ECONOMICS OF PLANTAIN FLOUR AND CHIPS PROCESSING IN OYIGBO LGA OF RIVERS STATE, NIGERIA.

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ABSTRACT
The research considered the economics of plantain chips and flour processing in Oyibo Local Government Area of Rivers State. Purposively, six (6) communities were selected for the study because of the concentration of plantain processors in those areas. Structured questionnaire were used in data collection. From the result, with a gross margin of 175,062.99 and a BCR of 1.28 in flour processing, the industry is profitable. The prospect in plantain chips production also is profitable at a gross margin of ₦112, 203.38, operating expense ratio of 0.51 and BCR of 1.0. At z-value of 2.103 ($p<0.05$), between the number of bunches of plantain converted into flour and chips, the study suggests, the null hypothesis should be rejected. The coefficient of multiple determinations for the linear, semi log, double log and exponential functions are 0.909, 0.879, 0.548, and 0.708 respectively in flour processing while in chips processing, the semi logarithm functional form was selected as the lead equation of the regression analysis because of the magnitude of R^2. The coefficients of determination (R^2) of 0.588 shows that about 58.8% of the variation in gross profit was influenced by the combined effects of the individual parameters,

Key words: Plantain, Processing, Gross Margin Chips, Flour

INTRODUCTION

Folayan et al(2011) citing Ogazi(1996) reported that Plantain is one of the major sources of carbohydrate food in humid tropical Africa containing about 35% carbohydrate, 0.2 to 0.5% fat, 1.2% protein, and 0.8% ash. In reference to Akalumhe(1999) he indicated that with respect to gross value of production, plantain is a very important fruit in developing world. The Central Bank of Nigeria (2003) reported that plantain is a major stable food in Nigeria, with the highest percentage in output increase between 1999 to 2003, Nigeria ranks as the highest producer of plantain in West Africa with an annual output of about 2.4 million metric tonnes mostly from the southern states (Folayan et al, 2011). Benjamin *et al*. (1995) indicated that the general public consume plantain derivatives in many different shades in Ghana which are in high demand. This reflects relatively in high prices of plantain products compared to other starch staples with yam being the only exception in Nigeria.

The Processing of plantain in Nigeria is done largely by smallholders or medium scale processors however; there are few large scale processors in the industry and, the processing of fresh plantain increases the shelf life (Ayanwale et al, 2016). Citing Ekunwe & Ajayi(2000), Yomeni et al.(2004) and Adeniji et al.(2010); Ayanwale et al (2016) noted that Plantain can be processed into various products like plantain chips, plantain flour, Plantain balls and biscuits amongst others. They observed that plantain chips results from frying slice unripe or moderately ripe plantain pulp in vegetable oil and plantain chips for now seem to be consumers' most preferred plantain products in Nigeria commonly sold by either vendors along the streets and even by the supermarkets. Procedurally, they reported that plantains flour is made by peeling the green plantains and bringing out the pulp, cutting into pieces and air drying; grinding the dried pulp manually for smallholders in a wooden mortar or mechanical grinder for large scale producers. Plantain flour can be converted into fufu, bread, biscuits, or cakes amongst others the stage of ripeness affects the quality and characteristics of the plantain chips or flour. Plantains chip or flour derivatives have a longer shelf life and less bulky to transport

According to Onyejegbu and Olorunda (1995) plantain chips is one of the most preferred of plantain products consumed in Nigeria. When packed in plastic sachets or in hermetic aluminium sachets, it can stay crispy for a longer time and at good quality for months at room temperature and away from light. The production, processing and marketing of plantain chips in most west African sub-region is mostly a reserve of the female gender (Tchango et al, 1999).

Similar to chips production, plantain flour goes through same process with a slight difference. The production process involves the acquisition of fresh unripe plantain pulp, peeling and storage of the pulp in water tanks to arrest enzyme induced degradation. Slicing of the pulp, drying and milling completes the process before the milled pulp is then sieved and packaged for the market. The product may be packaged in plastic bags of varying sizes for different markets(Foraminifera, 2013). The chart below shows the various stages the plantain goes to become the marketed flour.

Tchango et al(1999) citing Ngalani and Crouzet(1995) stated that plantain flour that has about 10 percent of humidity and packed hermetically in plastic sachets can be stored for months without spoilage or reduction in qualities. Flour of ripe plantain can be used in making bread, biscuits and instant flour Plantain flour can be used as a substitute for Garri for diabetics and raw

material in the production of cakes, puff-puff, biscuit, bread and pan cakes.The various use which plantain product can be put to and the nutrition and a medicinal alternative makes plantain a premium product. It is also a source of iron, protein and vitamin A and easily marketed through vendors, canteens, hotels and supermarkets (Foraminifera, 2013)

Incidentally, in spite of these benefits, the utilization of plantain and its derivatives in Nigeria has not been significant enough. Baruwa et al(2011) noted that the Food and Agricultural Organization,(FAO) in1997 observed that Nigeria is one of the leading producers of plantain in West and Central Africa, however the consumption per capita for Nigeria was one of the lowest in the sub- region. This development points to the existence of a market potential in production in the country which incidentally has not been fully exploited especially in income earnings.

METHODS AND MATERIALS

This study was carried out in Oyigbo Local Government Area of Rivers State, Nigeria. Oyigbo lies between 7.12 longitudes and 4.88 latitude with GPS coordinates of 53'12.703" N 7°7' 30.612"E. and bordered at the east by Tia local Government Area of Rivers State, Etche local government Area is at the west and Obio/Akpor to the south. A large population of the inhabitants is into farming and largely on small-holder bases. However, few process agricultural produce and trading.

Purposively, six (6) communities in the Local government were selected for the study because of considerable population of plantain processors. Simple random sampling technique was later used in selecting fifteen (15) plantain processors from each of the selected communities, bringing the total sample size to ninety (90). The objectives of the study were to assess the Gross Margin and determine the cost/returns and profit prospects in plantain chips and flours processing; compare the relationship between raw plantain use and the resulting derivatives (flour and chips) using the z-test and, assess the effect of cost factors on revenue in plantain chips and flour processing using the regression analysis. Structured questionnaire were used in data collection. The Gross margin for plantain chips and flour was specified by TR – TVC

Where

TR = Total Revenue and

TVC = Total Variable.

Gross margin was estimated using the expression:

$GM = P_yiyi - P_xixi$ (1)

Where GM represents gross margin, i the ith farm in the sample, P_yi the average price of plantain chips or flour of the ith enterprise in Naira as may be applicable, Yi the average quantity of chips or flour as may be applicable, Xi the average quantity of plantain bunches used in kg and P_xi represents average price of variable inputs. Subsequently, a net return was obtained from gross margin.

Net returns = GM - TFC

Where TFC represents Total fixed cost

The extent of profitability of plantain enterprises were assessed using.

Operating expense ratio = Total Variable Cost/Gross Revenue

Benefit Cost Ratio (BCR) = Total Revenue (TR)/Total Cost (TC)

If benefit cost ratio is equal to or greater than 1 at a given discount rate, the enterprise is considered viable.

The relationship between raw plantain and its derivatives was specified by the z-test to compare the quantity of plantain used to the resulting magnitude of the derivatives of flour and chips.

Linear, Semi-log and double log functions of Regression were used to assess the effect of cost factors on revenue in plantain chips and flour as specified below.

Linear function: $Y = b_0 + b_1X_1 + b_2X_2 + b_3X_3 + b_4X_4 + \ldots + e$

Semi log function: $Y = b_0 + b_1\log X_1 + b_2\log X_2 + b_3\log X_3 + b_4\log X_4 + \ldots + e$

Double log function: $\text{Log}Y = b_0 + b_{1L}\text{og}X_1 + b_2\log X_2 + b_3\log X_3 + b_4\log X_4 + \ldots + e$

Exponential function: $\text{Log}Y = b_0 + b_1X_1 + b_2X_2 + b_3X_3 + b_4X_4 + \ldots + e$

Where b_1 to b_9 represents regression coefficients, Y represents Gross Profit, X_{1f} represents Plantain flour (Kg), X_{1c} represents Plantain chips (Kg), X_2 represents Transport cost, X_3 represents Cost of raw plantain, X_4 represents Equipment cost, X_5 represents Machinery cost, X_6 represents Depreciation, X_7 represents Labour cost, X_8 represents Tax, X_9 represents Rent and e represents stochastic Error term.

RESULTS AND DISCUSSION

Result showing cost and return on plantain flour production

Net return was used to determine the profit from processing plantain into flour. The result is shown in the table below.

Table1: Cost and return on plantain flour production

S/N	Value	Amount (₦)
1	**Total revenue (TR)**	**257166.67**
	Variable cost	
1	Cost of raw plantain	28280.00
2	Transport cost	14225.00
3	Labour cost	35466.68
4	Tax cost	4132
	Total variable cost TVC	**82103.68**
	Fixed cost	
1	Building/rent	88923.08
2	Machinery (depreciated)	24900.32
3	Equipment (depreciated)	5695.97
	Total fixed cost	**119519.17**
	Gross margin (GM)= TR-TVC	**175,062.99**
	TC = TVC +TFC	**201622.85**
	BCR = (TR/TC)	**1.28**
	Operating Expense Ratio = TVC/GR	**0.60**

Sources, Field Survey, 2018

From the result, with a net return of 175,062.99 and a BCR of 1.28, the plausible conclusion is that plantain flour industry is very profitable. The implication of a BCR of 1.28 is that for every ₦1 spent in processing plantain into flour, there is a return of ₦1.28 kobo. This finding agrees with the study of Ekunwe and Atalor, (2007) that showed that plantain flour processing was profitable in Benin City, where the return per naira of processed plantain into flour was ₦4.66.

The gross margin also is encouraging. According to Ebben(2004), Gross margin impacts the prospect of attaining breakeven and earnings beyond breakeven. By implication, gross margin can impact risk and returns. The management of Gross margin helps an enterprise avoid problems with commodity prices that may be too low and direct costs that may be too high (Ebben, 2004), this the plantain flour enterprises can handle judging from gross margin outcomes.

Result showing cost and return on plantain chips production

Gross margin analysis, net return was used to determine the profit from processed plantain into **chips**

Table 2: Cost and return on plantain chips production

S/N	Value	Amount (₦)
	Total Revenue (TR)	**169415.38**
	Variable cost	
1	Cost of Raw plantain	4290.92
2	Transport cost	7869.68
3	Labour cost	36989.48
4	Tax cost	8062.52
	Total variable cost	**57212.6**
	Fixed cost	
1	Building	91575.76
2	Equipment	6972.47
3	Machinery	8533.23
	Total fixed cost	**107081.45**
	Total cost (TFC +TVC)	**164294.05**
	Gross margin (GM)= TR-TVC	**112,203.38**
	BCR = TR/TC	**1.03**
	Operating Expense Ratio = TVC/GR	**0.51**

Source; Field Survey, 2018

The prospects in plantain chips production appear good at a gross margin of N**112, 203.38 a**nd operating expense ratio of 0.51, however the BCR suggests marginal returns because there is a N1.03 kobo return for every ₦1 invested in the processing of plantain into chips. This is in agreement with the works of Ekunwe and Atalor (2007) in Benin City, Nigeria where every naira invested in processing plantain to chips had a return of ₦4.42. With an assumed high demand for chips as revealed by the magnitude of demand in the study area and shown in table 3, turn-over and mark-up may also be favorable with a good profit prospect. Narsey (2013) has observed that products with low turnover will require higher mark-ups for significant profit to be made. A high demand however, in this case will guarantee high turn-over all things being equal and a favorable profit prospect in the long run even when mark-up is low. Items with higher turnover have lower mark-ups if profits must be made.

Differentials in number of bunch of plantain used for flour and chips in the study area

Table 3: Results of z-test comparing number of bunches used for flour and chips in the study area.

Variable	N	Mean	Mean difference	Standard deviation	z-value	p-value	Decision
Flour	24	44.41	48.31	77.69	2.103	0.039	Reject null hypothesis
Chips	64	92.72		133.11			

Source: Field Survey, 2018

Results from table 3, the z-test difference between the number of bunches used for flour and the number used for chips suggested a significant difference at t-value of 2.103 ($p<0.05$), between the number of bunches of plantain converted into flour and chips in the study area. The null hypothesis is therefore rejected. This implies that processors convert more bunches into chips than flour and plausibly, the demand for chips, the result suggests, is more than that of flour since production has always been a function of demand.

Assess on the effect of cost factors on revenue in plantain flour.

Table 4 Cost/Revenue relationships in plantain flour production.

S/N	Explanatory Variables	Linear	Semi-Log	Double-Log	Exponential
1	Constant	74288.3	3.04725	20.9596	10.0763***
		(0.4310)	(1.537)	(1.101)	(6.636)
2	Rent	-1.70093	-26589.3	0.542696	1.61503
		(-1.222)	(-0.2079)	(0.4768)	(0.09689
3	Raw plantain cost	-28.3594 **	-401048*	-1.98460	3.00988
		(-2.965)	(-1.823)	(-1.044)	(0.2984)
4	Transport cost	10.3223	32576.0	-0.349528	-0.00051000
		(0.3731)	(0.3249)	(-0.4224)	(-1.648)
5	Labour cost	-7.59154	-2494.73	0.0646246	0.000132436
		(-0.5906)	(-0.2402)	(0.7741)	(1.170)
6	Machinery cost	2.196780**	-28064.0*	-0.114514	447.445
		(2.177)	(-2.112)	(-1.052)	(0.5334)
7	Equipment cost	2.19678**	-182313**	-0.729210	447.445
		(2.177)	(-2.708)	(-1.245)	(0.5334)
8	Tax amount	8.72614	-13132.9	0.401537	0.00317723**
		(0.1306)	(-0.2056)	(0.7121)	(2.871)
9	Depreciation	-5.27226**	267164***	0.662759	-10738.7
		(-2.177)	(3.025)	(0.8642)	(-0.5334)
R-Squared		0.909417	0.879182	0.548072	0.708567
Adjusted R-Squared		0.851185	0.801514	0.178312	0.470122

Source, Field Survey, 2018

Note: **** = significant at 1% ** = significant at 5% * = significant at 15%

Multiple regression analysis was used to determine the relationship between cost and revenue among plantain flour processors as represented in the table above.

Linear, semi log, double log and exponential functions were used at 1%, 5% and 10% level of probability. The coefficient of multiple determinations for the linear, semi log, double log and exponential functions are 0.909, 0.879, 0.548, and 0.708 respectively. The linear function model was however selected as the lead equation of the regression analysis because of the magnitude of R^2 and has four significant explanatory variables and the highest coefficient of multiple determinations. Therefore, it was chosen for further discussion of the results.

Based on the result of the analysis, the coefficients of determination R^2 was 0.909. This shows that about 90.9% of the variation in the dependent variable Y i.e. gross profits was influenced by the combined effects of the individual parameters, while the remaining 9.1% of the variation in the dependent variable Y was due to some other variables that were not captured in the regression model. Variables such as plantain cost, equipment cost, machinery cost and depreciation were statistically significant at 5% level of probability. This implies that these variables significantly determine the gross income of the plantain processors into flour in Oyigbo L.G.A, this finding agrees with the works of Folayan, and Bifarin (2011) on plantain processing in Akure South local government of Ondo State, Nigeria where these variables significantly enhanced profitability of processing plantain into flour. Variables such as transportation cost and tax were not significant at 5% level of probability. However, transport cost, equipment cost, machinery cost, and tax had a positive relationship with revenue accrued. Rent, raw plantain cost and labour cost had an inversely relationship with revenue suggesting that an excess of these factors were employed and eating into profit. The implication of the positive relationship between gross profit in the analysis of plantain processing into flour and transport cost, equipment cost, and tax is that increase in these explanatory variables led to the increases in profit.

Table 5 Result showing Assess on effect of cost factors on revenue in plantain chips production; Cost/Revenue relationships in plantain chip production

S/N	Variables	Linear	Semi log	Double Log	Exponential
1	Constant	330070**	-1.00815	11.7574	13.5351***
		(2.595)	(-1.642)	(2.257)	(13.23)
2	Rent cost		42124.7***	0.0723118**	5.629850**
			(3.295)	(0.6665)	(2.050)
3	Raw plantain cost	-5.42267	-8227.88	-0.392535	-0.000495473
		(-0.1000)	(-0.1343)	(-0.7551)	(-1.189)
4	Transport cost	11.0614	6836.52	-0.125329	5.32009
		(0.9559)	(0.2450)	(-0.6198)	(0.6003)
5	Labour cost	4.22561	15813.6	0.0914052	-7.50426
		(1.337)	(0.8826)	(0.6011)	(-0.3092)
6	Equipment cost	-881933	141974	0.666472	1.14427
		(-1.164)	(1.597)	(0.8832)	(0.1872)
7	Machinary cost	-882000	11357.8	0.0642312	1.14434
		(-1.164)	(1.181)	(0.7871)	(0.1872)
8	Tax amount	-9.39569	453.693	0.0183189	-9.95906e-05
		(-0.5992)	(0.03637)	(0.1731)	(-0.8294)
9	Depreciation	2.11676e+07	-89126.0	-0.609689	-27.4642
		(1.164)	(-0.9665)	(-0.7790)	(-0.1872)
	R-Squared	0.405523	0.588116	0.332346	0.380441
	Adjusted R-Squared	0.320598	0.464303	0.223094	0.279058

Source, Field survey, 2018

Note: *** = significant at 1% ** = significant at 5%

The impact of cost to revenue in plantain into chips in Oyigbo L.G.A was analyzed using multiple regressions. Four functional forms were tested, they are linear, semi log, double log and exponential. Five variables were statistically at 5% and 1% level of probability. While some of them possessed the expected positive signs others did not fit in to the inferred expectation. The semi logarithm functional form was selected as the lead equation of the regression analysis because of the magnitude of R^2. The coefficients of determination (R2) of 0.588 shows that about 58.8% of the variation in gross profit was influenced by the combined effects of the individual parameters, while the remaining 41.2% of the variation in the dependent variable was due to other variables that were not captured in the

regression model. Increases in rent, transport cost, labour cost, equipment cost, machinery cost and tax also attracted increases in revenue from chips in the study area. Also, negatively signed coefficients such as raw plantain cost and depreciation caused decreases in profits for the processors of plantain chips. The coefficient of transport cost, labour cost and tax cost were positively signed but not significant. The coefficient of plantain cost and depreciation were negative but not significant. The coefficient of Rent was positive and significant at 1% level of probability.

SUMMARY/RECOMMENDATION

plantain chips is one of the most preferred of plantain products consumed in Oyibo Local Government and its environs judging from the magnitude of production which ordinarily should be in response to demand however, the flour has a higher gross margin. The reason for this was not part of the research objectives. The enterprises are very profitable judging from their gross margins and Benefit/Cost ratio, however, flour seem to have a higher margin despite low production comparatively. Field survey suggests other derivatives of plantain are not so popular. It is suggested that the processors diversify into other products of plantain to widen their profit prospects and break into new economic options or alternatives.

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