EFFECT OF PROCESSING ON ECONOMIC VALUE OF CASSAVA IN NASARAWA STATE, NIGERIA

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Abstract

The study examined effect of processing on economic value of cassava in Nasarawa State, Nigeria. Data were collected from 1,360 respondents and analyzed using regression model. The result shows that Cost of Cassava roots and labor significantly ($P<0.001$ and $P<0.05$) influenced the profit made from cassava. The cost of cassava, water, oil, spices and labour were significant determinants of profits of garri and cassava flakes at various risk levels. Quantity of products handled, purchase price, cost of transportation and cost of storage positively and significantly ($p<0.001$) influenced the incomes of cassava product traders. These results disagree with appriori expectation of supposed negative relationship between cost and income. Because of changes in marketing cost in an uncontrolled price market system, traders fix prices on their products arbitrarily. They had coefficients of 4.12, 1.32, 3.95 and 0.714, respectively. However, handling cost and tax had negative and significant coefficients at $p<0.05$ and $p<0.001$, respectively. Furthermore, R^2 of the result shows high values of 0.997, 0.840 and 0.984 with F-ratios of 1534.78, 258.93 and 4392.63 significant at $p<0.001$, respectively. The mean difference between the incomes of CRT and HQCF, cassava bread, cassava meat pie, and cassava flakes had t values of 6.95, 8.92, 13.45 and 20.07, all significant at $p<0.001$. However, the t values between the mean incomes of CRT, garri (1.05) and chips (1.54) were not significant. Processing significantly increases the economic value of cassava. Therefore, Cassava farmers should process CRT into varying products in other to get optimum value for their produce and effort.

Key words: Effect, processing, economic, value, cassava, optimum

1.0 Introduction

Cassava is a staple food in Nigeria. A staple as defined by Lawal *et al.* (2013) is one that is eaten regularly and which provides a large proportion of the population's energy and/or nutrients. Cassava serves this function as it is eaten raw or in processed form. As a result of growing urbanization, cassava has become an

essential part of the diet of more than 70 million Nigerians (FAO, 2012). The estimated per capita consumption of cassava in Nigeria is 238Kcal (Cock, 1985).

Cassava has the potential to be processed into a wide range of sub-products from food products to industrial sub-products (Paulin, 2011). However, the use of cassava products in the industrial sector is still at an experimental stage and it is hoped that it will develop steadily with the improvement of the country's political environment. To date, cassava is mainly processed into fries, flour, *garri*, tapioca, *Chikwange* and traditional alcohols drinks and starch; and the flour is further used for baking (Paulin, 2011). Fresh roots in many areas are generally processed on-farm shortly after harvest. The processed product is transformed into *Ckikwange* (or dried chips) and sold to local markets or traders. The dried chips are processed into cassava flour at the farmer level or by traders using modern milling to improve product quality. The greatest value addition in this chain occurs via farmers and micro bulk carriers.

Cassava processing represents one of the most important sources of income for farmers, middlemen and marketers in most tropical countries, especially Nigeria, and also as a viable cash crop for poor subsistence farmers. According to IITA (2005), *garri* is the most popular processed cassava product (constituting 80 percent of household processing and 70 percent output by processing enterprises). Levels of demand and supply of cassava and its products influence their prices in the market, and consequently the level of farmers' incomes (Oluwasola, 2010). According to a number of studies in Nigeria and Ghana (Onyemauwa, 2012; Achem, 2011; Oyewole and Phillip, 2009; Addy *et al.,* 2004 and Nweke, 2004) despite constraints affecting the processing of cassava, adding value to Cassava Root Tuber (CRT) remains a source for adding additional revenue to farmers, guaranteeing higher prices and therefore is potentially more profitable than additional efforts in marketing CRT for farmers.

Effect of processing on value of cassava in the context of this study refers to how processing is able to raise the economic value of the CRT, measured in monetary terms. The processing activities have varied levels of contribution to making the final value of the produce. The dried chips are processed into cassava flour at the farmer level or by traders using modern milling to improve product quality.

The effect of processing on the economic value of cassava was evaluated by comparing the incomes from the CRT and those of the processed products. This was achieved first through univariate analysis of the generalized linear model (GLM). The mean differential by turkey HSD and LSD, and the *t* values were considered appropriate and sufficient in explaining the effect of the processing.

2.0 Methodology

The study was carried out in Nasarawa State Nigeria located in North Central Nigeria and lies between North Latitudes 7^{o} and 9^{o} and 7^{o} and 10^{o} East Longitudes (Nuhu and Amed, 2013). It shares boundary with Benue State to the South, Kogi State to the South- west, the Federal Capital territory, Abuja to the North – West, Kaduna State to the north, and Plateau State to the north- east and Taraba State to the east (Ibrahim and Ibrahim, 2012) (Fig 1).

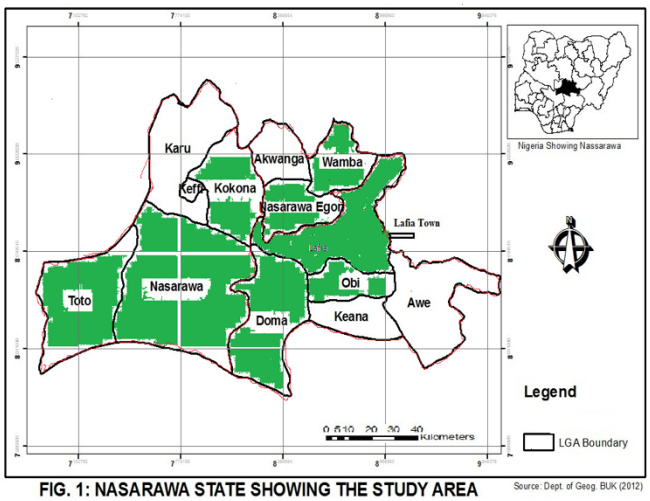

FIG. 1: NASARAWA STATE SHOWING THE STUDY AREA

Stratified random sampling method was adopted in the three agricultural zones (Nasarawa north, made up of Akwanga, Nasarawa Eggon and Wamba LGAs; Nasarawa west, encompassing Karu, Keffi, Kokona, Nasarawa and Toto LGAs; and Nasarawa south housing Awe, Doma, Keana, Lafia and Obi LGAs of the State) of Nasarawa State to draw up samples (1400) made up of 580 cassava farmers, 360 processors, and 420 traders. Questionnaire was used to collect data from the respondents, and a data collected success of 94% was recorded

Regression analysis was employed to estimate the effects of the various value addition processes (components) on the profit levels of the value chain actors and the cassava products. The modified regression model adopted for the study was of the mixed form as:

$$LnR = Ina + \beta_1 InX_1 + \beta_2 X_2 + \beta_3 X_3 + \beta_4 InX_4 + \beta_5 InX_5 + \varepsilon$$

--- (1)

Where

R = revenue of the farmer/processor/trader

α = regression constant

X_1= processed product (₦)

X_2= access to processing facilities

X_3 = processing technology

X_4 = market outlet

$\beta_1 \ldots\ldots \beta_5$ regression coefficients

Regression analysis was used by Brodrick (2014) to determine the effect of processing on value of agricultural produce.

Also, *t*-test model was used to test the hypothesis of the income differentials of the CRT and its products to demonstrate the effect of processing on the economic value of cassava as;

$$t = \frac{|\bar{x} - \bar{y}|}{\sqrt{\frac{sx^2}{Nx} + \frac{sy^2}{Ny}}}$$

--- (2)

where:

t = student t - test

$\boldsymbol{x}$ = sample No. 1

$\boldsymbol{y}$ = sample No. 2

$\boldsymbol{sx^2}$ = a square of the standard deviation of $\boldsymbol{x}$

$\boldsymbol{sy^2}$ = a square of the standard deviation of $\boldsymbol{y}$

$\boldsymbol{Nx}$ = sample size of $\boldsymbol{x}$

$\boldsymbol{Ny}$ = sample size of y.

According to Udofia (2016), the higher the critical value, the higher the discrepancy between the means of the samples and the population.

3.0 Results and Discussion

3.1 Effect of value addition on income of cassava products

Regression estimates of the effect of value addition on income of cassava products were obtained for HQCF, cassava chips,

garri, cassava flakes, cassava bread, cassava meat pie and boiled cassava (Table 1). With respect to HQCF, all the variables included in the model had positive coefficients. However, only the quantity of fresh cassava roots, cost of labor (which include; peeling, washing, pulping and pressing) and packaging significantly (P<0.001) influenced the profit income of the cassava products. The overall effect of the variables on influencing the income generated from HQCF as expressed by the R^2 value was 97.5%. In the case of cassava chips, cost of fresh cassava, quantity of chips processed, cost of labor (which include; peeling, washing and drying) and cost of packaging were significant at p<0.001 with R^2 value of 0.985. The result also revealed that fresh cassava roots, cost of cassava roots, quantity of product processed, cost of water and labor (peeling, washing, grating, pressing and frying) positively and significantly (p<0.001) influenced the income generated from *garri* with R^2 value of 0.998. Also, the income of cassava flakes was significantly (p<0.001) influenced by the quantity of flakes processed and the cost of labor (peeling, washing, grating, and frying). The variables included in the model influenced the income by 97.6%.

Cost of labour had positive coefficients and significant at P<0.05 for cassava bread, meat pie and boiled cassava, respectively. However, the coefficients for cost of water were negative but significant for the said cassava products. Packaging had negative and significant (P<0.001) coefficient for cassava bread, but positively significant (P<0.05) for meat pie. The coefficients for cost of sugar and yeast were negative for cassava bread and significant at P<0.001. The overall effect of variables included in the models for cassava bread, meat pie and boiled cassava as expressed by the R^2 values were 0.858, 0.980 and 0.864, respectively. All the F-ratios of the results were significant indicating the appropriateness of the model in estimating the effects of the variables.

Regression estimate of the effect of value addition processes on the income of cassava products in Table 1 shows that processing improves the value of cassava. The overall effect (R^2) of the variables (value addition processes) included in the models were 0.975, 0.985, 0.995, 0.976, 0.858, 0.980 and 0.864 for HQCF, dry cassava chips, *garri*, casssva flakes, cassava bread, meat pie and boiled cassava roots. These results are higher to the values reported by Uk essay (2014) of 0.452 for *garri*. The result means that value addition influence the prices of cassava products in the market. This position has also been reported by Umeh (2013) who concluded that value addition has positive influence on the income generation of farm households in Etim LGA of Akwa Ibom State, Nigeria.

Fuglie (1998) found processing of agricultural commodities to make an important contribution to agricultural development and farm income. This according to Fuglie (1998) processing of Agricultural produce into new food products, industrial starch and livestock feeds enhances the value of these commodities, which result to higher and more stable market prices and farm income for farmers.

Table 1: Regression Estimates of the Effect of Value Addition on Income of Cassava Products

Predictors	Cassava flour *β* *(t-value)*	Dry cassava chips *β* *(t-value)*	*Garri* *β* *(t-value)*	Cassava flakes *β* *(t-value)*	Csassava bread *β* *(t-value)*	Cassava meat pie *β* *(t-value)*	Boiled cassava *β* *(t-value)*
Constant	24511.1 (7.361)	-17780.301 (-2.083)	-16131.86 (-1.457)	607.328 (0.318)	2076.960 (0.703)	-74.257 (0.098)	872.494 (1.590)
Fresh cassava	0.027 (0.171)***	0.682 (0.539)	19.906 (2.353)**	437.828 (0.587)	-	-	-
Cost of fresh cassava/Flour	0.589 (6.419)	1.752 (16.565)***	1.690 (6.958)***	14.571 (1.242)	1.152 (1.743)	4.237 (4.608)**	1.511 (3.642)**
Quantity of processed products	0.434 (0.408)	11.241 (1.019)**	58.210 (2.163)***	7.946 (4.499)**	-	-	-
Cost of transport	3.567 (4.044)	0.780 (1.055)	2.737 (0.701)	2.703 (-0.311)	-	-	8.817 (4.392)**
Cost of water	2.096 (1.514)	-5.234 (0.438)	9.710 (3.648)**		-4.161 (-3.353)**	-5.893 (11.755)***	-0.547 (5.978)***
Cost of labor	6.691 (15.047)***	0.70 (5.267)***	1.432 (2.414)**	2.142 (3.718)***	8.821 (5.178)**	17.455 (2.605)**	1.104 (2.414)**
Cost of firewood	-	-	9.960 (1.248)	4.539 (0.391)	1.631 (0.391)	-	5.432 (0.766)
Cost of spices	-	-	-	-9.815 (0.736)	-	2.22 (26.072)***	-
Cost of oil	-	-	-	2.056 (2.056)	-	-	-
Cost of packaging	6.333 (3.140)**	18.635 (4.809)***	0.290 (0.193)	19.134 (0.294)	-6.040 (-7.471)***	9.230 (8.850)**	-11.846 (1.114)
Cost of sugar	-	-	-	-	-11.260 (-7.858)***	-	-
Cost of yeast	-	-	-	-	-5.571 (84.538)***	-	-
R^2	0.975	0.985	0.998	0.976	0.858	0.980	0.864
R^2– adj	0.974	0.982	0.998	0.948	0.716	0.966	0.761
F. ratio	857.687***	401.228***	1473.9***	35.493***	6.049***	68.722***	8.441**

Figures in parentheses are *t-values.* * Significant at p<0.01 ** significant at p<0.05 *** significant at P<0.001

3.2 Effect of value addition on income of cassava value chain actors

The result in Table 2 shows that cassava seed, farm size, cost of labour and years of experience positively and significantly ($p<0.001$) influenced the income of cassava farmers. This is because the higher the seed rate and farm size the more plant population and therefore yield. Experience helps farmers to manage farm resources and make better income. However, cost of fertilizer and age of the farmers had negative and significant ($P<0.001$) coefficients with income of cassava farmers. With respect to cassava root processors, the coefficients of household size, processing cost and market unit price were positive and significant at $P<0.001$. However, the coefficient of age was negative and significant at $P<0.001$.

The results for cassava product traders show positive and significant coefficients for variables such as quantity of products handled, purchase price, cost of transportation and cost of storage at $P<0.001$, respectively. The implication is that income of the trader will increase with increased quantity of product handled. Positive coefficients of purchase price and cost of transportation means an increase in the variables will increase the income of the trader. Furthermore, the results show R^2 values of 0.997, 0.840 and 0.984, with F. ratios of 1534.78, 258.93 and 4392.636 significant at $P<0.001$, for cassava farmers, cassava root processors and cassava products traders, respectively.

Regression estimate in Table 2 reveals that cassava seed, farm size, labour and years of experience had positive and significant coefficients of 6.11, 41136.37, 20.52 and 28967.31, respectively with income of cassava farmers. The positive relationship of the variable with income of the farmers is desirous. Farm size and seed quantity are factors of output. Experience in farming helps the farmer to manage risk and make better income from farming enterprise. Also the coefficients of fertilizer and age were significant however, negative. Apata (2015) had reported similar coefficients of 1.873 and 2.254 significant at $p<0.05$ for years of experience and farm size influencing the incomes of women cassava farmers in Southwest, Nigeria.

For cassava root processors, household size, processing (peeling, washing, grading, pressing, sun-drying/frying, packaging) and market price had positive coefficients and significantly ($p<0.001$) influenced the incomes of cassava root processors. This result is in tandem with the reports of Umeh, (2013) and Obinna, (2015) who concluded that value addition had positive influence on the income generation of farm household in Etim LGA of Akwa Ibom and Abia States, Nigeria.

Quantity of products handled, purchase price, cost of transportation and cost of storage positively and significantly ($p<0.001$) influenced the incomes of cassava product traders. These results negate *appriori* expectation of supposed negative relationship between cost and income. However, traders because of changes in marketing cost in an uncontrolled price market system, fix prices arbitrarily on the products they market. They had coefficients of 4.12, 1.32, 3.95 and 0.714, respectively. However, handling cost and tax had negative and significant coefficients at $p<0.05$ and $p<0.001$, respectively. Furthermore, R^2 of the result shows high values of 0.997, 0.840 and 0.984 with F-ratios of 1534.78, 258.93 and 4392.63 significant at $p<0.001$, respectively.

The result of the study implies that unit increases in the use of the significant variables included in the models increases or otherwise the incomes of the cassava value chain actors by the magnitudes of the coefficients depending on the mathematical signs. The reason for the controversies in relationships between some of the variables with the income of the value chain actors is that some occurrences in the market sector do not follow expected economic theories. Therefore while some results conform to

apriopri expectations, some do not. Experience, labour, farm size, quantity of products handled and purchase price had positive relationship with income while handling cost and tax had inverse relationship with income.

Table 2: Regression Estimate of the Effect of Value Addition on Income of Cassava Value Chain Actors

Predictors	Cassava farmers *β* *(t-value)*	Cassava root processors *β* *(t-value)*	Cassava products traders *β* *(t-value)*
Constant	500568.12 (15.42)	-230438.34 (-5.13)	7808.13 (1.99)
Cassava seed	6.11 (11.43)***	-	-
Cost of fertilizer	-28.82 (10.50)***	-	-
Farm size	41136.37 (9.61)***	-	-
Cost of labour	20.52 (13.44)***	-	-
Quantity of cassava roots	0.31 (0.74)	-1409.02 (-0.68)	-
Age (years)	-24367.18 (12.60)***	-3756.64 (-3.55)***	-106.00 (-0.97)
Household size	14939.53 (15.04)	12846.86 (6.14)***	-263.03 (-1.82)
Years of enterprise experience	28967.31 (13.64)***	-1910.41 (-1.43)	120.67 (1.00)
Quantity of processed product	-	8204.38 (1.32)	-
Processing cost	-	0.928 (5.62)***	-
Market unit price	-	60.03 (12.04)***	-
Quantity of products handled	-	-	4.12 (5.56)***
Purchase price	-	-	1.32 (46.61)***
Cost of transport	-	-	3.95 (12.58)***
Storage cost	-	-	0.714 (2.63)**
Handling cost	-	-	-1.57 (-2.92)**
Tax	-	-	-3.74 (-5.23)***
R^2	0.997	0.840	0.984
F. ratio	1534.78***	258.93***	4392.636***

** Significant at 5% *** significant at 1% - not applicable

3.3 Result of Hypothesis

Hypothesis: H_0 = There is no difference between the incomes from CRT and its products

The mean difference (₦114, 087.91) between the incomes CRT (₦227,422.79) and HQCF (₦113,334.88) was significantly ($P<0.001$) different (Table 3). This was suggested by t-test value of 6.951. Similarly, the mean income comparison of CRT and cassava bread, CRT and cassava meat pie, and CRT and cassava flakes had t-test values of 8.92, 13.45 and 20.07, all significant at 1% risk level. They had mean differences of ₦223, 414.46, ₦223, 345.08 and ₦222, 949.53. These imply that the income from CRT and those of its products were different. This may be attributed to processing where the CRT is completely transformed into more acceptable products. Therefore, the hypothesis of no difference between the income of CRT and its products is rejected.

However, the t-test values between the mean incomes of CRT and *garri* (1.05) and CRT and chips (1.54) were not significant. They had mean differences of 43,356.38 and 135,466.67. This means that the mean income of CRT and those of *garri* and chips were statistically the same. The production of chips and *garri* may share similar technologies. Therefore, the null hypothesis of no difference between the incomes of CRT and *garri* and chips is accepted.

This result suggests the acceptability differentials of the cassava products by consumers. Lawal *et al.,* (2013), Umeh (2013), Obinna, (2015), and Anyiro *et al.,* (2016) had also reported significant income differentials among cassava products due to processing in Kwara, Akwa Ibom, and Abia, States, Nigeria. The implication of this is that investors can be informed of the product(s) appreciated by the market and invest on market oriented products.

Table 3: Result of Paired t-test Comparing Mean Incomes of Cassava Value-added Products

Cassava roots/Cassava value added products	Mean income (₦)	Mean difference (₦)	standard error	t- value	P. value
Cassava roots	227,422.79				
HQCF	113,334.88	114,087.91	16,412.13	6.95	0.000***
Cassava roots	227,422.79				
Garri	182,957.45	44,465.34	41,433.17	1.05	0.298
Cassava roots	227,422.79				
cassava chips	372,857.14	145,434.87	87,792.89	1.84	0.031**
Cassava roots	227,422.79				
cassava bread	4,008.33	223,414.46	26,168.32	8.92	0.000***
Cassava roots	227,422.79				
cassava meat pie	4,077.71	223,345.08	16,529.20	13.45	0.000***
Cassava roots	227,422.79				
cassava flakes	4,473.26	222,949.53	11,108.73	20.07	0.000***

** Significant at $p<0.05$ *** Significant at $p<0.001$

4.0 Conclusion and Recommendations

4.1 Conclusion

Processing significantly increases the economic value of cassava and its acceptability for consumption.

4.2 Recommendations

i. Cassava farmers should process raw cassava into varying products in other to get optimum value for their produce and acceptance for consumption.
ii. Investors and the unemployed labour can key into processing of cassava into various products for income generation.

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