A Logistic Regression Analysis of Poverty Status among Cassava Processors and Marketers in Benue State, Nigeria.

Joseph Fefa,[a] Christopher O. Obute[b]

[a] Department of Economics, Benue State University, P.M.B. 102119, Makurdi, Benue State, Nigeria.
josephfefa@gmail.com

[b] Department of Economics, Benue State University, P.M.B. 102119, Makurdi, Benue State, Nigeria.
coobute@yahoo.com

Abstract. This study examined the poverty status among cassava processors and marketers in Benue State, Nigeria. The vicious circle of poverty and unbalanced growth theory were adopted for this study. A survey design was used to obtain cross-sectional data through questionnaires, focused group discussions (FGDs) and oral interviews. The research adopted the multistage random and purposive sampling techniques and obtained a sample size of 380.The study used descriptive statistical tools, Foster-Greer-Thorbecke (FGT) Index and logistic regression to analyze the data for this research. The study found that cassava processing and marketing provided income for sampled respondents which helped them in accessing basic needs of life. The study also showed that processing and marketing of cassava in Benue State was faced with several constraints such as lack of modern processing equipment; high cost of processing due to high cost of improved technologies; high transport cost of tubers from production areas to processing centres; lack of credit for processors; and poor access roads in transporting cassava products to market centres among others. The study recommended the following based on findings that there should be provision of improved technologies for processing and infrastructural support for the rural areas; provision of microfinance institutions that could be a source of credit to small-scale rural cassava processing units; development of rural infrastructure such as access roads to enhance accessibility of processors to market centres for sale of their products; government should provide modern processing technologies in key cassava production zones to help convert large quantity of tubers to processed products; extension agents should be employed to train processors on the use and adoption of modern technologies among others.

Keywords: Poverty, Cassava Processing and Marketing, Income, Logistic Regression

1 INTRODUCTION

The poverty situation in Nigeria is quite severe. Both the qualitative and quantitative measurements attest to the growing incidence and depth of poverty in the country (NBS, 2004; Okunmadewa, 2002). Recent evidence from the National Bureau of Statistics (NBS) supports the fact that poverty in Nigeria is on the increase.

According to NBS (2010), the national poverty rate of Nigeria increased from 28.1 per cent in 1980 to 54.4 per cent in 2004, and 69.0 per cent in 2010. In addition, the UNDP report of 2009 estimated the Human Poverty Index (HPI) value of Nigeria at 36.2 per cent, ranking the country 114 out of 135 countries measured. This implies that Nigeria is becoming poorer with the passage of time.

To underscore the international concern for this problem, the United Nations declared 1996 as the "International Year for the Eradication of Poverty". Also, October 17 each year has been set aside as "International Day for the Eradication of Poverty" worldwide. The decade 1997 – 2006 was also declared "United Nations Decade for Eradication of Poverty". In Nigeria, both the government and civil societies have become increasingly aware of the poverty problem. Successive Nigerian governments made several efforts to alleviate poverty, apparently with limited success as the depth and severity of the problem are still at their worst (Hammer and Nasehold, 2000; Barbier, 2000; Okunmadewa, 2002). Poverty in Nigeria is a paradox considering the vast human and physical resources that the country is endowed with. It is even more disturbing given the huge human and material resources that have been devoted to poverty reduction by successive governments. Hence, the need to establish a framework/measure of poverty reduction that can take care of the socio-cultural and economic peculiarities of the target group has become a necessity.

Benue State is predominantly agrarian and poor. The state therefore requires a carefully targeted agricultural strategy to address the problem of poverty. According to Ekpebu (2002), about 80 per cent of the population of Benue State is directly involved in agriculture, producing varieties of food and cash crops like yams, cassava, rice, beniseed, soybeans, mango, and citrus among others. In spite of the fact that Benue State is naturally endowed, the State's poverty indices are quite disturbing, poverty has been on the increase, with 21% extremely poor and 39% moderately poor in 1996, and only a small fraction of 36% are able to meet basic human needs and save (BENSEEDS, 2004). Although there is paucity of data on the current poverty status of the state, evidence suggests that poverty is growing, as the state is classified among the poorest states in Nigeria with more people living in extreme poverty than the national average. The National Consumer Survey (2007) cited in Fefa (2012) which analysed of poverty by state using the 36 states structure and Federal Capital Territory (FCT) ranked Benue State the 13th poorest state with poverty incidence of 64.2%. NBS (2012) confirmed this by placing the incidence of poverty in Benue at 73.1 per cent in 2010.

For poverty reduction programmes in Benue State to yield the desired results, they should be based on agriculture. This, however, depends on the value chain of the crops being produced and their relative importance to incomes and expenditures of households. Olomola (2007), in analyzing the value chain of cassava, cotton, maize, rice, soybeans and sugarcane industries, placed cassava third after rice and maize based on operating profit. In terms of yield, cassava is far ahead of other crops. It is observed that cassava is a competitive commercial agricultural crop with attendant benefits to its farmers, processors, marketers and consumers.

No doubt, cassava is produced, processed, marketed and consumed in Benue State of Nigeria. But there is a dearth of information about the extent of opportunities for enhanced income generation that exist in cassava processing and marketing. The basic question that arises is: to what extent have cassava processing and marketing contributed to household poverty reduction in Benue State in terms of improved income generation?

It is against this background that the paper seeks to investigate the opportunities that cassava processing and marketing present to generating income in the face of worsening poverty among households in Benue State.

The major objective of this study was to examine the contribution of cassava processing and marketing to poverty reduction in Benue State of Nigeria. The specific objectives of the study were to:

i. examine the extent to which cassava processing and marketing have contributed to income generation for households to enhance poverty reduction in Benue State; and

ii. identify major constraints on cassava processing and marketing in Benue State.

2 CONCEPTUAL LITERATURE

2.1 Concept of Poverty?

A review of the massive literature on poverty shows that there is no standard definition of poverty because of its multidimensional nature as well as its dynamic properties. In the words of Aboyade (1995) cited in Fefa (2012), "Poverty is like an elephant, it is more easily recognized than defined". But as Anyanwu (1997) points out, any study of poverty must begin with a definition of poverty in order to provide a focus by which one can determine the limits of understanding.

Most economists define poverty as a situation of low income or low consumption (Obadan, 1997), while some adopt a broader definition such as being unable to meet basic material needs, encompassing food, water, clothing, shelter, education, health as well as basic non-material needs including participation, identity, dignity among others (Ali and Thorbecke, 1998; Romer, 2005). Specifically, the pioneers in this field of inquiry defined poverty as a situation where the income of families was insufficient to obtain the minimum necessities for the maintenance of physical efficiency (Ravallion, 1994). This definition has been refined and extended such that it forms the background for the basic needs approach to the study of poverty. It was in this context that the concept of absolute poverty emerged.

2.2 Cassava Processing

The transformation of cassava processing from the traditional food crop to an industrial raw material complements the shift of cassava production from as a low-yielding, famine-reserve crop, to a high-yielding cash crop. However, the rate of cassava processing does not match the rate of its production in Nigeria (Oke, 2005). Inadequate investment in cassava processing has therefore led to a glut of the crop in the market (Osibo, 2007 in Fefa, 2012). Evidence from Southeast Nigeria, shows that high root yields attained through the adoption of improved cassava varieties would not have a substantial cost-saving advantage under manual processing technology (Nweke and Enete, 1999). It is therefore necessary to mechanize the processing of cassava especially into products such as chips, pellets, flour, pancakes, adhesives, alcohol, and starch, which are vital raw materials in the livestock, feed, alcohol/ethanol, textile, confectionery, wood, food and soft drinks industries. These products are also tradeable in the international market.

Cassava processing operations in Nigeria may be categorized into 5 levels of capacity, namely, household (or cottage), micro, small, medium, and large. Household level processing typically does not employ outside labour, and the household consumes virtually all of the processed products and sells a small amount to raise additional income to meet household needs. At present, most Nigerian processors fall within this category. At the level of micro processing capacity, the

employment of one or two labourers may take place as it involves processing various varieties of cassava products. The small and medium processing operations typically employ three to ten workers, and are very sparse at present. Large scale cassava processing enterprises employ 10-30 or more labourers, and have capacities for large tonnage processing and marketing opportunities. These are virtually non-existent in Nigeria. It is important to note that medium to large-scale cassava processing equipment and fabricators of such equipment are few in Nigeria. However, the staple food, *gari* is the only product that is currently able to push cassava processing industry from traditional to semi-mechanized status. In a survey of the Root and Tuber Expansion Programme (RTEP), respondents in 25 of the 36 states in Nigeria indicated a level of awareness of semi-mechanized equipment such as graters, pressers, and fryers that could be used for *gari* processing (FMARD, 2000; IITA, 2004).

2.3 Cassava Marketing

International trade in cassava is highly organized, with well-established channels of distribution and pricing systems. The world cassava market revolves around the export and import of cassava products – major exporters being: Thailand, Indonesia, China and Vietnam, all exporting cassava chips, cassava pallets, cassava starch and cassava flour. Today, Thailand is the largest exporter of cassava products, accounting for about 94% of the world's total export of cassava products in 2000 (FAO, 2004).

The most cassava product- importing countries are the EU nations, China, Japan, South Korea, Indonesia and the United States. As at 1997, the top six cassava product importers were: The Netherlands, Spain, China, Belgium, Luxembourg, and South Korea. Indonesia, however, displaced South Korea in 2000 from the first position as the highest importer by importing about 1.04 million tonnes as against 0.42 million tonnes in 1999, the EU imported 6.9 million tonnes of cassava products in 2000. In 1997, the EU and Thailand signed a cooperation agreement, which provided a guide for the volume of import. By this agreement, the volume was put at about 3.5 million tonnes. A 1999 revision of the agreement (1999-2002) sought to regulate access quota and in-quota tariff rates (UNIDO, 2005).

The volume of world trade in cassava increases yearly. For instance, between 1995 and 2004, the world trade volume recorded about 36% increase (i.e. from 6.17 million tonnes to 8.4 million tones.). Despite the increased volume of trade, the international market prices of cassava products remained low, especially when compared to the prices in the early 1990s.

Nigeria is the largest producer of cassava in the world with a current estimated output of 41 million tonnes. Nigeria and the rest of Africa, however, still play a negligible role in the world cassava trade. It is estimated that the total export from Africa and Latin America is only in the order of 400,000 tonnes a year.

2.3 THEORETICAL LITERATURE

The Vicious Circle of poverty and the Unbalanced Growth theories are the major theories adopted for this study. The vicious circle of poverty presupposes that poverty is a serious human problem that is self-perpetuating which, if not properly handled, can become intergenerational as well as capable of affecting prosperity of another person. As noted earlier, Benue State is predominantly agrarian. It has abundant agricultural resources and an overwhelming proportion of the population is engaged in Agricultural activities. Consequently, any result-oriented poverty alleviation programme necessarily has to be based on agriculture so that

development will be communicated to other sectors of the economy. This is the thrust of the unbalanced growth theory of development.

Given the resource constraints in developing countries, the unbalanced growth theory specifies that the key sectors for initial investment should be determined on the basis of industrial backward and forward linkages (Hirschman, 1958). Resources are therefore concentrated on strategic industries with significant forward and backward linkages. Cassava processing and marketing are agro-allied activities with substantial backward and forward linkages which can enhance income generation and employment creation capable of breaking the vicious cycle of poverty in the study area.

2.3 A REVIEW AND EVALUATION OF POVERTY ALLEVIATION PROGRAMMES AND INSTITUTIONS

Efforts at improving the rural areas of Nigeria predated the independence of the country in 1960. The major efforts made in pre-independence and the early days of independent Nigeria according to Omale and Molem (2003) were in the area of farm settlement schemes. The aim of these farm settlements was to bring scattered small communities together so that they could take advantage of economies of scale in farm inputs, agro services, marketing, etc. These schemes largely failed because those affected were not involved at the planning stages. Since then, a number of government programmes have been put in place to improve basic services, infrastructure and housing facilities for the rural population.

Ilori (1999) categorized rural poverty-related programmes into three: development programmes, palliative measures popularly known as the Social Dimension of Adjustment (SDA), and the sector-specific poverty related programmes. Examples of development programmes are: rural electrification schemes; rural banking scheme; and Operation Feed the Nation (OFN) later named Green Revolution. Palliative measures include programmes such as the Directorate of Food, Roads and Rural Infrastructure (DFRRI), the National Directorate of Employment (NDE), Family Support Programme (FSP) the National Agricultural Land Development Programme (NALDA), NEEDS, SURE-P as well as micro credit schemes such as Peoples Bank, and Community Bank among others. All the programmes put together are meant to provide a catalytic impetus for the take-off and subsequent advancement of the rural areas towards:

a) Linking them to national and international economic systems;
b) Increasing rural household income;
c) Providing basic socio-economic and physical infrastructure;
d) Efficient resource allocation to shift attention and interest of the private sector towards investment in rural areas to enhance rural development; and,
e) Enhancing rural welfare.

2.4 PROCESSING AND MARKETING OF CASSAVA AND POVERTY REDUCTION IN NIGERIA

According to FAO (1999), cassava plays a significant role in the global food system. It contributes to the energy and nutrition requirements of more than 2 billion people in developing countries and will continue to do so over the next two decades. Cassava is produced, processed and consumed by many of the world's poorest and most food-insecure households. Cassava processing and marketing constitute an important source of employment and income in rural (and often in marginal) areas, and for women.

Abdullahi (2007) maintained that cassava is an important source of dietary carbohydrates, which provides food for over 60 million people in Nigeria. This implies that cassava production, processing and marketing have a potential to create employment opportunities for the unemployed labour force. This will help to reduce poverty in the country.

NEPAD (2007) observed that cassava is a top fighter of poverty in Nigeria:

> *Cassava is a powerful poverty fighter by driving down the price of food to millions of consumers. For example, in Nigeria, during the rapid diffusion of the IITA's high yielding TMS (Tropical Manioc Selection) cassava varieties from 1984 to 1992, inflation adjusted cassava prices fell sharply by 40 percent from 1971 to 1983.*

This dramatic reduction in the real price of cassava represents a significant increase in the incomes of the millions of the rural and urban households who consume cassava as an important food staple; hence poverty would be reduced.

Cassava's role as a poverty fighter has been demonstrated in Nigeria, where its demand as an industrial raw material is also increasing. This led NEPAD to observe that:

> *Poverty reduction in Nigeria will not be possible success stories (sic) without identifying challenges and recommending strategies for the transformation of the entire cassava sector in Nigeria (NEPAD, Newsletter No. 36, 2007).*

SIGA (2010) observed that cassava which, a few decades ago, a subsistence food for the poor and animals in the tropics has grown to be a crop of high demand for food in several African countries and for use on industrial scale, on such a scale that the production and processing of the crop are now commercialized in many countries. Thus, in addition to providing food for locals, cassava products are being exported to earn foreign exchange for poor exporting countries. Furthermore, the relative ease of production; very high yields; ability to stay underground after maturity for long periods give cassava considerable advantage as a commodity that is being used by poor rural folks in Sierra Leone to fight poverty.

Olomola (2007) observed that the analysis of profitability and value chain indicators of cassava has attracted attention in Nigeria in recent times not only because the commodity is assuming increasing economic importance in terms of domestic and industrial demand but also in view of the current policy emphasis on export of cassava products. With regards to profitability, findings such as those of Fefa (2012) have shown that cassava enterprises are quite profitable and can be poverty alleviating.

Asinobi, Ndimantang and Nwajiuba (2010) found that in areas where cassava was already cultivated, the crop was important as a source of income to the large number of people who grew, processed and/or marketed it. Even though the potential for increasing farmers' returns from these activities was constrained by the cost of processing and marketing through hired labour, they had been able to generate incomes capable of reducing the poverty of participants.

2.5 PROBLEMS OF CASSAVA PROCESSING AND MARKETING IN NIGERIA

According to Okezie and Kosikowski in Tonukari (2004), a major limitation of cassava processing is the rapid post-harvest deterioration of its roots which usually prevents their storage in the fresh state for more than a few days.

According to Dipeolu *et al.*, (2010), transport is a major constraint to marketing. Based on this factor, in some locations, processors command a relatively low share of the wholesale (and retail) market prices. This leads middlemen to pay prices that are not sufficiently attractive to keep farmers production. They observe further that inadequate finance was a critical problem in cassava processing and marketing. Poor access to finance acts as a significant obstacle for processors wishing to scale-up their activity, which necessarily implies increased purchases of fresh cassava roots, the hiring of additional labour and possibly the adoption of improved equipment.

According to Oluwasola (2010), small-holder agricultural (cassava) systems in Nigeria, like most developing nations, are characterized by a number of drawbacks, including technical, financial, institutional and infrastructural support, which adversely affect the economic wellbeing of farm families and results in the continued marginalization of the rural space in which farming takes place. Major constraints smallholder cassava farmers are the paucity of affordable and environmentally appropriate technology (Okuneye, 2004; UNS, 2001; Akande, 1998; Oluwasola and Adewsi, 2008); absence of infrastructural support facilities, especially roads (UNS, 2001), and a development policy that fails to up-scale the cassava production process through the development of farm-gate processing enterprises. These constraints have negatively impacted on the employment generation and income earning potentials of the cassava sector as well as the sector's capacity to serve as the pivot for the drive to reduce poverty in Nigeria.

3 METHODOLOGY

3.1 Area of Study

Benue State lies within the lower river Benue river trough in the middle-belt region of Nigeria. Its geographic coordinates are longitude 7^{o} 47' and 10^{o} 0' East, Latitude 6^{o} 25' and 8^{o} 8' North. It shares boundaries with five other states namely; Nassarawa to the north, Taraba to the east, Cross River to the south, Enugu to the south-west and Kogi to the west. The state also shares an international boundary with the Republic of Cameroun on the south-east. Benue state has a population of 4,244,219 (2006 Census) and occupies a landmass of 32,518 square kilometers.

3.2 Population of the Study

This study covered only people participating in cassava processing and marketing in the study area. A pre-survey of the area showed that cassava processors were the same as marketers. The pre-survey using Vandeikya, Makurdi and Otukpo Local Government Areas as a case study indicated that there were a total of 1400 with 386, 182 and 245 cassava processing centres in Vandeikya, Makurdi and Otukpo Local Government Areas respectively. Cassava was processed and marketed in virtually all the local government areas of Benue State at the time of the pre-survey. The choice of Vandeikya, Makurdi and Otukpo Local Government Areas to represent the three geo-political zones of the State – Benue North-East (Zone A), Benue North-West (Zone B) and Benue South (Zone C) respectively was due to information that in each zone cassava processing was greatest in these local government areas

3.3 Sampling Technique and Sample Size

The study made use of the multistage random and purposive sampling procedures to select a sample size of 420 respondents. The population under study was considered homogeneous as earlier stated. First, the local government areas were purposively selected because they had the highest number of cassava processing centres as shown by the pre-survey. Secondly, six locations were purposively

selected, two from each of the three local government areas because they constituted the nucleus of cassava processing and marketing enterprises in the study area. In each of the six locations, ten (10) villages were randomly selected and in each village, seven (7) cassava processing and marketing households were randomly selected for the study. In all, 420 respondents were sampled. Questionnaires distributed to all the respondents. But only 380 were retrived.

3.4 Method of Data Collection

The data required for this study were basically primary and were collected through an open-ended and structured questionnaire, oral interview, personal observations and Focused Group Discussions (FGDs). These instruments helped in obtaining information for the study.

3.5 Method of Data Analysis

Data were analyzed using descriptive statistics, budgetary and logit regression analyses. Descriptive statistics, including frequency counts, tables, charts, percentages and means were used to analyze the socio-economic characteristics of the respondents. A Multivariate Logit regression model was used to test the hypothesis stated, using maximum likelihood estimation procedure; the Hosmer-Lemeshow test was used to test goodness-of-fit of the model and the correlation matrix was used to test for multicollinearity, correlation between pairs of variables and how the synergies affected the dichotomous variable- poverty status. Also, the Headcount Index and Poverty Gap Index were used to measure the poverty status of the respondents.

3.6 Model Specification

Oluwashola (2010), Apata, Apata, Igbalajobi and Awoniyi (2010), Yusuf, Adesanoye and Awotide (2008), Adeyemo, Oke and Akinola (2010), Chaudhry (2009) and Fefa (2012) provided a more flexible framework for analyzing cassava processing and marketing and poverty reduction in Benue State. This research adopted methods used by these researchers to analyze the relationship that exists between cassava processing and marketing and poverty reduction in Benue State.

The parameters were estimated by maximum likelihood, with the likelihood function formed by assuming independence over the observations. Thus given

$$P(Y) = \frac{\exp(\alpha + \beta Y)}{1 + \exp(\alpha + \beta Y)} \quad \ldots \quad (1)$$

P(Y) measures poverty status, where, Y might be poor (1) or non-poor (0). By taking the natural logs of (1) and simplifying, the log likelihood transformed the structural equation to:

$$LnYi = \frac{P_i}{1 - P_i} = \beta_0 + \sum_{j=1} \beta_k X_{ki} + U_i \quad \ldots \quad (2)$$

Where:

L_nY_i = Natural log of Y(poverty status)

Xk_i = A set of household socio-economic characteristics

βk = Parameters

μ_i = Random disturbance term.

β_0 = Intercept

From Equation (2), the model for this study was implicitly specified as:

$PTY = f(x_1, x_2, x_3, x_4, x_5, x_6, x_7, x_8, x_9, x_{10})$ … (3)

Where, PTY = dependent variable (poverty status), calculated as:

$$PTY = \frac{Average\,annual\,income\,of\,\,a\,household\,\,from\,cassava\,proces\sin g\,and\,marketing}{Total\,number\,of\,\,days\,in\,a\,year\,(365)}$$

If it was less than 1.5 US dollar, it meant the household was poor and it was assigned (1). If it was up to 1.5 US dollar, the household was non-poor and it was assigned (0).

X_1 = Annual income from cassava processing and marketing

X_2 = Quantity of cassava processed and marketed in bags (100kg).

X_3 = Number of square meals taken per day (1 if three square meals a day, 0 if otherwise).

X_4 = House type (1 if zinc roof and cemented completely, 0 if otherwise)

X_5 = Access to 'improved' medical services (1 if respondent visited dispensary, specialist and general hospitals, 0 if otherwise)

X_6 = Access to clothing (1 if at least 1 new cloth is purchased in a year as a result of cassava processing and marketing, 0 if otherwise).

X_7 = Level of education of the respondents (1 if the respondent attained secondary education and above, 0 if otherwise).

X_8 = House size

X_9 = Distance to the markets (local)(Kilometres)

X_{10} = Ownership of processing machine

Thus, the explicit form of the model became:

$$PTY = \beta_0 + \beta_1X_1+\beta_2X_2+\beta_3X_3+\beta_4X_4+\beta_5X_5+\beta_6X_6+\beta_7X_7+\beta_8X_8+\beta_9X_9+\beta_{10}X_{10}+ \mu_i \quad (4)$$

β_0 = Intercept of the model

β_1-β_{10} = Parameters

μ_i = A random disturbance term.

***A Priori* Expectation**

In this study, β_1, β_2, β_3, β_4, β_5, β_6, β_7, β_{10} were expected be negatively signed, while β_8, β_9, were expected to be positively signed.

3.7 Poverty Indices

Poverty status was measured using the headcount ratio and poverty gap measures.

Headcount ratio was expressed as:

$$H = \frac{Q}{N} \quad \ldots \quad (5)$$

Where: H = headcount ratio with values ranging from 0 to 1.

The Poverty Gap was measured using the Foster-Greer-Thorbecke (FGT) metric, which is a generalized measure of poverty within an economy. It combines information on the extent of poverty (as measured by the *headcount ratio*), the intensity of poverty (as measured by the *Total Poverty Gap)* and *inequality* among the poor (as measured by the *Gini* and *coefficient of variation* for the poor). The FGT measure was developed by Professors Eric Thorbecke, Joel Greer and James Foster in 1984. (See Foster, Greer and Thorbecke, 1984)

The formula for the FGT was given by:

$$FGT_\alpha = \frac{1}{N}\sum_{i=1}^{H}\left(\frac{Z - Yi}{Z}\right)^\alpha \quad \ldots \quad (6)$$

Where Z = an agreed upon poverty line ($1.5 in this case)

N = number of people in an economy
H = the number of poor (those with incomes at or below Z)
Yi = individual incomes
α = "sensitivity" parameter (FGT Index and takes on values of 0, 1, and 2)

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

$$FGT_0 = \frac{H}{N} \quad \ldots \quad (7)$$

which is Headcount ratio, or fraction of the population which lives below the poverty line. If α = 1 then the formula is:

$$FGT_1 = \frac{1}{N}\sum_{i=1}^{H}\left(\frac{Z - Yi}{Z}\right) \quad \ldots \quad (8)$$

Which is the average poverty gap (APG) or amount of income necessary to bring everyone in poverty right up to the poverty line, divided by total population. This refers to amount an average person would have to contribute in order for poverty to be just eliminated.

A good deal of technical literature on poverty uses α = 2 version of the metric.

$$FGT_2 = \frac{1}{N}\sum_{i=1}^{H}\left(\frac{Z - Yi}{Z}\right)^2 \quad \ldots \quad (9)$$

In this form, the index combines information on both poverty and income inequality among the poor i.e. the severity of poverty. Specifically in this instance the FGT can be rewritten as:

$$FGT_2 = H\mu^2 + (1-\mu^2)C_V^2 \quad \ldots \quad (10)$$

Where C_v = coefficient of variation among those with incomes less than Z, H is the total of the poor as above, and μ is given by

$$\mu = \frac{1}{H}\sum_{i=1}^{H}\left(\frac{Z - Yi}{Z}\right) \quad \ldots \quad (11)$$

The α = 2 version is a standard used by World Bank and other international agencies for measuring poverty.

The *Gini*-coefficient can be calculated using the formula below:

$$G = \frac{N+1}{N-1} - \frac{2}{N(N-1)\mu}\sum_{i=1}^{n} P_i X_i \quad \ldots. \quad (12)$$

Where
μ = mean income of the population
P_i = income rank of P of individual i, with income X, such that the richest person receives a rank of 1 and the poorest a rank of N.

4 RESULTS AND DISCUSSIONS

4.1 Assessment of Income Generation from Cassava Processing and Marketing

Data on respondents by income generated before and after joining cassava processing and marketing were collected and taking income as a continuous variable, these data are presented in Table 1.

Table 1: Distribution of sampled respondents by average annual incomes before and during cassava processing and marketing activities

Incremental Annual Income (₦)	Annual income before joining cassava processing and marketing		Annual income after joining cassava processing and marketing	
	Frequency	Percentage	Frequency	Percentage
<50,000	233	61.3	20	5.3
50,000-100,000	72	18.9	43	11.3
100,000-150,000	26	6.8	18	4.7
150-000-200,000	19	5.0	77	20.3
200,000-250,000	7	1.8	140	36.8
250,000-300,000	5	1.3	40	10.5
>300,000	18	4.7	42	11.1
Total	380	99.8(100)	380	100

Source: Fefa, 2012.

Table 1 shows that 61.3% of the respondents earned an average annual income of less than ₦50,000 before they joined cassava processing and marketing. But only 5.3% of the respondents indicated that they earned an annual income of less than ₦50,000 after they joined cassava processing and marketing. On the other hand, 18.9% of the sampled respondents earned an average annual income of ₦50,000 – ₦100,000 before joining cassava processing and marketing, while the proportion reduced to 11.3% when they joined cassava processing and marketing. Given an exchange rate of US$1/₦160 the category of respondents who earned less than ₦50,000, earned less than US$1.5 (₦240) per day. This implies that the proportion of respondents living below poverty line fell from 61.3% before they embarked on cassava processing and marketing to only 5.3% after they embraced the business. In other words, cassava processing and marketing enterprises have been able to generate income capable of moving up 91% of the respondents previously living below the poverty line.

Generally, cassava processing and marketing has increased the proportion of respondents earning up to ₦150,000 per annum. For instance, only 5% of the respondents earned between ₦150,000 and ₦200,000 before joining cassava processing and marketing. But after taking to the venture, the figure rose to 20.3%. The corresponding figures for annual income brackets of ₦200,000- ₦250,000 are 1.8% and 36.8% respectively.

A poverty line of ₦240 a day corresponds to a poverty line of ₦87, 600 per annum. This may be approximated to ₦100,000 (the current exchange rate is actually higher than US$1/₦160). Thus, before taking up cassava processing and marketing 80.2% of the respondents lived below the poverty line. But on embracing the business, only 16.6% of the respondents lived below the poverty line. Clearly, cassava processing and marketing have had a significant effect on poverty status of the respondents. This finding is consistent with that of Akighir (2011).

To determine by how much cassava processing and marketing have actually increased the income of the sampled respondents, the ratio of the aggregate income of the respondents before they joined cassava processing and marketing to their aggregate income when they joined cassava processing and marketing was computed. Data obtained indicate that aggregate annual income before cassava processing and marketing was ₦30,000,000.00 while the aggregate income of the sampled respondents after they joined cassava processing and marketing was ₦60,000,000.00.

The ratio (R) = $\frac{aggregate\ income\ during\ cassava\ processing\ and\ marketing}{aggregate\ income\ before\ cassava\ processing\ and\ marketing}$

$$R = \frac{N60,000,000}{N30,000,000}$$

$$= 2$$

This ratio indicates that getting involved in cassava processing and marketing has doubled the respondents' income. This increase in income undoubtedly has improved the quality of life of the respondents and hence has reduced poverty. This finding of 100% increase in income is consistent with Akighir (2011), who reported that aggregate income of respondents increased by 104% when they were involved in rice processing and marketing.

4.2 Determination of Poverty Status of the Sampled Respondents

In order to determine the poverty status of sampled respondents, the poverty line of US$1.5 was used to estimate the respondents' status before and when they were involved in cassava processing and marketing. These estimates were further used to classify the respondents into a category of either being poor or non-poor.

These criteria were used alongside the Foster-Greer-Thorbecke (FGT) index and the different dimensions of poverty and incidence, FGT_0, FGT_1, FGT_2 and *Gini* coefficient were calculated. The results obtained are presented in Table 2.

Table 2: Distribution of sampled respondents by their poverty indices before and after joining cassava processing and marketing

Index	Before cassava processing and marketing	After cassava processing and marketing
(i) Total Average Annual Income	₦30,000,000	₦60,000,000
Mean Average Annual Income	₦78,947.37	₦157,894.74
$^{2}/_{3}$ Mean Income	₦52,631.58	₦105,263.16
$^{1}/_{3}$ Mean Income	₦26,315.79	₦52,631.58
(ii) Headcount Index		
Core Poor	0.38 (38%)	0.21 (21%)
Moderate Poor	0.23 (23%)	0.24 (24%)
Non-Poor	0.39 (39%)	0.55 (55%)
(iii) Poverty Gap Index (FGT_1)		
Core Poor	0.45	0.37
Moderate Poor	0.37	0.32
(iv) Severity of Poverty (FGT_2)	0.203	0.137
(v) Gini Coefficient	0.25	0.09

Source: Authors' Computation

Table 2 shows data on poverty lines of the respondents before and after joining cassava processing and marketing. The table further shows that a respondent with an average annual income greater or equal to ₦52,631.58 before joining cassava processing and marketing was considered to be non-poor or rich. However, a respondent with an average annual income of ₦26,315.79 or less before joining cassava processing and marking was considered to have been poor.

Similarly, Table 2 shows that after joining cassava processing and marketing, the respondents' upper poverty line was ₦105,263.16. This implies that a respondent with an average annual income of up to ₦105,263.16 after joining cassava processing and marketing activity was considered to be non-poor or rich. However, a respondent with an income below ₦105,263.16 but greater than or equal to ₦52,631.58 joining cassava processing and marketing was considered to be moderately poor. A core or extreme poverty line of ₦52,631.58 was drawn. This implies, again, that a respondent whose average annual income fell below ₦52,631.58 after joining cassava processing and marketing was considered to be extremely or core poor.

It can be observed from Table 1 that a respondent who is considered to be moderately poor joining cassava processing and marketing, that is, with an average annual income of below ₦105,631.58, would have been considered as non-poor before joining cassava processing or marketing. This is because the poverty line before cassava processing and marketing was a benchmark average annual income of ₦52,631.58.

Table 2 shows the Foster-Greer-Thorbecke (FGT) indices of the incidence of poverty – FGT_0, FGT_1, and FGT_2 based on the classification of the respondents as non-poor, moderately poor and core poor before and after joining cassava processing and marketing. The table shows that the proportion of core poor fell from 38% before respondents joined cassava processing and marketing to 21% after engaging in the business. The proportion of moderately poor remained fairly stable at 23% and

24% respectively. However, the proportion of non-poor rose significantly from 39% before joining cassava processing and marketing to 55% after taking to the business.

A further confirmation that cassava processing and marketing have improved the quality of life of the respondents is provided by the severity of poverty index (FGT_2). Although this index does not indicate a serious severity of poverty among respondents before joining cassava processing and marketing, it was further reduced (from 0.203 to 0.137) when they joined cassava processing and marketing.

The *Gini* Coefficient also shows that before cassava processing and marketing an income inequality of 0.25 existed among the respondents. This *Gini* Coefficient from economic theory is tolerated and could be considered that income was almost equitably distributed among respondents. But equity in income distribution improved when the respondents joined cassava processing and marketing as the ratio fell to 0.09. This is in line with Ali and Thorbecke (2000), who reported that reducing inequality has a larger positive impact on poverty than does growth; Akighir (2011), who reported that rice processing and marketing activity have reduced poverty, augmented the quality of life and reduced inequality in the divergence among respondents' income in Kwande Local Government Area.

Table 3: Results of the Estimation of the Logistic Regression Model

Variables	Coefficients	S.E.	Sig.	Exp(B)	P-Value
AVINC (X_1)	-0.007	0.038	0.045**	0.583	0.412
QTY PROC (X_2)	-0.018	0.776	0.097*	0.593	0.409
NOSQM (X_3)	-0.455	0.055	0.033**	0.670	0.309
HOUTYP (X_4)	-0.907	0.851	0.040**	0.313	0.221
ACCHLTH (X_5)	13.369	0.697	0.050*	0.000	0.999
ACCCLTH (X_6)	-0.518	0.318	0.800	0.419	0.296
LEDU (X_7)	-0.782	0.924	0.030**	0.345	0.244
HOUSIZE (X_8)	0.925	0.381	0.868	0.509	0.218
DIST (X_9)	0.146	0.250	0.006***	0.630	0.379
OPMACH (X_{10})	-0.841	0.497	0.097*	0.330	0.233
Constant	-0.358	0.227	1.000	0.635	

Source: Authors' Computations from SSPS 17.0

Nagelkerke R- Square=0.580 Chi-Squared=520.516 -2LL=0.001

*** Significant at 1%, ** Significant at 5%, and * Significant at 10%.

Table 3 indicates that the coefficient of AVINC variable (i.e. average annual income of respondents from cassava processing and marketing) is negative (-0.007), correctly signed and is statistically significant at the 5% level of significance. This implies that average annual income has influence on the probability of a respondent being non-poor. The Exp(B) or odds ratio of 0.583 indicates that a unit increase in average annual income of the sampled respondents from cassava processing and marketing would reduce their likelihood of being poor by 58.3%.

Table 3 further shows that the coefficient of the QTYPROC (i.e. quantity of processed cassava) is also negative (-0.018), correctly signed but not statistically significant at 5% level of significance. This implies that the quantity of cassava processed only shows a weak influence on the probability of a respondent being non-poor.

The parameter estimate for the number of times a cassava processing and marketing household feeds in a day (NOSQM) with income generated from the

enterprise is negative (-0.455), correctly signed and statistically significant at the 5% level of significance. This implies that the number of times a household feeds in a day has an influence on the odds of a respondent being non-poor. The Exp(B) is 0.670.

The coefficient of HOUTYP (i.e. the type of house) a sampled respondent sleeps in financed from income generated from cassava processing and marketing, is negative (-0.907), correctly signed and statistically significant at the 5% level of significance. This implies that the type of household a respondent sleeps in has influence on the probability of a sampled respondent being non-poor.

The parameter estimate of ACCHLTH (i.e. access to 'improved' health facilities) of the respondent is positively – incorrectly signed (13.369), but it is statistically significant at 10% level of significance. This implies that access to 'improved' health by a sampled respondent would tend to increase his poverty status. This may be due to the fact that 'improved' health facilities in Benue State, the study area, are in short supply and very expensive, and hence access to them would rather impoverish those patronizing them.

The coefficient of ACCLTH (i.e. access to clothing) of a sampled respondent is negative – correctly signed (-0.518) but it is not statistically significant. This implies that even though the parameter estimate agrees with economic theory, the variable is not significant in explaining the poverty status of sampled respondents in the study area.

The level of education (LEDU) of a sampled respondent has a negative (-0.782) relationship with poverty status, and is statistically significant at the 5% level of significance. This implies that a respondent's level of education influences on the probability of him or her being non-poor. The Exp(B) is 0.345.

The coefficient of household size (HOUSIZE) of a sampled respondent has a positive – incorrect sign (0.925) and it is not statistically significant. This may be due to the fact that in the study area, a large number of household sizes belong to the group of dependants. A high level of dependency is more likely to throw a sampled respondent into poverty than otherwise. The Exp(B) of 0.509 indicates that a sampled respondent is 49.1% (i.e. 100-50.9)* probable to be poor. *Exp (B) values assume that all estimates meet their *a priori* expectations.

The coefficient of distance to a local market (DIST) is positively – correctly signed and statistically significant at 5% level of significance. This implies that DIST has influence on the probability of a sampled respondent being poor. The Exp (B) is 0.630. Lastly, the coefficient of ownership of processing machine (OPMACH) is negatively-correctly signed and statistically not significant at the 5% level of significance. This implies that ownership of processing machine has influence on the probability of a sampled respondent being non-poor. The Exp (B) of 0.330 indicates that the odds of a sampled respondent being non-poor are explained 33% by his personal machine.

Thus, the Chi-Squared value of 520.516 which is significant beyond 0.001 per cent shows that the model has performed well. The Nagelkerke R-Square of 0.580 shows that the explanatory variables influence 58% of the log likelihood of cassava processors and marketers being non-poor i.e. cassava processing and marketing activities of the respondents tend to influence their poverty status by 58%.

4.3 The Constraints of Cassava Processing and Marketing in Benue State

Data on the constraints of cassava processing and marketing in Benue State were collected and are presented in Table 4.

Table 4: Distribution of sampled respondents by their constraints on cassava processing and marketing in Benue State

S/No.	Constraints	Frequency	Percentage (%)
1	Local processing technology or lack of modern processing equipment.	294	77.4
2	Difficulty of peeling.	301	79.2
3	High hired labour requirement and cost.	335	88.2
4	High cost of processing due to high cost improved processing technologies.	215	56.6
5	Limited processing option.	203	53.4
6	Scarcity of fuelwood.	100	26.3
7	High transportation cost of tubers from the production areas to processing centres.	160	42.1
8	Lack of credit for processors.	380	100
9	Inadequate technical knowledge in the use of improved processing technologies.	280	73.7
10	High seasonal fluctuations for cassava products, uneven product quality and variation in cassava supply.	350	92.1
11	Poor access roads in transporting cassava products to market centres.	365	96.1
12	Poor processing, drying and storage capacity.	320	84.2
13	Poor linkage between processors, traders and consumers.	360	94.7
14	Disincentive of low prices and high seasonal price and high fluctuations for cassava products.	380	100
15	Low returns from small-scale processing of cassava.	281	73.9
16	Distant location of market centre.	211	55.5
17	Poor market demand for products.	150	39.5

Source: Fefa, 2012.

Table 4 shows 17 constraints on cassava processing and marketing in Benue State. The last column shows the proportion of respondents who have mentioned the constraints.

5 CONCLUSION AND RECOMMENDATIONS

The descriptive statistical analysis and the results of the estimation of the logistic regression model show that cassava processing and marketing operations have reduced poverty and have the potential for achieving the objective of poverty reduction in Benue State. The research work found a strong evidence that cassava processing and marketing have generated income for respondents in Benue State. This study also identified some of the constraints facing cassava processors and marketers. For the purpose of achieving poverty reduction, these constraints identified need to be addressed through the provision of improved technologies for processing and infrastructural support for the rural areas; provision of microfinance institutions that would be a source of credit to small-scale rural cassava processors; development of rural infrastructure such as access roads to enhance accessibility of processors to market centres for sale of their products; provision of modern processing technologies in key cassava production zones to help convert large quantity of tubers to

processed products; and employment of extension agents to train processors on the use and adoption of modern technologies among others.

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Joseph Fefa is an assistant lecturer at the Benue State University, Makurdi-Nigeria. He received his B.Sc. and M.Sc. in economics from the Benue State University, Makurdi-Nigeria in 2008 and 2012, respectively. He is currently a PhD student of the Department of Economics, at the Benue State University, Makurdi-Nigeria. His research interests include econometric analysis of data, poverty reduction strategies, and development economics.

Christopher O. Obute: biography not available.