will be credit facilities in cash and in kind (inputs) to enable potential and prospective entrepreneurs to thrive well in their chosen line of enterprise.*

Keywords: Benue State, Cassava Processing, Poverty Intensity, Technical Efficiency, Tomato Production

Introduction

Poverty is considered one of the leading challenges in the 21st century (Abimbola and Oluwakemi, 2013). Currently over 90 million Nigerians live in extreme income poverty, which is the highest globally (World Poverty Clock, 2018). The National Bureau of Statistics (2017) further revealed that Benue State is among the twelve poor Northern States in Nigeria. The rural farmers seems to be worst hit going by the report of Simpa (2014) that about 3.1 billion people in rural areas globally are poor with 1.4 billion living in less than 1.25 US dollar per day.

Poverty alleviation cannot be accomplished without the role of the small and medium enterprise (SMEs) in Nigeria. The Federal and State Government in Nigeria have recognized the importance of SMEs in alleviating poverty (Okeke, 2008).The SMEs constitute major avenues for generating income and contributing in economic development, especially among low income earners and rural farmers (Ogunwole, 2001). They provide farmers with steady source of income and improve their purchasing power. The National Council of Industries (2002) views the SMEs sub-sector as capable of creating sustainable job opportunities, wealth and reduce poverty income of Nigeria. The challenge facing developing nations especially Nigeria and Benue State is devising appropriate development strategies that will reduce the high level of poverty through small and medium scale entrepreneurs who contribute about 70% of the population (Olaitan, 2006).

Over 90% of agricultural output comes from farms of less than five hectares (United State Agency for Agricultural Development, 2015) characterizing the sector as predominantly small scale based. Small and Medium Scale Enterprise are the power house for most economics around the world (USAID, 2015). There is need to widen the base of farm business to reduce the high level of poverty. The agriculture is the primary source of livelihood for 70% of Nigeria Population and represents 40% of the gross domestic product. However, the sector is not productive, contributing to poverty, high infant mortality and malnutrition (Adigun et al, 2015).

Against this backdrop, this study was set out to examine the relationship between poverty intensity and technical efficiency of cassava processing and tomato production enterprise in Benue State, Nigeria, thus describing the socio-economy factors of these entrepreneurs, examining their technical efficiency, gross margin and poverty status of the respondent in the study area.

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Methodology/Materials and Methods

Study Area

The study area is Benue State, Nigeria. The State derives its name from River Benue, the largest river in Nigeria. It was created on 3rd February, 1976 along with six other States of the Federation. It lies between latitude 8^0 – 10^0N and between longitudes 6^0 – 8^0E of the equator, at an elevation of 97 meters above sea level in the southern guinea savannah agro-ecological zone. It has landmass of 6.575million hectares (BNARDA, 1988). Benue State has a total population of 4,219,244 (NPC, 2006), and is made up of 413,159 farm families (BNARDA, 1988). The State is bounded by Nasarawa State in the North, Taraba State in the East, Cross-River in the South, Enugu State in the Southwest, Ebonyi State in the South Central, Kogi State at the West and at the East by Cameroon Republic. The State is administratively divided into three zones namely Zone A (Eastern Zone), Zone B (Northern Zone), Zone C (Central Zone) and has twenty three (23) Local Government Areas. There are three prominent ethnic groups in the State namely; Tiv, Idoma and Igede. Other smaller ethnic groups are Etulo, Agatu, Abakpa, Jukun. The Tiv, the most populous, occupy the eastern and western parts of the state. Even though there are variation in norms, language and festivals, the entire population remains predominantly farmers. According to Ministry of Agriculture, Makurdi (1986), the predominant occupation of the people of Benue is farming with over 80 percent engaged in farming and highly noted for substantial cultivation of arable crops like yam, cassava, rice, soyabean, maize and other staples: livestock especially small ruminant are reared extensively in this area. Some are trader while others are fishermen. The main source of livelihood of the people is agriculture, hence the "food basket of the nation". The State has two distinct seasons, dry and rainy seasons. The wet season start in April and ends in November, while the dry season start in December and ends in March. The wet or rainy season, with the mean precipitation of 1500 mm has two peaks May/June and August/September. The dry season also called Harmattan is characterized by North-Eastern winds. These constitute the basis of a wide range of SMEs including cassava and tomato production in Benue State.

Sampling Technique

The population for the study comprised of all participants in the cassava processing and tomato production in Benue State. The sample for the study was drawn using a multi-stage sampling technique. In the first stage, a purposive selection of one Local Government each from the three agricultural zones (Zone A, B and C) of the State was made on the basis of participation; Ukum, Tarka, and Otukpo Local Government Areas respectively.

The second stage involved a random selection of five farming villages from each of the selected Local Government Areas giving a total of fifteen villages. The third stage involved a selection of 35% from Ukum Local Government Area (25 cassava entrepreneurs and 25 tomato entrepreneurs), 30% from Tarka LGA (20 represent from each enterprise) and 35% from Otukpo LGA (25 cassava entrepreneur and 25 tomato entrepreneurs respectively) to arrive at the targeted population of 140 entrepreneurs from the selected Local Governments. The selection thus produced 70 entrepreneurs each drawn from the cassava and tomato enterprise, to obtain a sample space of 140 respondents for the study.

Data and Analytical Technique

Data for this study was collected from primary source. The primary data were collected from cassava and tomato enterprise using a well-structured protested and validated questionnaire. The questionnaires contained all the necessary information of the participants in the study area. Both descriptive and parametric tools of analysis were used. The descriptive statistics such as mean, percentage, tables, frequency distribution were used for the socioeconomic characteristics, while the Cobb Douglas and transcendental logarithmic functional form using the stochastic frontier production function was used in estimating the technical efficiency of the farmers, gross margin and Foster-Geer-Thorbecke (FGT) poverty index were used to analyze profitability of the enterprise and poverty status of the entrepreneurs respectively.

Stochastic Production Frontier Model

This according to Ogundari and Ojo (2006) has been used by many empirical studies relating developing countries since Nigeria whose higher population is engaged in agricultural production.

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The Cobb-Douglas Model estimated was defined by

$LnY = \beta_o + \beta_1 l_n X_1 + \beta_2 l_n X_2 + \beta_3 l_n X_3 + \beta_4 l_n X_4 + \beta_5 l_n X_5 + (V_i - V_i)$

Where Ln = Natural Logarithm to Base e

Y = Output of the ith Farmers (in kg) represents the unknown Parameter associated with the β_o- β_i (Regression Coefficient) explanatory variables in the production function (i=O, 1,2,3,4,5).

Y = Total quantity produce in kg

β_o = Constant terms

β_1 = (1-5) vector of the parameter to be estimated

X_1 = Amount of tubers (cassava enterprise), quantity of seed (tomato enterprise)

X_2 = Labour in Mondays (cassava) and farm size in ha (tomato enterprise).

X_3 = amount of firewood (cassava) and fertilizer (tomato enterprise)

X_4 = Amount of water used in litres (cassava) and labour (tomato enterprise).

X_5 = Quantity of palm oil in litres (cassava) and agrochemicals (tomato enterprise).

V_i = Random errors, that are assumed to be independently and identically distributed by the U_i.

U_i = Non negative random variable associated with technical inefficiency of production which are assumed to be independently distributed, such that obtained by truncation (at zero) of normal distribution with varianceσ^2 and mean U_i where the mean is defined by:

Ui = $\delta_0 + \delta_1 Z_{1i} + \delta_2 Z_{2i} + \delta_3 Z_{3i} + \delta_4 Z_{4i} + \delta_5 Z_{5i} + \delta_6 Z_{6i}$

Where

δ is a (6 x 1) vector of unknown parameters to be estimated

Z_1 = is age of SME holder

Z_2 = is the gender of the respondent

Z_3 = is educational level of the participant

Z_4 = is the years of experience

Z_5 = is household size

Z_6 = is loan/credit facilities

Transcendental Logarithmic (Translog) function form of the stochastic frontier is stated as follows:

$LnY = \beta_o + \beta_1 l_n X_{1i} + \beta_2 l_n X_{2i} + \beta_3 l_n X_{3i} + \beta_4 l_n X_{4i} + \beta_5 l_n X_{5i} + \beta_6 (l_n X_{1i})^2 +$

$\beta_7 (l_n X_{2i})^2 + \beta_8 (l_n X_{3i})^2 + \beta_9 (l_n X_{4i})^2 + \beta_{10} (l_n X_{5i})^2 + \beta_{11} (l_n X_{1i} l_n X_{2i} l_n X_{3i}$

$l_n X_{4i} l_n X_{5i} + V_i - U_i)$

Where the variables are as explained above.

Technical Efficiency

Technical efficiency is embedded into equations linking SMEs output to resources inputs on one hand and SMEs output to inefficiency model. Inefficiency effects are linked with age of farmers, educational level, years of experience, income level, household size and expenditure among others.

Inefficiency Frontier Model

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Explicitly the inefficiency frontier model is expressed as:

$Yi = exp\ (X_i\beta + V_i - U_i)$

X = a (1 x k) Vector of Production inputs of the ith farm

β = a (k x 1) Vector of unknown parameters to be estimated

V_i = random error which assumed to be normally distributed with zero mean and variance σ i.e N (0, σ).

U_i = are non negative random variable which are associated with technical inefficiency and are assumed to be independently distributed of the V_i, they are obtained by truncation (at zero) of the normal distribution (Coelli and Battese, 1996).

The inefficiency effect U_i is specified as $U_i = \sigma Z_i + W_i$ where (1 x m) is vector of firm specific variables which may vary over time.

σ (m x 1) Vector of unknown coefficient of the farm specific inefficiency variables.

Technical efficiency is defined as $(TE) = {}^{Y}i/_{Y}*$ which is the ratio of the observed output, Y_i to the corresponding stochastic frontier output, Y*where $Y^* = \exp(X_i\beta + V_i)$ Technical efficiency (TE) is further define as

$TE = f(X_i\beta)\ \exp(V_i - U_i)/f(X_i\beta)\ \exp(V_i) = exp(-\mu)$

Technical efficiency firms are those that operate on the production frontier and the level by which a farm lies below its production frontier is regards as measure of technical inefficiency.

Battese and Coelli (1996) suggest that this quantity can be predicted by using its conditional expectation, given the composed random errors $(V_i - U_i)$ evaluates at the maximum livelihood estimates of the parameters of the model.

Gross Margin Analysis

Gross Margin (GM) = Value of enterprise output – variable costs

GM = TR – TVC

Where GM = Gross Margin,

TR = Total Revenue,

TVC = Total Variable Costs.

This was calculated for each enterprise (cassava and tomato) selected for this study.

Foster-Greer-Thorbecke (FGT) Poverty Model

The study adopted the FGT (1984) class of poverty measure which represents the level of income below which household and individual are considered to be poor. The FGT measure is defined as:

$$P\alpha = \frac{1}{N}\sum_{i=1}^{q}\left[\frac{y_i}{z}\right]^{\alpha}$$

Where

N = Total number of respondents

Yi = Income

Ɛ = Number of respondents with income less than Z

α = Poverty Aversion Parameter Index which falls on the value of 0, 1 and 2 representing incidence of poverty (Foster et al, 1984). The measure relates to different dimensions of the incidence of poverty. If α = 0, the FGT becomes

$$P_o = \frac{1}{N}q = \frac{q}{N}$$

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which is the proportion of the population that falls below the poverty line. This is called head count or incidence of poverty.

If α = 1, FGT becomes

$$P1 = \frac{1}{N}\sum_{i=1}^{q_z}\left[\frac{-\ y}{z}\right]^1$$

If α = 1, FGT becomes

$$P2 = \frac{1}{N}\sum_{i=1}^{q_z}\left[\frac{-\ y}{z}\right]^2$$

The FGT measure corresponds to other measures of poverty for particular values of α. For α = 0, the formula reduces to

$$P\alpha = \frac{H}{N}$$

Which is the Headcount ratio, or the fraction of the population which lives below the poverty line.

If α = 1, then the formula is

$$P2 = \frac{1}{N}\sum_{i=1}^{q_z}\left[\frac{-\ y\,i}{z}\right]$$

which is the average poverty gap, or the amount of income necessary to bring everyone in poverty right up to the poverty line, divided by total population. This can be thought of as the amount that an average person in the economy would have to contribute in order for poverty to be just barely eliminated.

While the two above versions are widely reported, a good deal of technical literature on poverty uses the α = 2 version of the metric (Foster et al, 1984):

If α = 1, FGT becomes

$$P\alpha = \frac{1}{N}\sum_{i=1}^{q_z}\left[\frac{-\ yi}{z}\right]^2$$

As in this form, the index combines information on both poverty and income inequality among the poor.

The higher the FGT Statistic, the more poverty there is in an economy (Maurice, 2003). The use of poverty line depends on the use of the so called P. alpha measure in analyzing poverty.

Poverty Indices

The measures relate to different dimensions of the incidence of poverty, P_0, P_1 and P_2 defined as:

P_o = Head Count/Incidence: This counts the number of people with expenditure/income below the poverty line.

P_1 = Depth of Poverty: This is the percentage of expenditure/income required to bring each individual below the poverty line up to the poverty line.

P_2 = Severity of Poverty: This is indicated by giving larger weight to the extremely (core) poor. It is done by squaring the gap between their expenditure/income and the poverty line to increase its weight in the overall poverty measure.

The Regression Model

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Following Adeniyi and Ojo (2013) was used to estimate the relationship between agricultural productivity (Technical efficiency estimates) and poverty alleviation (Poverty Intensity $P_1$and Gross Margin GM). The functional forms are specified thus:

Linear:

$$P1 = b_o + b_1 + TE$$

$$GM = b_o + b_1 + TE$$

Quadratic:

$$P1 = b_o + b_1 + TE + b_2TE^2$$

$$GM = b_o + b_1 + TE + b_2TE^2$$

Cubic:

$$P1 = b_o + b_1 + TE + b_2TE^2 + b_3TE^3$$

$$GM = b_o + b_1 + TE + b_2TE^2 + b_3TE^3$$

Where PI = Poverty Intensity $\frac{(Z-Yi)}{Z}$ as adopted by Etim and Patrick (2010).

TE = Technical Efficiency estimate of the respondents

GM = Gross Margin of the respondents

Table 1: Socio-Economic Characteristics of Cassava and Tomato Entrepreneurs in Benue State.

ITEM	CASSAVA (MEAN)	TOMATO (MEAN)
Age (Year)	43.9	51.0
Sex: Percentage Female	5.7	25.7
Sex: Percentage Male	94.3	74.3
Marital Status: Single	21.4	17.1
Marital Status: Married	54.3	52.9
Marital Status: Divorced	15.0	11.4
Marital Status: Widower	7.0	18.6
Education: Non Formal	27.1	62.9
Education: Primary	30.0	31.4
Education: Secondary	30.0	5.7
Education: Tertiary	12.9	-
Experience (Year)	12.1	17.1
Annual Expenditure (₦)	51,586	58,314
Household Size (No)	6.8	9.3
Labour (Mean)	6,809	17,567
Farm Size (Mean)	-	1.2
Annual Income (₦)	98,680	141,510

Source: Field Survey 2021

Table 1 presents the summary of the socio-economic attributes of the respondents in the study area. The results showed that greater percent of the respondents in all the enterprise were within age limit of 41-60 years, accounting for about 62.9 percent (cassava processing), 62.9 (tomato enterprise) respectively. This result implies that cassava and tomato entrepreneurs were in their active and productive age. This result agrees with the findings of Ogunwole (2001) that the mean age of farmers in Nigeria is between 45-48 years. The analysis of gender distribution of the respondents revealed that, majority of the respondent (70%) were male. The result clearly showed that the SME is dominated by the male folks. The reason attributed to this male dominance is due to cultural belief in the study area that what a married woman own is the property of the husband, thus ascribing SMEs to males as a mark of submission. This could also be attributed to the fact that most of the SMEs are strenuous and labor intensive that are fitted for men. On the basis of marital status, majority of the entrepreneurs, 54.3% as 52.81 for cassava and tomato enterprise were married, implying that both enterprises were run simultaneously by both members of the family. This is in agreement with the

members of Groh et al (2021) who reported that both male and female reached household in rural villages were engaged in small farm business.

Results on the basis of educational attainment showed that 58.3% of cassava entrepreneurs had non-formal education and have being in the business for average of 12 years. This will likely not aid the farmers in poverty reduction as education enhances innovation and productive use of inputs for better productivity. The result further indicates that 12.9% of cassava enterprise attained tertiary education. This implies that, the entrepreneurs of the cassava enterprise were more educated. This could be attributed to the fact that, cassava processing units are mostly metropolitan and electricity dependent in nature and as such requires more educated and skilled personnel to man the operations of the processing units unlike the tomato enterprise. Expenditures incurred on the basis of enterprise as expressed by entrepreneurs revealed an annual average expenditure of ₦51, 886 and ₦58,314 for cassava and tomato enterprise. The average household size of the entrepreneurs was 7 and 9 respectively. This suggests that labor will be readily available due to high household size among the respondents. The findings collaborates those of Bashir et al (2013) reported that the pasture relationship between household size, productivity and poverty. On the average, labor involvement was 6,801 and 17,567 man-days for cassava processing and tomato production enterprises. The high used of labor in tomato production enterprise explained its seasonality nature that demands intensive use of manual labor to meet up the production target and season unlike tomato enterprise.

The analysis of farm size was only applicable to tomato production enterprise and was indicated that, 67.1% of the respondents had form size of less than or equal to two hectares. The mean income from cassava and tomato enterprise was ₦98, 640 and ₦141, 510 respectively.

Gross Margin (GM) Analysis

Table 2: Summary Statistics of Gross Margin Earned (Naira per Amount)

ITEM	CASSAVA (MEAN)	TOMATO (MEAN)
Tubers (Cost/Amount)	18,864	NA
Firewood (₦/Annum)	1,156	NA
Cost of Palm Oil (₦/Annum)	370	NA
Grating (₦/Annum)	2,211	NA
Labour (Month-Days)	9,662	7,631.3
Cost of seed per (₦/Annum)	NA	1,643.7
Cost of Fertilizer HA (₦/Annum)	NA	8,075.0
Cost Agrochem. per HA (₦/Annum)	NA	715,37
TVC	32,664	18,065
TR	44,623	31,781
Gross Margin	**13,359**	**13,716**

Source: Field Survey 2021

The values indicate the average cost productive input in a production year. NA: Not available

The gross margin analysis for cassava processing enterprise was made on a ton basis while that of tomato enterprise was on hectare basis. The results of the data for cassava processing enterprise as shown in table 2 revealed that, the total variable cost of processing a unit ton of processed cassava (garri) was ₦32,664 while the total revenue that accrued to the industry was ₦45,623 ton, culminating in a gross margin of ₦13,359. This result shows that most of the costs incurred in cassava processing were borne from procurement of cassava tubers (₦8, 864) and labor (₦9, 662).

The Gm analysis for tomato enterprise revealed that the enterprise achieved a total revenue of ₦31,781 on a hectare basis with a total variable cost of ₦18,065 incurred from labor used (₦7,631.3), cost of seed (₦1,643), fertilizer (₦8,075) and other agrochemicals. The result showed that most of the costs incurred were on labor and fertilizer, which suggest unavailability or high cost of these productive inputs.

Stochastic Production Function for Cassava and Tomato Enterprise in Benue State

Table 3: Maximum Livelihood Estimates of Parameters in the stochastic production frontier model of the respondents

VARIABLE	COEFFICIENT CASSAVA	COEFFICIENT TOMATO

Constant	4.57 (4.69)	3.69 (4.98)
Ln Labour (Mondays)	0.16 (2.48)	0.008 (0.11)
Ln Seed (kg)	NA	0.06 (0.81)
Ln Farm Size	NA	0.21 (8.66)
Ln Fertilizer (kg)	NA	-0.005 (-0.090)
Ln Agrochemicals (Litres)	NA	0.19 (10.96)
Ln Tubers	0.15 (1.85)	NA
Ln Firewood	-0.15 (-0.72)	NA
Ln Water Used (Litres)	-0.04 (-0.21)	NA
Ln Palm Oil (Litres)	0.03 (0.98)	NA

Source: Field Survey, 2021, t-text significance at 1%, 5% and 10% level respectively values in parenthesis represent t-ratios. NA: Data not available

VARIABLE	COEFFICIENT CASSAVA	COEFFICIENT TOMATO
Constant	3.87 (1.14)	-0.16 (-0.16)
Ln Age	-1.98 (-2.04)	0.06 (0.24)
Ln Sex	3.03 (4.90)	-0.17 (-2.11
Ln Education	-0.08 (-0.91)	0.001 (0.04)
Ln Farming Experience	-0.82 (-1.04)	0.008 (0.08)
Ln Household Size	0.63 (1.00)	1.18 (7.17)
Ln Loan	0.02 (0.92)	-0.04 (-5.34)
Sigma Square	0.47 (2.54)	0.05 (4.76)
Gamma	0.87 (14.4)	0.99 (257.6)
Log Livelihood Function	-20.752	36.27

Note: ** and * indicate 1% level and 5% levels respectively. Values in parenthesis represent t – ratio.

The maximum livelihood estimates of the Cobb-Douglas Stochastic production frontier model are presented in table 3. The result showed the presence of technical inefficiency among entrepreneurs of cassava and tomato enterprise in Benue State. This was evident by the Livelihood Ratio (^) and the Significance of Gamma (Y) in the two SMEs (0.87 and 0.83) for cassava and tomato enterprises which were all significant at 1% level.

This implies that the dominance of one-sided random inefficient components in the measurement error and other random disturbance indicating that 87% and 83% variation in actual output from the maximum output (production frontier) among the SMEs mainly arose from difference in entrepreneurs' practices and management peculiar to their respective enterprise rather than random variability.

Elasticity and Return to Scale

The individual coefficients of the explanatory variables in the Cobb-Douglas Stochastic Frontier Model represent the elasticity of labor, cassava tubers, quantity/amount of firewood, water and quantity of palm oil used with respect to cassava processing and labour, seed, fertilizer, agrochemicals as applicable to the output from tomato enterprise. The sum of respective coefficients of Cobb Douglas production frontier indicates the nature of the return to scale.

Inefficiency Model

The result of the inefficiency model presented in table 3 revealed that the determinants of technical efficiency in enterprise showed age (-1.98) was significant at 5% ($P \geq 0.05$) for cassava enterprise. Sex of the entrepreneurs was significant among cassava and tomato enterprises (3.03 and -0.17 respectively). It implies that the older the age of the entrepreneurs, the higher his technical efficiency as its evidence in the case of cassava enterprise. This confirms the apriori expectation that the older the entrepreneur, the higher the experience in the enterprise thus leading to enhanced efficiency.

The results on gender revealed that increasing participation of male farmers reduce technical efficiency among cassava processor, but increases the technical efficiency among tomato enterprise. This implies that women involvement in garri (cassava processing) will increase the technical efficiency of the enterprise. The effect of household size loan was visible among tomato enterprise as it was significant at 5%. The findings

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corroborates those of Asogwa and Umeh (2012) who revealed that loan contribute to household income and would lead to increased farm production and consequently improved the wellbeing of the entrepreneurs.

Household Poverty Incidence among Cassava and Tomato Enterprise in Benue State

Table 4: Summary of Poverty Statistics of the Respondents among SMEs in Benue State

VARIABLE	ENTREPRENEURS' HOUSEHOLDS		
Poverty Indices	**Non-Poor**	**Poor**	**Total/Mean**
Recommended per capital expenditure (E) = N23,733.00 (NBS, 2005)			
Household Heads	80 (40%)	120 (60%)	200 (100%)
Sex: (i) Male (ii) Female	63 17	97 23	146 34
Age of households (yr)	45.45	48.56	46.42
Household size (adjusted to adult equivalent)	6.0	10.0	8.0
Household Annual Income (₦)	193,688	165,450	179,569
Household Daily Income (₦)	311.47	234.11	272.79
Total Expenditure (₦)	167,815	120,546	144,182
Average Household per capital expenditure(₦)	25,798.15	12,054.9	18,926.53
Poverty Index (Z)			
Mean Expenditure	167,815	120,549	144,182
Standard deviation	17,972.53	89,293	107,265.52
Households per capital expenditure	25,798.15	12,054.90	18,926.53
Standard deviation	1,460.28	8,257.66	4,858.97
Surplus/short fall index (P)	1,087	0.507	0.797
Standard deviation	0.0615	0.3486	0.2051
Headcount ration (H/N)	0.4	0.6	1

Source: Field Survey, 2021

Table 5: Household's Incidence of Poverty

Primary Occupation	Frequency	Percentage (%)	Incidence of Poverty (P_0)	Poverty Gap (P_1)	Severity of Poverty (P_2)
Cassava	46	23.0	0.657	0.647	0.637
Poultry	35	17.5	0.583	0.574	0.566
Tomato	39	19.5	0.557	0.549	0.540
Mean	60	20	0.599	0.590	0.581

Source: Field Survey Analysis, 2021

The result showed a clear dichotomy between the non-poor and poor respondents using the 1 US Dollar a day as a benchmark (National Bureau of Statistics, 2017).

The result in table 4 revealed that 80 (40%) of the respondents on aggregate from the two enterprises were well-up (non-poor) above the poverty line, while 120 (60%) were poor. Based on Sex segregation, 63 males and 17 females were above the poverty line (non-poor) while 97 and 23 females were considered poor.

The household size, adjusted to adult equivalent of 6.0 was for the non-poor entrepreneurs and 10.0 for the poor entrepreneurs. The daily per capital income for the non-poor was N311.47 and N234.11 for the poor entrepreneur. The surplus index (p) for non-poor entrepreneurs was 0.0615 (6.15%), indicating that non-poor entrepreneurs were spending about 6.15% above minimum expenditure requirement per household.

The incidence of poverty, Po was found to be 65.7% for the cassava enterprise and 55.7% for the tomato enterprise as shown table 5. This indicated that the poor entrepreneurs were below poverty line by 65.7% and 55.7% thus implying that cassava enterprise was able to lift 34.3% out of poverty likewise the tomato enterprise was able to lift 44.3% out of the poverty. The result is in consonance with the finding of (Federal Office of Statistics 1999) that "region where agriculture is the main occupation have high poverty incidence". The depth of poverty, P1 which is the percentage required to bring the poor to the poverty line was 0.64% and 0.549 for cassava and tomato enterprise respectively. Finally, the severity of poverty P2 showed that poverty was severe to the magnitude of 63.7% and 54.0% for cassava and tomato enterprise.

Table 6: Relationship between Gross Margin and Technical Efficiency among Tomato Enterprise

Variable	Linear Coefficient	Quadratic Coefficient	Cubic Coefficient
Constant	-27325.78 (-2.63)	-15670.15 (-0.26)	-18069.74 (-0.43)
TE	64538.49* (4.92)	33767.63 (0.21)	4615.81 (0.56)
TE^2	-	19800.74 (0.20)	0.00 (-0.54)
TE^3	-	-	9972.41 (0.23)
F	24.23*	11.96*	12.00
R^2	0.26	0.263	0.263

Note: ** and *indicate 1% level and 5% levels respectively. Values in parenthesis represent t – ratio. Dependent Variable = Gross Margin

Influence of Technical Efficiency on Gross Margin on Cassava and Tomato Entrepreneurs

The result of the maximum livelihood estimates of the parameters in the regression equation for cassava entrepreneurs revealed that the cubic functional form fitted the data for cassava enterprise better with r^2 of 0.64 while the functional model, fitted data for tomato enterprise better (r^2 = 0.26).This implies that about 64% and 26% of variations in the Gm of cassava and tomato entrepreneurs respectively was a result of changes in the entrepreneurs technical efficiency. Furthermore, the coefficient of TE for both enterprise was positive and statistically significant (p=0.05). This showed that as the technical efficiency of these entrepreneurs increases, the produce closer to their production frontier (maximum output) and hence increase in their Gm.

Table 7: Relationship between Poverty Intensity and Technical Efficiency among Cassava Entrepreneurs

Variable	Linear Coefficient	Quadratic Coefficient	Cubic Coefficient
Constant	0.86 (4.34)	-0.31 (-0.92)	0.60 (0.50)
TE	-0.96* (-3.94)	3.16* (3.03)	-2.97 (-0.38)
TE^2	-	-3.24* (-4.04)	7.71 (0.56)
TE^3	-	-	-5.86 (-0.79)
F	15.52	17.65	11.91
R^2	0.19	0.35	0.35

Note: ** and *indicate 1% level and 5% levels respectively. Values in parenthesis represent t – ratio. Dependent Variable = Poverty Intensity PI = $\frac{(Z-Y)}{Z}$

Table 8: Relationship between Poverty Intensity and Technical Efficiency among Tomato Enterprises

Variable	Linear Coefficient	Quadratic Coefficient	Cubic Coefficient
Constant	-1.01 (-2.87)	-0.11 (-0.06)	-0.40 (-0.28)
TE	1.26* (2.81)	-1.12 (-0.21)	0.04 (0.01)
TE^2	-	1.53 (0.45)	0.00 (0.10)
TE^3	-	-	-0.66** (-2.10)
F	7.91	4.01**	4.01**
R^2	0.104	0.107	0.107

Note: ** and *indicate 1% level and 5% levels respectively. Values in parenthesis represent t – ratio. Dependent Variable = Poverty Intensity PI = $\frac{(Z-Y)}{Z}$

Influence of Technical Efficiency on Poverty Intensity

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The result of maximum livelihood estimates of parameter showing the influence of TE on Poverty Intensity (Z) of Cassava and Tomato Enterprise revealed that the quadratic and cubic functional form were chosen as the lead equation for cassava and tomato enterprise respectively based on the goodness of fit with an r^2 (0.35 and 0.11), as well as the b's conformation to the a priori expectation of the variable.

The result further showed that TE was negative and statistically significant at 1% and 5% for cassava and tomato enterprises. This implies that with a decrease in TE, the poverty intensity of the entrepreneur increases, hence taking the entrepreneurs deeper in poverty. On the other hand, increase in TE will reduce their poverty intensity.

Conclusions and Recommendations

The study had obtained scientific evidence on the relationship between poverty intensity and technical efficiency among cassava and tomato entrepreneurs in Benue State, Nigeria with a view of reducing the intensity of poverty among cassava and tomato SMEs. The study concluded that the greatest problem confronting cassava and tomato enterprise in Benue State is poverty incidence which is considered high thus creating poverty gaps among entrepreneurs.

The inherent poverty which expresses itself in terms of lack of fund, low return to investment, high cost of productive resources, non implementation of research findings and policies by the government.

The study further concludes that increase in technical efficiency will reduce significantly poverty intensity of cassava and tomato entrepreneurs. In the like manner, this will increase the gross margin which will bring about profitability and equally reduce the intensity of poverty among the enterprises. The study recommends that the capacities of entrepreneurs should be enhanced especially in the areas of technical operations such as the use of improved seedlings and labor. Government at all levels should create an enabling environment where there will be credit facilities in cash and in kind (inputs) to enable potential and prospective entrepreneurs to thrive well in their chosen line of enterprise.

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